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VOL. IV.—PART II.

TODD—APPENDIX.

(TESTIMONIALS AT THE END OF THIS VOLUME.)

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Todd, county of S. E. Dakota, bordering on Nebraska, and lying between Missouri and Niobrara rivers. The uplands are mostly prairies; the soil of the river-bottoms is fertile. Cap. Fort Randall. Area, about 550 sq. m. P. 337.

Todd, county of S. W. Kentucky, bordering on Tennessee, drained by Pond River and several considerable creeks, and intersected by Louisville and Nashville and Great Southern and St. Louis and South-eastern R. Rs. Surface generally hilly, soil fertile. Swine, sheep, and cattle are numerous. Staples, tobacco, Indian corn, wheat, and wool. Cap. Elkton. Area, 350 sq. m. P. 12,612.

Todd, county of Central Minnesota, watered by Long Prairie and Partridge rivers, and crossed in its N. part by Northern Pacific R. R. Surface generally level, interspersed with many small lakes; soil productive. Staples, wheat, oats, and potatoes. Cap. Long Prairie. Area, 960 sq. m. P. 2036.

Todd, tp., Crawford co., O. P. 1156.

Todd, tp., Fulton co., Pa. P. 631.

Todd, p.-v. and tp., Huntingdon co., Pa. P. 781.

Todd (Charles Scott), son of Judge Thomas, b. near Danville, Ky., Jan. 22, 1791; graduated at William and Mary College 1809; became a lawyer at Lexington 1811; took part as brigade quartermaster and judge-advocate of Gen. Winchester's division in the war of 1812; became captain of the 28th Infantry May, 1813; was aide to Gen. Harrison at the battle of the Thames; was appointed assistant inspector-general Nov. 1, 1813, inspector-general (rank of colonel) Mar. 2, 1815; settled at Frankfort, Ky.; was secretary of state of Kentucky 1817, member of the legislature 1817–18, confidential agent to the republic of Colombia 1820–21; editor of the Cincinnati *Republican* 1840, in which capacity he took a leading part in the campaign in favor of his former commander, Gen. Harrison, to whose biography, prepared by Benjamin Drake (1840), he also contributed; and was minister to Russia 1841–45. D. at Baton Rouge, La., May 14, 1871.

Todd (Henry John), b. in England in 1763; graduated at Hertford College, Oxford, about 1785; took orders in the Church of England; became successively a minor canon of Canterbury, vicar of Milton 1792, rector of All Hallows, London, keeper of the MSS. at Lambeth Palace 1803, rector of Settrington, Yorkshire, 1820, prebendary of York 1830, and archdeacon of Cleveland 1832. D. at Settrington Dec. 24, 1845. He wrote biographies of Milton, Spenser, Gower, Chaucer, Cranmer, and Bishop Walton; edited Johnson's *Dictionary* (4 vols., 1814); demonstrated Bishop Gauden to be the author of *Eikon Basilike*; published *An Authentic Account of our Translation of the Bible, and of the Translators* (1834), and other works.

Todd (James Henthorne), D. D., b. in Dublin, Ireland, Apr. 23, 1805; graduated at Trinity College, Dublin; became a fellow there 1831; took orders in the Church of England; became regius professor of Hebrew 1849, and librarian of the University of Dublin 1852; was twice chosen Donellian lecturer; was treasurer and precentor of St. Patrick's cathedral 1864; was the chief founder of the Irish Archæological Society, and president for five years of the Royal Irish Academy. D. at Rathfarnham, near Dublin, June 28, 1869. Author of numerous theological and miscellaneous writings, including *Historical Memoirs of the Successors of St. Patrick and Archbishops of Armagh* (2 vols., 1861), and *St. Patrick, Apostle of Ireland* (1863), and editor of *The Wars of the Danes in Ireland, The Irish Version of the Historia Britonum of Nennius* (1848), *The Martyrology of Donegal, The Book of Hymns of the Ancient Church of Ireland* (1855), and other rare MSS. and tracts in the Irish language; also of three treatises of Wycliffe, and wrote much for the *Transactions* of learned societies.

Todd (John), b. in Pennsylvania about 1740; educated in Virginia; became a lawyer at Fincastle; emigrated to Kentucky 1775; located land near Lexington 1776; accompanied Gen. George Rogers Clarke in his expedition against Kaskaskia and Vincennes; succeeded him in command at Kaskaskia; was appointed by the Virginia legislature in 1777 colonel in command of the Illinois region, then erected into the "county of Illinois;" was colonel of a frontier regiment 1778, delegate to the Virginia legislature 1780, and killed in fighting against the Indians at the battle of Blue Licks, Ky., Aug. 19, 1782.

Todd (John), D. D., b. at Rutland, Vt., Oct. 9, 1800; graduated at Yale College 1822 and at Andover 1826; was pastor of a Congregational church at Groton, Mass., 1827–31, of the Edwards church at Northampton 1833–36, of the First Congregational church in Philadelphia 1836–42, and of the First church at Pittsfield, Mass., 1842–72; was one of the founders of Mount Holyoke Female Seminary, and for some years president of the trustees of the Young Ladies' Institute at Pittsfield, where he d. Aug. 24, 1873. Author of *Lectures to Children* (Northampton, 2 vols., 1834), *Student's Manual* (1835), *Index Rerum* (1835), *Truth made Simple* (1839), *The Young Man* (1843), *The Daughter at School* (1844), *Mountain Gems* (4 vols., 1861), *Woman's Rights* (1867), *Sunset Land, or the Great Pacific Slope* (1869), *Old Fashioned Lives* (1870), and many other popular works, some of which, especially the *Student's Manual*, have had an immense circulation, and exerted great influence both in the U. S. and in England. (See *John Todd, the Story of his Life, told mainly by himself*, New York, 1876, edited by Rev. John E. Todd.)

Todd (John Blair Smith), b. at Lexington, Ky., Apr. 4, 1814; graduated at the U. S. Military Academy 1837; served during the Florida and Mexican wars, and subsequently on frontier duty till 1856; resigned and became a trader with the Indians in Dakota; delegate to Congress 1861–65; during the civil war was brigadier general of volunteers, and commanded the 6th division of the army in Tennessee; was Speaker of the house in the Dakota legislature 1867–69, governor 1869–71, and one of the founders of Yankton, where he d. Jan. 5, 1872.

Todd (Robert Bentley), M. D., brother of James Henthorne, b. at Dublin, Ireland, in 1809; educated at Trinity College, Dublin; settled as a physician in London 1831; acquired an extensive reputation; became professor of physiology and anatomy in King's College 1837; took a leading part in the founding of King's College Hospital 1839, and was professor of clinical medicine there until his death, at London Jan. 30, 1860. He was joint editor (with Dr. Grant) of *The Cyclopædia of Anatomy and Physiology* (5 vols., 1836–59), joint author with Dr. William Bowman of *The Physiological Anatomy and Physiology of Man* (2 vols., 1845–56), and author, besides other professional works, of three series of *Clinical Lectures* (1854–60), of which a new edition was prepared (1860) by his eminent pupil, Dr. Lionel Smith Beale, who has written a memoir of his life.

Todd (Thomas), b. in King and Queen's co., Va., Jan. 23, 1765; received a good English education; was a soldier in the war of the Revolution; emigrated to Kentucky 1786; became a lawyer at Danville; was several years clerk of the district court, and subsequently of the court of appeals, of which he was judge 1801–06; was chief-justice of Kentucky 1806–07, and a justice of the U. S. Supreme Court from Mar. 3, 1807, to his death, Feb. 7, 1826.

Todd Creek, tp., Johnson co., Neb. P. 542.

Todhunter (Isaac), b. at Rye, England, in 1820; graduated in 1848 as senior wrangler at St. John's College, Cambridge, where he became fellow, tutor, and principal mathematical lecturer. Author of a series of textbooks in calculus and the higher mathematics, of a *History of the Mathematical Theories of Attraction and the Figure of the Earth* (2 vols., 1873), and of a monograph on the literary productions of Prof. Whewell (2 vols., 1874).

To'di [anc. *Tuder, Tudertum*], town of Italy, province of Perugia, on a high hill overlooking the Tiber, not far from the confluence of the Naja with that river, about 30 miles S. of the city of Perugia. This was an ancient Italic city, and the innermost of its three ruinous walls is still a fine specimen of the old cyclopean or Etruscan construction. Portions of a temple and other fragments of buildings belonging to the Roman era may still be seen. The Gothic cathedral contains good frescoes by Lo Spagna, etc., but the church of S. Maria della Consolazione is especially noteworthy. It is the work of the celebrated Bramante, and by many thought to be his masterpiece. This church is characterized by connoisseurs as "one of the most perfect structures in Italy." The city of Todi was not without importance in Italian mediæval history, but there is little life or industry of any kind in the modern town. P. 14,934.

Tod'idæ [from *Todus*—Latinized form of an Indian name—the designation of one of the genera], a family of birds peculiar to the tropical regions of America. They resemble in physiognomy and form the Alcedinidæ (kingfishers), to which they are allied: the bill is moderately long (at least as long as the head) and much depressed, with the tip rounded or pointed; the nostrils are sublateral near the base, and open; the wings short and rounded; the tail rather short; the tarsi quite slender and long; toes three in front and one behind, all well developed; and the anterior "syndactylous"—*i. e.* united by their first joints; claws short and well curved. In most details of structure of the skeleton and other parts, so far as examined, they resemble the Momotidæ and Alcedinidæ, and belong to the same great group (or super-family) of Coccygomorphæ. They dwell mostly in damp places in South and Central America and the West Indian islands. Except in the

breeding season, they remain generally single and alone. When at rest they sit "in a crouched manner on the branches, with the head drawn in between the shoulders, and are so dull and stupid that they are easily approached sufficiently near to be caught with the hand." (*Gray.*) They are nevertheless sufficiently spry to readily catch insects that come near them. They are said to make their nest generally in holes in the ground, and to lay about three or four eggs. Five species are recognized by Sharpe, the latest monographer of the group. (*Ibis*, 1874, pp. 344–355.) Their characteristics and relations have been best discussed by Marù (*Proc. Zool. Soc. London*, 1872, pp. 664–680), and to this reference must be made for a full exposition of the characters of the family.

THEODORE GILL.

Tod'leben (FRANZ EDUARD), b. at Mitau, Courland, May 8, 1818; educated in the schools at Riga and at the school of engineering at St. Petersburg; served in the Caucasus against Schamyl 1848–51; was distinguished in the campaign on the Danube 1853–54, and on the outbreak of the Crimean war in the latter year was ordered to Sevastopol on the invasion of the allies. To his genius in developing the inchoate works and in improvising defensive expedients adapted to the peculiar circumstances is attributed the so long successful defence by which the place resisted for nearly a year (349 days) the efforts of the allied armies. (See SEVASTOPOL.) Within the course of a year he had risen from the rank of captain through successive grades to be major-general, and was also honored with the appointment of A. D. C. general to H. T. M. the emperor. Besides other honors, that of the decoration of the third class of the order of St. George was conferred on him—a distinction only bestowed for services of the most distinguished and brilliant character. He was subsequently entrusted with the defence of Nikolaief and Cronstadt. In 1869 he attained the grade of general (of engineers). As "adjoint" to the inspector-general of engineers in Russia (the grand duke Nicholas), Gen. Todleben exercises *de facto* the functions of that office. Aside from his eminent military distinction, he commands esteem for his high personal character and affable manners. His important work (using the French title), *Défense de Sevastopol, Ouvrage rédigé sous la direction de Lieutenant-Général E. de Todleben*, etc., etc., in 2 4to vols., with elaborate maps, appeared (1863–70) simultaneously in the Russian, French, and German languages; it was drawn up under the sanction of the Russian government, with full access to the archives, and after French and English special works relating to the siege had appeared, and after a thorough survey of the localities, designed to rectify discrepancies in the various accounts. Though commenced in virtue of his position as chief of engineers as a redaction of the "journal of the defence," the author states that "a more thorough study of the matter confirmed in me this conviction, that any purely technical description of the operations of siege and defence of places, if not accompanied by the detailed narrative of the co-operation of the other arms (*i. e.* infantry and artillery), must be utterly inadequate to furnish a correct idea of the progress (*marche*) of the attack or of that of the defence. Just as the art of the engineer is closely associated with the science of the artillerist and of the tactician, so also the success of the defence through the engineer depends in a great degree on the power and on the *matériel* of the artillery, on the character of the weapons of the infantry, and especially on the aptitude of the troops for the combat." Among the important "conclusions" Gen. Todleben draws from the siege is the following: "Many military men have expressed the opinion that the defence of Sebastopol showed conclusively that it is useless in time of peace to expend immense sums in the construction of permanent fortifications: . . . *the defence of Sebastopol has proved directly the reverse*"—a conclusion confirmed by Marshal Niel, and illustrated by Gen. Todleben by various arguments drawn from the actual facts.

J. G. BARNARD.

Tody. See TODIDÆ.

Toe River, tp., Mitchell co., N. C. P. 619.

Tofana. See AQUA TOFANA.

To'ga [Lat.], the distinctive garment of the Roman citizen, was of probable Etruscan origin. The youth wore it in the form called *toga prætexta*, and not till they came of age could they put on the *toga virilis*, or manly gown. It was a loose and ample long cloak, not much worn by rustics and artisans, and was, at least in later times, almost distinctive of the upper classes.

Togrul Beg. See SELJOOKS.

Tokat', town of Asiatic Turkey, in Asia Minor, 20 miles S. of the Black Sea, is beautifully situated in a valley among vine-clad hills on the banks of a small river, but it is meanly built, and although the neighborhood contains rich marble-quarries, most of its houses are built of sun-dried brick, or even of mud, and huddled together in dirt and confusion. It was formerly the entrepôt of an important transit-trade, but the route of the traffic has changed of late, going now by Trebizond, and the commercial importance of the city has greatly declined. It has some dyeworks and manufactures of silks and copperware, the copper ore from the mines of Diabekir being brought hither on camels for smelting. P. 45,000, partly Turks and partly Greeks, Armenians, Tartars, and Jews.

Tokay', small town of North-eastern Hungary, county of Zemplin, on the right bank of the Theiss, at the influx of the Bodrog, is famous as the entrepôt of the celebrated Tokay wines, which are produced in the neighborhood. P. 5012.

Tokay Wines. See WINE.

Tokio, or **Tokei,** the new name of Yedo. See JAPAN, by C. LANMAN.

To'land (JOHN), b. near Redcastle, Londonderry, Ireland, Nov. 30, 1669, of Roman Catholic parents; was originally called JANUS JUNIUS, but changed his name while at school at Redcastle, where he also became a zealous Protestant, and under the patronage of some dissenters entered the University of Glasgow 1687; removed to that of Edinburgh, where he graduated M. A. 1690; studied theology two years at Leyden, with a view to becoming a dissenting minister; made the acquaintance of Leibnitz and other eminent men; resided several years at Oxford, where he spent his time in the Bodleian Library and prepared his first work, *Christianity not Mysterious* (London, 1696; 2d ed., Amsterdam, 1702), which made a great sensation, was censured by convocation, replied to by Stillingfleet and many others, and burnt by the hangman at Dublin by order of the Irish Parliament Sept. 11, 1697; the author being then in that city, proceeded to London, where he published an *Apology for Mr. Toland* (1697); went to Amsterdam; published there the first edition of Milton's *Works, Historical, Political, and Miscellaneous, with a Life* (3 vols. fol., 1697–98), in which he made an indirect attack on the Gospels, which was replied to by Dr. Blackall in a sermon preached before the House of Commons; wrote a rejoinder entitled *Amyntor, or a Defence of Milton's Life* (1699), which occasioned a polemic with Dr. Samuel Clarke and others; turned his attention to politics; wrote a pamphlet entitled *Anglia Libera* (1701) in favor of the succession of the house of Brunswick, which procured him the favor of the princess Sophia at the court of Hanover, and employment in a quasi-diplomatic capacity at Berlin and other German courts; held a theological discussion with Beausobre; returned to England and published *Vindicius Liberius* (1702), a new defence of his first book, in which he asserted his claim to be "a true Christian" and "a good Churchman," but in his *Socinianism truly Stated* (1705) avowed himself a pantheist; in 1704 published *Letters to Serena* (that is, the queen of Prussia); resided abroad in the employ of Harley 1707–10, and was subsequently a voluminous pamphleteer in London. D. at Putney Mar. 11, 1722. Among his numerous works were *State Anatomy of Great Britain* (1714), *Nazarenus, or Jewish, Gentile, or Mahometan Christianity, containing the History of the Ancient Gospel of Barnabas, etc.* (1718), *Tetradymus* (four treatises, 1720), and a *Life* of Servetus (1724). A biography appeared in 1722, and a collection of his miscellaneous pieces, with a memoir, was published in 1726 by Peter des Maizeaux (again in 1747).

Tole'do, one of the oldest cities of Spain, and the capital of a province of the same name, is built on an immense granite rock at an elevation of 2400 feet above the level of the sea, and enclosed on three sides by the Tagus, toward which the rock presents steep and abrupt sides, while on the fourth side, where the ground slopes gently, it is defended by two walls—an inner wall built by the Goths in the seventh century, and an outer built by Alfonso VI. in 1109—both profusely adorned with towers and gates. From 467 to 714 it was the capital of the Goths, from 714 to 1085 that of the Moors, and after 1085 it was the residence and capital of the kings of Castile. Its most remarkable edifice is the cathedral, the metropolitan church of Spain, and one of the most magnificent church buildings in the world, founded in 587, 404 feet long, 204 feet wide, and in its chief nave almost overloaded with sculpture. Besides the cathedral, the city contains 26 other churches, 37 monasteries, a splendid though never completed royal palace, and other architectural monuments; but its general aspect is gloomy, and almost desolate. The splendor has become sepulchral; an air of decay has crept in; the place, which once contained about 200,000 people, is now inhabited by only 20,000. Its once flourishing industry has also died out, the only two branches still alive being the manufactures of sword-blades and confectionery; but Toledan blades

and Toledan marzipan are still exported to every country in Europe.

Toledo, p.-v. and tp., cap. of Tama co., Ia., on Toledo and North-western branch of Chicago and North-western R. R., has 8 churches, good schools, 2 banks, 1 newspaper, 2 elevators, and 2 grain-warehouses. P. of v. 888; of tp. 1579. JAMES B. HEDGE, ED. "CHRONICLE."

Toledo, p.-v. and tp., Chase co., Kan. P. 368.

Toledo, city, cap. of Lucas co., O., on the bank of Maumee River, 9 miles above its junction with Lake Erie. Incorporated in 1836 on the union of the two villages of Fort Lawrence and Vistula, the straggling settlement then numbering less than 1000 souls, it has increased to a city with a pop. of 60,000 in 1876. This development has resulted, first, from remarkable natural and acquired advantages as a collecting, shipping, and distributing point; and, second, from the energetic and enterprising character of the people who have directed her industries during the past twenty years. Besides her intimate connection with the great inland lake-navigation of the North-west, Toledo is the terminus of Wabash and Erie and Miami canals. Her railroad system includes 13 working lines, 4 of which have independent Eastern connections, while the two new roads to be completed in 1876 will bring to the city the vast coal-deposits of South-eastern and Central Ohio. Her narrow-gauge lines number 2 completed and 2 projected roads; 7 lines of horse railway intersect her streets. The city is governed by a mayor, board of aldermen, and council, and patrolled by a police force of 50 men. It has a central station house costing $72,000, and a house of refuge and correction capable of containing 150 youth. The property of the city is protected by a paid fire department, distributed among 9 engine-houses, equipping 6 steam fire-engines, and controlled by a complete fire-alarm telegraph system. To this is added an extensive system of waterworks on the standpipe plan, having 46½ miles of pipes, the whole having been established at a cost of $1,000,000. The educational interests of Toledo are represented by 25 public and 12 parochial schools, a university of the arts and trades, and a free public library of 10,000 vols. She has 3 daily, 1 semi-weekly, and 14 weekly newspapers, and semi-monthly publications. Fifty churches minister to her spiritual needs, while 106 societies—including 3 hospitals, 3 orphans' homes, a home for friendless women, and an industrial school for children—are effectively organized for charitable, benevolent, and miscellaneous purposes. Twenty hotels provide for travellers; 6 national, 3 savings, and 3 private banks are in active operation, and are supplemented by 6 building loan associations. The jobbing trade in all its branches is an important and steadily-increasing element of Toledo's prosperity, and her numerous wholesale firms are dealers in books and stationery, crockery, cutlery, drugs, dry goods, notions, furnishing goods, groceries, boots and shoes, hardware, hats and caps, lumber and hard woods, wines, liquors, etc. Many of her leading houses now import goods directly from Europe. The extensive manufacturing interests of the city are headed by the largest wagon-works in the country, and embrace 14 planing-mills, 7 manufactories of sash and blinds, 4 moulding-factories, 3 pump-factories, and other establishments devoted to bridge and boat building, carriage-making, and the manufacture of furniture, cabinet ware, bent-work, etc.; 1 furnace, 6 foundries, 1 car-wheel factory, 1 for the casting of ploughs, 4 for boiler-making, 5 for the building of steam-engines, and 1 for the construction of mowers and reapers. The miscellaneous manufacturing interests of the city are numerous and diversified. The Toledo Produce Exchange, numbering 60 life members, holds daily sessions; 11 elevators have been erected, with a capacity of 4,175,000 bushels, the largest having a storage for 1,500,000 bushels. The lake marine numbers 78 vessels. Toledo received during 1875, for distribution throughout the West and South, 92,946,379 feet of lumber, 15,390,000 lath, and 16,303,000 shingles. There were shipped by lake and railway during the same time to Eastern and foreign markets, 740,758 barrels of flour, 6,709,686 bushels of wheat, and 14,928,589 bushels of corn. P. in 1870, 31,584. J. P. JONES, PROPRIETOR "TOLEDO BLADE."

Toledo War, The, was a strife which almost reached bloodshed between the State of Ohio and the Territory of Michigan in regard to their dividing-line. In the ordinance of 1787 for the government of the Territory N. W. of the Ohio River, Congress granted certain rights to the inhabitants, and reserved to itself the right to form one or two States "in that part of said Territory lying N. of an E. and W. line drawn through the southerly bend or extreme of Lake Michigan." In the act of 1802 for the admission of Ohio as a State the same line is described as its northern boundary, but the people specified a more northerly line in their State constitution. The only data then extant as to the position of Lake Michigan was a map published by Mitchell in 1755, on which the "southerly bend or extreme" of that lake is shown at 12° 32′ N. lat. Its true location is 41° 37′ 19″, or nearly 61 miles S. of what Mitchell represented. Had his map been correct, the boundary-line would have passed due W. from the mouth of Detroit River. In 1805, Michigan Territory was organized, the boundary being defined according to the ordinance of 1787; but when the States of Indiana and Illinois were subsequently organized, this boundary was ignored, and they stretched N. of it. The difference between the acts of Congress and the constitution of Ohio in regard to her northern boundary caused that State to apply for a survey of the same. Congress ordered a survey in 1812, but it was not made until 1817. The line then run was called the "Harris line;" one run according to the words of the act was called the "Fulton line." The former is the present boundary, while the latter intersects Lake Erie E. of the mouth of the Maumee River, and includes within Michigan the important city of Toledo. This city, as the outlet of the Wabash and Erie Canal, was the apple of discord, and gave its name to the "war." While measures were in progress for the admission of Michigan into the Union under the provisions of the ordinance which authorized such a measure when her free population should reach 60,000 (it having been ascertained in 1834 to be 87,273), the legislature of Ohio (Feb. 23, 1835) passed an act to organize the disputed tract of about 650 sq. m. into townships, and provided for a resurvey of the "Harris line." Up to this time, Michigan Territory had held undisputed possession as far S. as the "Fulton line," and all the local officers had been amenable to Michigan. Her authorities being informed of the contemplated encroachment, on Feb. 12, 1835, passed an act to prevent any foreign jurisdiction within the limits of the Territory, in which it was made a penal offence to exercise any official functions within her borders save those derived from the government of the U. S. or of the Territory. It being understood that Michigan would resist both the resurvey of the "Harris line" and the assumption of jurisdiction by Ohio over the disputed tract, Gov. Robert Lucas of Ohio called out the militia to protect his surveyor, and Acting Gov. Stevens T. Mason of Michigan summoned his militia to assist the civil authorities in repelling the expected invasion. Both State and Territory made urgent appeals to Pres. Jackson to support their respective claims. He referred the matter to Attorney-General B. F. Butler, who wrote an opinion favorable to Michigan. The President took no action save to send three commissioners for effecting an amicable settlement, if possible; but as neither party would yield a hair's breadth, this peace commission failed. The attempt by Ohio to exercise jurisdiction over the disputed tract led to several squabbles and the arrest of officers from Ohio and their sympathizers by the authorities of Michigan. The rival governors directed the proceedings in courts of law which followed these disturbances. On Sept. 6, 1835, Acting Gov. Mason assumed command of the militia *en route* for Toledo to prevent the organization of Wood county by the Ohio authorities, which was to take place at Toledo Sept. 7. Although the Michigan militia occupied the town, a detachment of Ohio forces, accompanying the proper officers, entered at 3 o'clock A. M., and, having gone stealthily through the formalities, withdrew. Ohio having gained her point, the militia on both sides were disbanded. Orders to supersede Acting Gov. Mason, on account of his zeal and nerve in the cause of Michigan, were issued by the President Aug. 29, 1835. After a sharp debate in Congress, Michigan was admitted into the Union by act of June 15, 1836, on condition of her acceptance of the "Harris line." At the same time she received the addition of the territory known as the Upper Peninsula from Wisconsin. She thus exchanged a strip of farming land for one of the richest mineral regions of the world. A convention of delegates, called to consider this proposition on Sept. 26, 1836, rejected it by 28 yeas to 21 nays. A second convention of delegates, called without authority of law by the Democratic county committee of Wayne county, was elected, and gave its full assent (Dec. 14, 1836) to the above conditions. Its authority being recognized at Washington, Michigan came into the Union as a State Jan. 26, 1837, under her constitution framed and adopted in 1835. The "Toledo war" cost the poor pioneers of that region $250,000; but by voting to become a State prior to Jan. 1, 1837, Michigan saved her share of the surplus revenue then distributed by the general government, and the 5 per cent. on the sales of public lands within her borders, amounting to $500,000 or more. So the "submissionists" had solid justification.

W. S. GEORGE.

Tolenti'no, town of Italy, province of Macerata, on an elevated bank of the Chienti, which is here crossed by a solid stone bridge dating from the thirteenth century. Of

the several churches, the most venerated by the inhabitants is that of San Nicola, the miracle-working patron of the city, who was buried here in 1310. There is considerable traffic and manufacturing industry in this town, iron-foundries, woollen-mills, tanneries, etc., being in active operation. Tolentino stands near the site of an early Greek settlement, afterward superseded by a Roman colony, which was totally destroyed by the Northern invaders. The present town, which rose up during the Middle Ages, enjoyed a popular government for a long period, though it did not escape the disorder of the times. It is now chiefly known as the place in which was concluded (in 1797) the celebrated peace between Pope Pius VI. and Gen. Bonaparte as representative of the French republic. It was also near Tolentino that Murat suffered a defeat by the Austrians (1815) which cost him his throne, and eventually his life. P. 11,229.

Tolera'tion [Lat. *tolerare*, to "endure"] denotes the endurance of something which is not wholly liked, especially of religious opinions or worship contrary to the religion established by law. The ancient heathen states were little called to the exercise of this quality, because their religions consisted in forms chiefly, while doctrine was vague and unformulated. Yet at Athens *asebeia*, or want of due veneration to the gods, was a punishable offence in various shapes; it was on accusation of this offence that the most religious Greek, Socrates, suffered death. Greeks and Romans punished novel *rites*, especially secret ones, until under the emperors of Rome so many new religions rushed into the western parts of the empire that they could not be repressed. In the Jewish system nothing but the worship of Jehovah without images was endured at all. The plan was much the same when Christianity became the religion of the empire; and in the Middle Ages nothing was tolerated that deviated, in faith or form, from the Catholic Apostolic Church. Protestantism, by its free thought and doctrine of the right of private judgment, paved the way for a multitude of minor differences of opinions; and yet where the prince, as representing the people, set up an established Church, all were obliged to conform to it under severe penalties. These penalties contributed to make the Established Church in England so odious that, with the help of political allies, the dissentients from the Church overturned both Church and State, and settled everything on a new basis. After the Restoration everything went back to its old order, but the dissenters were now an important third party in the state, which must not be forced to ally itself with the court and the Roman Catholics in order to secure its own religious liberties. The harsher restrictions on Protestant religious worship other than that of the Established Church were removed by the Toleration act of 1 Wm. and Mary, which, however, was arbitrary, unequal, and unsystematic in its provisions. (See Macaulay's criticisms on it in his *History*, iii. 86, and onward.) It removed no disabilities and repealed no penalties of the earlier legislation against the nonconformists. An Independent who could accept all but five or six of the articles of the Church of England was still subject to the persecuting laws, but a Quaker who rejected the Eucharist could preach without making any declaration of his faith. (Macaulay, *u. s.*) This law, however, as an entering wedge, was a great gain for religious liberty. The unpersecuting but indifferent eighteenth century went considerably further. Warburton's work on the alliance between Church and State, or the *Necessity and Equity of an Established Religion and a Test-law Demonstrated*, first published in 1736, shows the position that a firm Churchman, who was yet an enemy of persecution, could take on this subject. His doctrine is that the care of civil society extends only to the body and its concerns, and the care of religion to the soul. The civil magistrate, if he will avail himself of the benefits of religion for civil society, must seek some union or alliance with a Church, and, if there are several claiming to be such, with that one which is the largest, and so the best fitted to secure the ends of the alliance. "When the Church," he says, "loses its superiority of extent to any considerable degree, the alliance becomes void." After discussing the motives for such alliance—from which he excludes altogether the wish on the part of the Church to engage the State to use force on behalf of the establishment, as being contrary to the natural right of every man to worship God according to his own conscience—he considers the terms of the alliance, which, although a very important part of the treatise, does not concern us here. He then shows that the Christian religion is best fitted for such an alliance with the state, and the English establishment is the most perfect of all. His last argument is spent on the propriety and necessity of a test-law, or of such a law as shall keep out from offices of trust under the State those who do not belong to the Church by law established.

The argument of Warburton being based on the principle that the care of the state ends with the body and goods, and that the true end for which religion is established is not to provide for the true faith, but for civil utility, gave a platform for a certain kind of toleration on the most earthly grounds. A defence for the abolition of all laws imposing tests would be that they conflict with personal rights, that there is no possibility in any such way of producing a harmony of opinions in society on the subject of religion, and that there is danger of alienating from the state those who, while otherwise competent, cannot hold office on account of their religious scruples.

In modern times *toleration* has disappeared from most Protestant and some Roman Catholic countries, in order to give place to entire religious equality of all sects and eligibility to office of all persons of every confession. Toleration is the intermediate state between persecution for opinion's sake and separation of State from Church.

T. D. Woolsey.

Toll [Ang.-Sax.], the duty imposed on travellers and goods passing along public roads, rivers, bridges, etc. In the later Middle Ages it formed a considerable item in the revenues of a monarch, but exercised a very bad influence on the free development of trade and traffic. Thus, heavy tolls were levied on the Rhine by the German emperor and other minor German princes; on the Elbe and in the Sound by the Danish kings, etc. This form of toll has now been entirely abolished.

Tol'land, county of N. E. Connecticut, bordering on Massachusetts, drained by Willimantic and Hop rivers, and intersected by several railroads. Surface in the W. part level and fertile, in the E. part hilly and unproductive. There are numerous manufactures of cotton, woollen, and silk goods, of shoddy, hosiery, leather belting and hose, carriages, boots and shoes, boxes, machinery, and iron castings, bleaching and dyeing establishments, and flour-mills. There are many cattle, swine, and sheep. Staples, Indian corn, oats, potatoes, tobacco, hay, and dairy products. Cap. Tolland. Area, 440 sq. m. P. 22,000.

Tolland, p.-v. and tp., cap. of Tolland co., Conn., on New London Northern R. R. P. 1216.

Tolland, p.-v. and tp., Hampden co., Mass. P. 509.

Tol'lens (Hendrik Cornelisz'oon), b. at Rotterdam Sept. 24, 1780; was educated for mercantile business, but devoted himself to poetry: published in 1802 his first volume of poems, and won in 1804 the second ("Lierzang op Hugo de Groot"), and in 1806 the first prize ("Egmond en Hoorne") of the Academy of Amsterdam. Of his dramas, the most remarkable are *De Hoekschen en Kabeljaauwschen* and *Andromache*; of his epics, *De Overwintering der Hollanders op Nova Zembla*; of his lyrics, his patriotic songs, *Wapenkreet* and *Vaterlandisch Kriigslied*. His *Gezamentlijke Dichtwerken* (8 vols.) were published 1855–57. D. at Ryswick Oct. 21, 1856.

Tol'na, town of Southern Hungary, on the Danube, has manufactures of leather, potash, tiles, and spirits, and in the neighborhood saffron, wine, and tobacco are extensively cultivated. P. 6852.

Tolo'no, p.-v. and tp., Champaign co., Ill. P. of v. 777; of tp. 1413.

Tolo'sa, town of Spain, province of Guipuzcoa, at the confluence of the Orria and Araxes, has important manufactures of paper and arms. P. 7639.

Tol'tecs, an ancient Indian nation of the Mexican table-land, so called from their capital, Tula, situated in the valley of the same name in the present state of Hidalgo, about 50 miles N. of the City of Mexico. According to tradition, they had settled there about the seventh century, and long lists of their emperors and accounts of their wars have been given by several writers, though but little reliance can be placed upon such data. In the period preceding the advent of the Aztecs and other Nahuatl tribes the Toltecs are represented as having exercised supremacy over a vast region, but to have been conquered by the Chichimecs, and to have emigrated in great numbers to Guatemala, where they are supposed to have founded the Quiché empire. At the time of the conquest there were no pure Toltecs remaining in Mexico, but the principal monuments of Mexican architecture, as well as their hieroglyphics, their knowledge of astronomy and of mechanics, and their civilization generally, were ascribed to the half-mythical Toltecs. Modern researches do not discover any confirmation of these legends in the vicinity of Tula.

Tolu' Balsam, a balsamic juice obtained from *Myrospermum toluiferum*, a lofty tree of the natural order Leguminosæ, growing in Venezuela and New Granada. The tree averages seventy feet in height, with a straight trunk rising forty feet without branching. The balsam is ob-

tained by slashing the bark of the stem through to the wood in many places, and allowing the juice which spontaneously exudes to collect in small calabashes fixed to the tree. The balsam when fresh is a light-brown, thick, resinous substance, but by keeping concretes into a solid, brittle in cold weather, but easily softened by slight warmth. It has a delicate and fragrant odor, most perceptible when the balsam is warmed, and a correspondingly pleasant taste. Its most important constituents are an amorphous resin and cinnamic acid. Balsam of tolu was found in use by the natives when South America was first explored, and was introduced into Europe in the latter part of the sixteenth century. It is now exported from New Granada. This balsam has scarcely any medicinal virtue, but is largely used in pharmaceutical preparations and extemporaneous prescriptions to impart to mixtures its agreeable odor and taste. The officinal preparations of it are a syrup and a tincture, and it is an ingredient of the compound tincture of benzoin. EDWARD CURTIS.

Tolu'ca, town of the Mexican confederation, 20 miles S. W. of the City of Mexico, is regularly built, in the centre of a fertile and well-cultivated plain, and has extensive manufactures of soap and candles. Many swine are reared here, and the place is famous for its hams and sausages. P. 12,000.

Tol'uene (*Toluol, Hydride of Benzyl, Hydride of Tolyl, Methyl Benzene*), (C_7H_8), was discovered in 1837 by Pelletier and Walter in the oily product of the dry distillation of resins. It is obtained by the dry distillation of tolu balsam and many resinous bodies, by the action of potash on benzylic alcohol, and by heating toluic acid with lime; but is most readily prepared by collecting the portion of coal-naphtha which distills between 212° and 248° F., agitating it with sulphuric acid, and redistilling, and collecting the part that goes over between 226° and 230° F. Toluene is the second member of the benzene series of hydrocarbons (see HOMOLOGY), as is shown by its formation from monobrombenzene by the action of methyl-iodide. It forms a mobile liquid of sp. gr. 0.883 at zero Centigrade, and boils at 230° F. It is soluble to some extent in alcohol, in ether, and in the fixed and volatile oils, and dissolves iodine, sulphur, and many resins. A large number of substitution-products of toluene are known, the most interesting of which are those of chlorine and nitric acid. J. P. BATTERSHALL.

Tolu'ic Acid (*Toluolic Acid, Tolylic Acid*), ($C_8H_8O_2$), an aromatic homologue of benzoic acid and an isomere of methylic benzoate, is produced by the action of nitric acid on cymene or xylene, and by the action of sodium and carbonic acid on bromotoluene. In a pure state it is colorless and tasteless. The fusing-point of the acid is 347° F.; at a higher temperature it sublimes without decomposition, forming fine needles. When heated with lime, toluic acid is decomposed into TOLUENE (which see) and carbonic acid. Toluic acid is monobasic, and forms crystalline salts, which, however, have not been fully investigated.
J. P. BATTERSHALL.

Tolu'idine (*Amido-Toluene*), (C_7H_9N), an isomere of benzyl-amine, is produced by reducing nitro-toluene with ferrous acetate or sulphuretted hydrogen. It dissolves in boiling water, and in alcohol, ether, and chloroform. From a dilute alcoholic solution it crystallizes in large colorless laminæ, which evaporate somewhat at the ordinary temperature of the air, and possess a burning taste. Toluidine fuses at 101° F. to a liquid which boils about 388° F. It imparts a slight blue color to reddened litmus, and forms a series of compounds with many of the acids.
J. P. BATTERSHALL.

Tom, tp., Benton co., Mo. P. 799.

To'mah, p.-v. and tp., Monroe co., Wis., at the junction of Wisconsin Valley and Ohio Milwaukee and St. Paul R. Rs., contains good schools, 2 newspapers, 1 bank, 5 hotels, and is in close proximity to several extensive cranberry-marshes. It is principally engaged in agriculture and lumbering. P. of v. 837; of tp. 1666.
J. A. WELLS, ED. "JOURNAL."

Tom'ahawk [Algonkin, *tomehagen*], strictly, was the war-club of the North American Indians, but for a long time the name has been given, probably through misapprehension, to the war-hatchet, originally of stone. Europeans introduced steel tomahawks, which were sometimes so made as to serve as tobacco-pipes, the handle forming the stem. The natives used this weapon as a battle-axe, and also possessed great skill in throwing it so that its edge would strike first.

Tomahawk, tp., Searcy co., Ark. P. 719.

Tomales, p.-v. and tp., Marin co., Cal. P. 1121.

Toma'to [Mex. *tomatl*], the *Lycopersicum esculentum*, a plant of the order Solanaceæ whose fruit is extensively employed as an article of food, both raw and cooked. It is a native of tropical America, but is much grown in kitchen gardens in nearly all warm and temperate countries. The tomato enters into the composition of a great number of dishes, as well as sauces and pickles.

Tom'bac [Malay, *tambâgo*, "copper"], a term applied to different alloys of copper and zinc, with about 80 per cent. of copper. An English tombac gave, copper 86.38 and zinc 13.61. A German tombac gave, copper 84 and zinc 15.5. The alloy of copper 84.5 and zinc 15.5 is very malleable and ductile. Dutch metal, pinchbeck, imitation bronze, prince's metal, and Mannheim gold are similar alloys. A *white tombac*, or *white copper*, has been made, containing copper 75 and arsenic 25. H. B. CORNWALL.

Tombig'bee River rises in Tishomingo co., Miss., and after a very indirect S. by E. course of 450 miles in Mississippi and Alabama, joins the Alabama River 45 miles above Mobile, and the united stream is called Mobile River below the junction. It is navigable to Aberdeen, Miss., 410 miles from Mobile Bay.

Tombs (Sir HENRY), K. C. B., V. C., b. in Gloucestershire, England, in 1824; educated at Addiscombe and at the Sandhurst Military College; entered the service in 1842, when ordered to join the Bengal Artillery, and soon engaged in the Gwalior campaign and subsequent active operations; appointed to the artillery staff and engaged in the Sutlej campaign. On the outbreak of the Indian mutiny, Tombs was a brevet major in command of a troop of horse artillery; ordered to join the army for besieging Delhi, he led the force which captured the Eed Gate and commanded the horse artillery at the final assault. Under Sir Colin Campbell he was then engaged in the Oude campaign at Lucknow, etc. Made lieutenant-colonel Jan., 1858; colonel the following July, and named commander of the Bath. Besides the many medals of honor heretofore won, the Victoria Cross was now added. Commanded the Bhootan expedition, and named K. C. B.; major-general 1867. D. at Newport, Isle of Wight, Aug. 2, 1874.

Tom'cod [perhaps corrupted by the Newfoundland fishermen from the French *tacaud*, applied to the *Gadus luscus* of Europe], a name applied in the U. S. to small codfishes, forming the genus *Microgadus*. These, in external characters, do not differ from the large codfishes (*Gadus*), having, like them, three dorsal and two anal fins, a barbel at the chin, and teeth on the vomer; the anus, however, is under the last rays of the first dorsal fin, instead of being under the first ones of the second, and the skull is essentially different; it is inflated laterally and on each side of a sphenoidal groove; the epiotics are obtusely rounded, and their posterior or outwardly descending ridges blunt; the frontal has an anterior low crest, continued forward, dividing into narrow lateral wings, and the anterior frontals are mostly covered by the frontal in front. The species on the eastern coast is the well-known *M. tomcodus*, that on the western (California, etc.) the *M. proximus*. The species are not of much economical importance, although the eastern one at least is brought in considerable quantities to the eastern markets. They are often caught from the wharves by anglers who seek them there. THEODORE GILL.

Tomes (ROBERT), M. D., b. in New York City in 1816; graduated at Washington College, Hartford, 1837; studied medicine at Philadelphia, Edinburgh, and Paris; settled as a physician in New York; made several voyages as surgeon to the Pacific Mail Steamship Co.; translated various works from the French; wrote for several magazines, and was for some time assistant editor of the New York *Evening Post*; wrote the American portion of Appletons' *Cyclopædia of Biography* (1855); aided Dr. Hawks in preparing for the press the official narrative of Commodore Perry's expedition to Japan, and drew up a popular abridgment of that work (1857); was a contributor to Appletons' *New American Cyclopædia*, and for two years after the civil war resided at Rheims, France, as U. S. consular agent. Author of *The Bourbon Prince* (1853), biographies of *Richard the Lion-Hearted* (1854) and *Oliver Cromwell* (1855), *Panamá in 1855* (1855), *The Battles of America by Sea and Land* (3 vols., 1859–60), *The War with the South, a History of the Great American Rebellion* (3 vols., 1867), both of which histories were originally published in semi-monthly 4to numbers; and *The Champagne Country* (1867).

Tom Green, county of S. W. Texas, bordering on New Mexico, bounded S. W. by Pecos River, and intersected in the E. by the head-streams of the Colorado. It was formed in 1874, and, with Crockett co., formed in 1875, constitutes what was formerly known as the Bexar region or territory. Cap. Ben Ficklin. Area, about 14,000 sq. m.

Tom'linson (Charles), F. R. S., b. in London, England, in 1808; became lecturer on physical science in King's College School, London; made many valuable scientific experiments, which were communicated to the *Philosophical Magazines* of London and Edinburgh and to the *Transactions* of scientific societies; was a member of the editorial staffs of Knight's *English Cyclopædia* and of the *Encyclopædia Britannica* (8th ed.); was editor of several of the publications of the Cavendish Society and of the Geological Association; and author, among other works, of *The Student's Manual of Natural Philosophy* (1838), *Rudimentary Mechanics* (1840), *Amusements in Chess* (1845), *The Chess-Player's Annual* (1856), *The Cyclopædia of Useful Arts and Manufactures* (2 vols., in parts, 1852–53; 4th ed., 3 vols., 1867), of a series of small treatises on physical phenomena (1859–61), *Experimental Essays* (1863), *The Rain-Cloud and the Snow-Storm* (1865); and edited, with a memorial of the author, Sir William Snow Harris's *Treatise on Frictional Electricity, in Theory and Practice* (1867).

Tomlinson (Gideon), LL.D., b. at Stratford, Conn., Dec. 31, 1780; graduated at Yale College 1802; became eminent as a lawyer at Fairfield; was a member of Congress 1818–27, governor of Connecticut 1827–31, and U. S. Senator 1831–37. D. at Fairfield Oct. 8, 1854.

Tommase'o (Nicolò), b. at Sebenico, in Dalmatia, in 1802; his education was begun in Dalmatia, but he took his legal degree at the University of Padua. Literary criticism, however, especially attracted him, and on the invitation of Vieussenx he went to Florence, where he became one of the principal writers for the well-known periodical, *L'Antologia*. This journal being suppressed for an article for which Tommaseo, though not the author, generously assumed the responsibility, he was banished and retired to France. Previous to his exile, however, he had published an important work, *Il Dizionario dei Sinonimi* (Florence, 1832). In France he wrote several works on education, besides two novels, *Il Duca d'Atene* and *Fede e Bellezza*. After this he went to Corsica, where he made a collection of popular songs, which were preceded in their publication by a volume of Tuscan songs, and followed by a collection of Greek and Illyrian popular songs. In 1839 he returned to Venice, where he published *Memorie Poetiche*, and his first *Dizionario Estetico*, which is a collection of his best critical articles. Having taken part in the national movements of 1847–48, he was imprisoned with Daniel Manin. Being liberated at the same time by the people of Venice, and the provisory government proclaimed, Manin, as president, invited Tommaseo to take part in it. He accepted the portfolio of instruction, and was soon after sent as minister to Paris. On the fall of the Venetian republic Tommaseo retired to Corfu, but in 1854 returned to Piedmont, where he continued to labor incessantly, though nearly blind, until 1859, when he went back to his old friend Vieussenx in Florence. There he prosecuted his literary work with unabated zeal (being engaged on the largest Italian dictionary yet published, and which is now advanced as far as the letter T) until his death, in 1874. Florence honored him with an imposing funeral.

Tomp'kins, county of Central New York, drained by tributaries of Cayuga Lake, which lies partly in the county and is connected with the Erie Canal, and intersected by several railroads. Surface generally hilly, soil better adapted for grazing than for tillage. There are manufactories of woollens, agricultural implements, carriages, furniture, iron castings, machinery, organs, printing paper, tobacco and cigars, hubs and wagon materials, and railway cars, grist-mills, saw-mills, tanneries, and currying establishments. Cattle, sheep, horses, and swine are numerous. Staples, oats, Indian corn, wheat, barley, buckwheat, potatoes, flax, tobacco, wool, lumber, and dairy products. Cap. Ithaca. Area, 506 sq. m. P. 33,178.

Tompkins, tp., Warren co., Ill. P. 2215.

Tompkins, p.-v. and tp., Jackson co., Mich. P. 1262.

Tompkins, tp., Delaware co., N. Y. P. 4046.

Tompkins (Daniel D.), b. at Scarsdale, Westchester co., N. Y., June 21, 1774; graduated at Columbia College 1795; was admitted to the bar of New York City 1796; was elected to the legislature, and also to the convention for revising the State constitution 1801; was a member of Congress 1804–05; appointed judge of the New York supreme court 1804; was governor of the State 1807–17; was conspicuous as an advocate of "Jeffersonian principles" and an opponent of the banks; commanded the 3d military district during the war of 1812–15, to the success of which he contributed by his energy in calling out troops and equipping them for service, but by his carelessness in keeping accounts was afterward charged with being a defaulter; was chosen Vice-President of the U. S. 1816 on the ticket with Monroe, and re-elected 1820, when he was an aspirant for the Presidential nomination; recommended by a special message of Jan. 28, 1817, the abolition of slavery in New York, which was effected by an act to take effect July 4, 1827; was chancellor of the University of New York; delegate to the State constitutional convention of 1821, and for a time its president. D. on Staten Island June 11, 1825.

Tompkinsville, p.-v., cap. of Monroe co., Ky. P. 218.

Tompkinsville, p.-v., Richmond co., N. Y.

Tomp'son (Benjamin), b. at Braintree, Mass., July 14, 1642, son of Rev. William, minister of that parish; graduated at Harvard 1662; was master of the Boston Public School 1667–70, and afterward of that at Cambridge preparatory to the college for about forty years. D. Apr. 9, 1714, and was buried at Roxbury, where his tombstone commemorates him as the "learned schoolmaster and physician and ye renowned poet of New England." Author of a poem of some length upon King Philip's war, entitled *New England's Crisis*.

Tomsk, government of Siberia, bounded W. by Tobolsk, E. by Yeniseisk, and S. by China, between lat. 49° and 61° N., and between lon. 75° and 90° E. The surface is one vast plain sloping from the Altai Mountains, which occupy the southernmost part. The foot of the mountains is covered with extensive forests of oak, cedar, and pitch trees, and on the adjacent steppes live large droves of wild horses and herds of oxen. Where agriculture is pursued, in the central parts of the government, good crops of rye, barley, oats, hemp, and flax are raised, as the climate generally is mild. The northern part is marshy, and partly covered with sombre forests of fir and pine. The inhabitants live as nomads; hunting and fishing form important occupations. In the southern part an extensive mining business is carried on. Gold-washing is in many places very remunerative, and, being free, it has attracted large multitudes of people. The mineral wealth is very considerable, and an important transit-trade between Russia and China is carried on on the large system of lakes and rivers which the government contains. Of manufacturing establishments there exist several tallow-smelting works, tanneries, breweries, tileworks, and ironworks. Area, 329,027 sq. m. P. 838,756.

Tomsk, town of Siberia, capital of the government of Tomsk, at the Tom, an affluent of the Obi, in lat. 56° 29′ N. It is well built, has many handsome edifices, important foundries, tanneries, soap-factories, and other manufactories, and carries on, besides its transit-trade, an active trade in furs, grain, and cattle. Snow falls in October, and in December quicksilver freezes, but the summer is beautiful and the climate generally healthy. P. 24,431.

Tom's River, p.-v., cap. of Ocean co., N. J., on Southern New Jersey R. R., 56 miles S. of New York City, has 4 churches, a graded school, 1 bank, 1 newspaper, building and loan association, 2 hotels, and Masonic, Odd Fellow, and Sons of Temperance lodges. Principal business, coasting-trade and cranberry-raising. P. about 3100.

George M. Joy, Ed. "New Jersey Courier."

Ton. See Weights and Measures.

Tonawan'da, p.-v. and tp., Erie co., N. Y., at the mouth of Tonawanda Creek, a tributary of Niagara River, on the Erie Canal and Erie and New York Central R. Rs., has manufactures, a private bank, and weekly newspaper. Part of the v. lies in Niagara co. P. of v. 2125; of tp. 3039.

Tonawanda, v., Wheatfield tp., Niagara co., N. Y. P. 687.

Tone [Lat. *tonus*; Fr. *ton*; Ger. *ton*], in music, a word having for its primary meaning a *sound*, or the impression made on the ear by a vibrating string or other sonorous body. The derivative meanings of the term relate to the qualities, relations, or conditions of such sounds, as (1) their place on the scale, a high tone or a low tone; (2) the interval made by two sounds, as a major or a minor tone; (3) any special quality of a sound, as a fine, clear, rich, sweet, or feeble tone. In a more technical sense a tone (or whole tone) means one of the steps of the scale, as C — D, G — A, etc. This is capable of division into two *semi*tones. (See Interval.)

William Staunton.

Tone (Theobald Wolfe), b. in Dublin, Ireland, June 20, 1763; educated at Trinity College, Dublin; studied law in London; was called to the bar at the Middle Temple 1789; wrote a number of pamphlets to expose English misgovernment in Ireland; was an ardent sympathizer with the doctrines of the French revolution; promoted the combination of the Irish Roman Catholics with the Protestant dissenters in opposition to the British government; founded at Belfast the first society of United Irishmen 1791; became secretary and agent of the Roman Catholic committee 1792; was involved in secret negotiations with France, on account

of which he came to the U. S. 1795; resided a few months at Philadelphia and at Princeton, N. J., but sailed for France Jan., 1796; aided the French Directory in fitting out Hoche's projected expedition to Ireland, in which he was appointed brigadier and adjutant general; served in the Bavarian army 1797; was captured in Sept., 1798, on board a French squadron bound for Ireland; was taken to Dublin, tried by court-martial, and sentenced to death, but committed suicide by cutting his throat with a pen-knife Nov. 19, 1798. His *Autobiography* was published by his son, William Theobald Wolfe Tone (Washington, D. C., 1826), who served in the French armies under Napoleon, and subsequently in the army of the U. S.

Toner (Joseph Meredith), M. D., b. in Pittsburg, Pa., Apr. 30, 1825; studied at the Western University and at St. Mary's College; graduated at the Vermont Medical College in 1850, and at the Jefferson Medical College in 1853; began the practice of medicine at Summitville, Pa., and in 1855 took up his residence at Washington, D. C. He is a member and officer of many medical societies and other learned associations; in 1872 founded the Toner lecture to encourage the discovery of new truths in medicine, placing a fund in charge of the Smithsonian Institution, the interest of which is paid for two annual essays on medical science; has contributed largely to medical literature and to medical biography, and devised a system of symbols to indicate geographical localities, which has been adopted by the post-office department. Among his numerous publications are—*Abortion in its Medical and Moral Aspects* (1859), *Maternal Instinct, or Love* (1861), *Compulsory Vaccination* (1865), *History of Inoculation in Massachusetts* (1867), *Necrological Notices of Deceased Surgeons of the Rebellion* (1870), *Natural History, etc. of Yellow Fever in the United States* (1871), *Medical History and Physical Geography of Maryland* (1875), *Biographical Sketch of Dr. J. D. Jackson* (1875), *Medical Men of the Revolution* (1876), and has in preparation a *Dictionary of Deceased American Physicians.*

Tonga Islands. See Friendly Islands.

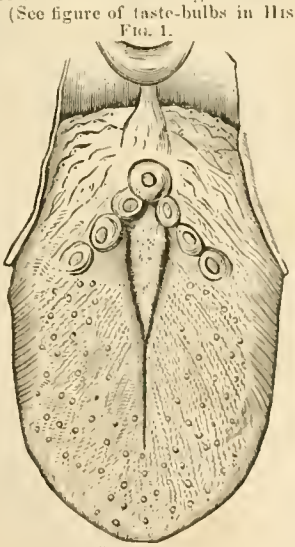
Tongunoxie, p.-v. and tp., Leavenworth co., Kan. P. 1600.

Tongres [Flem. *Tongern*], town of Belgium, province of Limburg, on the Jaar, has breweries, tanneries, and manufactures of tiles and chicory. In its neighborhood is a hot mineral spring, which was well known in ancient times, and is mentioned by Pliny. P. 7080.

Tongue (and Diseases of), the organ of the special sense of taste, situated on the floor of the mouth. This body consists of muscles by which it can be protruded, retracted, and curved upward, downward, and laterally. The base or root of the tongue is attached below to the hyoid bone, and the tip of the tongue, when inactive, rests forward against the inner surface of the lower incisor teeth. The tongue consists of two symmetrical halves, with a fibrous middle septum; hence, one side may be paralyzed and the other active, as in cases of apoplexy. The muscles of the tongue are supplied by the hypocervical motor nerve. The upper surface or dorsum of the tongue is essentially the seat of taste. (See figure of taste-bulbs in Histology.) It is covered by delicate processes or papillæ, which contain the ultimate ramifications of blood-vessels and the terminal fibres of the nerves of sensation and taste. The fore part and sides of the tongue derive their sense of taste from the gustatory branch of the fifth nerve. The base of the tongue and sides and the larger papillæ receive their special sense through the lingual branch of the glossopharyngeal nerve. The facial nerve also has an influence upon taste, paralysis of this nerve impairing the special sense. The papillæ vary in size and length on different parts of the tongue—broad, "circumvallate" near the base, "fungiform" and "filiform" on the anterior part. Food and viands of decided flavor can be definitely tasted and distinguished by a single papilla, as found when applied through cylindrical glass rods. It is claimed that only the circumvallate and fungiform papillæ contribute to the sense of taste, the filiform to sensation. Sensation (tactile) is more acute in the tongue than elsewhere in the body. Thus, Valentine found that distinct perception of two needle points was obtained at the tip of the tongue when the points were separated only .183 of a Paris line, the most sensitive part of the body, the tip of the finger, requiring .723 of a line. The several papillæ are imbedded in the "corium" or body of the mucous membrane, which corresponds to the cutis vera of the skin, and are covered with scaly epithelial cells. The tongue may be inflamed from various causes, as hot drinks and irritants. It is often the seat of aphthæ, ulcers, "cancers," the result of catarrh of the mouth. The "coated tongue" may be in fact due to a relaxed, flaccid, and pale condition of the papillæ, and when noticeably coated has an accumulated stratum of thickened saliva and rapidly exfoliated epithelial cells; the yellow color the result of the fatty metamorphosis which the cast-off cells speedily undergo. When the stomach is inflamed or irritable, the papillæ of the tongue will often appear as distinct points. The tongue is occasionally attacked by epithelial cancer. Ranula is a cystic tumor beneath the tongue, due to occlusion of some one of the salivary ducts. When any part of the tongue is the seat of motor paralysis, loss of sensation or taste, the part so deprived may be experimentally defined, and a study of the nerve-supply of the tongue will point to the part of the brain in which the lesion exists. Exceptionally, in infants the "frænum" or fibrous cord beneath the tongue is too short; the "tongue-tied" infant cannot nurse well, and when older speaks imperfectly: the cure is by cutting.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Fig. 1.



The Tongue.

Fig. 2.

Papillæ of Tongue: loops of vessels and nerves.

Ton'ic, in music, the keynote, root, or prime of a scale.

Ton'ica, p.-v., La Salle co., Ill., on Illinois Central R. R., 100 miles S. W. of Chicago, has 3 churches, a large graded school, 1 bank, 2 newspapers, and a large mill. P. about 700. Alfred Heath, Ed. "Local."

Ton'ics, in medicine, a term used to refer generically to the various means employed by the physician to remove the condition of *debility*, general or special. Nourishing food, fresh air and exercise, cold bathing, etc., are thus spoken of as having a tonic effect. Among drugs, such as directly improve nutrition, or indirectly accomplish the same end by exciting the appetite and increasing digestive power, are called "tonics." The most prominent examples of the former are *iron*, which in anæmia directly stimulates the manufacture of the red blood-corpuscles; *cod-liver oil*, which operates as a fatty food of unusually easy assimilation; *phosphorus*, which in some cases of nervous exhaustion or functional nervous derangements seems to improve the nutrition of the nerve-structures; and preparations of some of the higher *metals*, as silver, zinc, mercury, arsenic, which in peculiar conditions of malnutrition tend in some unknown way to determine the nutritive processes back into the healthy channels. Of the drugs which are "tonic" by improving digestive power, the most serviceable are vegetable bitters, as cinchona and its alkaloids, gentian, columbo, quassia, nux vomica, etc.; aromatics and spices; acids, both mineral and organic; and weak alcoholic beverages in very moderate quantity. But the list might be greatly extended, for it is a general property of irritants that, taken internally in small doses, their irritation tends to increase the activity of the digestive organs and the secretion of the digestive fluids. Edward Curtis.

Tonkin', or **Tonquin,** the northernmost province of the kingdom of Anam, opened to foreign commerce by the

French treaty of Aug. 31, 1874, extends on the western coast of Farther India, between lat. 20° and 23° N., along the Gulf of Tonkin, and is traversed by the river Songka, which enters it from the Chinese province of Yun-Nan, and is navigable up to the Chinese frontier. At its mouth is situated the principal port, Hai-Phong, in lat. 20° 53′ N., lon. 106° 45′ E.; on its middle course the capital, Hanoi. Hai-Phong can be reached by vessels drawing 20 feet, Hanoi only by vessels drawing from 4 to 6 feet. Three small river-steamers belonging to a Hong-Kong firm ply on the stream. The climate is comparatively healthy. Europeans spend several years here without experiencing any serious influence on their health. The range of temperature is similar to that of Hong-Kong. The soil is very fertile, and specially adapted to the cultivation of rice, which yields two crops a year. The production of silk and the cultivation of cotton are also important. The country is rich in metals; 14 gold, 7 silver, 3 copper, 1 zinc, 17 iron, and 3 salt mines are in operation: coal deposits are found in the neighborhood of the coast. Commerce, however, will not be able to draw any great advantage from the above treaty until Tonkin becomes the road to Yun-Nan with its immense wealth of metals. The inhabitants are very poor; moreover, they are suspicious and avaricious; direct business with them is impossible. Chinese middlemen are indispensable, and the government does not favor foreigners. E. SCHLAGINTWEIT.

Tonneins′, town of France, government of Lot-et-Garonne, on the Garonne, manufactures sailcloth, cordage, leather, tobacco, and trades in hemp and plums. P. 7947.

Ton′qua Bean, the seed of a noble leguminous tree of South America, the *Dipterix* (or *Coumarouna*) *odorata*. It abounds in the fragrant principle coumarine; is used in scenting snuff and tobacco, and in perfumery. It is also employed to keep moths from woollens. In medicine, it relieves the paroxysm of whooping cough.

Tonquin. See TONKIN.

Tonquin′, Gulf of, an inlet of the China Sea, bounded S. and W. by Cochin-China, N. by China, and E. by the island of Hainan. Its fisheries are very rich and very important.

Tonsilitis. See QUINSY.

Tonsils. See HISTOLOGY, by COL. J. J. WOODWARD, M. D.

Ton′son (JACOB), b. at Holboro, London, England, in 1656; was apprenticed to a bookseller; set up business for himself as a stationer in Chancery Lane, near Fleet street, about 1677; soon published some of Otway's and Tate's plays and Dryden's *Troilus and Cressida* (1678); was thenceforth the regular publisher of the writings of Dryden, who edited for him the famous *Miscellanies*; brought out the first good edition of Milton's poems and the first complete octavo edition of Shakspeare; brought out in 1703 a *Cæsar*, admitted to be the handsomest specimen of English typography to that date; established his shop at Gray's Inn Gate 1697, and at the Shakspeare Head in the Strand 1712; had a warehouse in the Savoy and a printing-office in Bow street; was printer to the excise, publisher to most of the fashionable authors of the day, and stood at the head of his trade; was secretary to, and one of the founders of, the famous "Kit-Cat Club," for whose use he built a room at his fine villa at Barn Elms on the Thames, which became a place of assembly for the wits. He retired from business in 1720, and devoted himself to the management of an agricultural estate. D. Mar. 18, 1736. His collection of portraits of the members of the Kit-Cat Club, by Sir Godfrey Kneller, is still kept intact by his present heir at Bayfordbury Park, Hertfordshire.

Ton′sure [Lat. *tonsura*, a "shaving"], in the Roman Catholic and Oriental churches, the shaving of the beard and of a portion of the hair from the head of an ecclesiastic. In the Roman Catholic Church the size of the tonsure is not uniform, but its place is at present upon the crown of the head. This is the tonsure of St. Peter. In the ancient Irish and British churches the tonsure of St. James formerly prevailed, in which the front part of the head was shaved as far back as a line passing over the top of the head from ear to ear. The Eastern churches anciently shaved the whole head. In former times the controversies with regard to these forms of the tonsure were very bitter. The tonsure is one of the preparations for orders, and it is regarded as symbolizing the crown of thorns worn during our Lord's Passion.

Tontine. See LIFE ASSURANCE, by J. H. VAN AMRINGE.

Tontog′any, p.-v., Wood co., O.

Tonty, de (HENRY), CHEVALIER, son of Lorenzo Tonti, b. about 1650; entered the French army as a cadet; served also in the navy; accompanied La Salle to Canada 1678 and in his exploration of the Mississippi; was left in command of a fort near Peoria 1680; made an unsuccessful attempt to found a settlement in Arkansas; took part in an expedition of the Western Indians against the Senecas 1685; twice descended the Mississippi to its mouth in search of La Salle, and a third time to meet Iberville; remained in that region, and d. at Fort Louis (now Mobile) in Sept., 1704. He contributed to Margry's *Relations et Mémoires* an *Account of La Salle's Last Expedition*, of which an English translation appeared in London 1698; was republished at New York 1814, and is included in vol. i. of Benjamin F. French's *Historical Collections of Louisiana and Florida* (1846).

Tooe′le, county of W. Utah, bordering on Nevada and bounded N. E. by the Great Salt Lake. A great portion of it is a barren desert, although there is in the E. part some arable and grazing land, and mines of gold, silver, copper, and lead. In the W. part are fertile valleys and several mining-districts. Cap. Tooele. Area, 8320 sq. m. P. 2177.

Tooele, p.-v., cap. of Tooele co., Ut.

Tooke (JOHN HORNE), b. at Westminster, England, June 25, 1736, son of John Horne, a wealthy poulterer; educated at Westminster and Eton schools; graduated at St. John's College, Cambridge, 1758; became usher in a school at Blackheath, Kent; took orders in the Church of England at his father's desire, but much against his own wishes; became incumbent of a chapel at New Brentford 1760; visited France as tutor to a son of Elwes, the famous miser; began his political career in 1765 by writing a defence of Wilkes, entitled *The Petition of an Englishman*; became intimate with Wilkes, whose election to Parliament he strongly advocated, and aided him in founding the Society for Supporting the Bill of Rights 1769, but soon afterward had a bitter quarrel with him; was in consequence denounced in the *Junius* letters, and defended himself with vigor 1771; resigned his living and resumed the study of the law at the Middle Temple 1773; started a subscription for the widows and orphans of the Americans "murdered by the king's troops at Lexington and Concord 1775," for which he was prosecuted by the ministry for libel July, 1777; conducted his own defence; was found guilty of libel, sentenced to a year's imprisonment and a fine of £200; wrote while in prison a *Letter to John Dunning, Esq.* (1778), in which he examined the legal aspects of his trial, and incidentally started upon a grammatical disquisition on the irregularities of the English language; was refused admission to the bar 1779 on the ground of being a clergyman; assumed his additional name in 1782 out of regard to Mr. Tooke of Purley, who made him his heir; published his chief work, ΕΠΕΑ ΠΤΕΡΟΕΝΤΑ, or *The Diversions of Purley* (1786, vol. ii., 1805), an ingenious treatise on etymology which occasioned much controversy, and has been widely read; wrote several political pamphlets, including letters on parliamentary reform to Lord Ashburton (1782) and Dr. Richard Price (1794); was an unsuccessful candidate for Parliament at Westminster 1790 and 1796; was an active member of the Society of Correspondence formed by the admirers of the French revolution, on which account he was committed to the Tower, tried for high treason 1794, but acquitted, being defended by Gibbs and Erskine; obtained a seat in Parliament for Old Sarum 1801, and passed his later years in affluence at Wimbledon, where he d. Mar. 18, 1812. He was never married, but had several natural children, to one of whom he left his large estate. (See his *Memoirs*, by Alexander Stephens, 2 vols., 1813.)

Tooke (THOMAS), son of William, b. at St. Petersburg, Russia, in 1774; was for more than forty years successfully engaged in the Russian trade; was a pioneer of free-trade doctrines. Author of numerous writings on the currency, the corn laws, finance, and banking, including a valuable *History of Prices and of the State of the Paper Circulation from 1798 to 1856, etc.* (6 vols., 1838–56); wrote the famous "Merchants' Petition" for free trade in 1820; was the founder of the Political Economy Club (1831), and the promoter of many public enterprises connected with industrial and philanthropic reforms. D. in London Feb. 26, 1858. After his death, his admirers raised a subscription with which they endowed in King's College, London, a "Tooke professorship" of economic science and statistics.

Tooke (WILLIAM), b. at Islington, London, England, Jan. 18, 1744; originally a printer, was ordained in the Church of England 1771; became soon afterward minister of the English church at Cronstadt, Russia, and was chaplain to the factory of the Russia Company at St. Petersburg 1774–92. D. in London Nov. 17, 1820. Author of *Russia, or A Complete Historical Account of all the Nations which compose the Russian Empire* (4 vols., 1780–83), *Life of Catharine II., Empress of Russia* (3 vols., 1797), *A View*

of the Russian Empire during the Reign of Catharine II. (3 vols., 1799), *A History of Russia A. D. 862–1762* (2 vols., 1800), *Varieties of Literature* (London, 1795, 2 vols. 8vo), *Extracts from Foreign Literary Journals and Original MSS.* (London, 1796, 2 vols. 8vo), of several volumes of sermons, novels, and translations, among which was *The Works of Lucian*, from the German translation by Wieland (2 vols. 4to, 1820), and editor of vols. i.–v. of the *General Biographical Dictionary* (1798). His younger son, WILLIAM, b. at St. Petersburg in 1777, was a London solicitor, a Liberal member of Parliament 1835–37, and one of the founders and long the treasurer of the Society for the Diffusion of Useful Knowledge. D. in London Sept. 20, 1863. He edited the *Works* of Charles Churchill (2 vols., 1804), and wrote *The Monarchy of France* (1855).

Too'la, or Tula, government of Central Russia, bordering N. on the government of Moscow, comprises an area of 11,875 sq. m., with 1,154,292 inhabitants. The surface is level or slightly undulating, the climate temperate, and the soil fertile. One-sixth of the surface is covered with forest; around the capital are extensive iron and coal mines; the rest is under tillage. Corn, hemp, flax, mustard, turnips, potatoes, tobacco, and hops are raised; sheep, cattle, and horses are reared. Breweries, distilleries, and manufactures of ironware are numerous.

Toola, or **Tula,** town of European Russia, capital of the government of Toola, on the Oopa, is well built and has a fine cathedral, 28 other churches, a theatre, several museums, several technical schools, and other educational institutions. Its manufactures of hats, silks, leather, platina-ware, jewelry, and ironware are very important. Locks, tea-urns, cutlery, bells, muskets, pistols, sword-blades, etc. are made to perfection in large quantities. The imperial manufactory of arms employs 7000 men, 9600 women, besides 3500 hands in subsidiary occupations. P. 58,150.

Toombs (ROBERT), b. in Wilkes co., Ga., July 2, 1810. His father died when he was young, leaving a good estate. His mother looked carefully to his education, which was obtained partly at the University of Georgia, which was then under the presidency of the distinguished educator, Moses Waddell, D. D.; and partly at Union College, Schenectady, N. Y., then under the presidency of the famous Eliphalet Nott; at this institution he graduated in 1828; in 1829 he took a course of law-lectures at the University of Virginia. In every department of study he was regarded as an intellectual prodigy. In 1830, before his majority, he was admitted to the bar by special act of the legislature, and opened an office at the town of Washington in his native county, where he has continued to reside ever since (1876). Few men ever rose more rapidly in his profession than he did. William H. Crawford, Georgia's great statesman, who was then on the bench of the northern circuit, saw in the young barrister genius of no ordinary character, and often expressed the opinion that high fame awaited him. When the war with the Creek Indians broke out in Alabama in 1836, Toombs raised a company of volunteers, and led them, as captain, to the field, serving under Gen. Scott until the close of the conflict. In 1837–40 and 1842–43 he was a member of the State legislature, where from the beginning he took a most conspicuous position. He was brought up in the Jeffersonian school of politics, to which creed he has ever adhered. In 1844 he was elected a member of Congress. He then belonged to a class known as Southern Whigs, and as such supported Harrison for the Presidency in 1840, and Clay in 1844. His début in the House of Representatives was on the Oregon question, and his first speech placed him in the front rank of the debaters, orators, and statesmen of that body. He remained a member of the House until Mar., 1853, when he took a seat in the Senate. While a member of the House the most conspicuous part he acted was on the adjustment measures of 1850, and no one, not even Mr. Douglas or Mr. Clay, contributed more to the passage of those measures than he did. In the Senate he had no superior in debate. He was re-elected to that body in 1859, and continued to hold his seat in it until Georgia passed her ordinance of secession in 1861. He then resigned, and took his seat in the State secession convention, where he also acted a conspicuous part, and was chosen a delegate to the Confederate Congress at Montgomery. In that body, as in all other assemblages of which he was a member, he stood amongst the ablest and most eloquent. He was the Mirabeau of that Congress, and but for a misunderstanding, without time for an explanation, he would most probably have been chosen President of the Confederacy. After the election of Mr. Davis to that office, the secretaryship of state was tendered by him to Mr. Toombs. This Mr. Toombs at first positively declined to accept, but on the earnest entreaty of friends reconsidered so far as to agree to hold it for a short time; and accordingly in July resigned it, and took a commission as brigadier general in the army. He greatly distinguished himself at the second Manassas and Sharpsburg battles. For causes which space will not allow to state, he resigned his commission and returned to Georgia, where he was made a brigadier general of the State militia upon the invasion of the State by Sherman in 1864. After the close of the war, he left the country, spending his time in Cuba, France, and England, remaining abroad until after the restoration of the privilege of the writ of *habeas corpus* in 1867. He then returned home and resumed the practice of law, which he has pursued with great success ever since. His fees some years have been reported as high as $50,000. As a talker he has ever been entertaining, instructive, and brilliant. The reconstruction measures of Congress he denounced in the beginning, and still continues to denounce, with all the force and power of language he can command. ALEXANDER H. STEPHENS.

Toomes's Grant; tp., Tehama co., Cal. P. 40.

Tooms'borough, p.-v., Wilkinson co., Ga., has a weekly newspaper.

Toon, the *Cedrela Toona*, a large timber tree of India, belonging to the order Cedrelaceæ. It is found throughout a wide area in Asia, and its wood, though soft, is very useful. The bark is a strong astringent.

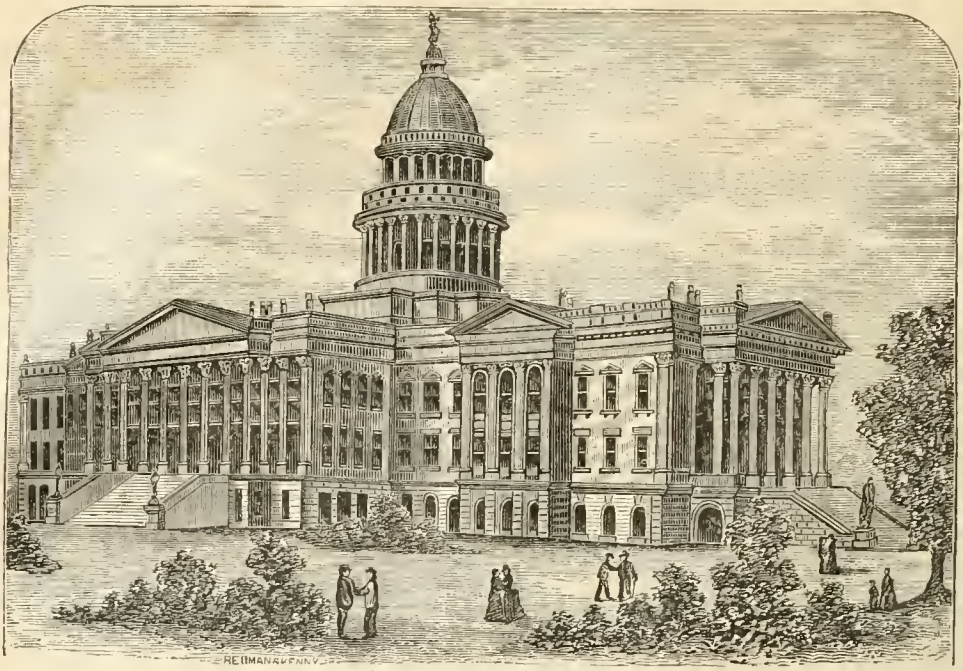
Toorkistan. See TURKESTAN.

Toothache Tree. See PRICKLY ASH.

To'paz, a gem, which is not the τοπάζιον of Pliny, the latter being described as "opaque and green, and probably some variety of agate or jasper." It was named from its locality, an island in the Red Sea. The *chrysolite* of Pliny and later writers, according to Dana, included our topaz. The mineral species *topaz* is orthorhombic in crystallization, with a fine basal cleavage which causes it to split into lustrous plates—a feature which will always serve to distinguish a white transparent topaz from the diamond. Its hardness is 8, lying between quartz and sapphire. The diamond will therefore scratch it very easily. It contains silica, alumina, and fluorine, but the proportions are as yet uncertain, the best analyses giving an excess of 5, or even 7, per cent.—which is undoubtedly oxygen taken up during the analysis in the conversion into oxide—of silicon which exists in the mineral as fluoride. As there is no method known as yet of determining the amount of fluorine directly, the constitution of this mineral remains, strange to say, even at this late day, largely a matter of conjecture. The hypothesis which is adopted by Dana makes it $(Al_2O_3)_2.SiO_2.SiF_2$, which requires SiO_2 16.2 per cent., SiF_2 28.1 per cent., and Al_2O_3 55.7 per cent. (See also PRECIOUS STONES.) HENRY WURTZ.

Tope, the English name of the *Galeorhinus galeus* (or *Galeus canis*), a shark common in the British seas, and widely distributed elsewhere, but not found in the American waters. It belongs to the family Galeorhinidæ, and is distinguished by the following combination of characters: the teeth are nearly alike in both jaws, oblique, and notched and serrated ($\frac{34}{34}$ in number); the first dorsal is opposite the space between the pectorals and ventrals; the caudal fin has a single notch, and there are no median pits at its base; the color is the usual slate-gray above and lighter beneath. It attains a length of about six feet. It does not differ in habits or economy in nature from the common sharks of the American coast. THEODORE GILL.

Tope'ka, city and tp., capital of the State of Kansas and county-seat of Shawnee co., on Kansas River, 68 miles W. of the State line between Missouri and Kansas. Kansas Pacific and Atchison Topeka and Santa Fé R. Rs. intersect at this place. The location of the city is high and commanding, and some of the most charming prairie landscape-scenery in the West is observable in all directions. The legislature, supreme court, and the U. S. circuit and district courts hold sessions here. A site for a government court-house and post-office has been purchased, which will be improved as soon as the requisite appropriation is made by Congress. The city is supplied with excellent public schools, and also possesses several collegiate institutions. The College of the Sisters of Bethany, for the education of girls, is under the auspices of the Protestant Episcopal Church. The college edifice cost $80,000, and is the most complete and thorough educational institution for young ladies W. of the Alleghany Mountains. Washburn College is a Congregational institution, and is situated on 160 acres of land adjoining the city. The edifice cost $65,000, and the endowment fund is $45,000, which will soon be $100,000. The Seminary of the Assumption is a Roman Catholic school for boys and girls. The general offices and principal machine-shops of the Atchison Topeka and Santa Fé R. R. Co. are established at Topeka. A rolling-mill for the manufacture of rails is in operation here. It cost $125,000, and gives employment to 150 men.



State Capitol, Topeka, Kan.

Within 2 miles of the city one of the cottages for a State insane asylum is building; the institution when completed will cost $500,000. There are 3 daily newspapers (all of which issue weekly editions), 2 weekly, and 1 monthly. P. of city, 5790; of tp., exclusive of city, 1079.
F. P. BAKER, ED. "DAILY COMMONWEALTH."

Töpf'fer (RUDOLPHE), b. at Geneva Feb. 17, 1799; studied first painting, afterward literature and philosophy, and was appointed professor of æsthetics at the academy of his native city, where he d. June 8, 1846. In 1839 his novel, *Le Presbytère* (translated into English in 1848 under the title *The Parsonage*), attracted great attention in France and Germany; also his other novels, *La Bibliothèque de mon Oncle*, *Rose et Gertrude*, and *Nouvelles Génevoises*, were much appreciated, as well as his sketches and illustrations, *Voyage en Zigzag* and *Collection des Histoires en Estampes*.

Tophet. See GEHENNA.

Top'knot, a name given in England, or at least in English books, to flat fishes (Pleuronectidæ) of the genera *Zenogopterus* and *Scophthalmus* (or *Phrynorhombus*). These do not agree in special characters, although they resemble each other in physiognomy, the wide (high) oval body, ciliated scales, sinistral and fringed eyes, narrow interorbital ridge, and long based ventrals.

Toplady (AUGUSTUS MONTAGUE), b. at Farnham, Surrey, England, Nov. 4, 1740; was educated at Trinity College, Dublin; preached at Leicester Square chapel, London, from 1775 to his death, Aug. 11, 1778. He was editor of the *Gospel Magazine* and author of many beautiful hymns.

Töp'litz, or **Teplitz,** town of Bohemia, near its north-western frontier, is beautifully situated in a valley of the Erzgebirge, and is one of the most celebrated watering-places in Europe. It has eleven hot alkalo-saline springs, whose waters are considered very effective in many diseases, and which are generally used by 10,000 persons each season. P. 6854.

Top, Motion of the. See GYROSCOPE, by GEN. J. G. BARNARD, A. M., LL.D.

Topog'raphy [Gr. τόπος, "place," and γράφειν, to "write"]. Topography and hydrographic topography, as the subject is sometimes divided, come in general terms under the head of surveying, but their object is more limited than the aim of geodesy, being only to determine the relative positions of points of the earth that can be referred without error to a tangent plane, and therefore independent of the sphericity of the globe. The operations of a topographical survey, consequently, are two—namely, to first project a system of points upon such a tangent plane, and, secondly, to find the distances of the same above or below the plane; or, in other words, measure the lengths of the projecting normals. The first process is ordinary surveying—the second, levelling. If the tangent plane be assumed at the centre of the country to be embraced in the survey, it will result that for a surface extent even of one degree the errors will be less than in the ratio of $\frac{3}{100000}$ths, and may be considered inappreciable.

The problems of topography are such as the following: To find the distances of inaccessible points; to prolong right lines; to draw parallels to inaccessible lines; to bisect the angles of inaccessible lines; to find the radii of inaccessible curves; to lay out curves; and, in hydrographic topography, to determine on the map the position of an unknown point from which three known points have been observed, and to establish a base at sea. In the operations of hydrographic topography the surveying is done with a sextant or a compass, and the levelling by the methods of sounding. A topographical survey having been made on water by these means, or on land by aid of transit and level, or more roughly and rapidly by the plane-table and telcometer, the results are embodied in a plat of the work, on which the horizontal and vertical distances are quoted in some manner, either by a scale or written numbers; and finally the plat may be transformed into a topographical map in some of the styles adopted for that kind of finish. The object of topographical drawing is to perfect a map by shading, grading, and delineating the form and features of a surface in such a manner that it presents a picture somewhat similar to a vertical view of the country. Certain of the signs used are purely conventional; others aim to represent the appearances of nature as in a landscape, at least in horizontal projection, and therefore in topographical drawing there is field for taste as well as precision. These maps are finished either with pen and india-ink, or with brush and color. In pen topography the form of every actual outline, as of rivers, coasts at high and low tide, shoals, reefs, roads, farms, and buildings, is inked, as is usual in plats of farm-surveying, and the shading and grading are done, by consent of all draftsmen, as follows: Mountains are graded either by a series of enveloping lines close together, representing horizontal sections, which suffice best to suggest a precise idea of their form, particularly if the quotations of the horizontal lines are given on them, or else by lines of greatest declivity, which are supposed always perpendicular to the horizontal lines, whether these last are drawn or not. The steepest parts of declivities are made darkest; and this rule asserts itself necessarily in case the shading is applied in the first manner, and also to a degree in the last. Rivers, bays, etc., are shaded by lines parallel to the banks or shores, these lines diminishing in thickness and increasing in separation as they recede from the water-line. Forests, marshes, sands, meadows, and other features, whether natural or artificial, are represented by conventional signs, which for a rule are made to resemble what they stand for—sands by dots, meadows by tufts of grass, forests by a plunging view of tree-masses. In colored topography mountains are graded with sepia, darkest at top or on the

greatest declivities; water is shaded with graded tints of indigo, darkest at the shore-line; and the rest approximates closely to an actual sketch of landscape. This last method, being rapid, intelligible, and picturesque, is decidedly the best for elegant topographical maps not intended for engraving or photographing. F. L. VINTON.

Topol'ya, town of Austria, Servian waywodeship, has 7516 inhabitants, mostly engaged in wine-cultivation and rearing of cattle and sheep.

Tops'field, p.-v. and tp., Essex co., Mass., is the seat of an academy. P. 1213.

Tops'ham, p.-v. and tp., Sagadahoc co., Me., on Androscoggin River and on Maine Central R. R., has considerable shipbuilding. P. 1198.

Topsham, p.-v. and tp., Orange co., Vt. P. 1418.

Top-Shell, a collector's name for species of shells of the family Turbinidæ.

To'querville, p.-v., cap. of Kane co., Ut.

Tor'bay, a fishing-town of Newfoundland, 7 miles N. of St. John's. The anchorage is poor. P. 1270.

Torbert (ALFRED T. A.), b. in Delaware July, 1833; graduated at the U. S. Military Academy July 1, 1855, when appointed brevet second lieutenant of infantry; second lieutenant 5th Infantry July 19; served on frontier duty in Texas and Florida 1856–57, on Utah expedition 1857–60. In the civil war he was engaged, Apr.–Sept., 1861, in mustering New Jersey volunteers into service, and Sept. 16 was appointed colonel of the 1st regiment, which he led in the Virginia Peninsular campaign of 1862 at Yorktown, West Point, Gaines's Mill, and Charles City Cross-roads; assigned to command of a brigade in the 6th corps Aug. 28, 1862, and engaged in the second battle of Bull Run, at South Mountain (wounded), and Antietam. Promoted to be brigadier-general of volunteers Nov. 29, 1862, he was on sick leave until June, 1863, when again in command of brigade in 6th corps, and engaged in the battle of Gettysburg, July 2–3, and subsequent operations of that corps during the winter of 1863–64. In the Richmond campaign of 1864 he commanded the cavalry remaining with Gen. Grant's army during Gen. Sheridan's raid on Richmond, and 1st division on the latter's return May 25, being engaged in the frequent actions from May 15 to Aug., 1864, including battles of Hawes's Shop and Cold Harbor. Chief of cavalry of the middle military division, and engaged in all the operations in the Shenandoah campaign, Aug., 1864–Jan., 1865, and frequently in command. In command of the Army of the Shenandoah Apr.–July, 1865, and of various districts in Virginia till mustered out of the volunteer service, Jan. 15, 1866. Brevet major for gallantry at Gettysburg, lieutenant-colonel for Hawes's Shop, colonel for Winchester, brigadier-general for Cedar Creek, and major-general for gallant and meritorious services during the war. Resigned his commission of captain 5th Infantry Oct. 31, 1866; was consul-general to Havana 1871, and U. S. consul-general at Paris since 1874.

Torch Lake, p.-v. and tp., Antrim co., Mich. P. 269.

Torch'-Wood, the *Amyris floridana*, a small tree or shrub of South Florida, having shining leaves, clusters of yellowish-white flowers, and a resinous juice. It belongs to the order Burseraceæ.

Tor'denskjold, p.-v. and tp., Otter Tail co., Minn. P. 140.

Tore'ño (JOSÉ MARIA **Queipo de Llano**), COUNT OF, b. at Oviedo, Spain, Nov. 26, 1786; took an active part in promoting the uprising of Spain against Napoleon, 1808; was sent to England to negotiate for assistance; was a prominent member of the Cortes at the restoration of Ferdinand VII., but, like most of his companions of liberal opinions, was soon driven into exile; was recalled to Spain by the revolution of 1820; again went into exile on the triumph of absolutism 1823; returned to Spain after the death of Ferdinand 1832; became minister of finance under the regency 1834, minister of foreign affairs and president of the council 1835; was again an exile 1836–37, and once more after the revolution of Barcelona. D. at Paris Sept. 16, 1843. Author of the standard work on the Spanish war of independence, *Historia del Levantamiento, Guerra y Revolucion de España* (Madrid, 5 vols., 1835–37).

Torfæ'us (the Latin name of THORMODR TORFASON), b. at Engö, Iceland, May 27, 1636; studied at the University of Copenhagen; was sent by Frederick III. to Iceland in 1662 to collect manuscripts of the sagas; made royal antiquary in 1667 and royal historiographer in 1687. D. in Karmö, near Stavanger, Norway, in 1719. He was the first to apply the Icelandic literature to the study of Scandinavian antiquities and history, and his writings, of which the most remarkable are *Historia Vinlandiæ antiquæ* (1705), *Groenlandia antiqua* (1706), *Historia Rerum Norvegicarum* (4 vols., 1711), are still of interest.

Tor'gau, town of Prussia, province of Saxony, on the Elbe, is strongly fortified, and contains barracks, hospitals, magazines, and other military establishments; also manufactures woollen and linen fabrics and hosiery. P. 10,867.

Tornadoes. See STORMS, by PROF. A. GUYOT, PH. D., LL.D.

Tor'neå, river of Northern Europe, forming the boundary between Sweden and Russia, rises in Lake Torneå in Sweden, flows southward, and enters the head of the Gulf of Bothnia after a course of 230 miles. It is rapid, and celebrated for its beautiful cataracts and salmon fisheries.

To'ro, town of Spain, province of Zamora, on the Duero, is enclosed by walls, has 21 churches and 11 monasteries, and was in the Middle Ages a flourishing and large city; it is now rapidly decaying. P. 8430.

Török-Sz-Miklos, town of Hungary, on the Theiss, has valuable fisheries, and rears numerous horses, cattle, sheep, swine, and poultry. P. 10,437.

Toron'to, city of the Dominion of Canada, capital of the province of Ontario, is in lat. 43° 39′ N., lon. 79° 21′ W., on the northern shore of Lake Ontario, on a bay formed by an island, 3 miles long, 2 miles wide, at a distance of 333 miles from Montreal, 513 miles from Quebec, 500 miles from New York, and 593 miles from Boston. The bay forms a spacious and well-sheltered harbor, and the Grand Trunk, Great Western, Northern, Toronto Grey and Bruce, and Toronto and Nipissing railway lines connect the city with all the principal points of the provinces of Ontario and Quebec and with the U. S. The site on which the city stands was selected in 1791 by Gov. Simcoe, and the place bore the name of York up to 1834, when it was incorporated as a city. It was the capital of Upper Canada till 1841; the seat of the united government, alternately with Quebec, between 1849 and 1858; and the capital of the province of Ontario since 1867. It had 44,821 inhabitants in 1861; 56,092 in 1871. The city is finely laid out, the streets crossing each other at right angles, generally well built, and containing several fine parks and many handsome public buildings, of which the most remarkable are—the university, completed in 1859; the cathedral of St. James, commenced in 1852, with a spire 316 feet high; the cathedral of St. Michael; the city hall, the opera-house, the post-office, the Osgood Hall, etc. There are 78 churches, numerous schools and educational institutions of various grades, besides the university and University College—a normal school, a college of technology, St. Michael's College; 4 daily, 17 weekly, 4 bi-monthly, 11 monthly, and 1 quarterly paper, etc.; and many benevolent institutions—the asylum for the insane, capable of accommodating 700 patients, the city hospital, 2 houses for unprotected children, an orphan asylum (Protestant), and a house of providence (Roman Catholic), etc. The commerce and manufacturing industry of the city are considerable. Foundries, mills, tanneries, breweries, boot and shoe stores, car-shops, furniture-factories, are in operation. For the year 1871 the value of the manufactures of the city was estimated at $13,686,093. For the year ending June 30, 1874, the value of imports amounted to $14,716,824, and the custom revenues collected to $1,967,997. For the year ending June 30, 1875, the value of imports amounted to $14,436,091, and the custom revenues collected to $1,293,644. The official returns of exports are imperfect, but give a value of about $2,000,000. The city has 5 banks, besides branch offices of 5 Quebec and Montreal banks.

Toron'to, p.-v. and tp., Woodson co., Kan. P. 310.

To'ropetz, town of Russia, government of Pskow, on the Toropa at its influx into Lake Solomino. It has many educational institutions and some manufactures. P. 5248.

Torpedin'idæ [from *Torpedo*, the ancient name of a species], a family of selachians of the order Raiæ, famous for their electrical apparatus, by means of which they are capable of giving quite severe shocks, and species have on this account been also named "cramp-fish," "cramp-ray," "numb-fish," etc. The disk formed by the union of the body and pectoral fins is broad, and more or less inclined to roundish, squarish, or pyriform, and the tail is very fleshy and considerably like that of a shark; the skin is quite smooth and naked; the head is not produced into a snout, but is bluntly rounded, or even emarginated in front; the anterior nasal valves are confluent in a single five-margined (behind) quadrangular lobe; the mouth is small or moderate; the teeth pointed or flat; dorsal fins mostly two (in typical forms), but sometimes only one, and sometimes wanting; caudal well developed, terminal, and more or less triangular; ventrals behind the disk, and free from or united with the disk. The most noteworthy additional character is the electrical apparatus, which is situ-

ated between the head (eyes and spiracles) and the inner concealed bases of the pectorals; this is composed of numerous approximated hexagonal columns, at right angles to the surfaces of the body, and with their ends often visible through the skin above and below, occupying as the apparatus does the entire depth between the upper and under surfaces of the body; these batteries are provided with nerves from the "eighth pair." The shock transmitted from the fish is co-ordinated with a depression of the convexity of the upper surface, and immediately after it has been given the normal form is resumed: the shock is quite subject to the volition of the animal. It is used probably for offensive as well as defensive purposes. In ancient days the animal was impressed into use for medicinal purposes, and was the original electro-therapeutic medium. Its application as a remedial agent has been mentioned in connection with Dioscorides, a physician of Antony and Cleopatra. Representatives of the family are quite generally distributed throughout the warm and temperate seas of the globe. About twenty species are known, which indicate several quite essential modifications of structure. These are (1) Torpedininæ, with the genus *Torpedo* (10 species); (2) Narcininæ, with the genera *Discopyge* (1 species), *Narcine* (5 species), *Astrape* (2 species), and *Temera* (1 species); and (3) Hypninæ, with the genus *Hypnos* (1 species). The genus *Torpedo* is the only one represented by species in the northern Atlantic, and of this three are in the European seas, and one (*Torpedo occidentalis*) along the eastern coast of the U. S.; the other genera are chiefly represented in the Pacific and confluent oceans and the South Atlantic. The literature relating to the family, and especially the anatomy and physiology of the electrical organs, is very voluminous. Among the most notable are memoirs by C. Matteucci (1836–65), R. Wagner (1847), A. Ecker (1848), Marey (*Détermination de la Durée de la Décharge électrique chez de Torpille*, in *Comptes Rendus*, 1871, and *Mémoire sur la Torpille*, in *Journ. Anat. et Phys.*, 1872, pp. 468–499), and M. Beicheuheim (*Beiträge zur Kenntniss des electrischen Centralorgans von Torpedo*, in *Arch. Anat. Phys.*, 1873, pp. 751–759, pls. 15–16). THEODORE GILL.

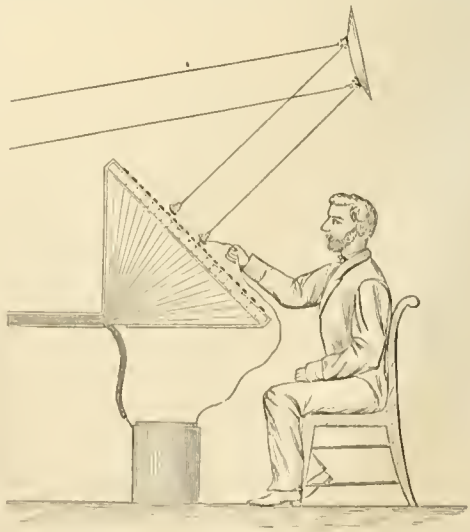
Torpedo. See TORPEDINIDÆ.

Torpe'do [Lat.], the modern name given by Robert Fulton to a submerged military mine designed to destroy hostile shipping. The germ of the idea is found in the Greek fire of the ancients, from which the torpedo of to-day has been naturally developed by reason of the introduction of gunpowder into warfare.

Historical Notes.—The earliest "infernal machine" on record dates from the siege of Antwerp in 1585, where an Italian engineer, Zambelli, destroyed an important bridge laid by the enemy over the Scheldt by setting adrift against it four scows, each carrying a masonry mine heavily charged with gunpowder. Ignition was to be effected either by a slow match, or by a gun-lock discharged by clockwork after the lapse of a certain time. One of these floating mines exploded against the bridge with tremendous effect, and thus stimulated investigation in a new field of warfare. Other similar attempts were made during the next two centuries by the French, English, and Russians, but, like the fiasco before Fort Fisher in our late war, they usually proved to be failures. The condition now regarded as essential in attacks directed against shipping, that the charge shall be submerged, was totally ignored. To an American engineer officer of the Revolution, Capt. David Bushnell, the credit is due not only of experimentally developing this principle, but also of devising a submarine boat, by which the first attempt to apply it to the destruction of an enemy was ever made. Capt. Bushnell was born at Saybrook, Conn., in 1742, and died in 1826. He was a graduate of Yale College (1775), and by his fertility of invention and persevering efforts to perfect the new weapon he has justly won the right to be considered the originator of submarine mining as practised at the present day. His first practical trial was made in 1776, use being made of his submarine boat, navigated by Sergeant Ezra Lee. The attack was directed against the Eagle, the flag-ship of Lord Howe, lying in New York harbor, and the vessel narrowly escaped destruction. In 1777, Bushnell caused the blowing up of a prize schooner, lying at anchor astern of the frigate Cerberus off New London, by means of a drifting torpedo which he had directed against the latter, and which was ignorantly taken on board the schooner. In the following winter he set adrift many torpedoes to annoy the British fleet in the Delaware, thus giving occasion to the so-called "Battle of the Kegs," which was commemorated in a humorous song by Hopkinson, the author of "Hail Columbia." Twenty years later, Robert Fulton revived the general ideas of Bushnell, and attempted to introduce submarine warfare in the French navy. He made a submarine boat named the Nautilus, by which in Aug., 1801, he blew up a launch in the harbor of Brest—the first instance on record of a vessel destroyed by a submerged charge of gunpowder. Rejected by France, he next induced England to organize an abortive "catamaran" expedition against the French fleet lying at Boulogne. Although supported by Pitt, and successful in experimentally destroying the brig Dorothea by a drifting torpedo, his projects were finally rejected by the British government as unsuited to the interests of a nation that enjoyed the sovereignty of the sea. Fulton returned disappointed to America, where, after some successful experiments, he finally met a like repulse, largely through the active opposition of Commodore Rogers of the navy. He ultimately abandoned his efforts in submarine mining, as his attention became absorbed in steam navigation. Although Fulton began his experiments by employing a submarine boat, experience led him to abandon this device. As finally rejected by our government, his system included four classes of torpedoes: (1) Buoyant mines, anchored in the channel to be defended, and exploded by a mechanical device set in action by contact with the enemy's hull. (2) Line torpedoes, designed to be set adrift and fouled by the cables of the hostile fleet at anchor. (3) Harpoon torpedoes, to be discharged from a gun, and thus attached to a vessel and fired by clockwork. (4) Block ship torpedoes, to be carried on booms projecting from vessels of a peculiar type, and exploded by contact with the enemy. The modern system includes all these devices in a modified form, except the third—a fact which sufficiently shows how far Fulton was in advance of his age in appreciating the capabilities of submarine warfare. In the war of 1812 several abortive attempts were made by individuals to employ Fulton's system against British shipping in our waters, but the government took little interest in the operations, and no success was achieved, although considerable alarm was excited in the fleet of the enemy.

During the next thirty years torpedo warfare was neither forgotten nor neglected in Europe, as many writings abundantly prove, but it was again left to an American, Col. Samuel Colt of Hartford, best known as the inventor of the revolving pistol which bears his name, to make the next great advance. It consisted in introducing, as the igniting agent, electricity, at that date considered rather as a toy of the philosopher's laboratory than as a practical force in engineering. Colt began his torpedo experiments in 1829 or 1830, and after years of labor elaborated a system of buoyant submarine mines, to be planted quincuncially in the threatened channel and operated by electricity. To convey the current he devised one of the very first submarine cables ever attempted, which in the winter of 1842–43 he successfully laid across East River, New York harbor. Gutta-percha was then unknown as an insulating material, and Colt employed a wrapping of cotton yarn soaked in asphaltum and beeswax, and in exposed localities enclosed in a leaden tube. When designed for torpedo purposes, each cable included two separate conductors, which, entering the mine, were united by a fine platinum wire imbedded in gunpowder. The operator, by sending at pleasure a strong current of voltaic electricity through this bridge,

FIG. 1.



heated the platinum to redness and determined the explosion. For convenience of manipulation the shore-ends of

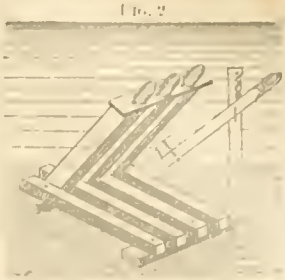
the cables were all led to a casemate. The preceding sketch, found among Colt's papers after his death, and bearing the date 1836, shows one of his devices for igniting the mines at the proper instant; it is of course only applicable to an elevated site. A secret believed to relate to a method of making the vessel telegraph her own position died with him. This sketch explains itself. One set of conductors from all the cables are united and permanently attached to a single pole of a powerful battery. The other conductors lead to a map of the channel, and each is secured at the point corresponding to the known position of its mine. The reflector is arranged to throw the image of the hostile ship upon the map, and as it passes over a wire terminal the operator with his other battery-wire closes the proper circuit and explodes the torpedo. Colt's experiments extended over a period of about fourteen years, the latter part of the time under the auspices and at the expense of the government. He destroyed several vessels at anchor, and finally, on Apr. 13, 1843, accomplished the feat of blowing up a brig under full sail on the Potomac, operating his battery at Alexandria, 5 miles distant. This decisive trial was witnessed by many members of Congress and by the President, and its success at that date stamps Col. Colt as a man of extraordinary ability. The time, however, was not yet ripe for the introduction of the new weapon, and, like those of his predecessors, Col. Colt's plans were ultimately rejected by the government.

The Anglo-French war with Russia in 1855 furnished the next occasion for the application of submarine mines to harbor defence. Sebastopol, Cronstadt, and Sweaborg were protected in this manner by devices of Prof. Jacobi. Unfortunately for the success of his system, the charges were too small (8 or 9 pounds), and although explosions occurred under two or three English frigates, no serious damage was done. The fuze consisted of a small bottle of sulphuric acid imbedded in a mixture of potassium chlorate and sugar; the mechanical breaking of the bottle by contact with the vessel effected ignition. The great improvement of placing the igniting apparatus within the torpedo, independent of external levers, is due to Prof. Jacobi, who also made use of electrical mines to be fired by an operator on shore. The Italian war of 1859 gave occasion for Col. von Elmer of the Austrian engineers to employ in the defence of Venice a system of electrical mines more carefully elaborated than any which had preceded it, but no opportunity for practically testing its merits occurred.

In fine, it was reserved for American engineers to demonstrate upon a grand scale the important part which the modern torpedo can be made to play in maritime warfare. The civil war of 1861–65 offered conditions peculiarly favorable to its development. The Southern Confederacy was possessed of no fleet worthy of the name, while a long line of seacoast and many navigable rivers exposed its territory to easy assault by water. It could, therefore, well afford to sacrifice most of those routes of communication, provided they could be closed to the war-vessels of the Union. Every variety of torpedo became, therefore, admissible. After some preliminary trials, the service was formally legalized in Oct., 1862, and an efficient bureau was established at Richmond, which continually extended the scope of its operations until the end of the war. Seven U. S. iron-clads, eleven wooden war-vessels, and six army-transports were destroyed by torpedoes, and many more vessels were more or less injured. The Confederates lost three vessels by their own mines, and a fine iron-clad, the Albemarle, by the counter-operations of the U. S. fleet. This wholesale destruction occurred chiefly during the last two years of the war; and if at its beginning the system had been as well organized as at its close, the influence which might have been exerted upon the naval operations of the Union forces can hardly be estimated. The details of the Confederate system were published to the world soon after the end of the war, and they have formed the common basis upon which different nations have begun the investigations now actively prosecuting for perfecting appliances in submarine warfare. For this reason they will be considered somewhat in detail. The several devices may be grouped in five distinct classes—stationary torpedoes or submarine mines, automatic drifting torpedoes, infernal machines, offensive spar torpedoes, and submarine boats.

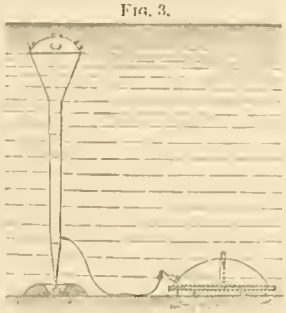
Stationary Torpedoes, often called Sea-Mines.—To form an obstruction in the channel which shall stop the enemy, either by his actual destruction or by his fear of it, is the object of this class. Several types were used. The frame torpedo was one of the most simple. Each shell weighed about 400 pounds, and contained 25 pounds of gunpowder. The fuze, consisting of a vial of sulphuric acid imbedded in potassium chlorate and sugar, was placed in the loading-hole, protected by a thin lead cap to be crushed by the vessel. The pile torpedo, a similar pattern of mine, also shown on the figure, was found in the water approaches to Savannah. The swaying boom torpedo was a marked improvement upon this device, since, being free to move, it was not so easily discovered by dragging. To render it still more effective, it was often attached by a line to a "turtle" containing a fuze made upon the principle of an ordinary cannon primer. The attempt to grapple and raise the boom torpedo exploded this auxiliary, which was planted in front, so as to be well under the bottom of the enemy. The charge of the boom torpedo was about 70 pounds, and of the turtle 100 pounds; the whole device was called the "devil-catcher." Another approved pattern was known as the Singer or Fretwell torpedo, invented by Singer and introduced by Fretwell. The principle of its action was similar to that of the "turtle," the charge (50 to 100 pounds) being fired by a percussion-cap acted upon by an external plunger released when the inverted saucer-cap was thrown off by the touch of the enemy. The weakening of the spring under continued tension, and the growth of seaweed and shellfish, were found to destroy efficiency after the torpedo had remained a few weeks in position. To obviate this difficulty—which is inherent to all mechanism acting externally—Gen. Rains, when in charge of the laboratory at Augusta, Ga., devised a fuze priming said to consist of fulminating mercury and fulminating silver, which was exceedingly sensitive, a slight blow being sufficient to cause detonation. Fuzes containing it, protected against moisture by a lead cap easily crushed by contact, were used in his barrel torpedoes. These torpedoes contained from 70 to 120 pounds of gunpowder, conical ends of light wood being added to increase flotation and to strengthen the case. The Rains fuze served its purpose well, and was used in land-mines, in hand-grenades, and in several types of torpedoes. Lastly, electrical mines, to be fired by the act of an operator on shore, were employed; but the difficulty of procuring the requisite insulated cable restricted their use, and it is worthy of note that no attempt was made to make them automatic. The charges employed were usually enormous, amounting to 2000 pounds of gunpowder. The Commodore Jones was destroyed on May 6, 1864, by a torpedo of this type. It was planted in a narrow part of the channel of James River, in about 35 feet of water, and was operated from a pit on the river-bank containing a small Bunsen battery. The Commodore Jones was allowed to advance safely over the mine, which was reserved for

Fig. 2



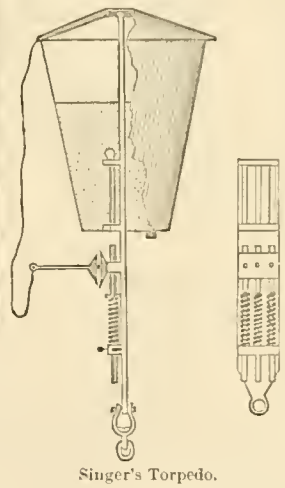
Frame and Pile Torpedoes.

Fig. 3.



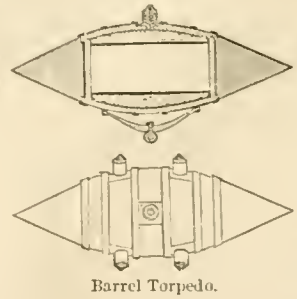
Swaying boom and turtle Torpedoes.

Fig. 4.



Singer's Torpedo.

Fig. 5.

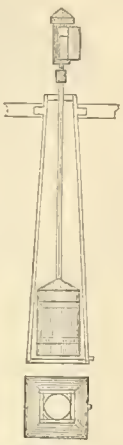


Barrel Torpedo.

the flag-ship, but the operator hearing the order given to return preparatory to a more thorough search for torpedoes, the vessel was blown up as she backed down stream. She appeared to be lifted bodily by the explosion, and was utterly destroyed, more than three-quarters of her crew being killed or wounded.

Automatic Drifting Torpedoes.—This class was especially designed for rivers where the current, setting in one direction, could be depended upon to sweep the apparatus down to the hostile fleet, and perchance to bring it into contact with some vessel. Night was often selected for the attempt, but the ease with which a ship at anchor may be protected by nettings rendered the several devices of little avail. The simple form shown in the figure was used in great numbers on James River. A piece of slow-match was arranged to burn down the tube to the charge. These torpedoes were often caught by nets, but did no damage. A more complex arrangement is shown in Figure 7. This torpedo was often set adrift, connected to a log by a knotted line, which, fouling the anchor-chain, would bring the former to rest under the bottom, when the current acting on the wheel would release the plunger and determine an explosion.

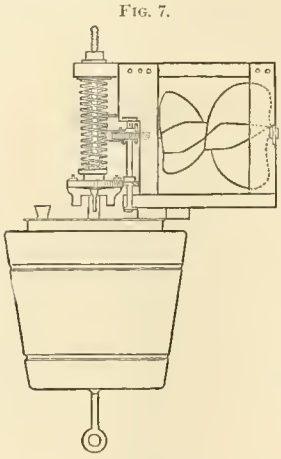
Fig. 6.



Drifting Torpedo.

Infernal Machines.—This class of torpedoes is not generally considered to come within the limits of legitimate warfare as practised at the present day, because it subjects non-combatants to great peril without any previous warning. It was designed to be smuggled on board the Union war-vessels or transports, and thus to effect their destruction. Two types were employed. The most simple was known as the "coal torpedo." It consisted of a metal case containing several pounds of gunpowder, cast and colored to closely resemble a lump of coal. When ignorantly thrown into the furnace, it caused the explosion of the boiler. The Greyhound was destroyed in this manner on James River, as were also several transports on the Western waters. The other type was known as the "horological torpedo." It consisted of a case containing a large charge of gunpowder and a clockwork arrangement set to run for a certain time, at the expiration of which it released a plunger and fired the charge. A disastrous explosion was caused in the army powder-fleet at City Point in 1864 by an arrangement of this character, which was placed on board one of the barges by a spy. At Mound City a similar explosion was effected.

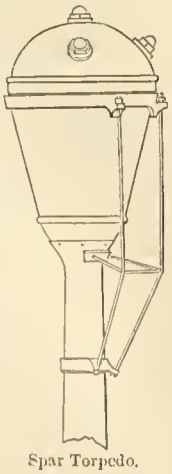
Fig. 7.



Current Torpedo.

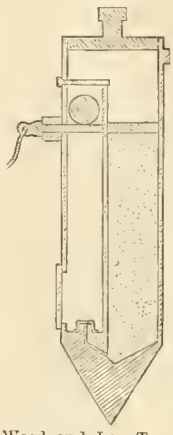
Offensive Spar Torpedoes.—This form of the new weapon afforded the best opportunity for the display of personal gallantry, and several officers won distinction in its use. An outrigger spar, from 20 to 30 feet in length, carried a torpedo designed to be brought in contact with the enemy's hull and exploded in a hand-to-hand conflict. The Confederates early supplied ram torpedoes to their iron-clad fleet, but a lighter pattern was chiefly used, operated from a special craft termed "Davids," by reason of their small size and insignificant appearance as compared with their adversaries. The type used at Charleston was built of boiler iron, and was about 35 feet long, shaped like a cigar, with a low combing to exclude the waves. Small engines driving screw-propellers gave a maximum speed of about 7 knots per hour. The torpedo was of copper, charged with about 50 pounds of fine gunpowder. Under cover of the night these boats approached the hostile fleet, trusting to suddenly dart alongside and discharge the torpedo with impunity in the confusion and alarm created by their sudden appearance. Another type of this class of boats consisted of an ordinary steam-launch equipped in a similar manner. Several of the Union war-vessels—the New Ironsides on Oct. 5, 1863, the Memphis on Mar. 6, 1864, the Minnesota on Apr. 8, 1864, and the Wabash on Apr. 18, 1864—narrowly escaped destruction, and the Confederate iron-clad Albemarle was sunk at her moorings by this mode of attack. The latter feat was performed by Lieut. Cushing, U. S. N., and for its exceptional gallantry it deserves a special description. The boat was an ordinary steam-launch equipped with a Wood and Lay torpedo and a brass howitzer. This torpedo was provided with an air-chamber, and at the proper moment was to be detached from its boom and allowed to rise under the enemy. A strong pull upon the lanyard then released the ball, which, falling on the percussion-cap, ignited the charge. Lieut. Cushing with a crew of thirteen officers and men advanced 8 miles up Roanoke River, passing the Confederate pickets undiscovered. On approaching the Albemarle, moored to the wharf and protected by a pen of logs about 30 feet from her side, he suddenly darted upon her, and under a heavy fire exploded his torpedo against her bottom, thus sinking her. Most of his party were captured, and some were drowned; Lieut. Cushing himself and one man escaped by swimming and threading the swamps to the Union lines.

Fig. 8.



Spar Torpedo.

Fig. 9.



Wood and Lay Torpedo.

Submarine Boats.—But one boat of this character won a record during the war, and hers was sufficiently tragic to deter imitation. She was of boiler iron, 35 feet long, was propelled by hand at a maximum speed of 4 knots, and could remain submerged to any desired depth for half an hour. Her crew consisted of nine men. In the preliminary trials (see SUBMARINE NAVIGATION) she sank three times, drowning 23 men. Finally, under Lieut. Dixon, C. S. N., she sailed out of the harbor, attacked and sunk the Federal steam-sloop Housatonic, and disappeared for ever with her crew. She was designed to pass under the enemy, dragging a floating torpedo, which would explode when brought in contact with his hull, but on this occasion she was used like an ordinary David.

The Schleswig-Holstein war of 1864, although short, afforded an opportunity for employing defensive mines, and one of the invading vessels was sunk through their agency. The Paraguayan war of 1864–68 furnished the next occasion for submarine warfare. Immediately after the Brazilian fleet entered the waters of that little state, a fine iron-clad, the Rio Janeiro, was sunk by two torpedoes against which she had struck. Subsequently, a division of the fleet ran past the batteries of Curupaity, only to find itself entrapped between two lines of torpedoes, one in front and the other planted in rear, after the passage, to bar the retreat; the defective nature of these obstructions alone prevented a serious disaster. Later in the war the Tamandaré was crippled by a submarine mine. The Paraguayan torpedoes belonged to the anchored or drifting class, and the sulphuric-acid fuze was largely used. During the Franco-German war of 1870–71 no conspicuous use was made of torpedoes, but the German ports were protected by them, and the French contributed a new device to the list. It is known by the name of the "ball of Verdun," devised by Capt. Bussière of the engineers to destroy a military trestle-bridge thrown by the Prussians over the Meuse a short distance below the fortress. It consisted of a large sheet-iron sphere, over 3 feet in diameter, heavily charged with gunpowder, and provided with a clockwork train, which after a certain time was to discharge a pistol and thus ignite the mine. It was but little heavier than water, and was carefully adjusted so as to make the centre of figure and of gravity coincident. A body fulfilling these conditions will be rolled along the deepest part of the channel by the current, and will, of course, be far more difficult of detection than a floating object. The capitulation of the fortress prevented a trial of its efficiency, but many letters were introduced into Paris during the siege by similar balls caught by nets spread for the purpose.

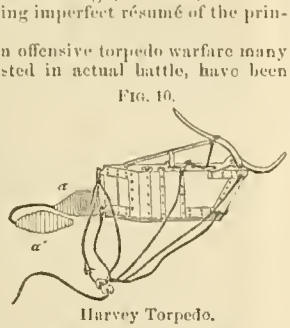
Torpedo Warfare in the Future.—It is apparent, from

the foregoing historical résumé, that torpedoes are no longer to be regarded as experimental devices, but that they have become recognized weapons of maritime warfare, admitting of very varied applications. They may be employed offensively in the combats between hostile vessels, or they may be used defensively to repel an apprehended attack upon a harbor or district by preventing the passage of the enemy's squadron through the channel of approach. Entirely different principles of construction and of manipulation mark these two classes of the weapon. The former requires the technical skill of a sailor to move the charge into position and explode it within destructive range. The latter differs in no essential respect from the mines so long employed in the defence of land fortifications. Accordingly, in the U. S., England, and some other countries possessing an extended seacoast, the service of torpedoes has been divided between the navy and the engineers of the army—the former operating offensively afloat, and the latter defensively from the shore. Our naval station is at Newport, R. I., where the needful investigations are conducted, and where classes of officers now receive regular instruction in the use of the new weapons. The army school is at Willett's Point, New York harbor, where the subject is experimentally studied, and where the officers and the enlisted men of the engineers are exercised in all the duties of defensive submarine mining. While, in general, the line of demarcation between the two services is thus plainly marked, some of the weapons—such, for example, as fish torpedoes steered by electricity—may be conveniently operated either from land or from shipboard, and they would be used in war either by army or navy as occasion might offer.

All maritime nations are now carefully investigating the subject of submarine warfare, but the greatest secrecy is thrown around these studies. Enough, however, has transpired to enable the following imperfect résumé of the principal results to be given:

Offensive Torpedoes.—In offensive torpedo warfare many improvements, not yet tested in actual battle, have been suggested, and are now under trial by naval officers. The Harvey torpedo belongs to this type. The charge is contained in a narrow copper vessel, encased in wood strapped with iron, and so ballasted as to ride vertically in the water. A tow-line of wire rope passes from the slings of the torpedo through a block on the yard of a fast steamer to a reel fitted with a brake on her deck. The enemy is passed at full speed, with the torpedo diverging at an angle of about 45° from the quarter, and the course is so directed as to bring the weapon in contact with his hull. Just before striking him the torpedo is made to dive by suddenly slacking the tow-line, and then to rise under his bottom by checking it with the brake. Explosion is effected through the agency of the projecting levers, which when struck either detonate a contact fuze or close an electric circuit, and thus cause the passage of a powerful current through a platinum fuze. These torpedoes are made of various sizes, one of the largest patterns being 4.5 feet long, 2 feet deep, and 6 inches wide, designed to contain 100 pounds of gun-cotton or dynamite. The requisite flotation is given by the cork buoys *a a'*, as when at rest the torpedo sinks by its own weight. This weapon was devised by a skilful sailor, Capt. Harvey of the Royal navy, and he claims that it can be successfully used on the high seas even during a gale. Official trials in 1870 at Portsmouth, England, caused it to be adopted in the English service. The torpedo was operated from a steam-tug against the iron-clad Royal Sovereign. At first the latter remained at anchor, and thus received ten attacks from different directions. In every case the torpedo struck her at depths varying from 1 to 16 feet. The iron-clad fired blank cartridges, and succeeded in discharging seven and four shots in two of the trials, and only two shots in the others. The Royal Sovereign then got under way at a speed of 8 or 9 knots, the tug moving at about 11 knots. Six attacks were thus made, all of which were successful, although every effort was made to avoid the blows. From two to twelve shots were fired at the tug in each attack while manœuvring to effect her object. The Harvey torpedo is now definitely adopted by several nations of Europe, and is highly commended by many naval officers.

Fig. 10.



Harvey Torpedo.

Another new type of offensive torpedo is that known as the Luppis Whitehead. The idea developed by this weapon is due to an officer of the Austrian marine artillery, now dead, but the first practical trials were made in 1864 by Robert Whitehead, superintendent of ironworks at Fiume, acting upon the suggestions of Capt. Luppis, an officer of the Austrian navy. The torpedo has undergone great improvements between that date and the present time, and the right to use it has been purchased by many European nations. The latest type consists of an iron and steel vessel, nearly in the shape of a spindle of revolution, 16 feet 3 inches long and 1 foot 5 inches in greatest diameter. Its weight, including the charge, is 750 pounds. It is driven by a propeller moved by compressed air, and it is claimed to be capable of maintaining a speed under water of 15 knots for a distance of 1300 feet, or 12 knots for 3500 feet. It can be projected from a launching tube or started by hand, and is capable of regulating and preserving its depth and direction, within narrow limits, in still water; but cross-currents or seaweed may introduce large variations. It can be set to explode on contact or after a definite time, and either to sink or rise to the surface after finishing its course. Great secrecy is preserved as to details of mechanism.

Submarine rockets, carrying explosive charges and started from submarine guns, have received and are now receiving attention, both in this country and in Europe. Such a weapon, if its course can be successfully controlled, will be especially dangerous in the combats of iron clad vessels at short range, since the blow, being delivered under the armor, cannot fail to achieve decisive results.

Submarine boats now appear to be passing out of favor with all nations, partly because their history in former wars has been nearly uniformly tragic, and partly because the necessity for their use has been done away with by the invention of the fish torpedo steered and controlled by electricity. This idea was first patented by Lieut.-Col. Ballard, Royal Engineers, in Aug., 1870, and again by Lieut.-Col. Foster, U. S. Engineers, in 1872. It has been independently elaborated by Mr. Lay and Mr. H. J. Smith in this country, and by Col. von Scheliba in Russia. A device of the kind is also patented by Mr. Adamson, assistant engineer U. S. navy. The general claim to priority in the invention has been the subject of litigation in this country; but the decision of the commissioner of patents (June 13, 1873) has awarded it to Mr. Lay, whose boat has also been brought most conspicuously before the public. This type of torpedo consists essentially of a boat of the Luppis Whitehead class, which carries and unreels a coil of insulated wire through which the electric current from a battery on shore or on shipboard can be passed at will to certain electro-magnets. By closing and breaking the circuit, and reversing the direction of the current, valves connected with the motive-power are controlled, and thus the rudder may be put to starboard or port, and the engine may be started or stopped. In this manner the motion of the fish is under perfect control from the instant of starting. The motive-power may consist of liquefied carbonic acid, or ammonia, or compressed air, or steam peculiarly applied. The boat may be made to move at the surface or below it. Her position is known to the operator from two small flags carried near the water-level, which at night are replaced by two lanterns shaded in front so as not to be seen by the enemy. A speed of about 8 knots and a range of a couple of miles have been obtained. Any of the modern explosives may be employed, and detonation results from the action of a mechanical fuze or of a circuit-closer and battery. A modification of this torpedo is proposed by Capt. Ericsson, who supplies his motive-power to the engine by a flexible tube drawn after the boat. This motive-power is compressed air generated by an engine near the operator; and by regulating the supply the boat is steered without the aid of electricity.

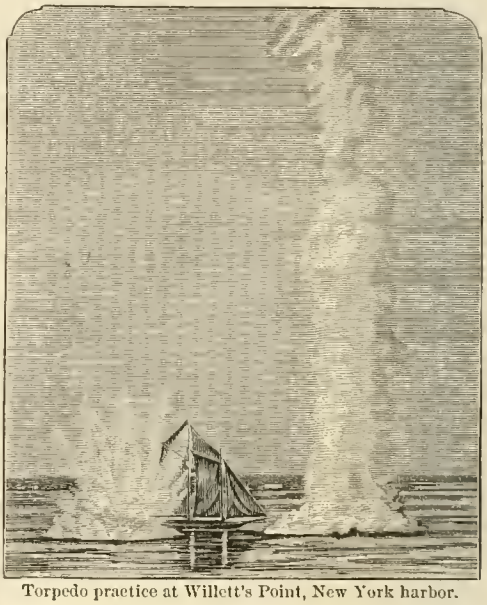
But it is not exclusively to new inventions that attention is now directed. The offensive spar torpedo, as already stated, has made a brilliant record in actual battle, and continues to be favorably regarded both in our own and foreign navies. It furnishes better opportunities for dashing exploits than any other type of the weapon, and thus naturally commends itself to gallant seamen eager for distinction. Speed and the cover of night or fog are conditions highly favorable to success. The circumstances characterizing a contest with this weapon are dramatic in a high degree: for size, heavy armament, massive iron plating, and the close vicinity of friendly ships are of little avail in repelling the dash of the tiny antagonist, which suddenly appears out of the darkness, spreading confusion on every side. Hurried slipping of cables and getting under way, accompanied by random, desperate firing, last for an instant, and then the blow is received, or the assailant is again lost to view in the surrounding gloom. It is the fight of the sword-fish and the whale introduced into modern warfare. The tendency at present seems to be toward a more general use of this type of torpedo; for while during

the late war it was chiefly operated from steam-launches or similar craft, the larger vessels of our navy are now provided with it. In Europe vessels are specially constructed for the purpose, the essential conditions being high speed, noiseless machinery, and invulnerability to small projectiles. A launch recently made in England for the Austro-Hungarian government developed a speed of 18 knots, with noiseless machinery. She was 67 feet long and 8 feet 6 inches beam, and carried two spars 38 feet long, so arranged as to deliver the attack directly ahead. A special torpedo-vessel, the Alarm, has recently been constructed under the direction of Admiral Porter for our own service. She is 166 feet long on the water-line, with a height of side of 10 feet forward and 8 feet aft. She is plated with iron, and carries a formidable ram and a 15-inch gun, trained to fire forward in the direction of her keel. Four Gatling guns are mounted to repel boat-attacks, and she can employ four spar torpedoes on iron booms shoved out through ports below the water-surface, on her bow and broadsides, to a distance of fifty feet. She is provided with a Fowler wheel, which both propels and steers the ship, giving great power of rapid manœuvring. All her movements are controlled by one man in the pilot-house, and electricity is skilfully used for conveying orders and exploding the torpedoes.

Defensive Torpedoes.—To understand the full importance of the submarine mine in defending our great seaports against hostile fleets, it is necessary to consider the changes in ships of war which immediately preceded its introduction. Before the invention of the screw-propeller, vessels in attacking forts were at the mercy of winds and currents; and long experience proved that one gun ashore was more effective than many afloat. Moreover, since stone walls were more resisting to shot and shell than bulwarks of oak, the rule introduced into land defence soon after the invention of gunpowder, that no masonry must be exposed to a direct fire of artillery, could be ignored in water-batteries, thus rendering it easy to mass the guns and provide a heavy fire against hostile shipping, even where the site was restricted. The screw-propeller, followed shortly after by armor-plating and big guns afloat, effected a radical change in the conditions of the problem. The fleet was now free to steam rapidly past the batteries under favorable conditions not before practicable. The new class of guns required to assail the armor-plating with a reasonable chance of success was far more bulky and difficult to manœuvre than the former armament of the forts; moreover, it was discovered that earthen parapets and substantial traverses must take the place of the compact masonry casemates heretofore in use. The defence thus found itself at great disadvantage. The hostile ships of war, more under control, less vulnerable, and possessed of much higher speed, were to be encountered by guns more unwieldy, and, in most of our harbors, much fewer in number from the naturally contracted sites available for the earthen batteries. The attention of military engineers was thus urgently directed to the devising of some obstruction which by holding the enemy under fire, and depriving him of the comparative immunity resulting from a high rate of speed, should restore to the defence its lost superiority. The modern submarine mine has accomplished this vitally-important object. Evidently, if through its influence the guns can be fired 100 times at a slowly-moving ship, instead of once at a rapidly-passing enemy, the effective power of the battery is multiplied more than 100 times. Independently, therefore, of its own destructive power, the defensive torpedo has become an essential auxiliary of the land gun. Indeed, they are inseparable in a judicious system of harbor defence, for, while the former is necessary to developing the full power of the latter, the latter is no less essential in protecting the former against the operations of the enemy; for it is an admitted principle that electrical submarine mines cannot defend themselves without the aid of flanking guns to keep off boats, and of a fort secure against assault wherein to place the necessary batteries and operating apparatus. The trifling expense and superior power of this combination as compared with monitors for harbor defence has effectually disposed of the latter, which at one time were popularly believed to be our only dependence in the future for protecting our great seaboard cities against the dangers of a bombardment. They are now reduced to the grade of a useful auxiliary reserve force, which should not be neglected in a few of our large harbors. The navy is thus released from an irksome confinement to a defensive warfare in our ports, and is free to strike effective blows where the enemy may be most vulnerable to attack, and where he will fear something more than a simple repulse as the result of an unfortunate naval action.

Some of the more important of the recent improvements in submarine mining are the following: The modern explosives (see EXPLOSIVES) have largely superseded gunpowder, because greater power with less bulk may thus be secured. The latter is an important matter, since upon the size of the torpedo depends the depressing effect of the current, and hence the amount of buoyancy necessary to keep the case always high enough to be touched by the enemy in passing. This buoyancy, of course, regulates the weight of the anchors and the size of the mooring connections, and, in fact, the principal dimensions of the system. The increase in intensity of explosive action is also important, for efforts are now making to give increased strength to the hulls of war-vessels by employing iron in the form known as the double-cellular bottom, thus reducing the destructive range of the torpedo, and exacting the employment of more powerful charges. In England experiments upon the Oberon, a vessel of this type, have shown that the horizontal destructive range of gun-cotton in charges even as large as 500 pounds is restricted to a few feet. This charge was fired on the bottom in 48 feet of water at horizontal distances from the ship of 100, 80, 60, 50, and 30 feet, and finally vertically under her side. Although she was much shaken and injured by some of these shots, only the last burst through the double bottom and sunk the vessel. At our own engineer school of defensive submarine mining at Willett's Point, N. Y., a long series of trials has been conducted to determine the effective range of different charges of different explosives sunk at different depths below the surface; and by the careful measurements of several hundred explosions the matter has been successfully brought within the scope of mathematical analysis. The formulæ and results are not yet made public, but they confirm the fact of restricted destructive range. The subject is full of interest in a scientific point of view. To illustrate one striking feature developed—viz. the effect upon the jet

FIG. 11.



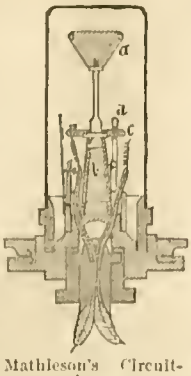
Torpedo practice at Willett's Point, New York harbor.

caused by varying the depth of submergence—the figure is given. The original picture was made by the instantaneous photographic process by Lieut. (now Capt.) Mercur, corps of engineers, and advantage was taken of the passing of an unsuspecting schooner to obtain a convenient scale of comparison. Both charges consisted of 100 pounds of mortar powder, the one on the apparent right sunk 4 feet, and the other 10 feet, below the surface. The height of the columnar jet exceeded 400 feet by accurate measurement.

Electricity is now chiefly used as the igniting agent in submarine warfare, because this enables the obstructed channels to be safely traversed by friendly vessels. The mines are usually arranged to be fired at will, or automatically by the touch of the vessel. The best systems are designed to work either on an open or closed circuit at pleasure, because this largely increases the danger of tampering with the torpedoes. By the use of proper fuzes (see FUZES) ignition may be effected with certainty. To cause the explosion to occur automatically by the touch of the vessel, a device called a circuit-closer or circuit-breaker, according to the circuit chosen, is employed. Many ingenious devices have been proposed. The figure shows the most improved form of the Mathieson arrangement, now adopted in the English service. The lead ball *a*, supported

by the coil *b*, is caused to vibrate by its inertia when the torpedo is struck by the vessel. The contact-disk *c* is thus made to close or open the circuit through the agency of the surrounding springs *d*. More simple contrivances than this are in use in some other services. Even for contact-mines unconnected with the shore, and hence under no control, electricity is now available for ignition; and its use largely reduces the danger of handling and planting the mines. A small battery is placed in the torpedo or in a hollow anchor under it, and when everything is in position the circuit to the circuit-closer is completed after the boat has reached a safe distance from the mine.

Fig. 12.

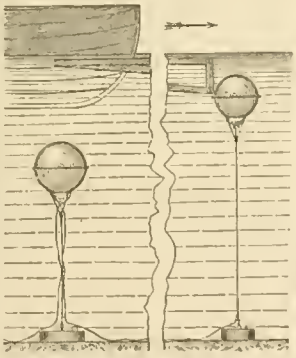


Mathleson's Circuit-closer.

In the matter of torpedo cases, experience has shown that metal, usually iron, must be employed where the mines are to remain submerged for long periods. Wood in such cases cannot be trusted to exclude water, although lager-beer kegs supply a good temporary expedient. It is an essential condition that the form shall be symmetrical, in order to reduce the tendency to rotary motion to a minimum. Wire rope is found to supply the best moorings. The electric current is conveyed by armored cable, not unlike that employed for the Atlantic telegraphs; but india-rubber is superior to gutta-percha as an insulator, because less likely to be injured by changes of temperature in storage and laying. To avoid a multiplicity of cables, as well as to reduce cost, several different cores are often united in a bundle and included in a common armor.

While the details of our own system of submarine mines, as elaborated by the writer at Willett's Point, are not made public, its general features were exhibited at the Centennial Exhibition at Philadelphia in 1876, and are as follows: Two types of electrical mine are in use, the ground and the buoyant. The former is employed in comparatively shallow water, and consists of a case resting upon the bottom and containing a large charge of dynamite. Floating near it, but so far below the water-surface as to be concealed from view, is a buoy carrying a circuit-closer or breaker to regulate the current through a fuze embedded in the former. The buoyant mine is designed for use in deep water, and consists of an anchor holding in position a torpedo floating just below the surface; the latter contains the charge of dynamite, the fuze, and the circuit-closer or breaker. If desired, the latter may be carried by a separate buoy so placed that when touched by outriggers or other torpedo-catchers, the mine will be directly under the vessel. The channel to be defended is thickly studded by lines of these mines, so arranged with respect to each other that no vessel can pass without coming in contact with one or more of them. Single-conductor electric cables running from each mine combine in multiple cables, and are extended through a subterranean gallery to a secure bombproof casemate within the fort, where is placed the apparatus by which, at the will of the operator, the mines may be fired by judgment, or be rendered either inert or automatically explosive when struck by a vessel. The system is arranged to permit easy electrical tests, by which any injury at once becomes known, as well as its nature and locus. Wires also extend from the casemate to flanking guns, so that if a boat succeeds by night in cutting a cable or in disturbing a mine, by so doing it draws upon itself a heavy automatic discharge of canister, grape, or case shot, according to its distance from the fort. Electric lights are arranged to sweep the lines of mines, and thus give additional security against hostile operations conducted under cover of the darkness. The casemate is connected by telegraph with a lookout, so that the whole system is under the perfect control of an officer who can see what is required, and instantly give the needful orders. For instance, one of our vessels might be chased by a cruiser. She could pass with absolute safety the mines, which for her pursuer would at once become deadly engines of destruction.

Fig. 13.



Detailed maps and plans for the torpedo defence of all our most important channels have been carefully prepared by the board of engineers for fortifications, and are now on file in the engineer department at Washington. The casemates and galleries for the introduction of the cables have been actually constructed at several of our forts. Large stores of torpedo material are accumulating at the engineer dépôt at Willett's Point, where, as already stated, our engineer troops receive the training needful to prepare them, in case of sudden war with a maritime power, to rapidly plant and operate the defensive mines along our extended seaboard. HENRY L. ABBOT.

Torqua'tus (TITUS MANLIUS), a member of the celebrated patrician family, the Manlia gens, of ancient Rome, received his surname TORQUATUS in 361 B. C. for slaying a gigantic warrior among the Gauls in single combat on the Anio, and ornamenting himself with the neck-chain (*torques*) of the fallen foe. He was several times consul and dictator, and finished the wars with the Latin League. During one of his campaigns he forbade all single combats. His son, nevertheless, fought with a Latin warrior and slew him, but when he returned to the camp and laid the spoils at the feet of his father, he ordered him to be punished with death; hence the expression, *Manlia imperia*, common in the Latin literature.—Another member of the same family, LUCIUS MANLIUS TORQUATUS, became very conspicuous in the civil war. He was prætor when the war broke out in 49 B. C., and as he belonged to the aristocratic party, he was opposed to Cæsar. He was stationed at Alba with six cohorts, but on the fall of Corfinium he abandoned Alba, and his soldiers went over to Cæsar. He subsequently joined Pompey in Greece, and in 48 had the command of Oricum, but was compelled to surrender to Cæsar, who, however, sent him away unmolested. He immediately joined Pompey again, and fought under him at Dyrrhachium. After the battle of Pharsalia he went to Africa, and here he was taken prisoner by P. Sittius at Hippo Regius, and slain. He was well versed in Greek literature, a man of elegance and taste, and a pupil of the Epicurean school of philosophy. He was a friend of Cicero, and is introduced by him in his dialogue *De Finibus* as the advocate of the Epicurean philosophy. In his letters to Atticus, Cicero calls the first book *Torquatus* in his *De Finibus*, and speaks of him with much respect.

Tor'quay, town of England, county of Devon, is handsomely situated on the Torbay, an inlet of the English Channel, and frequented as a bathing-place. It has a good harbor. P. 16,419.

Torque [Lat. *torques*; Celtic *torc*], a spirally and almost circularly bent rod of gold, worn as a personal ornament upon the neck by the ancient Celts and other rude races of the Old World. Numerous examples exist in archæological collections.

Torquema'da [Lat. *Turrecremata*], **de** (JUAN), CARDINAL, b. at Valladolid, Spain, in 1388; entered the Dominican order of friars in Valladolid 1403; was present at the Council of Constance 1417; afterward pursued the study of theology at the University of Paris, where he graduated 1424; became an instructor there; was successively prior of the Dominican convents at Valladolid and Toledo; was called to Rome by Pope Eugenius IV., by whom he was made "master of the sacred palace" 1431; was papal theologian at the Council of Bâle, where he contributed to the condemnation of the doctrines of Wycliffe and Huss, and advocated the doctrine of the Immaculate Conception; participated in the same capacity in the Council of Florence 1439, where he drew up the project of union between the Greek and Latin churches, for which he received from the pope the title of "defender of the faith" and the rank of cardinal; attended the Council of Bourges 1440; became bishop of Palestrina 1455, and of Sabina 1464. D. at Rome Sept. 26, 1468. Author of *Meditationes* (1467), *Expositio brevis et utilis super toto Psalterio* (1470), which were among the earliest productions of the press at Rome, *Quæstiones Spiritualis Convivii Delicias præferentes super Evangeliis* (1477), *Commentarii in Decretum Gratiani* (Lyons, 6 vols., 1519), and of several other works, as yet unprinted.

Torquemada, de (TOMAS), b. at Torquemada, Spain, about 1420; became a Dominican monk and prior of the monastery of Santa Cruz at Segovia; was appointed by Ferdinand and Isabella first inquisitor-general of Spain 1483; was confirmed in that post Oct. 17 of that year by Pope Innocent VIII., who gave him the title of "confessor of sovereigns;" labored with great vigor and success in organizing the Inquisition throughout Spain, especially at Seville, Córdova, Jaen, and Ciudad Real; drew up the code of procedure subsequently followed; was influential

in causing the expulsion of Jews and Moors from Spain, and burned at the stake during sixteen years from 9000 to 10,000 persons. (See INQUISITION.) In his later years his authority was curtailed by the appointment of four colleagues by express orders of Pope Alexander VI. D. at Avila Sept. 16, 1498.

Torrear'sa (VINCENZO), MARQUIS, b. at Trapani July 17, 1808; was inspector-general of the customs when the revolution of 1848 broke out; professing liberal ideas, was chosen president by the committee of finance; was also made president of the Sicilian Parliament, and publicly announced the fall of the Bourbons on Apr. 13: on July 10 proclaimed the duke of Genoa king of Sicily; Aug., 1848, accepted the presidency of the ministry, holding the portfolio of foreign affairs. The Bourbons being re-established, he emigrated to Nice, and put himself in communication with Cavour; in 1860 joined Garibaldi, who had entered Palermo; proposed a Sicilian constituent assembly, which was convoked in October, and took a seat in it himself as deputy; was commissioned to bear to King Victor Emmanuel the vote of Sicily for union with the kingdom of Italy; has since been vicar-president of the Italian Parliament, ambassador extraordinary from the kingdom of Italy to Sweden and Denmark, prefect of Florence, and president of the senate of the kingdom.

Tor're del Gre'co, town of Italy, province of Naples, on the eastern coast of the Bay of Naples, at the foot of Vesuvius, whose eruptions have destroyed it several times. It was always rebuilt, however, and it is very celebrated for its wine and fruits; tunny, anchovy, sardine, and coral fishing are carried on with energy by the inhabitants. P. 5477; before the eruption in 1861, about 15,000.

Tor're, del'la (GIOVANNI BATTISTA CRESCENZI), MARQUIS, b. at Rome in 1595; studied painting and architecture, and was made superintendent of public works by Pope Paul V. In 1617 he accompanied Cardinal Zapata to Madrid, where he gained the favor of Philip III. by his flower-pictures, and was entrusted with the ornamentation of the burial pantheon of the Escurial, one of the most magnificent monuments of Europe. Philip IV. ennobled him and made him a marquis, Della Torre, and his house was the rendezvous for all artists and literary people in Madrid. D. in 1660, or, according to some accounts, in 1665.

Torre, della (GIOVANNI MARIA), b. in Rome in 1713; was professor of natural philosophy at the Academy of Naples, and subsequently director of the royal library, museum, and printing-house. D. in Naples in 1782. He was the first who undertook to descend into the crater of Vesuvius, and wrote, besides his *Elementa Physices* (1767), *Storia e Fenomeni del Vesuvio* (1755).

Tor're dell' Annunzia'ta, town of Italy, province of Naples, at the foot of Vesuvius, noted for its thermal springs and its manufactures of arms. P. 15,500.

Tor're de Moncor'vo, town of Portugal, province of Tras os Montes, picturesquely situated on the southern slope of the Roboredo Mountain, between the Sapor and Douro, is surrounded with walls and defended by an old castle. It is supposed to be the ancient *Forum Narbasorum*. It has some silk manufactures, and the silkworm is extensively reared in the vicinity. P. about 2000.

Tor're di Ma're, village of Naples, at the mouth of the Basento in the Gulf of Taranto, is famous for the ruins of the ancient *Megapontum* which are found in its vicinity. Megapontum was at one time one of the wealthiest and most celebrated cities of Magna Græcia, the homestead of Pythagoras, but its prosperity received a fearful blow when, after the fatal battle of the Metaurus (207 B. C.), Hannibal was compelled to give up this part of Italy, and carried with him all the citizens of Megapontum in order to defend them from the vengeance of the Romans. In the time of Cicero the city still existed, but in a state of rapid decay.

Tor're Don Jime'no, town of Spain, province of Jaen, near the Guadalquivir, in a fertile and well-cultivated plain, producing excellent wines, olives, and wheat. P. 6777.

Tor're Maggio're, town of Southern Italy, province of Foggia, about 4 miles from San Severo. The old ducal palace is a fine building. The agricultural products of the district are abundant—grain, wine, oil, and fruits—and the pasturage is excellent. The town, however, is subject to violent earthquakes, having been almost totally destroyed in 1627, and again in 1688. P. 9260.

Torremuz'za, de (GABRIEL), PRINCE, b. at Palermo in 1727; devoted himself to the study of Sicilian antiquities, and published *Siciliæ Populorum, Urbium, Regum et Tyrannorum Numismata* (1767), *Siciliæ et objacentium Insularum veterum Inscriptionum nova Collectio* (1769), and *Siciliæ veteres Nummi* (1781). D. in 1792.

Tor'rens (ROBERT), F. R. S., b. in Ireland about 1780; entered the naval service 1797 as lieutenant of marines; rose to be colonel 1837; subsequently became major-general in India; was for some years a member of Parliament, where he was a vigorous supporter of the Reform bill, and acquired great note as a political economist; received from 1852 a pension of £200 from the civil list. D. May 27, 1864. Among his numerous treatises were an *Essay on Money and Paper Currency* (1812), *Essay on the External Corn Trade* (1815), *Essay on the Production of Wealth* (1821), *The Budget, a Series of Letters on Financial, Commercial, and Colonial Policy* (1841–43), *Tracts on Finance and Trade* (1852), and several single *Letters* on similar subjects addressed to prominent statesmen.—His son, SIR ROBERT RICHARD, b. in 1814, educated at Trinity College, Dublin, became collector of customs in South Australia 1841, treasurer 1852, subsequently chief secretary and registrar-general; returned to Great Britain about 1865; sat in Parliament for Cambridge 1868–74, and was knighted 1872. Author of works on Australian subjects.

Torrens (WILLIAM TORRENS **McCullagh**), b. at Greenfield, county Dublin, Ireland, in Oct., 1813; graduated at Trinity College, Dublin, 1834; was called to the Irish bar 1836; became commissioner of the poor law inquiry in Ireland 1835; private secretary to Lord Taunton 1836; sat in Parliament for Dundalk as an advanced Liberal 1848–52; was an unsuccessful candidate for Yarmouth 1852; was elected from that borough Mar., 1857, but was unseated on petition; has represented Finsbury since July, 1865; was prominent during the American civil war as an advocate of the Union cause; aided Mr. Disraeli in 1867 to carry his household suffrage bill, to which he procured the addition of the lodger franchise; introduced in 1868 the artisans' dwellings bill, which was carried after protracted debates; obtained in 1869 an important reform in the management of pauper children by the poor-law guardians in London, and secured in 1870 the adoption of the extradition act, and in the same year proposed the creation of the London school board. He is a member of Lincoln's Inn, and a practitioner at the common-law bar; assumed in 1863 the maternal name of Torrens in addition to the paternal one of McCullagh; is author of *The Use and Study of History* (Dublin, 1841), *The Industrial History of Free Nations* (2 vols., 1846), *Memoirs of Richard Lalor Sheil, with Anecdotes of Contemporaries* (2 vols., 1855), *Life and Times of Sir James Graham, Bart.* (2 vols., 1863), *The Lancashire Lesson* (1864), and *Our Empire in Asia: how we came by it* (1872).

Tor'res-Caïce'do (I. M.), b. at Bogota Mar. 30, 1830; devoted himself after his seventeenth year to poetry and literature; was editor of *El Progresso*, and subsequently of *El Dia*, which brought him into a severe conflict with the government; was elected a member of the legislative assembly, and filled afterward various diplomatic positions at Paris, London, the Hague, and Washington, but retired in 1864, in order to devote himself exclusively to literature. He has published in Paris *Religion, Patrie et Amour*, a collection of poems, and *Essais biographiques sur les principaux Publicistes, Poëtes et Littérateurs latino-américains* (2 vols., 1863).

Tor'res Strait, the name of the channel which separates New Guinea or Papua from Australia. It is 80 miles broad, but covered with islands and full of shoals and reefs, which make its navigation difficult. It was discovered by Torres in 1606.

Tor'res Ve'dras, The Lines of, consisted, when completed, of 152 distinct works, arranged in two lines, 25 miles N. of Lisbon, and extended from the Tagus to the sea. They were provided with an armament of 534 pieces of ordnance, and their garrisons were calculated at 34,125 men. Of the two principal lines, the advanced was 29 and the rear 25 miles in length, following the principal features of defence, the distance in a direct line between their flanks being 22 and 25 miles respectively. These works were generally small enclosed redoubts, armed with from two to six pieces of ordnance, and requiring infantry garrisons of from 100 to 300 men. The largest, "the great work at Monte Agraça," had a perimeter of 2435 feet, an armament of 25 guns, and required an infantry garrison calculated at 1590 men. Their artillery consisted of 6, 9, and 12-pounder guns and 5½-inch howitzers, mostly on rude truck-carriages. The allied army fell back and entered their line Oct., 1810, holding the invading forces at bay till Mar., 1811, when they retired discomfited. The genius and foresight of Wellington in providing this strong position was thus fully vindicated. (See Jones's *Sieges in Spain*.) (For a comparison of these lines with others, and with the defences of Washington, see *Prof. Papers Corps of Engineers U. S. A.*, No. 20.)

J. G. BARNARD.

Tor'rey, tp., Yates co., N. Y. P. 1281.

Torrey (Charles Turner), b. at Scituate, Mass., in 1813; graduated at Yale College 1833; studied theology with Rev. Dr. Jacob Ide of Medway, whose daughter he married; was successively pastor of Congregational churches at Princeton and at Salem, Mass., but relinquished his professional position to devote himself to anti-slavery labors in Maryland, where he was tried and sentenced to imprisonment for aiding slaves to escape, and died of consumption in the State prison at Baltimore May 9, 1846. His remains were buried in Mount Auburn Cemetery, near Boston. Author of a *Memoir of William R. Saxton* (1838) and *Home, or the Pilgrim's Faith Reviewed* (1845), the latter being a volume of sketches of home-life in Massachusetts possessing considerable merit, written while in prison. His biography was published under the title *Memoirs of the Martyr Torrey* (1847).

Torrey (John), M. D., LL.D., b. in New York City in 1798; graduated in medicine in College of Physicians and Surgeons, New York, 1818; was professor of chemistry, geology, and mineralogy in the Military Academy, West Point, 1824–27, of chemistry and botany in the College of Physicians and Surgeons 1827–55, and of chemistry and natural history in the College of New Jersey 1830–54; was chief assayer of the U. S. 1853–73; was one of the founders of the New York Lyceum of Natural History, of which he was for many years president, and at the request of which he prepared, as early as 1817, while still a medical student, a *Catalogue of Plants growing spontaneously within Thirty Miles of the City of New York* (Albany, 1819); published vol. i. of a *Flora of the Northern and Middle States* (New York, 1824) and a *Compendium* of the same (1826), both in accordance with the Linnæan system; suspended this task in consequence of the general adoption of the natural system of Jussieu in preference to that of Linnæus; was appointed botanist of the geological survey of New York 1836; published a monograph on the *Cyperaceæ of North America* (1836); began in 1838, in connection with his former pupil, Dr. Asa Gray, the publication in numbers of a *Flora of North America* in accordance with the natural system of classification, which had reached the close of the great natural order Compositæ when in 1843 the vast accumulation of materials compelled its suspension; published the *Flora of the State of New York* (2 vols., 1843–44), forming vols. vi. and vii. of the *Natural History* of that State; edited Dr. L. D. de Schweinitz's *Monograph of the North American Species of the Genus Carex* (New York, 1825) and Dr. John Lindley's *Introduction to the Natural System of Botany* (New York, 1831), to which he added an *Appendix;* was from 1822 to 1858 the chief botanical editor of the numerous reports of U. S. surveying and exploring expeditions; was a frequent contributor to the *Annals* of the New York Lyceum, to the New York *Medical Repository*, *Silliman's Journal*, the *Smithsonian Contributions to Knowledge*, the *Transactions* of the American Association for the Advancement of Science, and other learned societies; was a distinguished chemist, and frequently consulted by the treasury department at Washington on matters relating to coinage and currency; was many years a trustee of Columbia College, to which institution he presented in 1860 his valuable herbarium and botanical library, the fruit of forty years of research, and in which he was largely influential in extending the curriculum and organizing a post-graduate course; was a member and frequently an officer of the leading scientific associations of the U. S., and an honorary member of several similar bodies in Europe. D. in New York City Mar. 10, 1873. A brief *Memoir* by his pupil and associate, Prof. Asa Gray, may be found in the annual discourse of the latter delivered in 1874, as president of the American Academy of Arts and Sciences.

Porter C. Bliss.

Torrey (Joseph), D. D., b. at Rowley, Mass., Feb. 2, 1797; graduated at Dartmouth College 1816, and at Andover 1819; was pastor of a Congregational church at Royalton, Vt., 1819–27, professor of Greek and Latin in the University of Vermont 1827–42, professor of intellectual and moral philosophy 1842–67, and president of the University 1863–65. D. at Burlington Nov. 26, 1867. Author of a posthumous volume of lectures, *A Theory of Art* (1875); editor of the *Remains* (1843) of Pres. James Marsh, and of the *Select Sermons* (1861) of Pres. Worthington Smith, to both of which he prefixed carefully-prepared *Memoirs;* and translator of Neander's *General History of the Christian Religion and Church* (Boston, 5 vols., 1854), accompanied by elaborate and scholarly notes, which may be considered as the great literary work of his life.

Torrey (William), b. at Combe St. Nicholas, Somersetshire, England, about 1590, was descended from an eminent family of that county; received a good classical education, and emigrated to Massachusetts with his brother James about 1632, the two being ancestors of all of the name in the U. S. James settled at Scituate, and William at Weymouth, where he became a magistrate and captain of the train-band of the colony (the highest military rank at that time); was many years representative for Weymouth in the general court, of which, as he wrote a good hand, he was usually clerk or secretary, and was a member of its committees whenever they had to do with education or literature, as in the case of that appointed to examine Eliot's Indian Bible. D. at Weymouth about 1675. He wrote a work on the millennium entitled *A Discourse concerning Futurities, etc.*, first printed by Rev. Dr. Prince in 1757, with a biographical notice. His son Samuel, b. in England in 1632; graduated at Harvard 1652; became an eminent minister at Weymouth, preached the "election sermon" three times, and twice declined the presidency of Harvard College. D. at Weymouth in 1707.

Torrey'a [named in honor of Dr. John Torrey, the illustrious botanist], an interesting genus of trees of the order Coniferæ, allied to the yews, but easily distinguished by the naked drupe and the ruminated albumen of the seeds. *T. Californica* is a fine ornamental species; *T. taxifolia* of Florida has a durable, strong-scented, heavy, and close-grained wood and horizontal whorled branches. It sometimes attains a height of fifty feet. Eastern Asia has several species. *T. myristica* has a useful timber. The seeds of *T. nucifera* afford an oil used in cooking food. The astringent nuts of some species are used by the Japanese courtiers to repress the renal secretion during the long audiences of their monarch. When burnt, the leaves and wood of the *Torreyas* give off a powerful and disagreeable smell. Before the formation of this genus, several unsuccessful attempts were made thus to honor Dr. Torrey by naming a genus after him. Rafinesque applied the name *Torreya* to a group of sedges, now referred to *Cyperus*, and Sprengel applied it to a proposed genus of verbenaceous plants.

Torricel'li (Evangelista), b. at Faenza Oct. 15, 1608; studied mathematics and physics in Rome under Castelli, and in Florence under Galileo, whom he succeeded in 1642 as professor at the Academy. D. at Florence Oct. 25, 1647. In 1644 he published his *Opera Geometrica*. His most remarkable discovery is that of the Barometer (which see).

Torri'jos (José Maria), b. at Madrid, Spain, May 20, 1791; was in youth a page at the court of Charles IV.; served with credit in the war of independence, gaining the rank of colonel on the field of battle; distinguished himself as captain-general of Valencia by his zeal for the constitution of 1812, which occasioned his dismissal from the army by Ferdinand VII., and his imprisonment 1817–20; was appointed by the Cortes in 1820 field-marshal and commander-in-chief of Navarre and the Basque provinces; held out to the last against the French intervention of 1823, but was finally forced to capitulate at Cartagena; lived several years in exile at London, where he was considered the head of the numerous Spanish refugees; obtained, through the influence of John Sterling in 1830, sufficient funds to equip an expedition for the liberation of Spain from the despotism of Ferdinand VII., but being unsuccessful on landing, had to take refuge at Gibraltar, whence in 1831 he made another expedition to the S. of Spain; was captured with 53 companions, tried by court-martial, and shot at Malaga Dec. 11, 1831.

Tor'rington, p.-v. and tp., Litchfield co., Conn. P. 2893.

Torshok', town of Russia, government of Tver, on the Tertza, has extensive manufactures of vinegar, earthenware, tiles, candles, leather, shoes, and gloves which are embroidered with gold and silver and largely exported. The trade in these articles and in grain and eggs is very lively. P. 12,137.

Tor'sion [Lat. *torqueo, torsum*, to "twist"], in surgery, the twisting of the cut end of an artery in a wound or after a surgical operation, for the purpose of restraining hæmorrhage. This method has had enthusiastic advocates, but is now seldom employed except in special cases, where no better method is safely applicable.

Torsion Balance, for measuring delicate electrical or other attractions and repulsions, was invented by Coulomb. The attraction or repulsion is measured by the resistance offered to it by the twist of a filament of spun glass or other fibre. (See also Radiometer.)

Torsk, or **Dorse** [Dan. *torsk*]. (1) The *Morrhua callarias*, or Baltic cod, a valuable food-fish of the North European seas. (2) Tonsk or Tusk, the *Brosmius vulgaris*, a valuable European food-fish, considered by some as the same as the *cusk* (*B. flavescens*) of our American Atlantic waters. All the above are of the cod family, and are eaten fresh, or more generally are salted and dried. Our Pacific

coasts have another torsk, *Brosmophycis marginatus*. (See DORSE.)

Tor'stenson (LENNART), b. at Torstena, West Gothland, Sweden, Aug. 17, 1603; was educated as a page at the court of Gustavus Adolphus, whom he accompanied in 1630 to Germany; distinguished himself greatly as commander of the artillery in the battle on the Lech, Apr. 5, 1632; was taken prisoner before Nuremberg Aug. 24, 1632, and kept for six months in a damp, subterranean dungeon in Ingolstadt by Maximilian of Bavaria; was appointed commander-in-chief of the Swedish army in Germany in 1641 (see THIRTY YEARS' WAR), but was compelled by the gout to resign his command in 1646; returned to Sweden; was made count of Ortala by Queen Christina and governor-general of the province of West Gothland. D. in Stockholm Apr. 7, 1657.

Tort [Fr. *tort*, "wrong;" Lat. *torquere*, *tortus*, to "twist," "twisted"], in law, is a wrongful act, default, or omission, not consisting in a mere breach of contract, whereby a civil injury is done to another, and a remedial right of compensation therefor accrues to him—the violation of a civil duty owing to another, and not arising solely from contract. The common law divides all civil wrongs or delicts for which a compensatory action lies into torts and breaches of contract. Although the distinction is in the main a plain one and easy to be traced, yet at certain points the two classes become intermingled, and it is very difficult to determine with accuracy in which of them a given wrongful act should be placed. Among the essential differences are the following: The duty which is violated, and the breach of which constitutes a tort, may, and generally does, spring from some other relation between the parties than that of contract. As, for example, when a man is assaulted or defamed or his land is trespassed upon, his right to his own person, reputation, or property free from molestation by others, and the corresponding duty resting upon all mankind not to molest him in his enjoyment, are not based upon any contract, express or implied, between the parties. This is in general the characteristic feature of most torts, yet it is not universal, for, as will be seen hereafter, a tortious act may be a breach of contract, or may be inseparably connected with contract. Another difference is that persons under disabilities to bind themselves by contract, as infants, married women, and even the insane, may be liable for torts which they have committed. Again, if a tort is done to the person or reputation—that is, not directly to property—and either the wrongdoer or the injured party dies, all right of action ceases; while both the right and the liability for the breach of all contracts (with a very few special exceptions) survive on the death of either contracting party. In respect to the form of the remedy, where a tort is committed by several persons jointly, a suit or suits may be maintained against all, some, each, or any of the wrongdoers; but in the case of a joint contract all the promissors or obligors must, as the general rule, be united in the action and sued together. On the other hand, torts may be closely connected with breaches of contract. The act by which a contract is broken may be in every sense of the term tortious. This dual character occurs especially where the delict or wrong consists in negligence or want of skill, but is not confined to such cases. To illustrate: where passengers are injured on railways or other conveyances, where goods are lost or damaged by common carriers, where persons hired to perform special services fail through carelessness or lack of skill, where the property of guests left in the custody of innkeepers is not forthcoming, and in many other similar relations, the defaulting party has at once violated his contract with his employer and has committed a tort. In all these instances the one who has suffered the loss or wrong has an election to regard the delict as merely a violation of contract, or to treat it as a breach of duty and sue for the tort. Fraud also, which is certainly a species of tort, is generally and almost necessarily connected in some manner with contract. Here also an election often exists, either to sue on the contract, considering the deceit as incidental, or to abandon the contract and base the right of action wholly on the fraud as an independent and separate wrong.

When torts are considered in their essential nature, they may be arranged into different classes according to their characteristic elements. In one class the delict consists in a positive act of wrong, the doing what ought not to be done, the breach of a duty to forbear. In another class it consists in a wrongful omission or default, such as negligence or want of skill, the doing something in an improper manner. In many cases the very essence of the tort and of the consequent liability lies in the wrongful intent or malice with which the act is done. In others the injurious act or omission alone constitutes the tort and the liability, without any reference to the intent which accompanied it. Certain torts are entirely of a statutory origin; as, for example, the wrongful killing a person, and the consequent action for damages which is now given to the representatives of the deceased by the legislation of England and of the American States. Finally, there is an intimate connection between torts and crimes. The wrongful intent or malice which is the constituent of certain species plainly assimilates them to criminal delicts, and many wrongs to person, character, or property may be punished as crimes, and at the same time give a right of action to recover damages. The common-law doctrine, that if the tortious act amounts to a felony, the civil right of action is swallowed up in the crime and the public punishment, has been generally rejected in the U. S. It is impossible in this article to enumerate all the species and instances of torts; and, in fact, such an enumeration can never be made complete, since new varieties of wrong are constantly invented, and the maxim *ubi jus ibi remedium* finds here its most direct and appropriate application. A general classification, however, may be made of—(1) those done to persons, in all their possible relations, private, domestic, professional, and official; (2) those against character and reputation; and (3) those done to property, real and personal. When it is considered that in all these three classes the injury may be direct or consequential, intentional or accidental, by positive acts or by omissions, it is plain that the variety of possible torts is practically unlimited.

JOHN NORTON POMEROY.

Tor'ti (GIOVANNI), b. at Milan 1774; d. at Genoa 1851. A volume of his poems was published at Genoa. In reference no doubt to his elegant epistle in verse on *I Sepolcri* of Ugo Foscolo, Manzoni wrote in his *Promessi Sposi* these somewhat exaggerated words: "Pochi valenti come i versi del Torti."

Tor'toise-Plant, also called ELEPHANT'S FOOT (which see).

Tortoises [Lat. *tortus*, alluding to its crooked feet], an order of reptiles, by some called Testudinata and by others Chelonia, peculiar, among all animals, in the box-like case, formed chiefly by an outgrowth of the ribs, into which they can wholly or in part withdraw their head and members. The general form is universally familiar. The skull has all its bones forming a continuous solid framework (excepting only the lower jaw and the hyoidean arch), and the quadrate bone is connected by suture with the periotic region; the lower jaw has its rami entirely and largely connected at the symphysis; the jaws are destitute of true teeth, and are generally encased in corneous sheaths simulating the bill of a bird, but sometimes (in Trionychidæ) have fleshy lips; the dorsal vertebræ are immovably connected together, and the ribs are more or less expanded, sometimes united by suture, sometimes disconnected, and, together with certain bones developed in the integument of the embryo, constitute the framework of the upper shell, which is called the carapace; opposed to the carapace, and more or less closing it from beneath, is a flattish covering of the abdomen, which is composed of bones also developed in the integument, and constituting the so-called plastron; both carapace and plastron are mostly covered with horny shields arranged in regular order (on the carapace five in a median row, eight—four in each—in the lateral rows, and generally 23 to 25 in a marginal series), but sometimes are invested in smooth thick skin: the feet are always well developed, and fitted for walking or swimming; their bones are developed in a normal manner; the heart is trilocular; the copulatory organ is simple. Such are the most prominent characters in which the tortoises contrast or compare with the other orders of reptiles. They stand alone in the development of the ribs and dermal bones into a shell, and are indeed quite isolated in this respect, no other reptiles, so far as known, living or extinct, to any considerable extent exhibiting an intermediate condition between this complete development of a carapace and the normal development of ribs. The order is well represented in the present epoch, and members thereof are found in all continental areas and almost all the older islands; but in this respect there are some notable contrasts. Thus, while there are numerous species in North America, there are very few in Europe, and none (save occasional marine stragglers) in Great Britain. In time they are claimed to have survived from the closing period of the Silurian age to our own, but the evidence as to such antiquity is unsatisfactory and based on footprints of equivocal character. They, however, indisputably existed during the Jurassic and succeeding epochs. The types flourishing in ancient days in Europe and North America were to a large extent not allied to the predominant forms now existing in those countries, but were more related to certain marine forms (the Sphargididæ) and to fresh-water

types of an inferior grade of structure now limited to the southern hemisphere, and especially South America and Australia. The members of the order have been variously distributed according to the views of systematists respecting the value of the several chief modifications of structure. Fitzinger, who seems first to have grouped the families in higher categories under the order in 1843, gave primary importance to the development of the members, and arranged (1) under the "order Tylopoda" the club-footed or true land-tortoises; (2) under an order, Steganopodes, all the web-footed fresh-water tortoises; and (3) under a sub-order, Oincopoda, the finned marine tortoises. J. E. Gray in 1870 elevated the families and sub-families of Duméril and Bibron severally to sub-ordinal rank under the names Tylopoda (= Chersites D. and B.), Steganopodes (= Elodites cryptodères D. and B.), Pleuroderes (= Elodites pleurodères D. and B.), Trionychoidea (= Potamites D. and B.), and Oincopodes (= Thalassites D. and B.). Agassiz differentiated the families into two sub-orders—(1) the Amydæ, or footed tortoises, and (2) the Chelonii, or finned tortoises. Cope, entirely disregarding the modifications of the limbs for primary purposes, distributed the families among three sub-orders—viz. (1) Atheeæ, distinguished by the slight degree of ossification of the shell, including the Sphargididæ and extinct Protastegidæ; (2) Cryptodira, including all the tortoises which draw in their neck in a curve along the longitudinal axis of the body, and including the common sea-turtles, the Trionychidæ, the typical Cryptodères of Duméril and Bibron and Gray, and the true land-tortoises; and (3) Pleurodira, including the tortoises which draw in their neck sideways, all of which are web-footed fresh-water forms, and correspond with the Pleurodères of other authors. Finally, Huxley has divided the order into (1) Testudinea (= Chersites and Tylopoda), (2) Emydea (= Elodites), (3) Trionychoidea (= Potamites), and (4) Eucreta (= Thalassites), thus, like Duméril and Bibron, assigning primary importance to the modifications of the feet and the characters co-ordinated with them. The families admitted by Cope are the following: under Atheeæ, Sphargididæ and *Protastegidæ*: under Cryptodira, Cheloniidæ, *Propleuridæ*, Trionychidæ, Emydidæ, Chelydridæ, Cinosternidæ, Testudinidæ, *Pleurosternidæ*, and *Adocidæ*: and under Pleurodira, Podocnemidæ, Chelydidæ, Hydraspididæ, Pelomedusidæ, and Sternothæridæ; those indicated by italic letters are extinct. (More detailed information is given under several of the family names, and under CHELONIA.) THEODORE GILL.

Tortoise-shell, the scales which form together the carapace of *Testudo imbricata*, a large turtle found in the Indian and Pacific oceans and in the Red and Arafoora seas, and occasionally taken in the Atlantic. The species is known as the hawk's-bill turtle. Its flesh is unwholesome as food. Tortoise-shell is remarkable for its plastic quality, which enables the artificer to give it almost any desired shape while under the influence of heat. Pieces of the shell may even be welded together, and the filings and chips are moulded and shaped as desired when heated to the proper temperature. Tortoise-shell is chiefly used for making combs, inlaying boxes and toilet-articles, etc. Of late it is successfully imitated by various artificial compounds of much less cost. It is customary in some regions to apply heat to the back of the living tortoise, and then remove the plates, but the crop of shell which replaces the first is thin and of inferior quality.

Torto'na [Lat. *Dertona*], town of Italy, province of Alessandria, about 12 miles E. of the city of Alessandria, on a hill nearly 900 feet above the sea. Tortona was once a strongly-fortified city, but its last defences were destroyed, by order of Napoleon, after the battle of Marengo. Some of the public buildings are worthy of notice. The old cathedral, originally a Jewish synagogue, was converted into a church during the reign of Constantine, but it was destroyed by an accidental explosion of gunpowder in 1609, which at the same time demolished a large part of the town. In the new cathedral (1575) there are some valuable pictures, among them a beautiful San Sebastian; here may also be seen a grand old sarcophagus with Greek and Latin inscriptions. The library of Tortona is very rich in early ecclesiastical works. The theatre is one of the finest in Piedmont. The principal industries are silk-reeling and the manufacture of coarse cotton fabrics, both these occupations being chiefly carried on in private houses. Tortona was an important town under the Romans. Under the Lombards the Benedictines became very wealthy and powerful here, and extended their influence widely and beneficially over the neighboring country. Later, Tortona constituted itself into an independent republic, and was conspicuous during the whole mediæval period, even after the loss of popular liberty. Remains of the great aqueduct, the cloacæ, baths, and other Roman constructions are still to be seen. In the fourteenth century a rich harvest of antique statuary, vases, urns, mosaic floors, coins, etc., was discovered, and similar objects are frequently found even now. P. 13,504.

Torto'rici, town of Sicily, province of Messina, about 25 miles from Patti. The adjacent country is very productive, and near the town are the ruins of a grand old Roman bridge. P. 7835.

Torto'sa, an old but well built and fortified town of Spain, province of Tarragona, on the Ebro, in a fertile and well-cultivated district, has manufactures of cotton and linen goods, glass, soap, and pottery. P. 15,830.

Tortricidæ. See LEAF-ROLLERS.

Tortric'idæ [from *Tortrix*, "tartar," the name of the chief genus], a family of serpents of the sub-order Angiostomata. They are worm-like in appearance; have no constriction separating the head and trunk; the head is shielded above; the maxillary bones have alveolar ridges and teeth; the pupils of the eyes are round; the body is covered with smooth scales; the tail is short and conic, and there are rudiments of posterior extremities. The skull has the mastoid entering into the cranial walls; a coronoid bone is present; ectopterygoids and prefrontals are developed; and the maxillary is horizontal and in contact with the prefrontal. (*Cope.*) The family has few species, and is mostly confined, as thus restricted, to South America, Southern Asia, and Australia. The typical species, *Tortrix scytale*, is sometimes known as the "coral snake," but is not to be confounded with the Elapidæ, which are also frequently designated by the same name; it is a South American species. The Oriental species belong to the genus *Cylindrophis*, and are said to be viviparous. (See Günther, *Ann. and Mag. Nat. Hist.*, vol. i. p. 428, 1868.) THEODORE GILL.

Törts'var, or **Törzburg,** town of Austria, in Transylvania, on the Törz, has a strong citadel. P. 8930.

Tortugas. See DRY TORTUGAS.

Tor'ture [Lat. *torquere*, to "twist," to "torment"], the production of severe bodily pain for the purpose of extracting an avowal of guilt, the revelation of accomplices, or evidence in general. It was quite common among the Greeks, and in certain cases it even seems to have formed a standing feature of their legal proceedings. But it was inflicted only on slaves; a free Greek citizen could not be tortured. From Greece it was introduced to Rome, where it also became common, though at times it was loudly denounced by their jurists and orators as barbarous of itself and doubtful in its results. With the Romans, however, it found in course of time a wider application. During the emperors, and in cases of *crimen læsæ majestatis* also, free citizens—yea, even members of the first families—were tortured, and thus it became a part of the code of Justinian. Hence it was adopted during the Middle Ages by all European states in which the Roman law was made the basis of legislation, and in many countries—for instance, in Germany—it flourished rankly. In the town-house of Ratisbon can be seen a complete set of the various instruments of torture, and the criminal code of Maria Theresa, promulgated in 1769, was accompanied by 45 large plates of engravings representing the various methods of proceeding. It was not entirely abolished in Germany until the beginning of this century. In England it was known in the fourteenth century. In 1310, Edward II. consented, at the instance of Pope Clement V., to subject the Templars to torture. During the reign of Henry VI. the rack was introduced as an engine of state by the duke of Exeter, and in the reign of Henry VIII. torture became quite common. It was, however, never recognized by the common law except in the one case of *peine fort et dure*: it was considered a prerogative of the Crown, and during the Tudors the privy council assumed the right of issuing torture-warrants to the lieutenant of the Tower and other officers for the purpose of extorting discoveries of criminal offences. The last case occurred in 1640. Its worst application it found in the hands of the Inquisition. In the thirteenth century the Roman law concerning *crimen læsæ majestatis* began to be applied to heresy as a *crimen læsæ majestatis divinæ*, and in 1282, Pope Innocent IV. called on the secular powers to put to the torture persons accused of heresy in order to extract confessions against themselves and others. When, finally, the Inquisition was broken up, its dungeons and archives revealed horrors truly appalling. The rack, on which men were stretched till their joints were loosened, the Spanish boot, which compressed the muscles of the leg to a jelly, the thumb-screw, etc., were the common instruments of torture, but the Inquisition possessed the most ingenious tools of tormenting, besides using water, fire, melted metals, mutila-

tion, etc. In the eighteenth century Thomasius, Voltaire, Beccaria, and others wrote with some effect against the application of torture, and finally the French revolution swept it entirely out of existence.

Torula Cerevisiæ, or **Yeast-Plant.** See FERMENTATION, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

To'ry [a word of Irish origin, probably signifying a "robber"], a name first applied to the Roman Catholic outlaws who lived in the bogs of Ireland during the reign of Charles II.; afterward extended (1679) to all those, whether English, Scotch, or Irish, who were opposed to the bill excluding the duke of York from the succession. Finally, the name came to designate the conservative party in British politics. In the Revolutionary war of the U. S. the loyalists were called Tories.

Toscanel'li (PAOLO DEL POZZO), b. at Florence, Italy, in 1397; became one of the keepers of the Florentine library 1427; erected, about 1468, the famous gnomon on the Duomo of Florence; was learned in the scientific and geographical literature of the Greek and Latin classics, and by his letters to Columbus was instrumental in confirming the latter in his views of the figure of the earth and the practicability of a voyage westward to Cathay. D. at Florence May 15, 1482.

Total Abstinence. See TEMPERANCE, by H. I. BOWDITCH.

Tola'na, town of Spain, province of Murcia, at an elevation of 4870 feet. Ice is an important item of its trade. P. 6875.

Totaro, tp., Brunswick co., Va. P. 5043.

To'tem [Algonkin, *totêm*], a rude figure of some object, generally of an animal, used by the North American Indians as the symbol of a tribe, or sometimes of a particular band, to which they belong. The same custom prevails in Northern Asia, Australia, Oceanica, etc., as formerly in Europe.

Tot'ila, chosen king by the Ostrogoths in 540 after the defeat and capture of Vitiges at Ravenna by Belisarius; besieged and conquered Rome in 546, and extended and consolidated the Ostrogothic empire in Italy after the recall of Belisarius in 549, but was defeated and mortally wounded in the battle at Taginæ by Narses in 552.

Totonicapan, town of Guatemala, Central America, is really only an Indian village, but the inhabitants number about 10,000, and the soil is remarkably well cultivated and very productive, though not very fertile. Some manufactures of hardware, wooden articles, and woollen stuffs are also carried on.

Tot'ten (JAMES), b. in Pennsylvania in 1816; graduated at West Point 1841; served in the Florida and Mexican wars as an officer of artillery; was in command of the arsenal at Little Rock, Ark., when it was seized by the secessionists; served as chief of artillery in Missouri under Gens. Lyon and Fremont; commanded an artillery division under Gen. Halleck; became successively inspector-general of the departments of the Missouri and of the Atlantic, and was brevetted major-general of volunteers 1865. D. at Sedalia, Mo., Sept. 11, 1871.

Totten (JOSEPH GILBERT), b. at New Haven, Conn., Aug. 23, 1788; was graduated from the U. S. Military Academy July, 1805, when commissioned second lieutenant in the corps of engineers. In 1805 he accompanied his uncle, Jared Mansfield, then surveyor-general of Ohio, to the West as an assistant on this the first systematic survey of any of the new States of the Union, and Mar. 31, 1806, resigned from the army. His tastes, however, led him back to the army, and Feb. 23, 1808, he was reappointed a second lieutenant of engineers, commencing his career as a military engineer under Jonathan Williams, the first chief of the corps, and was engaged on the construction of Castle William and Fort Clinton, New York harbor, 1808–12. At the commencement of the war with Great Britain, Totten (captain in his corps, July 31, 1812) was assigned to duty as chief engineer of the army under Gen. Van Rensselaer in the campaign of 1812, on the Niagara frontier, and in that capacity took a conspicuous part in the battle of Queenstown. He was subsequently chief engineer of the army under the command of Gen. Dearborn, in the campaign of 1813, and of the army under Gens. Izard and Macomb, in the campaign of 1814 on Lake Champlain. For "meritorious services" he was brevetted major June, 1813, and lieutenant-colonel Sept. 11, 1814, for gallant conduct at the battle of Plattsburg. In Nov., 1816, a board of engineers was constituted, with Totten as a member, with instructions to make examinations of the sea-coast, and to prepare plans for defensive works. In 1817, Totten was relieved, and placed in charge of the fortifications at Rouse's Point, N. Y.; but was again made a member of the board in 1819, which by the resignations of Gen. Swift and Col. McRee, came to consist of himself and Gen. Bernard only, and the labor of working out the fundamental principles of the system, and of elaborating the projects of defence for our great seaports, thus devolved mainly on these two officers. A series of reports drawn up by this board, mostly from the pen of Totten, exhibit in a masterly manner the principles of sea-coast and harbor defence, and their application to our own country. As soon as the original board of engineers had sufficiently matured the general system of defence, and completed plans for the works first required, its members applied themselves to the duty of construction. In 1825, Totten (a major since 1818, and brevet colonel 1824) took charge of the construction of Fort Adams, Newport harbor, and continued until Dec., 1838. This work, the second in magnitude of the fortifications of the U. S., is one of the best monuments of his genius as a military engineer. Advanced to the grade of lieutenant-colonel in 1828, he conducted (1830–31) a series of experiments on the expansion and contraction of building-stone by natural changes of temperature, and the effect of these variations on cements employed to secure the joints of stone copings; also to ascertain the relative stiffness and strength of various kinds of timber—experiments attended with important practical results. His work on *Hydraulic and Common Mortars* was published in 1838, containing, besides original experiments extending over the period from 1825 to 1838, translations of essays by the best French writers on the subject. Col. Totten was appointed colonel of the corps of engineers and chief engineer Dec. 7, 1838, and took up his residence in Washington. Since 1819, as a member of the board of engineers, Totten had also been engaged in the planning of new works, and at the date of his appointment as chief engineer the system of coast defence had been for about twenty years in progress of construction, during which period most of the important ports and harbors had been at least partially fortified. Called on by Gen. Scott, who reposed in his professional skill the most unbounded confidence, Col. Totten assumed in 1847 the immediate control of the engineering operations of the army destined to invade the Mexican capital, directing in this capacity the siege of Vera Cruz. For his services he was brevetted a brigadier-general Mar. 29, 1847, "for gallant and meritorious conduct at the siege of Vera Cruz." Having thus successfully accomplished the special task for which he had been selected, he left the army and resumed his station at Washington. During the whole time of his chief-engineership he labored indefatigably to bring the ports and harbors along the whole seaboard into a defensible condition. Generally, once in about every two years, he inspected every fort of the U. S., making himself thoroughly familiar with each detail of all the works under charge of his bureau. In addition to the manifold duties of his office, involving the inspection and supervision of the Military Academy, Gen. Totten was an active member of the lighthouse board from its organization in 1852; a regent of the Smithsonian Institution from its establishment in 1846; a corporator of the National Academy of Sciences, created in 1863; one of the harbor commissioners for the cities of New York and Boston; and a member of various scientific associations. In 1815, after careful study, Totten modelled an embrasure for casemated batteries which remained unchanged until 1858, but the casemate continued a subject of study and experiment during most of his life, establishing his right to be considered the author of the American casemate. From 1851 to 1855 he conducted a series of experiments "on the effects of firing with heavy ordnance from casemate embrasures," and also on the effects of firing against the same embrasures with various kinds of missiles. D. at Washington, D. C., Apr. 22, 1864. G. C. SIMMONS.

Tot'tenville, p.-v., Westfield tp., Richmond co., N. Y., at the southern extremity of Staten Island. P. 1571.

Toucan. See RHAMPHASTIDÆ.

Tou'cey (ISAAC), LL.D., b. at Newtown, Conn., Nov. 5, 1796; received a private classical education; was admitted to the Hartford bar 1818; member of Congress 1835–39, attorney-general of Connecticut 1842–44, governor 1846–47, U. S. attorney-general 1848–49, U. S. Senator 1852–57, and secretary of the navy under Pres. Buchanan 1857–61. D. at Hartford July 30, 1869.

Touch'-Paper is a loose bibulous paper which is soaked in solution of saltpetre and then dried. It was used in lighting fires with flint and steel, and is sometimes burnt in a room to relieve the paroxysm of asthma.

Touch, Sense of. Bell and Magendie established the distinction of motor and sensory bundles of nerves—the anterior and posterior roots—on either side of the spinal cord. Through these, from every part of the body, the ultimate sensory nerves, having received impressions by

their bud like, tactile ends, return sensations to the spinal axis and to the brain; the nerves of the head communicating directly. The sensory nerves are cognizant of pain, heat and cold, size, shape, roughness, and various physical qualities of special materials and objects. This power is developed to a variable degree upon different surfaces, the tactile sensibility of some, as the finger-tips and tongue, being very acute, other parts being relatively obtuse. The acuteness of touch is due in part to the number and distribution of ultimate nerve-fibres, in part to habitual education of the part. The part which has the most finely-educated touch, the tips of the fingers, may be far less susceptible to pain, to heat and cold, or to tickling. The tactile sensibility of parts is measured by means of needle-points in arms movable upon a graduated bar—the instrument termed the "æsthesiometer." The shortest distance at which the surface appreciates distinct perceptions of the two points is thus recorded. From the experiments of Valentin the following will suffice to illustrate. The unit of measure is a line, one-twelfth of an inch:

Tip of tongue	.483	of a line.
Palm of fore finger	.603	"
" " little finger	.733	"
Surface of lip	1.500	"
" " eyelid	3.833	"
Skin of cheek	4.541	"
Forehead	6.000	"
Back of hand	6.966	"
Lower part of thigh	10.208	"
Leg	13.708	"
Middle of forearm	17.083	"
" " back	24.208	"

The finger, tongue, toes, and other surfaces may be highly educated. Each artisan in his special line acquires wonderful tactile recognition of the kind and quality of fabrics, minute sizes, shapes, and relative smoothness of surfaces. The blind learn to read the raised alphabet, recognize persons by feeling their features, and manufacture various articles, many of delicate structure. The part, as the region of the trifacial nerve—the face—which is sensitive to pain, but deficient in touch, has its nerves distributed more deeply beneath the superficial tissues. In the sensitive tactile part at the finger-tip the touch-corpuscles, or nerve-termini, are situated near the surface, constituting sensitive papillæ; as many as 108 have been found in one-fiftieth of a square inch. (See nerve-fibres and corpuscles in article HISTOLOGY.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Touch'stone, a piece of black basalt, or, better, of the bituminous jasper called Lydian stone. Small bars of gold, silver, and of various known alloys are prepared, and kept as standards of comparison. The goldsmith makes a streak upon the touchstone with the metal to be tested, and beside it makes other streaks with the bars, which are called *touch-needles*. A rude qualitative analysis is made in this way, the artisan judging of the purity of the gold or silver by the known fineness of that metal which makes the streak nearest like that of the metal tested. The metal thus thinly spread on the stone may be tested with acid, which discolors base metal when present.

Touch'wood, or **Spunk.** (1) The dried fungus *Polyporus igniarius*, used in getting fire with flint and steel; also employed as a port-fire. (See AMADOU.) (2) Also, the decayed and crumbling wood of the ash or willow which has undergone dry rot. It is used for the same purposes as the foregoing; and it is remarkable that close examination shows that such wood is always the seat of a growth of fungi much like that referred to above. All the varieties of spunk are much improved by wetting with solution of nitrate or chlorate of potash and then drying. Spunk, although a native product, is also imported to this country from Europe. It is also called *punk*.

Toughened Glass. See GLASS, by C. G. LELAND, A. M.

Toul, town of France, department of Meurthe-et-Moselle, on the Moselle, is fortified, has a fine cathedral, and manufactures lace, calicoes, tiles, faïence, vinegar. P. 8506.

Toul'min (HARRY), son of Joshua, b. at Taunton, England, in 1767; was several years a dissenting minister at Chorobert, Lancashire; settled at Norfolk, Va., 1793; was president of Transylvania College 1794–96; secretary of state of Kentucky 1796–1804; was appointed U. S. district judge of Mississippi 1804; passed his later years in Alabama; assisted in framing the constitution of that State, and served in its legislature. D. in Washington co., Ala., Nov. 11, 1823. Author of *A Description of Kentucky* (1792), *Collection of the Acts of Kentucky* (1802), *Magistrate's Assistant*, *A Digest of the Territorial Laws of Alabama* (1823), and other publications, and aided James Blair in the preparation of his *Review of the Criminal Law of Kentucky* (1804).

Toulmin (JOSHUA), D. D., b. in London, England, May 11, 1740; educated at St. Paul's school and at the dissenting academy of Dr. S. M. Savage; was for some time minister of a dissenting congregation at Colyton, Devonshire; became in 1765 pastor of a Baptist church at Taunton, where he also conducted the business of a bookseller; subsequently adopted Unitarian views; became prominent in their advocacy, and was pastor of Dr. Priestley's former church at Birmingham from 1804 to his death at that place July 23, 1815. Author, among other works, of *Memoirs of Faustus Socinus* (1777), *Dissertations on the Internal Evidences of Christianity* (1785), of biographies of John Biddle (1789), Dr. Priestley (1804), and Rev. Samuel Bourne (1809), and was editor of Rev. Charles Bulkley's posthumous *Notes on the Bible* (3 vols. 1802) and of Daniel Neal's *History of the Puritans* (Bath, 5 vols. 1793–97), with notes and a memoir of the author, and subsequently published as a supplement to that work *An Historical View of the State of the Protestant Dissenters in England under King William* (1811). A volume of his *Posthumous Discourses* (1818) was edited by Theophilus Browne.

Toulon', town of France, department of Var, at the head of a narrow but deep inlet of the Mediterranean, from which it rises like an amphitheatre on an acclivity, leaning against a row of lofty hills which encircle the bay. Next to Brest, Toulon is the principal naval station of France, and a fortress of immense strength. It is surrounded by a double bastioned wall, and all the commanding heights in the neighborhood bristle with forts and redoubts. The harbor is double; one part, given up to commerce, is lined with convenient quays; the other, arranged for naval purposes, is surrounded with shipbuilding docks, cannon-foundries, ropewalks, magazines, arsenals, schools, hospitals, barracks, and naval establishments of every description; and this part of the harbor is separated from the roadstead by hollow but bombproof moles lined with batteries. Toulon carries on a considerable trade with Algeria. P. 69,127.

Toulon, p.-v. and tp., cap. of Stark co., Ill., on Peoria and Rock Island R. R., has a private bank and 2 weekly newspapers. P. of v. 904; of tp. 2060.

Toulouse', city of France, capital of the department of Haute-Garonne, had 124,852 inhabitants in 1872, and is situated in a fertile plain on the Garonne and the Canal du Midi. Although it contains several beautiful and interesting monuments; as a whole, however, it has no architectural interest, the streets being narrow, crooked, and badly paved, the houses built of brick and without any characteristic style. Of the cathedral, dedicated to St. Stephen, the nave dates from the twelfth and thirteenth centuries, the front façade from the fifteenth. The church of St. Sernin is one of the most beautiful Romanesque structures in France, commenced in the eleventh century, completed in the fifteenth, 116 mètres long, 32 mètres broad, and with a tower 61 mètres high. The churches of St. Aubin, St. Nicolas, the Jesuits, etc., are also remarkable. Very interesting are the edifices of the Jacobins from the beginning of the fourteenth century, now the seat of the faculties and the library, and among the other public buildings the Hôtel de Ville, a magnificent building, constructed by Cammas (1750–60), and ornamented with columns and beautiful sculptures; the palais de justice, in front of which stands the bronze statue of Cujas by Valois; the museum, formerly an Augustine monastery, containing a unique collection of objects from the Stone age, and rich collections of paintings and sculptures, among which are 40 marble busts of Roman emperors, found at Calagorris; the public library, with 60,000 volumes and 7000 manuscripts; the Hôtel d'Assezat, a beautiful structure of the sixteenth century; the Maison de Pierre, also of the sixteenth century, heavy, but powerful and original, etc. The Pont Neuf has suffered frequently by the inundations of the Garonne, which have carried off several bridges both above and below; at one end of the Pont Neuf stand the waterworks, which furnish the city daily with 5,000,000 litres of water. Noticeable promenades are the Jardin Royal, the Allée St. Michel, St. Étienne, des Zéphyrs, des Soupirs, and the Grande Allée, all of which connect in the Grand Rond or Boulingrin. Toulouse is the residence of an archbishop, and has seminaries, monasteries, etc., a court for the departments of Haute-Garonne, Tarn, Tarn-et-Garonne, and Ariège, a commercial court, faculties of theology, medicine, and law, many special and general schools, and numerous benevolent institutions. It is also the residence of the commander of the 12th army corps and the 34th division, and has military schools, arsenals, powder-factories, etc. The manufacturing industry is very important, especially in cloth, woollen and cotton fabrics, machinery and agricultural implements, candles, oil, soap, oilcloth, paper, paper-hangings, etc. The commerce is very active, especially in grain (2,000,000 hectolitres annually), wine, marbles from the Pyrenees, wood, etc. Four large fairs for cloth, woollens, and cattle are held annually.

Toulouse was the name of an ancient French family which ruled independently over the city and the country along the Garonne. In 852 the possession was made a dukedom, and for some time it was united to the countship of Auvergne and the dukedom of Aquitaine. In 1208, Pope Innocent III. waged war against Toulouse, conquered the country, and gave it to Simon of Montfort. His successor, pressed hard by the legitimate heirs of Toulouse, transferred his rights to Louis VIII. of France, and a war ensued between this king and Duke Raymond VII. The country was finally incorporated with France by Philip III.
AUGUST NIEMANN.

Touraine', an ancient province of France, in the central part of the country, on both sides of the Loire, with Tours for its capital, corresponded nearly to the present department of Indre-et-Loire. It was inhabited by the Turones when Cæsar arrived in Gallia, and was annexed to the French crown in 1203. As most of its inhabitants were Protestants, it suffered very much from the Revocation of the Edict of Nantes.

Tourcoing', town of France, department of North, is a large manufacturing place, where great quantities of wool, cotton, and flax are spun and woven into very various kinds of fabrics; its breweries, distilleries, and sugar-refineries are also important. P. 43,222.

Tourgee (ALBION WINEGAR), b. May 2, 1838, at Williamsfield, O.; educated at the University of Rochester, N. Y.; served in the U. S. army in the civil war of 1861–65, and was twice wounded; after the war, settled in the practice of the law at Greensboro', N. C., and at the Southern loyalist convention in Philadelphia, Pa., in 1866, prepared the report on the condition of the Southern States; since 1868 has been judge of the North Carolina superior court. With Messrs. Barringer and Rodman he prepared *A Code of Civil Procedure for North Carolina* (1868).

Tourlaville', town of France, department of Manche, has large stone-quarries in its vicinity, and manufactures glass, mirrors, tiles, and pottery. P. 5824.

Tourmaline. See PRECIOUS STONES, by PROF. H. B. CORNWALL, E. M.

Tour'nament, or **Tour'ney,** a military pageant of the Middle Ages, in which two armed bands of knights contended in a mock fight for the purpose of exhibiting their strength, skill, and courage, or for the honor of the ladies attending. Strictly a single combat of this kind was called a *joust*, but the distinction is not always apparent. The knights were armed with lance and sword, and depended for defence chiefly upon the strength of their armor, the weapons being used chiefly for offensive purposes. The contestants were usually mounted, and the object of each party was to unhorse as many gentlemen and to break as many spears as possible. From a dangerous and exciting struggle the tournament finally degenerated into a frivolous court pageant, conducted according to a punctilious heraldic formula.

Tournay', an old but very handsome and interesting town of Belgium, province of Hainaut, was fortified by Vauban, and is on the Scheldt, which here is crossed by several elegant bridges, and lined with quays which are planted with trees and afford beautiful promenades. It contains many fine edifices, among which the cathedral is the most remarkable, and important manufactures of carpets, porcelain, hosiery, leather, and liqueurs. P. 31,003.

Tournefort', de (JOSEPH PITTON), b. at Aix, France, June 5, 1656; studied botany and travelled extensively in Southern Europe; was made professor at the Jardin des Plantes in Paris in 1683; went to the Levant with the support of Louis XIV. 1700–02; was appointed professor of medicine at the Collége de France. D. at Paris Nov. 28, 1708. His *Eléments de Botanique* (3 vols., 1694) be translated in 1700 into Latin, *Institutiones Rei Herbariæ*, and this translation was republished with additions by Jussieu in 1719, and translated into English (London, 1719–30). He also wrote *Histoire des Plantes qui paraissent aux Environs de Paris, avec leur Usages dans la Médicine* (1698), enlarged by Jussieu in 1725, and translated into English by Martyn (London, 1732), and *Voyage du Levant* (2 vols., 1717; translated into English, 1741).

Tour'niquet [Fr.], an instrument for checking the flow of blood from wounds or during surgical operation by means of pressure applied to the principal artery supplying the blood. A rude but often very useful tourniquet may be made by tying a handkerchief around the wounded limb between the heart and the wound, passing a stick through the handkerchief, and then twisting it till the flow of blood is checked. In the more effective forms a pad is strongly pressed against the main artery by means of a screw.

Tournus', town of France, department of Saône-et-Loire, on the Saone, manufactures potash, beetroot-sugar, leather and cotton goods. In its vicinity are good marble-quarries. P. 5598.

Tou'ro (JUDAH), b. at Newport, R. I., June 16, 1775, son of Rev. Isaac, a native of Holland, who in 1762 became rabbi of the Jewish synagogue at Newport; engaged in mercantile business in the counting-house of an uncle, in whose employ he sailed to the Mediterranean as supercargo 1798, on which occasion he was victorious in a desperate conflict with a French privateer; settled in New Orleans as a merchant 1802; served as a volunteer at the battle of New Orleans 1815, where he was severely wounded and permanently injured by a cannon-ball; acquired a large fortune, of which he made a most liberal use, contributing $10,000 to the Bunker Hill Monument Association, giving a valuable building-lot for the erection of the First Congregational church at New Orleans, and bequeathing at his death, which occurred at New Orleans Jan. 18, 1854, most of his property to the public charitable institutions of that city. Among them was the Touro Almshouse, occupied during the civil war as barracks for colored troops, by whom it was burned.

Tours, town of France, capital of the government of Indre-et-Loire, on a small strip of land between the Cher and the Loire, which here is crossed by one of the most magnificent bridges in Europe, and lined with handsome quays and finely-planted promenades. It has a magnificent cathedral, several other remarkable edifices, and many good educational institutions. Silk manufactures were first established here by Henry IV., and during Richelieu's time more than 40,000 hands were employed in this branch of industry. But the Revocation of the Edict of Nantes drove the workmen into exile, and gave the city a blow from which it never recovered, though its manufactures of silk stuffs, ribbons, serges, rugs, starch, and wax candles are still extensive. P. 43,368.

Tourville', de (ANNE HILARION DE COTENTIN), COUNT, b. at Tourville, department of La Manche, France, Nov. 24, 1642; was educated for the navy, and made a captain in 1667; distinguished himself in the battle of Astoga, 1676; commanded the vanguard in the battle of Palermo, 1678; made several successful expeditions against the pirates of Northern Africa 1682–88; was created a vice-admiral in 1689; defeated a Dutch-English fleet off the Isle of Wight July 20, 1690, and pursued the English to the mouth of the Thames; attacked, by positive orders of the king, a Dutch-English fleet off La Hogue May 28, 1692, though it was far superior to his own, and retreated safely into port after twelve hours' fight; was made a marshal in 1693, and defeated and destroyed a Dutch-English fleet off Cape St. Vincent May 26, 1693. On the outbreak of the Spanish war of succession he was made commander-in-chief of the naval force in the Mediterranean of the two united powers, but d. in Paris May 28, 1701.

Tous les Mois, the starch of the tubers of *Canna edulis*, a marantaceous plant cultivated in Peru, Trinidad, and St. Kitts. It is prepared much as ARROW-ROOT (which see). It is agreeable food for invalids and infants. Other species of canna are probably employed also.

Toussaint' (FRANÇOIS DOMINIQUE), surnamed L'OUVERTURE, b. at Breda, near Cape St. François, Hayti, in 1743, of slave parents of pure negro blood, his father, a native African and the son of a chieftain, having been sold by slave-traders to the Count de Noé, on whose estate he was born; was known in his youth as TOUSSAINT BREDA; was favored by the director of the count's estate, M. Bayon de Libertas, who advanced him from the position of coachman to the supervision of the sugar manufactory, affording him also facilities for learning to read and write; was much impressed by reading the denunciations of slavery in the Abbé Raynal's *History of the European Colonies in the East and West Indies*; remained quiet, and apparently contented with his lot, during the slave insurrection and massacres of 1791, though strongly urged by the insurgents to join them; but after securing the escape of his former benefactor, M. Bayon, with his family and personal property, entered the negro army, at first in a medical capacity, having long since enjoyed some note for his knowledge of simple remedies; was soon advanced to the post of brigadier-general; distinguished himself by the capture of an entire army of whites under Brandicourt, the occupation of Dondon, Marmelade, and Gonaives (1795), and the defeat of the French colonel Desfourneaux; rose to be commander-in-chief of the negroes; acted at first in concert with the Spanish forces, and against the English, French, and mulattoes, but ultimately concluded to accept the proposals of the French republic, which offered the abolition of slavery and an integral union with France; succeeded in winning the other negro leaders to his views; joined his forces with those of Laveaux, the French commander, who gave him the rank of general of division; made a vigorous campaign

against the united English and Spanish, capturing twenty-eight Spanish batteries in four days; brought the whole northern division of the island under the control of France; rescued Gen. Lavenux from the mulatto leader Rigaud, who had imprisoned him; closed the campaign by receiving from the English the surrender of all their strongholds; was appointed commander-in-chief of the entire island by Southonax, the commissioner of the Directory, 1796; came into conflict in 1797 with Hédouville, the new French commissioner, who incited the mulatto leader Rigaud to an insurrection, which was only suppressed after a year's hard fighting between the blacks and the mixed race; arrested, imprisoned, and sent to France Roume, the new French commissioner, for having countenanced the slave-trade; assumed the civil government in the name of the French Directory Nov. 26, 1800; took possession of the eastern part of the island, previously under the control of Spain, Jan., 1801, thereby becoming ruler of the whole island; administered the government with considerable skill and success, restoring prosperity and security to the island; assumed great state, surrounding himself with a large bodyguard in brilliant uniforms; created a council of state consisting of eight white proprietors and one mulatto, by which body free trade was proclaimed, a constitution was drawn up, and the presidency for life conferred upon him. Toussaint sent this constitution, with a respectful letter dated July 16, 1801, to Bonaparte, then first consul, on receipt of which the latter, finding himself temporarily at peace in Europe, determined to give employment in Hayti to a large body of his officers, procured a decree of the French council "restoring the French colonies to their condition previous to 1789"—*i. e.* re-establishing slavery, from the effect of which decree Hayti was, by a subsequent decree of Bonaparte, excepted, but only temporarily; and in Nov., 1801, Bonaparte despatched his brother-in-law, Leclerc, with 66 vessels of war and 30,000 veterans, who arrived on the coast of Hayti Jan., 1802, and were accompanied by the renegade Haytiens Rigaud, Pétion, and Boyer. Toussaint responded to the menace by a proclamation dated Dec. 18, 1801, in which he professed loyalty to France, but manifested his intention to resist the invasion; rejected the advances made him by Leclerc, by whom he was declared an outlaw, Feb. 17, 1802; was deserted by his generals Christophe and Dessalines, but nevertheless maintained for some months a desperate resistance in the mountain fastnesses; was at length induced to surrender by assurances of personal immunity and a guaranty of the liberty of the negroes, given by Leclerc in a personal interview, and resided some weeks undisturbed on his plantation near Ennery, when, through a treacherous plot on the part of a French general, Brunet (probably instigated by Leclerc), he was summoned for a conference at Gonaives, seized, and placed at midnight with his family on board a French frigate, carried to France, kept a short time a prisoner at the Temple without trial, his requests for an interview with Bonaparte being refused and his family being not allowed to see him; was afterward transferred to the castle of Joux, department of Doubs, where he soon fell a victim to ill-treatment, intense cold, and insufficient food, and was found dead Apr. 27, 1803. Biographies of Toussaint have been written by James Stephen (1814), St. Rémy (1850), by Rev. John R. Beard, D. D. (London, 1853), and by Mrs. Hannah F. Lee (1853), and his career forms the subject of Harriet Martineau's novel *The Hour and the Man* (1840, 1843, 1853), and of a lecture by Wendell Phillips. PORTER C. BLISS.

Towamen'sing, tp., Montgomery co., Pa. P. 1209.

Towan'da, p.-v. and tp., McLean co., Ill., on the Chicago and Alton R. R. P. 1235.

Towanda, p.-v. and tp., Butler co., Kan. P. 597.

Towanda, p.-b. and tp., cap. of Bradford co., Pa., on Pennsylvania and New York R. R. and Susquehanna River, contains 5 churches, a collegiate institute, 2 national banks, 4 newspapers, large mills and shops, and ironworks; butter is the principal product of the county. P. of b. 916; of tp. 2096. E. A. PARSONS, Ed. "BRADFORD ARGUS."

Tow'er (DAVID BATES), b. in Massachusetts in 1808; graduated at Middlebury College 1828; became a highly-successful teacher; was principal of the institution for the blind at Philadelphia 1839–41, and for some years professor of mathematics in the City University at St. Louis, Mo., and afterward principal of the Park Latin School, Boston, Mass. Author of a series of *Gradual Readers, Lessons in Arithmetic*, grammars, speakers, etc., of which the annual sale has been counted by hundreds of thousands. D. at Cambridge, Mass., July, 1868.

Tower (ZEALOTS BATES), b. at Cohasset, Mass.; was graduated from the U. S. Military Academy at the head of his class, and appointed a second lieutenant in the corps of engineers July 1, 1841. After a brief service as assistant with the board of engineers, he was recalled to West Point Aug., 1842, serving as assistant professor until Apr., 1843, and as principal assistant professor of engineering Apr. Aug., 1843, when, returning to duty with his corps, he served as assistant engineer in the construction of the defences of Hampton Roads, Va., until 1846, in which year he accompanied Gen. Scott's army to Mexico, and was engaged at the siege of Vera Cruz and subsequent operations resulting in the capture of the City of Mexico. For gallantry at Cerro Gordo he was brevetted first lieutenant, captain for Contreras, where he led the storming column, and Churubusco, and major for Chapultepec, where wounded. From 1848 to 1853 he was engaged in the construction of fortifications at Portland, Me., and Portsmouth, N. H.; of the defences of San Francisco, Cal., 1853–58, during which latter period he also built in that city the custom-house and appraisers' store, and served as member of the board of engineers for the Pacific coast. In Feb., 1861, he proceeded to Fort Pickens, which work he placed in an efficient state of defence, and as chief engineer remained there until May, 1862, being brevetted lieutenant-colonel for gallant services, and appointed brigadier-general of volunteers from Nov. 23, 1861, the date of its bombardment. Transferred to the East in May, and assigned to command of a brigade in the Army of Virginia, he was engaged in the battle of Cedar Mountain, Aug. 9, and subsequent operations during Pope's campaign in Northern Virginia, including the actions at Rappahannock Station, Aug. 21, and Thoroughfare Gap, Aug. 28, and battle of Manassas, Aug. 30, where severely wounded and disabled until June, 1864. For gallantry at Cedar Mountain he was brevetted colonel, and the brevet of brigadier-general was conferred on him for Manassas. From July 8 to Sept. 8, 1864, he was superintendent of the U. S. Military Academy. Upon Gen. Thomas being assigned to the defence of Tennessee in Sept., 1864, Tower was appointed chief engineer of the defences of Nashville, which city he thoroughly fortified; was engaged in the battle of Nashville, Dec. 15–16, 1864; and from Oct., 1864, was inspector-general of the fortifications of the military division of the Mississippi, in addition to his duties as chief engineer at Nashville. Chief engineer of the military division of the Tennessee, July, 1865–Jan., 1866, during which time was also president of the board of appraisers of the extensive railroad property in that division. For gallant services during the war he was brevetted major-general Mar. 13, 1865. Returning to duty with his corps in Jan., 1866, in which he had attained the rank of lieutenant-colonel Nov., 1865, he was a member of various engineer and special boards, and during 1866–67 had charge of the construction of the defences of Portsmouth, N. H. In May, 1867, was appointed a member of the board of engineers for permanent fortifications and river and harbor obstructions. Became colonel of engineers Jan., 1874.

Tower City, p.-v., Schuylkill co., Pa. P. 358.

Tower Hill, p.-v. and tp., Shelby co., Ill. P. 1176.

Tower of London. See APPENDIX.

Tow'ers (JOSEPH), LL.D., b. in Southwark, England, in 1737; was for some time a printer and bookseller; became a dissenting minister at Highgate 1774, and at Newington Green 1778; was reckoned an Arian, and was closely connected with the Unitarians, though not a member of that body. D. May 20, 1799. Author of *A Review of the Genuine Doctrines of Christianity* (1763), *British Biography* (7 vols., 1766–72), *A Vindication of the Political Opinions of Mr. Locke* (1782), *Memoirs of Frederick the Great* (2 vols., 1788), *Tracts on Political and other Subjects* (3 vols., 1796), etc., and was a leading contributor to Dr. Andrew Kippis's *Biographia Britannica* (2d ed.).

Towers, Round. See ROUND TOWERS.

Towhee. See CHEWINK.

Towian'ski, b. in Lithuania about 1800; studied at Wilna, and made himself conspicuous early in life by his mystical enthusiasm and pretensions of receiving divine revelations. After wandering around in Europe, he came to Paris about 1841, obtained complete control of Mickiewicz, formed a sect which accepted him as a Messiah, but was expelled in 1842, and disappeared soon after altogether.

Towle (GEORGE MAKEPEACE), b. at Washington, D. C., in 1840; graduated at Yale College 1861, at Harvard Law School 1863; practised law in Boston 1863–66; U. S. consul at Nantes, France, 1866–68, and at Bradford, England, 1868–70, and managing editor of the Boston *Commercial Bulletin* 1870–71. Author of *Glimpses of History* (1865), *Henry the Fifth, King of England* (New York, 1866), *American Society* (Lond., 2 vols., 1870), and other works, and a contributor to English and American periodicals.

Town [Old English *tun*, from *tynan*, to "enclose"], a term which has several quite different significations. It is

often employed both in England and the U. S., in familiar language, as a synonym of any city, great or small, as in the expression "out of town," but more especially as a vague term nearly synonymous with "small city" in alluding to foreign countries. In England it technically denoted a municipality created by royal charter or possessing immemorial privileges. In the U. S., besides the vague meaning of the word, it has a more precise meaning as a subdivision of a county, without reference to its population, so that there are many townships entirely uninhabited. The political status of the township varies largely according to locality. In the New England States the township is the original political entity, and possesses large faculties of self-government, while the county is but an aggregation of towns, chiefly for judicial convenience. In the Middle and Western States the township enjoys considerable powers of self-government, but is subordinated in many things to the county, and in the Southern States generally the township has no separate powers whatever, being merely a geographical subdivision of the county.

Town, tp., Sanford co., Ala. P. 1078.

Town, tp., Raleigh co., West Va. P. 811.

Town (Salem), LL.D., b. at Belchertown, Mass., Mar. 5, 1779; was for forty years a teacher in the State of New York; was at one time elected to the New York senate, and resided many years in Aurora. D. at Greencastle, Ind., Feb. 24, 1864. Author of *A System of Speculative Masonry* (New York, 1822), *An Analysis of the Derivative Words of the English Language* (1830), of a *Speller and Definer*, etc., and with Nelson M. Holbrook, of a *Series of School Readers*, of which millions of copies were sold.

Town Creek, tp., Elmore co., Ala. P. 411.

Town Creek, tp., Brunswick co., N. C. P. 1780.

Town'ley (Charles), b. at Townley Hall, Lancashire, England, Oct. 1, 1737, of a Roman Catholic family; received his education on the Continent under the tutorship of the celebrated John Turberville Needham; resided at Rome 1765–72, engaged in the study of antiquities, and enjoying in that pursuit the advice and experience of Winckelmann and other celebrated archæologists; devoted his large fortune to the formation of a magnificent collection of ancient art, which he subsequently largely increased through his agents and by the purchase of the Nollekens collection, and arranged his museum in two houses which he purchased in Park street, Westminster, where he d. Jan. 3, 1805. The "Townley Marbles" were purchased by the nation for £20,000, and in 1814 his bronzes, coins, and gems were also acquired for £8200. They now form part of the Græco-Roman collection in the British Museum, of which institution Mr. Townley had been a trustee. Author of *Antiquities discovered at Ribchester* (London, folio, 1800).

Towns, county of N. E. Georgia, bordering on North Carolina, and drained by the head-waters of the Hiawassee River; surface hilly, soil moderately fertile. Staples, Indian corn, oats, wheat, and rye. Cap. Hiawassee. Area, about 250 sq. m. P. 2780.

Towns (George W. B.), b. in that part of Wilkes co., Ga., now embraced within the county of Taliaferro, May 4, 1802. Ill health in youth prevented him from receiving a collegiate education; began life as a merchant, but afterward studied law and moved to Alabama, where he was admitted to the bar in 1824, and for a time editor of a political newspaper; in 1826 returned to Georgia and settled in Talbot co., where he pursued his profession; served for several years in both branches of the legislature, and was a member of Congress from 1835 to 1839; was re-elected and served from 1845 to 1847. In the latter year he was elected governor of Georgia for two years, and re-elected in 1849. The most marked event in his administration was the calling of the sovereign State convention in 1850 to consider what action Georgia would take in reference to the admission of California into the Union, in conformity with an act of the legislature in 1849–50. California was admitted by act of Congress Sept. 7, 1850, as one of the series of the measures known as the adjustment of the slavery questions of that year. Soon after the passage of these measures, Messrs. Cobb, Toombs, Stephens, and others of the Georgia delegation addressed Gov. Towns, urging him not to call the convention, as they thought the admission of California was proper under the circumstances. He, however, called the convention, which assembled in 1850. A most exciting canvass took place in the election of delegates to that convention, in which the most distinguished defenders of the action of Congress were Messrs. Cobb, Toombs, and Stephens. An overwhelming majority was returned in favor of sustaining the action of Congress. Hon. Charles J. Jenkins was chairman of the committee to whom the subject-matter was referred; Messrs. Toombs and Stephens, members of the convention, were on the committee, the result of which was the presentation and adoption of what has ever since been known as the "Georgia Platform" of 1850, in which the admission of California was sustained, and all the other adjustment measures were accepted as a final settlement of the questions involved. Gov. Towns was a man of great equanimity of temper and amenity of manners, combined with generosity and magnanimity. D. at Macon, Ga., July 15, 1854. Alexander H. Stephens.

Town'send, p.-v., Newcastle co., Del.

Townsend, p.-v. and tp., Middlesex co., Mass., has a national bank. P. 1962.

Townsend, tp., Huron co., O. P. 1300.

Townsend, p.-v. and tp., Sandusky co., O., on Sandusky and Cleveland R. R. P. 1290.

Townsend (Edward Davis), b. at Boston Aug. 22, 1817. His father (David S. T.) served in the war of 1812, losing a leg on the Niagara frontier. His paternal grandfather was a surgeon in the army of the Revolution, his maternal grandfather being Elbridge Gerry, one of the signers of the Declaration of Independence. Townsend was educated at the Public Latin School in Boston, and entered Harvard University in 1832, but receiving a cadet's appointment at West Point the next year, abandoned the collegiate course and entered the U. S. Military Academy, graduating in 1837, when appointed second lieutenant of the 2d Artillery, of which he was for eight years adjutant, serving in Florida and the Cherokee country. Made captain in the adjutant-general's department in 1846, he served as assistant adjutant-general of the military division of the Pacific four years; as chief of staff to Lieutenant-General Winfield Scott in 1861, and on his retirement was attached to the adjutant-general's office, war department, of which (Mar., 1863) he was placed in charge; was assigned to the charge of arrangements for rehoisting the U. S. flag over the ruins of Fort Sumter, Apr., 1865; promoted adjutant-general, with rank of brigadier-general, Feb. 22, 1869; brevet major-general Mar. 13, 1865.

Townsend (Eliza), b. in Boston, Mass, in 1789; was an anonymous contributor of well-written poems to the *Monthly Anthology*, the *Unitarian Miscellany*, the *Port Folio*, and other periodicals, specimens of which have been included in all the manuals of American literature. D. at Boston Jan. 12, 1854. A collection of her best poems was privately printed in 1856 by her sister, Mary P. Townsend (d. 1861). (See Griswold's *Female Poets of America*, and an obituary notice by Rev. Dr. Convers Francis in Boston *Advertiser* 1854.)

Townsend (Franklin). See Appendix.

Townsend (George Alfred), b. at Georgetown, Del., in 1841; graduated at the Philadelphia High School 1859; became news editor of the Philadelphia *Inquirer*, and subsequently city editor of the *Press*; in 1862 war-correspondent of the New York *Herald*, in which he reported the Peninsular campaign; visited England and France; wrote for several London periodicals; returned to the U. S. early in 1865; war-correspondent of the New York *World*, for which he narrated over his own signature the incidents of the close of the war, the assassination of Pres. Lincoln, and the disbandment of the great armies, on which subjects he lectured with great success; travelled again in Europe 1866–67; described in correspondence with American papers the Austro-Prussian war of 1866 and the Paris Exposition of 1867; reported in 1867 the impeachment of Pres. Johnson for six newspapers, and was for several years from 1868 on the staff of the Chicago *Tribune* as editorial writer and correspondent. Several volumes of his newspaper correspondence have been published; he has also written a volume of poems and a novel entitled *Lost Abroad*.

Townsend (George Herbert), b. in England about 1835; received a good education; became a prominent London journalist in the interest of the Conservative party; compiled several volumes of anecdotes and essays; edited Fielding's *Tom Jones* and Smollett's *Roderick Random*; published an epitome of Russell's *Modern Europe* and *Summary of Persian History*, *The Handbook of the Year 1868*, and *The Manual of Dates, a Dictionary of Reference* (1862; 3d ed. 1870), and supervised the 7th ed. of *Men of the Time* (1868). Disappointed in his hopes of political advancement by the downfall of the Disraeli ministry in Dec., 1868, he committed suicide at Kensington Feb. 23, 1869. He left ready for the press *The Every-Day Book of Modern Literature, a Series of Short Readings from the Best Authors*, which was published in 1870.

Townsend (John K.), b. in Philadelphia, Pa., in 1809; devoted himself to natural history; made extensive journeys in the Western States and across the Rocky Mountains (1833–37) in company with Thomas Nuttall; visited the Sandwich Islands and South America, and was a contributor to the *Journal* of the Philadelphia Academy of

Natural Sciences. D. in 1861. Author of *A Narrative of a Journey across the Rocky Mountains to the Columbia River, etc.* (Philadelphia and Boston, 1839), which appeared in England under the title *Sporting Excursions in the Rocky Mountains* (London, 2 vols. 1840), and published in 1839 the first part of *The Ornithology of the U. S.*, a work which was not continued.

Townsend (Luther Tracy), D. D., b. at Oreno, Penobscot co., Me., Sept. 27, 1838; graduated at Dartmouth College in 1859; studied theology at Andover, where he graduated in 1862; adjutant in the army in 1863–64, and subsequently professor of practical theology in Boston University, a position which he still occupies. He has published—*True and Pretended Christianity, Credo, Sword and Garment, God-Man, The Arena and the Throne, Lost For Ever, Outlines of Theology*, and *The Chinese Problem*.

Towns'hend, p.-v. and tp., Windham co., Vt. P. 1171.

Town'shend (Charles), second Viscount Townshend, b. at Rainham, England, Mar. 10, 1674; succeeded to the peerage on the death of his father Horatio, the first viscount, Dec., 1687; took his seat as a Whig in the House of Peers 1695; was successively appointed lord lieutenant for the county of Norfolk, commissioner for treating of a union with Scotland 1706, captain of the Yeomen of Queen Anne's guard 1707, privy-councillor and joint-plenipotentiary with Marlborough (1709) at the conferences of Gertruydenburg for negotiating a peace with France, and ambassador to the states-general of Holland 1709–10; signed the "Barrier treaty" at the Hague Oct. 29, 1709; resigned his embassy and returned to England on the fall of the Whig ministry 1712, when he was dismissed from his captaincy; was censured by the House of Commons for having signed the Barrier treaty, and declared by vote of the same House an enemy to the queen and kingdom; entered into correspondence with the elector of Hanover, who on his accession to the throne of England made him secretary of state and prime minister Sept. 11, 1714; resigned that post, and was appointed lord lieutenant of Ireland 1717, but never took possession of that office; became president of the council June, 1720, and was again secretary of state from Feb. 10, 1721, to May 15, 1730, when he retired on account of differences with his brother-in-law and colleague, Sir Robert Walpole. D. at Rainham, Norfolk, June 21, 1738.

Townshend (Charles), grandson of the second viscount, b. in England Aug. 29, 1725; entered the House of Commons 1747 as a supporter of the Pelham administration; was appointed a commissioner of trade and plantations 1749, and a commissioner for executing the office of lord high admiral 1751; acquired prominence by an eloquent speech on the Marriage bill 1753; became a lord of the admiralty 1754, treasurer of the chamber and member of the privy council 1756; was secretary at war from Mar. 24, 1761, to Feb. 1763; became first lord of trade and plantations Feb., 1763, paymaster of the forces June 8, 1765, chancellor of the exchequer and lord of the treasury Aug. 2, 1766; supported Grenville's Stamp act 1765; introduced the celebrated resolutions for taxing the American colonies June 2, 1767, and having been virtually prime minister during the retirement of Pitt, was about to be entrusted with the formation of a ministry when he suddenly d. Sept. 4, 1767. For the instability of his political opinions he was commonly known as the "Weathercock," but had an immense parliamentary reputation for oratory, was a witty and genial companion, and was styled by Burke "the delight and ornament of the House of Commons, and the charm of every private society which he honored with his presence." He married the daughter and heiress of the second duke of Argyll and widow of the earl of Dalkeith; entrusted the education of his step-son, the youthful duke of Buccleuch, to the celebrated Adam Smith, and procured for his wife a peerage in her own right. His character has been largely discussed by Macaulay and by historians of the American war, especially Bancroft (vol. iv. new ed. 1876), and has been made the subject of a special biography, *Charles Townshend, Wit and Statesman* (1866), by Percy Fitzgerald.

Townshend (Chauncy Hare), b. in England in 1798; educated at Eton; graduated at Trinity Hall, Cambridge, 1821; took orders in the Church of England, but from ill-health never engaged in active professional life. Possessing an ample fortune, he devoted himself to poetry, literature, and art; was an accomplished musician; had considerable skill in drawing and painting; formed valuable collections of pictures and other objects of art; gave much time to the investigation of mesmerism, in which he was a firm believer, and spent much of his life at his villa of Menloisir at Lausanne, Switzerland. Early in life he obtained the friendship of Southey, whom he visited, by invitation, at Greta Hall, and was encouraged to publish his poems; and subsequently was much esteemed by a select circle of literary friends, chief of whom was Charles Dickens. D. at Park Lane, London, Feb. 2., 1868. By his will he bequeathed most of his art collection to the South Kensington Museum, and left a sum of money and the care of his MSS. to Mr. Dickens, requesting him to publish such extracts as would illustrate his religious views, which, though liberal, were peculiar, and were believed by him to be "conducive to the happiness of mankind." Mr. Dickens accordingly issued in Dec., 1869, *The Religious Opinions of the Rev. Chauncy Townshend, published, as directed by his will, by his Literary Executor.* Mr. Townshend gained the Cambridge University prize for English verse 1828, and was author of *Poems* (1821), *A Descriptive Tour in Scotland* (1840), *Facts in Mesmerism* (1840; New York, 1841), *Mesmerism Proved True* (1851), *Sermons in Sonnets, with other Poems* (1851), and *The Three Gates, in Verse* (1851; 2d ed. 1861).

Townshend (George), first Marquis Townshend, eldest son of the third viscount, b. in Norfolk, England, Feb. 28, 1724; entered the British army at an early age; distinguished himself at the battles of Dettingen, Fontenoy, Culloden, and Laffeldt; entered Parliament 1747; took part as brigadier-general in Wolfe's expedition to Canada 1759; succeeded that officer in the command on his death; received the capitulation of Quebec Sept. 18, 1759; contributed to the victory of the allied forces at Fellinghausen 1761; served in Portugal 1762; succeeded to the peerage on the death of his father Mar. 12, 1764; became a privy councillor; was lord lieutenant of Ireland from Aug. 12, 1767, to 1772; became master-general of the ordnance Oct. 17, 1772; was created earl of Leicester 1784, and Marquis Townshend Oct. 27, 1787. D. Sept. 14, 1807. He was an elder brother of the Charles Townshend, author of the legislation for taxing the American colonies.

Towns'ville, tp., Granville co., N. C. P. 2187.

Townsville, p.-b., Crawford co., Pa. P. 280.

Township. See Town; and Surveying, by Prof. W. G. Peck, LL.D.

Tow'son (John Thomas), b. at Devonport, England, in 1801, son of a maker of chronometers and watches, to whose business he was trained, but early devoted himself to science; was the first person to note the fact that the luminous and chemical foci are not of the same length—a discovery which enabled Dr. J. W. Draper of New York to take the first photograph from life; was also the inventor of the process of taking photographs on glass, and the first to use in photography the reflecting camera; devoted himself in 1846 to the determination of the quickest routes across the ocean to distant countries; constructed a set of tables to facilitate great-circle sailing and for the reduction of ex-meridian altitudes, invented and brought into practice methods of composite and windward great-circle sailing; presented the copyrights of his tables to the admiralty, which caused them to be printed for the use of all mariners; received a testimonial of £1000 from the ship-owners of Liverpool Jan. 9, 1857; has been since 1850 scientific examiner of masters and mates at the port of Liverpool; aided Dr. Scoresby at the meeting of the British Association in 1854 in securing the scientific investigation of the deviation of the compass on board iron ships, and prepared for the board of trade a manual published by it under the title *Practical Information on the Deviation of the Compass, for the Use of Masters and Mates of Iron Ships* (1863; 2d ed. 1875), which, as well as his other works, has been translated into several foreign languages.

Towson (Nathan), b. near Baltimore, Md., Jan. 22, 1784; was captain of a volunteer company of artillery and adjutant of the 7th Maryland regiment at the outbreak of the war of 1812, when he was appointed captain of the 2d U. S. Artillery (Mar., 1812); aided in the capture of the British brig Caledonia under the guns of Fort Erie Oct. 9; was engaged in the actions of Queenstown and Stony Creek, and in the capture and defence of Fort George, on which latter occasion (July 17, 1813) he was wounded; took part as commander of a battery in Scott's brigade in the capture of Fort Erie July 4, 1814; bore a prominent part in the battles of Chippewa (July 5) and Niagara (July 25), the latter being the hardest fought of the war; rendered valuable service in the defence of Fort Erie Aug. 15; brevetted major and lieutenant-colonel in May, 1816; paymaster-general 1819; brevetted brigadier-general 1834; served in the Mexican war, and brevetted major-general in Mar., 1849. D. at Washington, D. C., July 20, 1854.

Tow'sontown, p.-v., cap. of Baltimore co., Md., on Baltimore and Yorktown turnpike road, 7 miles N. of Baltimore, with which it is connected by a horse railway, contains 3 churches, excellent schools, 3 newspapers, 4 hotels, a money-order post-office, and court-house. The

Maryland and Pennsylvania R. R. is graded through the village. P. about 1000.

KEECH AND YELLOTT, EDS. "BALTIMORE CO. HERALD."

Toxicodendron. See SUMACH.

Toxicol'ogy [Gr. τοξικόν, "poison," and λόγος, "discourse"], the science of poisons. It embraces the nature and properties of poisons, their effects upon the animal system, including symptomatology, pathology, and treatment, their detection, and the medico-legal questions connected with poisoning.

Definition of a Poison.—A poison is a substance *capable* of producing seriously noxious or fatal effects upon the ordinary healthy organism otherwise than by mere mechanical action. Such substances are very numerous, and occur in all the three kingdoms, animal, vegetable, and mineral.

Modes of Poisonous Action.—The poisonous action may be simple or complex, but may be broadly stated as occurring in one or more of these three modes: I. By *direct local corrosion or irritation* of the alimentary canal. Here, if the poison be corrosive, death may result in a few hours from the shock of the injury; otherwise, it follows later from violent inflammation of the stomach and bowels. The symptoms come on speedily—with corrosive agents immediately, and with simple irritants within half an hour or so. They are in general an intense burning pain in the abdomen, with speedy and violent vomiting, purging, and cramps, the matters discharged being often bloody. Where the agent is corrosive, there are also an acrid burning taste in the act of swallowing and burning pain in the mouth and gullet, as well as in the abdomen. If the poison be *simply* corrosive or irritant, there are primarily no nervous symptoms proper, such as stupor, delirium, or paralysis. II. By a *general devitalizing action* upon some or all of the solids and fluids of the body, manifested after absorption of the poison into the blood. What the exact nature of the changes produced in such cases may be is generally unknown, but familiar examples of such general poisoning, as it may not inappropriately be called, are afforded by the action of prussic acid, phosphorus, and mercury. The symptoms vary so widely with the different poisons which act after this manner that no general description can be given. So, too, the period when death occurs may range from a few seconds, as with prussic acid, to many months, as in slow poisoning by mercury. III. By *specific disturbance of function* in some vital part or parts of the nervous or muscular apparatus. This most singular of all modes of poisoning takes place only after absorption of the poison into the blood, and is generally unattended by any recognizable physical or chemical change in the tissues of the affected part. Almost all the poisons which act purely or principally after this manner are of organic origin, and prominent among them are the poisonous *vegetable alkaloids*, such as morphine, strychnine, and the active principles of belladonna, aconite, hemlock, foxglove, etc. The fatal result in these cases is generally by direct interference with the function of the heart or respiratory organs; but again, the symptoms and fatal period vary so widely with different poisons that no general account is possible. But while these are in a general way the three modes by which noxious substances prove poisonous, it is most important to bear in mind that with a large proportion of poisons the action is highly complex, as where a substance like arsenic is both locally intensely irritant and also specifically poisonous after absorption into the circulation.

Career of the Poison in the System.—Poisons can enter the system through the surfaces of wounds or by inoculation, by the lungs (in case of gaseous or volatile poisons), by the stomach and bowels, and in some cases by the unbroken skin. These several avenues are named in the order of their absorptive power. With simple irritant and corrosive poisons, like the caustic acids and alkalies, which are taken by swallowing, the bulk of the poison goes no farther than the walls of the alimentary canal, and the whole story is one of local action. But with all other kinds of poisons some of the substance enters the blood, and then either at once begins and continues to be eliminated therefrom, under its own form, by the usual emunctories (principally the kidneys), or it first undergoes more or less chemical transformation, by which in some cases its poisonous property is destroyed (as with alcohol), or it is for a longer or shorter period temporarily fixed in the tissues, whence it is gradually reabsorbed into the blood and eliminated. The first two are the most usual modes of disposition, the last being mainly confined to certain mineral poisons, as mercury, lead, and silver.

Circumstances modifying the Effects of Poisons.—These are so numerous, so complex, and so potent that, especially with poisons which act only after absorption, it is impossible to predict in any case, even with a given dose of a given poison, how severe will be the effect, or at what period the symptoms will begin or cease, or death take place. Individual susceptibility, age, sex, state of health, and habitual indulgence are all important factors in determining the effect of a given poisonous dose. But the most powerfully disturbing circumstances are connected with the absorption and elimination of the poison. In general, with *absorbed* poisons, it is *only that which is taken into the circulation* that does the mischief; and again, for poisoning to occur, there must in such case be a certain percentage of the substance, differing with different poisons, actually present in the blood at some one time. Hence, a vital factor in the determining of poisonous effects is the comparative rate at which absorption on the one hand and elimination or chemical transformation on the other respectively occur. Where the substance is taken into the blood faster than it can be gotten rid of, it necessarily accumulates in the circulation, and more or less poisoning results. But if the reverse obtain, and the poison is disposed of as fast as it gains entrance, there may be no poisoning at all, even though a large dose may be passed through the system within twenty-four hours. Hence, the *avenue of introduction* often profoundly modifies the result, since different surfaces, as already hinted, absorb with different degrees of speed and certainty. And in this way it even happens that poisons like the South American arrow-poison, *curare* or *woorara*, the venom of snakes, of rabid animals, and of morbid animal fluids, which are deadly when applied to the highly-absorptive surface of a flesh wound, are harmless when swallowed. Again, where poisons are taken into the stomach, there are many circumstances which may greatly interfere with absorption, and thus prevent poisoning. These are prompt rejection of the poison by vomiting: the presence of masses of food or of substances which may chemically act on the poison; turgidity of the gastric blood-vessels, or a morbid condition of the system or of the stomach itself. The physical state of the poisonous substance also affects its absorption, the latter being far quicker and more certain with fluids or matters in solution than with solids. From all this it follows that there is no such thing as an absolute poisonous or fatal dose of any given poison. A teaspoonful of laudanum has often killed, while, on the other hand, from thirty to forty times that quantity has been repeatedly taken and recovered from.

Diagnosis of Poisoning.—This must be made by taking the sum of the evidence of all kinds. And while the mere *fact* of poisoning is generally easy, yet even this may sometimes be difficult to establish, especially with the certainty required to convict in a case of criminal accusation. A thorough discussion of this intricate subject in all its medico-legal relations is obviously impossible within the limits of this essay, but the following are the essential points to be borne in mind. In the first place, the diagnosis of poisoning cannot be made with *infallible* certainty from the symptoms alone, for there are no symptoms *absolutely* pathognomonic of any single poison. Neither does the mere fact, taken by itself, of the presence of a poisonous substance in the stomach, the excreta, or even the tissues of the dead body, necessarily prove that the illness or death was occasioned by the poison. On the other hand, neither does the circumstance of absence of characteristic symptoms or lesions, or of failure to detect the presence of poison, prove that the case is *not* one of poisoning. Presumptive evidence of poisoning, more or less convincing, is afforded by the following circumstances: (1) Sudden onset of the symptoms in a previously healthy individual, especially shortly after taking food, drink, or medicine. Still stronger is the presumption where several persons, so partaking, are similarly and simultaneously attacked. (2) Correspondence of the symptoms with those known to be produced by some poison. (3) Finding of a poison in the stomach, excreta, or tissues of the dead body. Proof of the existence of a poison may be obtained by chemical tests, physiological experimenting upon animals with the suspected matters, etc. But as regards chemical testing, which is very properly regarded as the means of getting most certain proof, it is important to know that in a body dead from poisoning chemistry may for many reasons utterly fail to detect any traces of the poison. This, because for some poisons no test has yet been found, and with others because the poison may have wholly disappeared by reason of volatility, or by being vomited, excreted, or decomposed during life, before the analysis is begun, to such an extent as to be no longer within the power of chemical means to detect. Hence in judicial cases it is not always necessary to demonstrate, quantitatively, a fatal dose within the person of the poisoned individual. (4) Outside corroborative circumstances. These are of course endlessly varied in character and weight. Examples are the finding of charred clothing and corrosion of the lips in a case of suspected sulphuric acid poisoning; proof of possession of the suspected poison by the adminis-

trator; finding of motive for the poisoning; proof of administration by direct or circumstantial evidence. From the more or less perfect chain afforded thus by the evidence from the symptoms, the results of analysis, and corroborative circumstances, the diagnosis of poisoning is made with greater or less certainty.

Treatment of Poisoning.—The aim here is to prevent absorption or local injury by combined attempts at bodily removal of the poison and chemical neutralization of its poisonous property, and then to combat the effects by general medical means. With inoculated poisons, as in bites from venomous reptiles or rabid animals, the part should be *instantly* washed, and then thoroughly sucked either by the mouth or a cupping-glass. At the same time, where practicable, a ligature should be tied tightly around the limb near the wound and between it and the heart. Then in dangerous cases the wound should be thoroughly cauterized with a red-hot iron, or caustic potassa, nitric or hydrochloric acid, etc. Silver nitrate (lunar caustic) is not a reliable agent for this purpose, as its action is very superficial. In the use of the more powerful caustics care must be taken not to injure any large artery or important organ. Where the poison is swallowed, the stomach should be evacuated with the least possible delay, and if there be one, the antidote to the poison should be immediately given. For emptying the stomach the means are emetics and the stomach-pump, but sometimes the poison itself excites such immediate and prolonged vomiting that the use of these agents is unnecessary. But generally, even if there have been some vomiting, a further thorough emptying of the stomach should be procured, and this even if the case be first seen long after the taking of the poison. For, as with opium, absorption is often so gradual that much of the poison may still be present in the stomach, unabsorbed, even many hours after administration. Of emetics, the best is the chloride of apomorphia, because it is prompt, thorough, unirritating, and, most important of all, because it will act if only put under the skin. One-fifteenth of a grain in solution in a little water should be injected under the skin by the hypodermic syringe, or double the quantity given by the mouth. Next in efficiency come the following: *cupric sulphate* (blue vitriol), given by the mouth in solution, in the dose of two or three grains, repeated if necessary; *zinc sulphate* (white vitriol), similarly given, dose from fifteen to twenty grains; common *ground mustard*, a dessert-spoonful diffused through a tumblerful of water; powdered *alum*, a teaspoonful, taken dry, mixed with sugar, or in molasses, mucilage, or solution in water. The above (except apomorphia) are all irritating, and must therefore be used with care, if at all, in irritant poisoning or with children. *Ipecac* is a safe and unirritating emetic, but is rather slow. Dose, twenty or thirty grains of the powder, or from one to two table-spoonfuls of the syrup or wine. All these doses are for an adult, and must be duly reduced for children. In all cases where an emetic is given, its action should be assisted by free drinking of nauseous potions, as warm water, warm salt and water, or warm chamomile tea. The stomach-pump is invaluable where emetics fail to thoroughly empty the stomach. This may happen where the substance is a powder, which, sticking to the mucous membrane of the stomach, cannot be dislodged by vomiting; or where, as is sometimes the case in narcotic poisoning, vomiting cannot be brought on at all. But in corrosive poisoning the stomach-pump should not be used for fear of perforating the corroded or softened walls of the stomach. When employed, water is to be repeatedly pumped into the stomach and then out again. In irritant poisoning, after evacuation of the stomach, copious draughts of bland and viscid fluids should be taken to sheathe the walls of the alimentary canal from the action of the poison. Such are mucilages, oils, flaxseed tea, milk, white of egg, barley-water, etc. As regards antidotes, the special substances to be used will be mentioned in connection with each poison. In general, antidotes act by chemically transforming the poison, while still in the stomach, into a comparatively innocuous compound. Thus, for acids *alkalies* are to be given, and, *vice versâ*, for alkalies, acids, whereby a salt is formed devoid of the caustic effect of either of its components. For the irritant metallic salts, *albumen*, as white of egg, is given to form the comparatively insoluble, and therefore inert, albuminate of the metal. In poisoning by vegetable alkaloids the antidote is *tannin* (tannic acid), or some vegetable infusion containing the same, such as strong green tea, infusion of galls, of cinchona, of blackberry-root, logwood, rhatany, etc. Here a rather insoluble tannate of the alkaloid is formed. But yet the efficacy of antidotes is generally small; they cannot reach such of the poison as has been already absorbed, and with irritant poisons, they generally come too late. Many are again, even at best, very imperfect in antidoting power (as tannin for alkaloids), and for many poisons no antidote is known. In all cases evacuation of the stomach is as necessary where an antidote is given as where not. The treatment of the effects of the poison necessarily varies greatly. In all cases, besides such local treatment as may be necessary, the special tendency to death should be recognized and intelligently combated by appropriate means.

Detection of Poisons.—This is by submitting the suspected matters to chemical analysis or experimenting with them upon living animals. The subject is too extensive and too purely technical to warrant its detailed discussion in this place, but the following general considerations may be properly presented. For many reasons, even in fatal poisoning, chemistry may fail to detect the poison. (See ante, *Diagnosis of Poisoning.*) In conducting an analysis in a criminal case the expert should take scrupulous care to remove as far as possible all *conceivable* sources of error. Thus, the matters to be analyzed, after once coming into his possession, should be either locked up, or the vessels containing them sealed, until the analysis be made. The mere possibility of their being exposed to tampering may vitiate at law the results of the examination. So, too, the various utensils employed must be positively known to be clean before being used, and the purity of the reagents established by actual testing. In all cases, also, the analyst should not be satisfied with one or two characteristic reactions, but should apply every known or possible test to demonstrate the poison, and, where possible, as with metallic poisons like arsenic and antimony, should obtain the metal itself and exhibit it in court. Many sad examples have occurred of the failure to convict a criminal where there was little moral doubt of guilt, and on the other hand of unwarrantable positive testimony by an "expert" as to the presence of a poison, all from neglect to observe rigidly these very obvious rules.

Individual Poisons.—Here only the commoner poisons will be discussed, and the symptoms and treatment of the poisoning alone treated of. (For the chemical tests and methods of conducting analyses the reader is referred to works on chemistry and toxicology.) The strong *mineral acids*, sulphuric, nitric, and hydrochloric, and also concentrated *acetic acid*, are poisonous, simply by reason of their powerful corrosive properties. Even when diluted till no longer caustic, they may in sufficient dose produce fatal irritation, and consequent inflammation, of the stomach and bowels. *Oxalic acid*, though not corrosive, is both intensely irritant and also constitutionally a virulent poison. Its soluble salts, such as *potassium oxalate* (salt of sorrel or salt of lemon), are equally poisonous. With all these acids an intensely sour taste is perceived in the act of swallowing, and the matters vomited will show a strong acid reaction. The symptoms are purely those of irritant poisoning already described (see ante, *Modes of Poisonous Action*), except with oxalic acid. With this poison there are in addition grave nervous symptoms, as profound collapse with stupor, numbness, and almost complete general paralysis. Sometimes death takes place within a few minutes from paralysis of the heart. The smallest recorded fatal doses in the adult are—for sulphuric acid, 1 drachm (about equal to a teaspoonful), for nitric, 2 drachms, for hydrochloric, ½ an ounce, and for oxalic, 1 drachm. But violent effects have followed smaller quantities, and on the other hand, as usual, much larger doses have been recovered from. The special antidote in acid poisoning is some non-poisonous base. Magnesia and lime and their carbonates are the best, as they are themselves innocent and have a high saturating power. The caustic alkalies are too corrosive. Lime is especially selected in oxalic-acid poisoning, as the resulting salt is very insoluble, and therefore inert. It may be given in the form of chalk, or powdered oyster-shell, or the scrapings of a plastered wall—a source of lime always available. Soap or wood-ashes may be used in default of the above. Evacuation of the stomach is often unnecessary in acid poisoning, from the prompt and free vomiting induced by the poison itself. Demulcent drinks should be freely given, and the inflammation and prostration from the corrosive action of the acid combated on general principles. The *alkalies*, potassa, soda, and ammonia, are powerfully corrosive, and their carbonates (including the substances commonly known as "potash," "pearl-ash," "soda-ash") are sufficiently irritating in considerable quantity and concentration to poison. The symptoms are similar to those in acid poisoning, except that an acrid alkaline taste is perceived instead of a sour one, and the vomited matters give an alkaline instead of acid reaction. Ammoniacal draughts can be told also by the odor. The antidote in alkaline poisoning is some non-corrosive acid, and none are better than the ever-ready vinegar or lemon-juice. But in poisoning by either the strong acids or alkalies such severe damage is done on the instant of swallowing that antidotes and all other treatment only too often prove utterly useless. *Potassium nitrate*

(nitre or saltpetre) in quantities of about ½ an ounce or more in concentrated solution is both an irritant and a constitutional poison; *potassium sulphate* (vitriolated tartar) is an irritant poison in large dose: there is no antidote to either. *Barium* salts are all irritant poisons. The antidote is some soluble sulphate, as sodium or magnesium sulphate. Other comparatively innocent salts, such as *cream of tartar*, *alum*, and even the ordinary purgative salts are dangerously irritant in inordinate dose, such as 2 ounces or more. With all these salts it is the concentration of the solution swallowed which determines the poisoning. In dilute solution and divided doses they are devoid of poisonous property. *Phosphorus* is intensely irritant and poisonous, and cases of poisoning occur from children eating the heads of matches or vermin-destroying compounds which commonly contain this substance. The smallest recorded fatal dose is 1½ grains, but far less quantities have produced violent symptoms. Small children have been killed by eating the heads of from two to eight matches. Phosphorus is but little given criminally, as it is easily detected by its strong and peculiar taste and smell, and by the luminosity in the dark of matters containing it, and even of the breath of the poisoned individual. (For symptoms and treatment, see PHOSPHORUS, MEDICINAL USES OF.) *Iodine*, *bromine*, and *chlorine*, like phosphorus, are all powerful irritants and constitutional poisons, but acute poisoning by them is not very common. (For chronic poisoning by iodine and iodides see IODINE, MEDICINAL USES OF, and for the effects of potassium bromide see POTASSIUM COMPOUNDS, MEDICINAL USES OF.) *Arsenic* in any combination is a well-known virulent poison, being both an intense irritant and a constitutional poison. Its effects are exerted no matter by what avenue the substance gain entry into the system. It is a favorite poison, by reason of the ease with which it can be obtained, the tastelessness of its compounds, and the small quantity necessary to produce death. Fortunately, however, on the other hand, the symptoms are strong and characteristic, and the tests for the detection of arsenic peculiarly reliable and delicate. Arsenic is most commonly taken in the form of arsenious oxide (arsenious acid or white arsenic) or cupric arsenite (Scheele's green). This latter compound constitutes wholly or in part the pigments known as emerald green, mineral green, Brunswick, Schweinfurth, or Vienna green. These are largely used in coloring wall-paper, confectionery, wafers, artificial flowers, tarlatan dresses, etc., and many cases of poisoning arise from the unwitting use of such articles. Even inhabiting a room lined with arsenicated wall-paper, or the handling of fabrics colored with these pigments, may cause death. In these cases the arsenic is probably absorbed through small particles becoming detached, floating in the air, and so being drawn into the lungs with the breath. The medicine called *Fowler's solution* or *tasteless ague drop*, which is a watery solution of potassic arsenite, 4 grains to the fluidounce, is also highly poisonous. Poisoning has also been caused by the sulphides of arsenic known as *orpiment* (yellow arsenic) and *realgar* (red arsenic). Orpiment is an ingredient of the pigment called king's or Naples yellow, and renders the latter poisonous. The symptoms in acute arsenical poison usually come on within half an hour or an hour, but may be postponed for several hours. They are, generally, those of irritant poisoning, the burning pain, thirst, vomiting, and cramps being very severe. There is great prostration, and coma, paralysis, or convulsions may supervene. Sometimes, even in fatal cases, the irritative symptoms are almost wholly absent. Death commonly takes place within twenty-four hours, but may be delayed several days. The smallest recorded fatal dose is the equivalent of 2 grains of arsenious acid. In chronic poisoning, where the arsenic is administered by repeated small doses, there will be, besides the symptoms of gastric irritation, an irritable and inflamed condition of the eyes and skin and various nervous disorders, as numbness and tingling of the extremities, with local paralyses. The sufferer becomes emaciated; may be salivated or jaundiced; hæmorrhages may take place; the hair fall out and the cuticle exfoliate, and death ensue from general exhaustion. Where the poison is introduced by inhalation, the abdominal symptoms, though present, are not so marked, and there are symptoms of bronchial irritation, as dryness of the throat, with cough and shortness of breath. The treatment of arsenical poisoning is the thorough evacuation of the stomach by emetics and the stomach-pump, and of the intestines by non-irritant cathartics, such as castor-oil, the free use of demulcent viscid drinks, and the continuous giving of large doses of the antidote—namely, the hydrated sesquioxide of iron, freshly prepared and in the moist state. This is made by taking any of the solutions of ferric salts, such as the persulphate or the common muriated tincture of iron, diluting somewhat with water, and precipitating by adding it to water of ammonia, also diluted. The bulky precipitate is then collected by straining through muslin, is well washed with water, and given freely in the pulpy state in tablespoonful doses. This antidote acts by forming an insoluble arsenical salt of iron, but as it only combines with arsenic already in solution, it is often very slow and inefficacious where the arsenic is in solid form, as arsenious acid or Scheele's green. Where the antidote cannot be had, hydrate of magnesia is to be given, also freshly made by precipitating a solution of a magnesian salt, such as Epsom salt, with water of ammonia, and straining and washing as just described. (For the tests for arsenic see ARSENIOUS OXIDE.) Compounds of *antimony* are highly poisonous, but the only two of practical toxicological importance are *tartar emetic* and *antimonious chloride*. The properties of the former are sufficiently treated of in the article TARTAR EMETIC (which see). The chloride (butter of antimony) is a highly corrosive liquid, producing effects like those of the strong mineral acids, but cases of poisoning by this substance are rare. Compounds of *mercury* vary greatly in poisonous properties, for while almost all can produce general mercurialization, some are also acutely irritant and poisonous. These latter are generally the *mercuric* compounds, as mercuric chloride (corrosive sublimate), cyanide, iodide (red iodide), oxide (red precipitate), ammoniated mercury (white precipitate), nitrate, and, in less degree, mercuric sulphide (vermilion or cinnabar). Of these, the first two are the most powerful, the cyanide being doubly poisonous from being a compound of hydrocyanic acid, and corrosive sublimate, being, as its name imports, corrosive as well as virulently poisonous. Few mineral substances indeed are more deadly, from 3 to 5 grains being easily fatal. Death commonly occurs in from three to five days. Metallic mercury, from its insolubility in the fluids of the alimentary canal, is generally harmless, even when swallowed in large quantity. The vapor of mercury, however, is highly poisonous, and artisans who work in mercury may suffer severely from constitutional poisoning. (For the details and treatment of mercurial poisoning see MERCURY, MEDICINAL USES OF.) *Silver*, *copper*, *lead*, and *zinc*, like mercury, are constitutionally poisonous when introduced into the blood, and their soluble compounds also acute irritants, lead salts, however, being less irritant then the others. Poisoning by *silver* is rare, generally occurring by the accidental swallowing of bits of argentic nitrate (lunar caustic): the antidote is common salt. *Copper* often proves poisonous by accidental impregnation of food and drink with the metal from the use of copper vessels. This occurs where *dirty* copper kitchen utensils are used, or where food is allowed to stand, *cold*, in copper vessels. *Boiling* in *clean* copper vessels is harmless. Acute irritant poisoning will also arise from swallowing cupric sulphate (blue vitriol or blue stone) or the subacetate (verdigris). The treatment is the same as with corrosive sublimate. *Lead* is a subtle constitutional poison (see LEAD POISONING), and the soluble salts, as the acetate (sugar of lead) in considerable quantity, may cause acute irritation, but are rarely fatal. The antidote in such case is some soluble sulphate; zinc sulphate may therefore be used as an emetic, and afterward Epsom salt administered. Poisoning by *zinc* is generally acute, from swallowing large quantities of zinc sulphate (white vitriol) or the chloride. The former is a sharp irritant, the latter a powerful corrosive. Treatment as in corrosive-sublimate poisoning. *Iron* is not constitutionally poisonous, but ferrous sulphate (green vitriol) and the ferric salts, as the chloride and sulphate, are, in sufficient dose and concentration, powerful irritant poisons. Treatment, again as with corrosive sublimate. Soluble compounds of *chromium*, *gold*, *platinum*, and *tin* are all irritant poisons, but accidents from them are for obvious reasons rare. Of *animal poisons*, besides the virus of rabid animals, venomous reptiles and insects, and morbid animal fluids, the most important are the following: The powdered body of the Spanish fly (*Cantharis vesicatoria*), used to make blistering plasters, is a violent irritant, producing, when swallowed, the usual effects of irritants, and also by absorption great irritation of the urinary organs with suppression of their secretion. Poisoning may even occur from external applications. Twenty-four grains of the powdered insect and an ounce of the tincture have killed. Uncooked or imperfectly cooked food containing *measly pork* (pork infested with the parasite *Trichina spiralis*), such as raw sausage or ham, may cause violent and even fatal poisoning. Poisoning with symptoms mainly of gastro-intestinal irritation often occurs from eating *unsound meat*, and also sometimes, under conditions not thoroughly made out, from eating *fish*, *shellfish*, especially mussels, and *cheese*. There are no antidotes to any of these animal poisons, and after evacuating the stomach the effects must be combated upon general medical principles. Among *vegetable substances*, there are many which like the foregoing are poisonous either wholly or in great part by reason of their violent

irritant properties. The active principle is generally, but not always, a volatile oil or an acrid resin. The principal members of this group are the drastic cathartics, *elaterium*, *croton oil* and *seeds*, the *seeds* of the *castor-oil plant* (but not the oil), *gamboge*, *colocynth*, *scammony*, *hellebore*, and in lesser degree *may-apple root* and *jalap*; also, *savin*, *colchicum*, *veratrum viride*, and *veratria*. *Carbolic acid* and *creosote* are both powerfully irritating and also intense neurotic poisons. The sufferer speedily falls insensible and collapsed. Half an ounce of strong carbolic acid has killed, and poisoning may even occur from external applications over a considerable surface. A whitened and hardened condition of the mucous membranes touched by the acid, and the peculiar smell of the substance, generally indicate the nature of the poison. There are no antidotes to any of these substances. *Hydrocyanic acid* is one of the most deadly poisons known (see HYDROCYANIC ACID): the medicinal dilute acid even (2 per cent. strength) may kill in dose of a teaspoonful. *Potassium cyanide* is similarly fatal in dose of 5 grains. Vegetable substances rich in hydrocyanic acid are also highly poisonous. The most powerful is *oil of bitter almonds*, 20 drops of which have killed. The *leaves of the cherry-laurel* (*Prunus laurocerasus*), and the water distilled from them, are poisonous if taken in considerable quantity, but their strength in prussic acid is very uncertain. Even *cherry* and *peach pits*, which contain the same substance in small proportion, have killed children who have eaten largely of them. Many species of *hymenomycetous fungi* (mushrooms or toadstools) are notoriously poisonous. Sometimes the effects are simply gastric irritation, and sometimes also a sort of intoxication and delirium, or stupor, or convulsions, are produced. There are no general distinguishing characteristics between the edible and poisonous fungi, experience alone showing what species are poisonous and what harmless. Sometimes even the edible mushrooms acquire poisonous properties, and to some persons they are always noxious. (See FUNGI.) There is no antidote to the poisonous fungi, the treatment being the use of emetics and mild purgatives (as castor-oil), and general treatment of the symptoms. Next, there are many plants which, while either but slightly or not at all irritant, contain principles which after absorption profoundly affect the nervous or muscular apparatus, and kill, generally, by paralyzing some vital part concerned in maintaining the action of the heart or lungs. In these plants the active principle is generally an alkaloid, and the action may be simple—that is, falling upon some one portion of the nervous apparatus only, as with hemlock or strychnine—or it may be highly complex, as with opium and belladonna, where several parts are simultaneously affected. In this case the influence may even be of opposite character in the different parts, functional activity being heightened in one portion of the nervous system, and simultaneously lessened in another. As might, therefore, be expected, the symptoms in this kind of poisoning vary in the widest manner, and the manner of death even differs with different poisons. By far the most prominent member of this group is *opium* and its various preparations. (For the symptoms and treatment of opium poisoning, see OPIUM.) The smallest recorded fatal doses, in the adult, of the commoner opiates are as follows: opium, 1 grains; laudanum (tincture of opium) 2 teaspoonfuls; extract of opium, 2½ grains; morphine, ½ a grain. But from many causes (see OPIUM) the effects of a poisonous dose of an opiate are very uncertain, and enormous quantities are frequently recovered from. It cannot be too strongly impressed upon the popular mind that young children are peculiarly susceptible to the poisonous action of opium, infants having repeatedly been killed by a very few drops of laudanum. The stronger opiates, such as laudanum, wine or vinegar of opium, and morphine, should therefore never be given to infants except upon physicians' prescription. "Mrs. Winslow's Soothing Syrup" is an opiate of very varying strength, and fatal poisoning has attended its use. A singular group of poisonous plants is afforded by the mydriatic Solanaceæ, all parts of which are generally poisonous. They are—*belladonna* or *deadly nightshade* (*Atropa belladonna*), *stramonium*, called also *Jamestown weed* and *thorn-apple* (*Datura stramonium*), *henbane* (*Hyoscyamus niger*), *bitter-sweet* or *woody nightshade* (*Solanum dulcamara*), *garden nightshade* (*Solanum nigrum*), and even the berries and young shoots of the common *potato* (*Solanum tuberosum*). The above are named, as near as may be, in the order of their respective virulence. The symptoms are essentially the same with all, being great rapidity of pulse, rather rapid, shallow breathing, excessive dryness of the mouth and throat, delirium, often even violent, and, most characteristic of all, wide dilatation of the pupil, the eye looking black, lustrous, and prominent, with confusion of sight, especially for near objects. Sometimes (generally in children, according to the writer's experience) the skin becomes suffused of a bright scarlet color. Death occurs from failure of respiration. The treatment is essentially the same as with opium, except that atropine, itself the active principle of belladonna, is of course not to be employed. Morphine has been recommended as a remedy on theoretical grounds, because of the benefit of atropine in opium-poisoning, but both sound reasoning and the results of experience hardly sustain the idea of its usefulness. The *purple aconite* or *monkshood* (*Aconitum napellus*) is an exceedingly poisonous plant, the root particularly. (See MONKSHOOD.) A drachm of the dried root, 5 grains of an extract, a teaspoonful of the tincture of the root, and far less of the stronger "Fleming's tincture," have severally proved fatal. Death is from failure of the heart, and special treatment must be aimed at sustaining that organ, as by ammonia, alcoholic drinks, perfect rest upon the back, artificial respiration, etc. From experiments upon animals it is probable that digitalis would prove a powerful means of stimulating the heart in aconite poisoning, but being itself a powerful poison, its administration should be entrusted to a physician only. The *purple foxglove* (*Digitalis purpurea*) is another cardiac poison, the leaves of the second year's growth being the most active part. Its primary influence is to cause the heart to beat more slowly than usual, and at the same time more forcibly, but in poisonous dose its tetanizing action upon the organ finally stops its beating altogether as surely as the paralyzing influence of aconite. With failure of the pulse in digitalis poisoning there are also associated great prostration and excessive and prolonged nausea and vomiting, with abdominal pains. The treatment is essentially the same as with aconite. The *spotted* or *poison hemlock* (*Conium maculatum*) is another potent poison. (See HEMLOCK.) Artificial respiration should be the main reliance in treatment of the poisoning. The root of the *yellow jasmine* (*Gelsemium sempervirens*) is poisonous very much in the same way as hemlock. (See JASMINE.) *Tobacco* (*Nicotiana tabacum*) and its alkaloid, *nicotine*, are, taken internally, most powerful poisons. (See TOBACCO, PHYSIOLOGICAL RELATIONS OF.) The *Indian tobacco* (*Lobelia inflata*) greatly resembles tobacco in its effects. (See LOBELIA.) *Nux vomica* and the *bean of St. Ignatius*, with their alkaloids, *strychnine* and *brucine*, are well-known virulent poisons. (See NUX VOMICA.) Half a grain of strychnine has killed, and a sixth of a grain has caused alarming tetanic convulsions. Other noxious vegetable substances by which poisoning may occur are the *Calabar bean* (seed of *Physostigma venenosum*), *Cocculus indicus* (seed of *Anamirta cocculus*), *extract of hemp* (*Cannabis indica*), *wormseed* (buds of *Artemisia santonica*), and *santonin*, the active principle of the same, *oil of wormwood* (*Artemisia absinthium*), *camphor* in considerable quantity, *water-hemlock* or cowbane (*Cicuta virosa*), *hemlock water-dropwort* (*Œnanthe crocata*), *fool's parsley* (*Æthusa cynapium*). Among organic derivatives the following may properly be classed as poisons: *Alcohol* in large dose, as by drinking inordinately of spirituous liquors, is an acute and even fatal poison. (See INTOXICATION.) *Chloroform*, taken internally or by inhalation, may kill; inhaled, as for purposes of anæsthesia, it is especially dangerous, death often taking place quite suddenly from paralysis of the heart. Care and skill in the administration, and the use of proper inhaling appliances, vastly lessen the risk, but yet chloroform has repeatedly killed even in cautious and practised hands, and not a week passes by but a new case of death from this cause is recorded. As long, therefore, as we have in ether an anæsthetic equally efficient, while entirely free from the tendency to produce fatal syncope, the giving of chloroform as an anæsthetic is, in the opinion of the writer, entirely unjustifiable except in certain peculiar circumstances, and its *self*-administration is fraught with the highest danger. In cases of chloroform syncope the treatment is the same as for drowning—namely, artificial respiration and the application of warmth and friction. The new remedy, *hydrate of chloral*, is readily poisonous in overdose, killing much in the same way as chloroform: 30 grains have proved fatal in one case, and have caused alarming symptoms in others. The treatment is similar to that for chloroform, or, if the respiration is most at fault, the treatment for opium poisoning should be instituted. There are also various fluids which are poisonous when taken internally, such as *petroleum*, *kerosene*, *aniline*, *benzole*, *naphtha*, *fusel oil*, *nitro-benzole*, *nitro-glycerine*, *oil of turpentine*, etc., but cases of poisoning by them are too infrequent to warrant discussion. Finally, there are many of the rarer products of the chemist's laboratory which are poisonous, but they have no interest in practical toxicology.

EDWARD CURTIS.

Toxodon'tia [Gr. τόξον, "bow," ὀδοῦς, "tooth"], a name framed by Richard Owen as an ordinal designation for a group of extinct mammals whose remains have been found

in South America. They were most nearly related to the ungulates, but differed in several characters, and especially the teeth. The molars of the upper jaw were broad, and extended severally into an externo-anterior angle; those of the lower jaw were narrow, and continuous in a uniform row; the incisors had incisorial crowns, but were diversiform in shape as well as the mode of insertion and number; the feet are mostly unknown; the hind feet, however, had the astragalus at its anterior face inclined obliquely inward, and articulating in front only with the navicular, and the calcaneum had an extensive upward-extended surface for the articulation of the fibula, and a large lateral process articulating in front with the astragalus. Two generally-recognized families—the Toxodontidæ and Nesodontidæ—represent the order, and to it have also been referred certain Eocene mammals discovered in the southwestern parts of the U. S., but these last have not yet been satisfactorily demonstrated to belong to it. (See TOXODONTIDÆ: also NESODONTIDÆ, in APPENDIX.) THEODORE GILL.

Toxodont'idæ (see TOXODONTIA), a family of placental mammals of the order Toxodontia, which formerly flourished in South America, and which were especially distinguished by their teeth, which increased like those of rodents. The teeth were in reduced number as compared with the Nesodontidæ—viz. 36 (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{0}{0}$, I. $\frac{2}{3} \times 2$): the molars had their enamel coats interrupted on the anterior and posterior walls; those of the upper jaw were mostly (P. M. 3, 4, M. 1, 2, 3) obliquely triangular, rapidly narrowed backward, and had a single simple fold re-entering obliquely forward from the inner side; the incisors of the upper jaw had incisorial crowns, and the outer ones roots of nearly uniform diameter throughout, and describing the segment of a circle (like those of rodents), and persistent pulp; the molars of the lower jaw were narrowed, especially at the posterior portions, and the incisors were developed in nearly a straight line. But one genus, *Toxodon*, is known. It was composed of large-sized mammals which lived in South America during the later Tertiary epoch. The remains first obtained of *Toxodon platensis* were found by the celebrated Darwin during his sojourn in the Banda Oriental, near the Sarandis, a tributary of the Rio Negro, about 120 miles N. W. of Montevideo, and were known to the natives as giants' bones. THEODORE GILL.

Toxot'idæ [from *Toxotes*—Gr. τοξότης, "archer"—the generic name of the type], a family of fishes of the order Teleocephali and sub-order Acanthopteri, remarkable for the power of "shooting" water at insects, etc., to ensure their capture. The form is peculiar in that the back declines forward in nearly a straight line from the base of the backward-placed dorsal to the snout; it is otherwise oblong and compressed: the scales are moderate or rather large; the lateral line is continuous to the caudal fin; the head is conic in profile and compressed; the eyes are large and lateral; the opercula unarmed; the mouth has a deep oblique lateral cleft; the upper jaw is very protractile, the lower jaw longer; teeth are developed on the jaws and palate, and are villiform; the branchial apertures are continuous beneath; branchiostegal rays in seven pairs; the dorsal fin is confined to the posterior half of the body, and composed of rather few (five) stout spines and a somewhat larger soft portion; the anal is opposite to, and about as long as, the dorsal, and armed with three spines; the caudal is well developed and free; the pectorals are pointed, and have the rays branched; the ventrals are thoracic, and have each a spine and five rays. The intestinal canal has few (about nine) cæca. The skeleton has ten abdominal and fourteen caudal vertebræ. The family is represented by but two known species—*Toxotes jaculator* (see ARCHER FISH for illustration) and *Toxotes microlepis*—in the East Indian and Polynesian seas. These (or at least the former) are said to catch insects and other small animals which rest on the aquatic plants or those growing on the banks near their quarters, by protruding their mouth into a tubular form and shooting at them drops of water, and it is said they can hit insects thus at a distance of three feet and more. This habit is a source of amusement to the natives of the countries which they inhabit, and they are kept to give specimens of their skill and industry. They attain a length of about six or seven inches. THEODORE GILL.

Toyn'bee (JOSEPH), M. D., F. R. S., b. at Heckington, Lincolnshire, England, 1815; studied surgery at St. George's and University College hospitals; devoted himself exclusively to aural surgery, on which branch he was surgeon and lecturer at St. Mary's Hospital; was vice-president of the Pathological Society and president of the Quekett Club (microscopical); organized the system of local natural history museums, and took much interest in sanitary reform. He fell a victim to his scientific zeal in the course of experiments upon himself in the inhalation of chloroform and hydrocyanic acid for the relief of singing in the ears, having been found dead at London July 7, 1866. Two papers were found in his room giving the results of a previous experiment and the partial result of the last one. Author of a standard work, *The Diseases of the Ear* (London, 1860; new ed. 1867), and other writings upon professional subjects.

To'zer (HENRY FANSHAWE), b. at Plymouth, England, May 18, 1829: educated at Winchester School and at University and Exeter colleges, Oxford, graduating with honors at the latter, where he became fellow 1850; has been tutor there since 1855; took orders; contributed accounts of his *Travels in Norway* to *Vacation Tourists* for 1861, and a *Visit to the Monks of Mount Athos* in the same annual for 1862; has devoted much time to classical geography, on which subject, besides articles in magazines, he has published *Researches in the Highlands of Turkey* (2 vols., 1869) and *Lectures on the Geography of Greece* (1873).

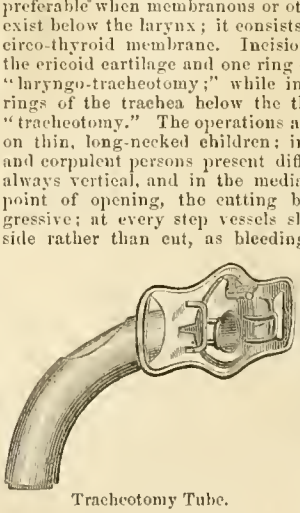
Trac'adie, p.-v., Gloucester co., N. B., near the mouth of Tracadie River and on the Gulf of St. Lawrence, 20 miles S. of Shippigan. It has a lazaretto for lepers. P. of settlement (chiefly of French descent), about 1500.

Tracadie, p.-v., Antigonish co., N. S., on the Bay of St. George, 22 miles E. of Antigonish. It has a safe harbor, a convent, and a monastery of Trappist monks from Belgium. P. of sub-district, 1882.

Tra'cery, in Gothic architecture, the ornamental work serving in the windows as a support for the glass, often of the richest design, and an endless variety in the different styles. Tracery is also a name given to the ornamental designs traced on panels and on the woodwork of Gothic structures.

Trachea. See WINDPIPE, by E. DARWIN HUDSON, JR., M. D.

Tracheot'omy [Lat. *trachea*, and Gr. τέμνειν, to "cut"], opening of the trachea or larynx by incision or puncture for the free ingress and egress of air when respiration is labored or suffocation is imminent from laryngeal obstruction. Older writers treat the subject under the title "bronchotomy." The operation is chiefly demanded when the larynx is obstructed by the membrane of croup or diphtheria, is the seat of acute œdema or dropsy, is closed by the impaction of foreign bodies, or contracted by previous inflammations or ulceration. It may also be performed to permit the escape of foreign bodies accidentally passing the larynx and entering the trachea and bronchial tubes. When goitre of great size compresses the upper part of the trachea, tracheotomy affords relief. Older writers advocate opening the trachea preliminary to artificial respiration in cases of asphyxia by noxious vapors or drowning, but it is seldom resorted to. The air-passage may be opened in either of three points. "Laryngotomy," the operation highest up and involving least danger, is preferable when membranous or other obstruction does not exist below the larynx; it consists in opening through the circo-thyroid membrane. Incision a little lower, cutting the cricoid cartilage and one ring of the trachea, is termed "laryngo-tracheotomy;" while incision of one or more rings of the trachea below the thyroid gland is strictly "tracheotomy." The operations are most easily performed on thin, long-necked children; infants with short necks and corpulent persons present difficulty. The incision is always vertical, and in the median line over the elected point of opening, the cutting being cautious and progressive; at every step vessels should be pushed to one side rather than cut, as bleeding delays the operation, and the entrance of blood into the air-passage endangers life by exciting broncho-pneumonia. When the trachea is fully exposed, it is incised; the lips of the cut are separated by scissor-like dilators, and a "tracheotomy tube" or cannula is inserted. The cannula is usually of silver or rubber, curved so as to descend in the air-passage. An inner tube is provided, slightly longer than the outer one. Mucus or membrane obstructing the end may be removed by withdrawing and cleansing the inner tube. The tube is retained in the wound by means of a tape around the neck, and should be worn until all danger from the original disease is past and the larynx is again free. Tracheotomy is performed more frequently each succeeding year, and with increasing success. It should not be left till too late; should be carefully performed at a point below all obstruction; blood should not enter the trachea; the tube should be of large size, adequate to admit air freely; an



Tracheotomy Tube.

attendant should be constantly at hand to keep the tube open; the patient should breathe a pure but moist atmosphere, and be supported by rich diet and tonics.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Trachin'idæ [from *Trachinus*—an ancient name from τραχύς, "rough"—the typical genus], a family of marine teleost fishes, of the order Teleocephali and sub-order Acanthopteri, containing the forms known as "weevers" in England and kindred types. The body is elongated, narrowed from shoulders to tail, and compressed; the scales are cycloid and very small; the lateral line high up and continuous; the head is quadrato-conical, and terminates in a conical snout; the eyes are lateral, but separated by a narrow interval, and far forward; the opercula are unarmed except the operculum, and this has a strong acute spine arising from its upper surface and pointing backward; the mouth has a lateral oblique cleft continued backward under the eyes; teeth are developed in villiform bands on the jaws and palate; the branchial apertures are continuous below; branchiostegal rays in six pairs; the dorsal is represented by two fins, the first short and sustained by a few diverging spines, the second elongated and with branched rays; the anal is very long, and composed of articulated rays; the caudal distinct; the pectorals large, and composed of branched rays; the ventrals are approximated to each other and jugular, and have each a spine and five rays; pyloric appendages are developed in small number (about six); the vertebral column has the normal number of abdominal, but an increased number of caudal, vertebræ (A. 10–11 + C. 25–31). The family is composed of a few species, chiefly found in the European seas (where are three) and along the western African coast, but one occurs along the coast of Chili. These species by most authors have been combined in one genus (*Trachinus*), but by Bleeker have been distributed among three. They are considerably feared by fishermen and others on account of the formidable opercular spines, with which they can inflict severe wounds. These spines are generally cut off when the fishes are caught, and thus they are exposed in the markets. The species are, however, of inconsiderable economic importance. (For illustration see GREAT WEEVER.)

THEODORE GILL.

Trachypter'idæ [from *Trachypterus* — Gr. τραχύς, "rough," and πτερόν, "fin"—the name of the representative genus], a family of teleost fishes of the order Teleocephali and sub-order Acanthopteri. The body is very long and exceedingly compressed, and gradually diminishes in height from head to tail; the skin is naked; the lateral line is low and continuous; the head is oblong and compressed; the eyes lateral, and in anterior half of head; the opercular bones unarmed, scaleless, and with radiating striæ; the mouth has a small cleft; the teeth are feeble; branchial apertures confluent below; branchiostegal rays in six pairs; the anus is in the anterior half of the length; dorsal fin very long, extending the whole length of the back, divided into a very short elevated anterior portion and a remaining continuous fin, all the rays of both of which are flexible spines (*i. e.* inarticulate as well as unbranched); anal wanting; caudal undeveloped, or composed of an enlarged upward-directed upper and a rudimentary lower portion; pectorals small; ventrals thoracic (and variously developed) or absent; there are five gills, and also well-developed pseudobranchiæ, "situated in a pouch formed by a fold of the mucous membrane (*Trachypterus*);" pyloric appendages are developed in large number; the skeleton has comparatively little consistency; the vertebræ are very numerous. This family is composed of large-sized, extremely-compressed, and thin fishes, which are inhabitants of the deep or open seas, and rarely stranded on shore or otherwise caught. They are probably more widely distributed than is at present known: specimens have been observed from time to time in many parts of the European seas, as well as in the Bermudian archipelago, the Australasian seas, the East Indian seas, and on the W. coast of North and South America. The large species have doubtless in part given rise to the belief in a sea-serpent, and been mistaken for such, as they well might from a distance on account of their size, some species of *Regalecus* attaining the length of nearly (if not more than) twenty feet. Nearly twenty species of the family are known, which are generally ranked under three genera —viz. (1) *Trachypterus*, in which the caudal is developed as above mentioned, and which has complete ventral fins; (2) *Regalecus*, in which the caudal is rudimentary or absent, and the ventrals reduced to single long filaments; and (3) *Stylophorus*, in which the tail is extended into a very long filament, and the ventrals are apparently wanting. No species has yet been found along the eastern American coast, but one (undescribed) has been obtained on the western coast.

THEODORE GILL.

Trachystom'ata [Gr. τραχύς, "rough," and στόμα, "mouth"], a group of amphibians by some considered as a sub-order of Gradientia or Urodela, and by others (*e. g.* Cope) as an independent order. It has been constituted for the reception of the family Sirenidæ, and has been characterized by Cope as follows: "Ossa maxillaria wanting; nasalia embraced by spine of premaxillaria; prefrontalia wanting; palatina wanting; pterygoidea wanting; orbito-sphenoids large; anterior forming part of palate; mandible with condyle, without teeth on the dentale; ceratohyals, first two distinct, with branchiæ, biconcave vertebræ, and cartilaginous corpus, as characters of less intrinsic value." (Cope, *Journ. Acad. Nat. Sc. Phila.*, N. S., vol. vi. p. 102, 1866.) (See also GRADIENTIA and SIRENIDÆ.)

THEODORE GILL.

Tra'chyte [Gr. τραχύς], a variety of lava which is often porphyritic, and when containing hornblende and augite passes into the varieties of trap called basalt, greenstone, dolerite, etc.

Tracta'rianism, and Tracts for the Times. The movement in the Church of England indicated by these words was one of the most remarkable that has occurred since the Reformation. It was partly theological, and partly ecclesiastical, and betokened the revival of Anglo-Catholic sentiments, such as had obtained more or less at previous periods, and had been strongly developed, in some respects, under Archbishop Laud, and in others by the nonjuring clergy at the end of the seventeenth century. Much stress was laid upon the teaching of the Nicene and Ante-Nicene Fathers, of the first four councils, and of divines in the Church of England, such as Andrews, Thorndike, Laud, Heylin, Kettlewell, Hickes, Wilson (bishop of Sodor and Man), and others. The doctrine of the Trinity in its Athanasian form, and of salvation by grace in an anti-Lutheran form—one which blended together the justification and sanctification of believers after the manner of Augustine and other Fathers—were salient points in the creed of those who were leaders of the revival. To the views of salvation entertained by the evangelical section of the English Church they were decidedly opposed, and they looked askance at the whole theology of the Genevan school, and deplored its effect on the minds of Reformers in the days of Edward VI. and Elizabeth. Equally, if not with still more prominence, did they bring out extremely high ecclesiastical opinions touching the relation of Church and State, clerical orders, sacraments, discipline, and worship. They lamented the control which the civil power exerted over the spiritual; they insisted upon episcopacy as divine and essential, upon apostolical succession, upon baptismal regeneration, upon the real presence in the Lord's Supper, upon the desirableness of exercising church discipline, and upon attention being paid to what they regarded as most reverent and impressive in conducting public divine service.

The movement was a reaction against tendencies of the age manifesting themselves very strongly at the time—against the rationalism of Germany, then being imported into England in many ways; against the deadness and dulness and dryness of what had been called the High-Church party, and also against what they deemed the enthusiasm in some respects, and the indifference and carelessness in other respects, of the Low-Church party; against prevalent irreligion and spiritual insensibility; against the spread of political liberalism and the ascendency of the Whig party; against the reduction of the number of bishopries, and other parliamentary proceedings in reference to Church affairs in England and Ireland; against certain ecclesiastical appointments of a latitudinarian kind; and, in short, against what they denounced as the Erastian spirit of the day.

A good deal of thought and feeling of the description thus indicated existed in the University of Oxford in the early part of the second quarter of the present century. It laid hold of a few earnest and able men—John Henry Newman, Robert I. Wilberforce, Richard Hurrell Froude, William Palmer of Worcester College, Arthur Percival, Hugh Rose, and John Keble. The *Christian Year* by the last of these (published in 1827) made a wonderful impression, and by exciting an indefinite and vague kind of High-Church feeling, having in it something devout and beautiful, did much to pave the way for what followed. These men, though united by strong sympathies, were not all of one mind as to the course of practical action to be pursued for reviving Anglo-Catholicism. Newman went abroad in 1832, and came back in July, 1833, greatly invigorated in health and spirits, and determined to set vigorously to work in the new direction. Keble preached an assize sermon on the 14th of that month upon *National Apostasy*. "I have ever considered, and kept the day, as the start of the religious movement of 1833," are Newman's words in

his autobiography entitled *Apologia*, which gives the inside history of the Oxford movement.

He now, as he says, "out of my own head began the *Tracts*." The first, without date, was entitled *Thoughts on the Ministerial Commission, respectfully addressed to the Clergy*. It dwelt upon their responsibility, and pointed to efforts for the renewal of church authority; and the bold tone assumed may be seen from the following sentence. Referring to bishops—and intimating how they should place themselves in the front of the coming battle—the writer says: "And black event as it would be for the country, yet (as far as they are concerned) we could not wish them a more blessed termination of their course than the spoiling of their goods and martyrdom." Another tract, on *The Catholic Church*, followed, and on Sept. 9, 1833, the first bearing a date then appeared: a third, containing *Thoughts respectfully addressed to the Clergy on Alterations of the Liturgy*, resisted stoutly any measure of the kind. These publications excited considerable alarm in the minds of some of Newman's friends, but he persevered, and was in 1835 and 1836 fully joined by Dr. Pusey, whose accession he deemed an event of immense value and importance, from his high position in the university, his distinguished family connections, and also his great learning and estimable character. Dr. Pusey had written a tract on *Fasting*, which appeared Dec. 21, 1833, but his tract on *Baptism*, in 1836, was his first great contribution. Much, however, as Dr. Pusey did to promote the enterprise, Newman remained its life and soul. He acknowledges that he wrote twenty-four out of the whole number of tracts, amounting to ninety. He thus describes what he did: "I had lived for ten years among my personal friends; the greater part of the time I had been influenced, not influencing; and at no time have I acted on others without their acting upon me. As is the custom of a university, I had lived with my private—nay, with some of my public—pupils, and with the junior fellows of my college, without form or distance, on a footing of equality. Thus it was through friends younger, for the most part, than myself, that my principles were spreading. They heard what I said in conversation, and told it to others. Undergraduates in due time took their degree and became private tutors themselves. In this new *status*, in turn, they preached the opinions which they had already learned themselves. Others went down to the country and became curates of parishes. Then they had down from London parcels of the tracts and other publications. They placed them in the shops of local booksellers, got them into newspapers, introduced them to clerical meetings, and converted more or less their rectors and their brother-curates. Thus, the movement, viewed with relation to myself, was but a floating opinion; it was not a power. It never would have been a power if it had remained in my hands." (*Apologia pro Vita sua*, p. 133.)

No doubt a great impetus was given to the movement by Pusey, Keble, and others. On and on it went, one tract appearing after another—some very short and pithy, and others long and elaborate, learned treatises, in fact, on Anglo-Catholic theology, containing large citations from early Fathers and seventeenth-century divines, with the view of pointing out a distinction between it and that of Rome as settled by the Council of Trent. The tracts, collected together, form six volumes. They attracted attention; they produced controversy. "These men are going over to Rome," cried multitudes of Protestants, "and are leading many more along with them." At last came No. 90. It was entitled *Remarks on Certain Passages in the Thirty-nine Articles*. It condemned any attempt to alter them, and protested against ordinary political methods by which professed reforms are carried or compassed in this day. Its drift was to show that the VIth and XXth Articles, on Holy Scripture and the authority of the Church, were not inconsistent with the Anglo-Catholic idea, that the true rule of faith is not in Scripture alone, but in apostolic tradition; that Article XI., on justification by faith only, did not exclude the doctrine of baptismal justification and of justification by works as well; that Arts. XIX. and XXI., on the Catholic Church and general councils, did not mean that the true Church is not infallible; but that the idea of express supernatural privilege, that councils properly called shall not err, lies beyond the scope of these articles, or, at any rate, beside their determination; that Art. XXII., on purgatory, pardons, images, relics, and invocation of saints, only condemned the *Romish* doctrine concerning them, not any other doctrine on these subjects, consequently not the Anglo-Catholic; that Art. XXV. did not deny that confirmation, penance, orders, matrimony, and extreme unction were sacraments, but only that they were not sacraments *in the same sense* as baptism and the Lord's supper; that Art. XXVIII. only condemned gross views of transubstantiation, not the mysterious presence of the body of Christ. The Articles on masses and clerical celibacy are in like manner explained away. This last tract created a greater sensation than any preceding one. At a meeting of the vice-chancellor, heads of houses, and proctors it was resolved that modes of interpretation such as were suggested in the tract were inconsistent with the statutes of the university; and four tutors, including A. C. Tait, now archbishop of Canterbury, wrote to the editor to say that, in their apprehension, the tract had a highly dangerous tendency. This letter was dated Mar. 8, 1841. On the 16th of March, Newman wrote, acknowledging his authorship of the tract in question. The violent controversy which preceded this publication became more violent afterward. Numbers of pamphlets were written which we have not space to enumerate, and the result was that the tracts were "*discontinued*," but, according to the persistent representation of Newman, "*not suppressed*." In 1846 he entered the Church of Rome.

This last event illustrated the tendency of the movement, and the tendency was further proved beyond all question by the numbers who just before or afterward took, under the same training, precisely the same step. The fact is, that in the space of a few years a transition occurred which epitomized the history of the Nicene and subsequent ages. Certain men began by being priestly, ascetic, and catholic, like Chrysostom, Ambrose, and Jerome, and they ended in being Roman Catholic, like Thomas Aquinas and the schoolmen—yea, in accepting ultimately the Tridentine decrees. Dr. Pusey and others have remained in the Church of England, and contend that stationariness is the Tractarian principle; but, however stationary some may have continued, others, who have not seceded, and are still in the bosom of the Establishment, have developed the tendency in ritualistic and other forms, of which neither Newman nor Pusey dreamt in 1833.

The literature of the subject is contained, as already shown, in the six volumes of tracts, and in a large collection of pamphlets and books arising out of their publication. JOHN STOUGHTON.

Tractarians. See TRACTARIANISM.

Tractors, Metallic. See PERKINS (ELISHA).

Tract Societies. The word "tract," though commonly applied to small unbound pamphlets, includes also, by derivation and early usage, any treatise or bound volume for general circulation, of whatever size. Tract societies are the most perfect realization yet found of the purpose to imbue with religious truth, by means of the press, the people of all classes and lands. Long before the invention of printing, the importance of multiplying copies of the best religious writings was recognized, for the sake both of preserving and diffusing them. Wycliffe, the English Reformer, wrote over 100 tracts, which were much copied and very useful; some of them having reached John Huss, the Bohemian Reformer, led him to the knowledge of the truth. The wonderfully timely invention of printing opened the way for a rapid growth of this method of doing good. In Bâle there was virtually a Bible society, a colporteur association, and a tract society for France in 1524. Tyndale and Luther both employed the press, the latter with amazing energy, his numerous tracts being eagerly sought for and proving a most powerful agency in the great Reformation, as were also those of Melanchthon, Calvin, Zwingli, and other Reformers.

In the eighteenth century the friends of religion began to associate themselves for greater efficiency in this work, three societies having been organized before 1701 by members of the Church of England—one "for the propagation of the gospel in New England and America," another "for foreign parts," and the third for "promoting Christian knowledge." In 1742, John Wesley was issuing numerous tracts and books; Coke and he, forty years later, organized a society for tract distribution among the poor. In 1750 was formed the first tract society in which different denominations united—The Society for Promoting Religious Knowledge among the Poor. In 1790 Hannah More began to issue her famous "cheap repository tracts" in great numbers. In 1793 the religious Tract and Book Society of Scotland was formed. In May, 1799, The Religious Tract Society was organized in London, the Rev. George Burder being the principal mover in this enterprise, which has since become the largest and most efficient tract society in the world. The first year its entire receipts were £2340; now, that two-thirds of a century have passed, its annual income is about £160,000, and its grants £30,000. It has issued a total of nearly 13,000 different publications, large and small, and has 9800 now on its catalogue. Its publications at home and abroad are in 119 different languages, and amount to a total of 1600 millions of copies. It owns no printing and binding establishment, but manufactures all its issues by contract with outside parties. It has three

depositories in London, and auxiliaries at many prominent points of the United Kingdom. It sells largely also "to the trade" and by hawkers or book-peddlers; and in foreign countries it aids missionaries with grants of its own publications, and of money to print tracts in the native languages. Besides this great and undenominational society, each religious denomination in England has a publication board of its own; and the opponents of religion have adopted the same means of disseminating their views. There are also tract societies, in which Christians of all denominations unite, at Paris, Lausanne, Toulouse, Brussels, Geneva, and some other points on the continent of Europe; also at various foreign missionary centres.

In the U. S., where common-school education and a free press have formed an eminently reading community, and where the States of New York and Massachusetts print more newspapers than all Great Britain, tracts and volumes on religion appeared early and in great numbers, and societies for printing and circulating them were at length formed—the Methodist Book Concern in 1789; the Massachusetts Society for Promoting Christian Knowledge, at Boston, in 1803, and other societies in Boston, New Haven, Middlebury, Vt., New York, Albany, Philadelphia, Baltimore, and Hartford. Prominent among these was the New York Religious Tract Society, organized in 1812, and afterward continued in the American Tract Society, New York; and the New England Tract Society, organized in 1814, which in 1823 changed its name to the American Tract Society, and in Massachusetts (1825) became a branch of the national society of the same name, then instituted. In the present American Tract Society, Christians of all denominations, and most of the local tract associations then existing, united to publish and circulate whatever would best "diffuse a knowledge of our Lord Jesus Christ as the Redeemer of sinners, and promote the interests of vital godliness and sound morality"—with only this restriction, that it should be "calculated to receive the approbation of all evangelical Christians." Such men, of twenty different denominations, have always been found among its officers, its laborers, and its warm friends and supporters. Its great object is to glorify God and save men by diffusing gospel truths through the press. But there are many subsidiary objects of great moment, such as the following: To preserve in usefulness the best writings of earlier days; to provide a channel through which the best Christian minds of the present age may impart to the world their fresh thought and their growing life; to forestall and withstand that flood of infidelity, licentiousness, and crime which has already produced hundreds of infidel works and thousands of novels, flashy books, and papers full of corruption, and to help give to American literature a truly Christian character; to furnish such publications for all classes—not for Christians alone, but for such as need to be won from their indifference or disabused of their errors; to provide them for all ages, and in forms suited to all tastes; to care for the spiritual wants of foreign immigrants; to aid in giving a Christian literature to foreign nations wherever American influence penetrates; to aid pastors in their all-important work, furnishing doctrinal and practical books for their own use, and writings adapted to every different case arising among their people; to promote and guide revivals of religion and individual effort for the good of others; to furnish these treasures of gospel truth at low prices, and thus give them the widest diffusion; to create a channel through which the charities of good people may flow in judicious grants of the most suitable books for the destitute; and to counteract sectarianism and develop that Christian union which our Saviour makes the precursor of the millennium.

For the first two years only *tracts* were published, for adults and for children. The issue of volumes, however, was intended from the first, and in the third year volumes began to appear—first, Doddridge's *Rise and Progress*, then the *Saint's Rest*, *Baxter's Call*, *The Pilgrim's Progress*, etc. In the fourth year monthly tract distribution began to be practised in New York City and elsewhere, and was soon very widely adopted, and has continued to the present day. In the sixth year prominence was given to the value of tracts in connection with faithful personal efforts to save souls. In the eighth year the "volume enterprise" was inaugurated by an attempt to reach every family in the South Atlantic States with one or more volumes. This effort was extended in the next year to include the West, and was very widely prosecuted in many parts of the country. The next step—and an exceedingly important one—was the organization in America of colportage, in 1841, to carry the gospel to the doors of neglected, scattered thousands—at least one-third of the entire population of the U. S.—who would never seek it and whom churches did not reach. Eleven self-denying and faithful men were commissioned the first year, 23 the second year, 76 the third, 113 the fourth, and before the war over 600 men were employed for the whole or a part of each year.

Another notable point in the progress of the society is found in the establishment of its periodicals. The first three were the *American Messenger*, the *Amerikanischer Botschafter*, and the *Child's Paper*. The *American Messenger* is a monthly paper, with over 100,000 subscribers. In 1847 the *Amerikanischer Botschafter* was commenced—like the *Messenger*—for the Germans. In 1852 the *Child's Paper* was commenced, a smaller monthly paper for children, beautifully illustrated, and, like the other two, edited with great ability and care. This popular favorite has had a circulation of over 300,000 monthly. In 1871 three new periodicals were added to those above named: the *Illustrated Christian Weekly*, a beautiful pictorial paper of twelve pages for home and Sabbath reading; the *Deutscher Volksfreund* (or "German People's Friend"), an eight-page illustrated weekly; and the *Morning Light*, a small illustrated paper for beginners.

The adaptation of the society to meet new exigencies was illustrated during the four sad years of the late war in supplying 172 new publications for soldiers; and in labors for the blacks, for whom quite a number of books were specially prepared and a large model school opened at Arlington Heights. In these last years also Providence has been opening one by one, in a remarkable manner, doors of access to the Spanish and Portuguese-speaking people of North and South America, the first twenty millions, and the last nine millions, in number. They are the special charge of the Christian Church in the U. S., and this society has engaged in earnest greatly to enlarge its list of publications for them, already over 300. It should also be mentioned that cash grants in aid of foreign missions began to be made in the second year of the society's existence, and have ever since been an important branch of its work, amounting often to $20,000 yearly.

Among *results* may be mentioned the providing of 5302 distinct publications, of which 1094 are volumes, and others tracts, handbills, etc., the whole constituting a collection of religious literature for our people unsurpassed in the world, many a single tract being worth the labor of a life for the good it has done. Among the home publications are 1500 in eleven foreign languages—German, French, Spanish, Italian, Portuguese, Swedish, Welsh, Dutch, Danish, Finnish, and Hungarian—for immigrants, for many of whom scarcely any other Christian literature is provided. Of the periodicals, a total of 164,000,000 copies have been issued, or, at present rates, 8,000,000 yearly, to 550,000 subscribers. Of the other home publications, over 27,000,000 of volumes have been printed and over 2,000,000,000 pages of tracts—a flood of gospel truth which has certainly told with immense power on the character and destiny of America. Probably there is no inhabited county in the land where some of these publications might not be found, and no citizen of the U. S. who is not indirectly benefited by their effect. Annual grants to our destitute are made to the amount of over $50,000 worth of its home publications. Besides large amounts thus transmitted by our shipping to foreign nations, a total of over $620,000 in money has been granted to aid the missionaries at 70 different stations in heathen lands to print books which the society approves for their mission-work; and thus 4000 different publications have been issued abroad, including over 600 volumes, in 148 languages and dialects.

Of the good results of colportage, a volume might be written, and yet but a small part be told. In its thirty-five years it has done a work equal to that of one man for over 6000 years; it has sold 10,700,000 volumes and granted 3,000,000; it has made 11,700,000 family visits; and has to a good degree met the wants of a rapidly-advancing population where no bookstores, schools, or churches existed, where the message of salvation would not otherwise have been borne.

The total amount received in donations and legacies, and expended in the charities of the society, is $4,400,000; and the sales amount to above $9,000,000, making a total of nearly $14,000,000 from its commencement to the present time. The business of the society fairly supports itself, leaving all donations and legacies to be sacredly used in its benevolent work.

The American Tract Society of Boston, for many years a branch of the national society, withdrew from it during the anti-slavery agitation, and for a time carried on its separate operations with great vigor, but is now comparatively inactive. The Western Book and Tract Society, at Cincinnati, had a somewhat similar history, but is now working in harmony with the national society.

Besides these undenominational societies, each of the leading denominations of the Christian Church in the U. S. has its own society or board of publication, some of

them large and prolific organizations. We may mention the Methodist Book Concern, the Presbyterian Board of Publication, the Baptist, Reformed, Congregational, and Lutheran boards. But as they are severally organs of a single sect, details respecting them do not come within the scope of this article. W. W. RAND.

Tra'cy (EBENEZER CARTER), b. at Hartford, Vt., June 10, 1796; graduated at Dartmouth College 1819, at Andover Seminary 1822; was tutor at Dartmouth 1823–25; became a Congregational minister; was editorially connected with the New York *Journal of Commerce*, the *Journal of Humanity*, and the Boston *Recorder*, and was editor of the *Vermont Chronicle* 1826–28, and from 1834 to his death, at Windsor May 15, 1862. Author of a *Memoir of Jeremiah Evarts* (1845).

Tracy (EDWARD D.), b. in Norwich, Conn., Mar. 1, 1791; went to Georgia and studied law; moved to Macon in 1823; was elected its first mayor, and as such received Gen. La Fayette and his party when they passed through this State; represented the county of Bibb in the house and in the senate at different times; in 1840 was elevated to the bench of his judicial circuit. D. at Macon Feb. 20, 1849. A. H. STEPHENS.

Tracy (JOSEPH), D. D., brother of Rev. Ebenezer C., b. at Hartford, Vt., Nov. 3, 1794; graduated at Dartmouth College 1814; studied theology; was pastor of the Congregational churches at Thetford and West Fairlee, Vt., from June 26, 1821 to 1829; subsequently preached at his native place; edited the *Vermont Chronicle* 1829–34; was for one year editor of the Boston *Recorder*, and for nearly forty years filled at Boston the post of New England secretary of the American Colonization Society. His residence for several years was at Beverly, Mass., where he d. Mar. 24, 1864. Author of *The Three Last Things* (1839), *The Great Awakening, a History of the Revival of Religion in the Time of Edwards and Whitefield* (New York, 1842), *The History of the American Board of Commissioners for Foreign Missions* (1842), and a *Refutation of Charges against the Sandwich Island Missionaries* (Boston, 1844); edited the *Memorial of the Semi-Centennial Anniversary of the American Colonization Society* (1867); contributed to the Semi-Centennial Memorial volume of the American Board of Commissioners for Foreign Missions (1862), wrote for the New York *Journal of Commerce* and New York *Observer*, and was associated with Rev. Dr. H. B. Smith as editor of the *American Theological Review* for several years.—His brother, Rev. IRA TRACY, for several years a missionary to Siam, subsequently a financial agent of the American Board and Congregational pastor in the Western States, was author of several publications, chiefly upon missions, and was a contributor to the *Bibliotheca Sacra*.

Tracy City, p.-v., cap. of Grundy co., Tenn., on the summit of the Cumberland Mountains, and on the Tennessee Coal and R. R. Co.'s road, has 1 church, 1 newspaper, 1 foundry, a steam saw-mill, and the railroad car and repair shops. Coal-mining and coke-burning are extensively carried on. P. about 1200.
CHARLES FOSTER, ED. "REPORTER."

Trade. See FREE TRADE, by HON. D. A. WELLS, LL.D.; and PROTECTION, by R. E. THOMPSON.

Trade, Balance of. According to the old mercantile theory which long ruled the commercial world, trade was regarded as profitable only as it brought money into a country. It was assumed that the statistics made up at the ports of entry furnished trustworthy data for determining the comparative value of the country's exports and imports, and that the difference between the two must always be adjusted by the transmission of specie one way or the other. Hence the inference that the balance of trade must be in favor of a country when its exports exceed its imports, and *vice versa*. A better exposition of the principles of political economy has shown that the theory is false, that the data are uncertain, and that the inference is unfounded and misleading. The theory rests on the idea that money alone is wealth. But money constitutes but a small fraction of the wealth of an individual, a nation, or the world, and its value consists simply in its utility as an instrument of exchange. The true advantage of foreign trade is found in the imports. By means of it a people obtain things which either they cannot produce at all, or which they must produce at a cost beyond that of the things exported to pay for them. As Mr. Mill says, "Commerce is virtually a mode of cheapening production," and "tends to the general increase of the productive powers of the world." Trade between two nations is profitable when it yields to both this advantage, made evident by the fact that with each the value of its imports exceeds that of its exports. This supposes the estimate to be made of the exports as they leave and of the imports as they come in. Just here it is that the custom-house statistics are fallacious, since the exports are stated at their value here, and imports at their value in foreign countries. It is to be noted, further, that the custom-house returns omit altogether some important phases of the trade, and the old theory of the balance of trade sets down the real profits of the trade as against the country. This may be illustrated by one of the two hypothetical or real cases thus presented: "American merchants ship to London beef, boots, etc., worth in New York $100,000,000, worth in London $110,000,000. The avails of the sale are invested in British goods worth in London $110,000,000, worth in New York $121,000,000. The custom-house returns show for the transaction exports $100,000,000, imports $110,000,000; balance against us, $10,000,000. And yet the merchants have made a profit of $21,000,000 real benefit to the country." Again: "There are shipped to Cuba wagons, etc., worth in Baltimore $1,000,000, in Havana $1,100,000. The proceeds are invested in cigars, worth in Havana $1,100,000, in Russia $1,210,000. The avails are invested in Russia iron, worth in Venezuela $1,331,000. This is sold, and invested in South American products, worth in Spain $1,464,000. There the avails are invested in olive oil, worth in Australia $1,610,510; sold there for gold, which is brought home. The custom-house reports $610,510 excess of imports over exports set down against us, though the excess is so much profit received in that which, according to the theory, is to be considered above all things else real wealth."

The profit of a prosperous foreign trade must appear in imports whose value exceeds that of the exports; and under a sound condition of finance it is of little consequence whether the surplus brought in takes the form of money or of goods. For Americans there is one aspect in which it is of great importance that the balance of trade should be studied. It is with reference to what we are actually purchasing our imports with—whether with real products of our present industry or with promises to pay in the future. The sum-total of evidences of debt in the form of government bonds, railroad bonds, etc., which have gone abroad is enormous; the annual interest on these makes heavy drafts on our national wealth; and it is the dictate of wise economy to pause and consider how the balance stands, lest we push our credit till dishonor and bankruptcy are made inevitable. A. L. CHAPIN.

Trade, Board of. See BOARD OF TRADE.

Trade'-mark. A trade-mark is a distinctive word, mark, symbol, or device affixed to an article of trade to indicate its origin or ownership. Very few products bear in their own external appearance sufficient evidence of their real character to protect the purchaser against fraudulent imitations. Integrity in manufacture and uniformity in quality are sought for by all users and consumers of merchantable goods, and when, by long experience, the public have learned to associate these with a special brand, the wide and profitable sale of articles bearing this brand is assured, and the exclusive possession of their distinguishing mark becomes, therefore, valuable and important. The trade-mark is a guaranty of genuineness, and its value is proportioned to the business reputation of the owners and the excellence of their manufactures. In other words, the recognition of trade-marks is the standing testimony of the commercial world to the money-value of honesty in all ages and countries. It is impossible to fix the date of their earliest use, but in the very nature of things it must have been very nearly "coeval with the birth of traffic." There can be but little doubt that they existed in pre-historic times; they were certainly in use as early as the building of Nineveh and Babylon, for the maker's marks are still plain on the ancient bricks and on the remnants of pottery that still remain.

A trade-mark may be any sign, word, symbol, or device not descriptive in its character, and not used by others on the same kind of articles or goods. As a rule, the simpler and more arbitrary a trade-mark, the less liable it is to be evaded by colorable imitations. If it embraces complex figures, one similar in general effect, but in reality quite different, may be adopted by a rival in trade, or a portion only may be taken; if it bears some real or apparent analogy to the article itself, or to the name of the maker or place of manufacture, it may be open to cavil as a mere label. The validity of a trade-mark, unlike that of a patent for an invention or design or a copyright on a printed work or a work of art, is not dependent upon its novelty *per se*. The same mark may have been used upon a hundred articles, and yet be quite valid in its application to still another. The word "Centennial" during the past and present year has been registered as a trade-mark for many different varieties of goods, and the list for the same word will doubtless be still further extended. One manufacturer

may appropriate the well known collocation of letters I X L as a trade-mark for cutlery, and another may appropriate its use for woollen stockings. So also of symbols: the figure of a lion may be applied in designating the cream cheeses of a dairyman, the cans of a tinsmith, or the volumes of a publisher, and each will be secured in the exclusive possession of the symbol for his own especial class of goods, the genuineness of which will be guarantied by the symbol, just as in mediæval times the written messages of the untaught barons were authenticated by the impress of their signet rings. But a trade-mark is not fully a trade-mark until actually affixed to an article of trade and for commercial purposes, although the commissioner of patents has decided that a trade-mark may be registered, in accordance with the patent law of July 8, 1870, previous to its actual use, the applicant for registry setting forth in his application that he proposes to use the mark upon a certain specified class of goods. The law in question, it must be remarked, is designed to supplement, not to supersede, the rights secured under the common law, and, when preferred, actions for infringement, instead of being brought in U. S. courts, may be proceeded with in State courts in the same manner as before the passage of the act. This law provides for the issue of certificates of registration protecting the use of the mark for a period ordinarily of thirty years from the date of registration, after which time the remedy for infringement lies in the common law. But trade-marks owned by persons in foreign countries affording rights of registry to American citizens may also be registered here, but the function of the registration will cease with the registry abroad, and the trade-mark will be remitted to the same position as by expiration of the term; but in all cases the trade-mark may be re-registered if application to that effect be made to the commissioner of patents six months before the expiration of the original term. The countries with which the U. S. by treaties and conventions has reciprocity in trade-marks are Austria and Hungary, by the convention proclaimed June 1, 1872; Belgium, by the treaty of July 17, 1858; France, by the treaty of Apr. 16, 1869; Germany, by the treaty of June 1, 1872; and Russia, by article to former treaty, Jan. 27, 1868. Canada, by her Trade-mark and Design act of 1868, permits the registry of American trade-marks; Great Britain, by the Merchandise Marks act of 1862, provided for the protection of trade-marks, and this was considered by our patent office as equivalent to a convention. But this makes no provision for registry. The date of adoption and public notice of exclusive claim could, however, be put on record in Stationers' Hall, London. On Aug. 13, 1875, an act of Parliament provided for the registration of trade-marks, and this has been supplemented by a set of cumbrous and imperfect rules.

As possession of a trade-mark is assumed to rest upon natural right, and not exclusively upon statute law, it might reasonably be inferred that any one could register and be protected in the use of a trade-mark, but it has been plausibly argued that many persons are excluded. For example, a trade-mark being no mark unless upon an article of trade, the person registering must, to a greater or less extent, be a trader, or, at all events, his position must not be wholly inconsistent with trade. For instance, it has been averred that a person inhibited from the pursuit of traffic by reason of clerical or monastic vows would be debarred. But with this view the writer cannot coincide. That an insurrectionist in arms or an alien enemy might be refused registry or protection is manifest; and the same would be true of one under sentence of outlawry. The opinion held by some that one pronounced *non compos mentis* by judicial authority would be incapable of holding a trade-mark is doubtless also correct, but in this case the right would inure in the hands of his legal representatives. The patent office ignores the disability of married women, under the laws of some of the States, to do business in their own names, and registers trade-marks without reference to local limitations. This is just, and it is doubtful if even the narrow spirit, in this respect, shown by the old common law would permit or warrant the flagrant wrong involved in the appropriation of an established trade-mark on any such ground as this.

A firm or corporation making or selling any vendible article may hold a trade-mark, and it is to such that the term "any corporation" is assumed to be limited in the statute. It is uncertain whether one registry will cover the same mark or symbol for an entire class of articles, or whether it must be registered for each variety included in the class. For example, whether a device can be registered broadly for, say, agricultural implements, under a single certificate, or whether separate certificates must be secured for hoes, spades, ploughs, etc. The former plan is followed in the practice of the patent office, but the latter is, for many reasons, to be preferred. In the first place, it follows closely the analogies of the patent law as concerns inventions. Again, it avoids the objection of non user, which might hold should a portion of the articles enumerated cease to be manufactured; and further, it enables the infringement of the trade mark as applied to one article to be met without calling into question its validity as applied to the other.

It is difficult within the narrow limits of an article to make plain the delicate shading that in many instances defines the boundaries of a valid trade mark. It is true that a geographical name is not a trade mark, although it may form part of a label (see LABEL), yet "Congress Spring Water" for mineral water from the Congress Spring at Saratoga, "Rockland Lake Ice," for ice from Rockland Lake, N. Y., and "Codorus" for a peculiar iron ore found in Codorus township, Pa., and for iron and steel made from that ore, have all been adjudged to be lawful trade-marks. They have been thus sustained because the owners of the marks were sole and exclusive owners of the products within the geographical limits indicated by the name, and the words could not be truthfully applied to articles produced anywhere else. It is also true that in general a proper name cannot be a trade-mark. Yet when the name is of such character that it affords no opportunity for two or more manufacturers or dealers of the same name to correctly indicate the origin of their wares by the same cognomen, a name may form a valid trade mark. Thus, Bismarck gloves or Kossuth hats or Roger Williams cloths or Garibaldi guns or Paul Jones whisky would be valid trade names. This is based upon the idea that none of the historic personages indicated, nor others of identical names, have ever engaged in the fabrication of such goods, and in all such connection the term is fanciful and arbitrary. In England the name Wedgwood has been judicially held to be a proprietary mark against all comers, but this is in reality more in the nature of a label than a trade-mark, and was sustained rather on the broad principles of justice protecting against unfair competition in trade, than by the strict application of the rules that are now deemed requisite in the administration of trade-mark cases properly so termed. Pseudonyms, if arbitrarily chosen, may be used as trade-marks, and so may a person's own signature or its facsimile, the shape of the latter making it an entity distinct from the name itself as displayed in the common or conventional imprint of type. It is true that a fanciful name may be a valid trade-mark, and frequently constitutes a most valuable one, but this fancy name must not either truly or falsely attempt to indicate the character of the article to which it is appended. If such indication is true, the mark is descriptive, and is properly a label; if false, the mark is void on the ground of fraudulent suggestion; thus, "Balm of a Thousand Flowers" was held by Justice Duer to be unworthy of protection. The compound was set forth as "the very balm and extract of healing blossoms," and was in reality a solution of highly-scented soap. So also an heraldic symbol may be a valid trade-mark, and *per se* would be so held in this country. But if registered abroad, and there declared invalid because included in the arms of some existent family, the validity of the mark in the American market might very properly be disputed on a transcript of the foreign judgment. A person cannot monopolize the national insignia of any country, but the connection therewith of his name or of another word or symbol may form a perfect trade-mark. The adoption of Masonic emblems (and by a parity of reasoning those of similar organizations) as trade-marks is not recognized by the U. S. patent office, and their use as such would probably be denied by the courts of this and other countries. Simple letters and numerals are among the most treacherous of trade symbols, being the most open to evasion on plausible grounds. A clean-cut, newly-coined word, not purely descriptive or grammatically derived from pre-existent terms, is perhaps the best, and after this a word indicative of excellence, but not descriptive. Of such the word "excelsior" is perhaps the most common. Probably the article whisky has been the subject of more delectable trade-mark names than any other: "magnolia" and "nectarine" may serve as examples. An occult suggestion of superiority, more readily appreciated than defined, is frequently an important element in attracting attention to an article, and terms having this characteristic constitute very available trade-marks. Figures of animals, or even of reptiles, form striking trade-marks, and allegorical representations, if not too complex, are also good.

But care must be taken that the mark makes no false suggestion. Thus, "Night-blooming Cereus" was declared void as a trade-mark when it was shown that the perfume to which it was applied was made not from the flower, as was pretended, but from other substances. If it had been the product of distillation from the flower of that name, it would, however, have been void for a quite different

reason—viz. it would then have been simply descriptive of the article; any one has the right to distil the perfume of any flower, and to call the product by its proper name. Medicated Mexican Balm was applied to a so-called hair tonic, and was accompanied by a false statement of its origin. This was an English case, and although the application for an injunction was denied by the master of the rolls on other grounds, there can be no doubt but the falsehood accompanying the term would have defeated it. This term, moreover, may serve as an illustration of the thin division between a trade-mark and a label. In one sense it is arbitrary and unconventional; in another merely descriptive. In either aspect it may be assumed as including a false suggestion of the place of its origin. But would the term Aztec or Toltec—adjectives that could hardly by any possibility mislead—be open to the same objection? and if not, why the distinction? The uncertainty attending the use of adjectives implying nationality in origin should, it is plain, discourage their adoption in trade-marks. The term "American Sardines" was refused registry by the U. S. patent office on the ground that it embraced a false suggestion, the so-called sardines being an inferior fish, the "moss-bunker" of the New England coast. Were the fish true sardines, the term would be purely descriptive, and no trade-mark.

As has been herein previously intimated, a lawful trade-mark holds good under the common law, independent of registration, for an unlimited time, and that registration holds good for thirty years, with the right of re-registration for a second period of equal duration. But to all this there is—according to the dictum of the patent office—an exception in the case of patented articles, by which it is held that the mark or term designating an article while patented becomes generic and lapses to the public with the expiration of the patent. I doubt if this is in accordance with sound justice or sound law. The question has never been carried to a tribunal by which it has been definitely set at rest.

If a dealer permits his trade-mark to go into use by others without asserting his exclusive right to it, he will be held to have abandoned it, and he will have no remedy. So also if he ceases to use it during a period so long that its original connection with his name and business is lost, another may adopt it, and by *bona-fide* use hold it even against the original owner. But mere non-use will not throw open the trade-mark to another so long as such use by another would tend directly to enable the infringer to trade on the reputation of his rival. This was decided in the case of Lemoine *v.* Ganton in the court of common pleas of the city of New York, Jan., 1854, and this ruling, from its manifest fairness, may be taken as authoritative. JAMES A. WHITNEY.

Trader's Hill, p.-v., cap., Charlton co., Ga., on St. Mary's River.

Tra'dersville, p.-v., Somerford tp., Madison co., O. P. 25.

Trad'escant (JOHN), b. in Holland about 1570; became a naturalist and antiquarian; travelled through various countries of Europe, Asia Minor, and North Africa, making a collection of objects of natural history; was in 1608 settled in Kent, England; subsequently established a botanic garden at South Lambeth, where he added largely to his collection of curiosities; had many rare exotics, and was the means of acclimatizing several useful plants in England; was employed by several of the nobility to lay out their gardens, and in 1629 was appointed gardener to Charles I. D. at Lambeth in 1638.—His son JOHN, b. at Meopham, Kent, in 1608, added largely to the collection by his travels, in the course of which he visited Virginia; enjoyed the patronage and friendship of many distinguished men, and published in 1656 a descriptive catalogue under the title *Museum Tradescantium, or a Collection of Rarities preserved at South Lambeth, near London,* ornamented with prints of the two Tradescants engraved by Hollar. D. at South Lambeth Apr. 22, 1662. The antiquary Elias Ashmole claimed possession of the museum by gift from the younger Tradescant, dating from Dec. 15, 1657, but the widow refused to surrender it, and the conflicting claims were decided by a chancery suit, which terminated in favor of Ashmole. The collection thus became the nucleus of the celebrated "Ashmolean Museum," presented by its founder to the University of Oxford 1683. A family group of the Tradescants, painted by Dobson, belongs to that museum, and was exhibited in 1866 at the National Portrait Exhibition in London.

Trades'-Unions. Trades-unions have undergone considerable change in their objects, character, and action, and no sound judgment can be formed respecting them without some knowledge of their origin and history. They originated in England, mainly in consequence of the breakdown, before machinery and the growth of large capitals, of the old industrial system. Production had formerly been carried on chiefly by small capitals; in a great number of employments the competition of workmen was limited by a law of apprenticeship; wages in many cases were fixed by public authority; and the poorest apprentice, if industrious and thrifty, might look forward with confidence to becoming a master and enjoying a position of comfort and independence. The steam-engine, by annihilating numerous handicrafts and creating vast accumulations of capital, revolutionized the whole organization of industry, altered profoundly the relations between capital and labor, and led to the repeal of the laws of apprenticeship; and hence workingmen in various trades formed societies to protect themselves against both the new power of capital and the new competition to which they were exposed. The conditions under which these early trade-societies were evolved, and the temper and spirit of an age far ruder than the present, must be taken into account. Their members were attacked in many cases in their means of livelihood by new methods of production; they were exposed suddenly to an unlimited competition of strange workmen, women, and children; they were deprived of their old paths to independence; and they had to deal with a new class of employers, distant from them in station, eager for gain, and possessed of novel powers over the labor-market. Starting under such conditions, and in an age which was fierce and brutal in its manners compared with our own, it is no wonder that trades-unions assumed a hostile and aggressive attitude toward both capital and external competing labor, that some of their rules are as unjust as impolitic, and that their practice was often worse than their rules. Crime and outrage are the chief incidents in the earlier annals of the trade-societies. In all the grosser forms they have since almost disappeared, and acts of violence, where they have occurred in recent years, have never been chargeable on the more powerful and completely organized societies.

In the minds of many employers, and of a large part of the public, trades-unions are identified with strikes as their promoters and principal cause. Nor can there be any doubt that the accumulated funds of which they have the disposal, and their power over their individual members, do enable them to carry on much more extensive and prolonged strikes than could otherwise take place. The capitalist, having a reserve fund, is necessarily in a better position to treat for terms than the individual laborer, and the loss of a single hand is of little or no importance to him. The workmen, on the other hand, by combination and contributing to a common fund, can often place themselves on a position of equality with, and sometimes of superiority to, the capitalist. Trades-unions thus do possess and exercise some control over wages and all the conditions of contracts with employers, and they have naturally exercised this power in the direction of raising wages and shortening the hours of work. Nevertheless, it would be nearer the truth to say that trades-unionism tends to prevent strikes and disputes with employers, rather than to make the common allegation that it foments them. The rules of many unions provide that no strike shall take place until amicable negotiations have failed, and surround them with various other preliminary conditions. And it was proved by the evidence before the British royal commission on trades-unions, which reported in 1869, that there had been fewer disputes with employers and greatest permanence in the rate of wages in the trades with the strongest, richest, and most extended unions. It is true that the diminished frequency of strikes through the action of unions has partly arisen from the fact that they have been powerful enough to obtain concessions without resort to a strike; but it is almost self-evident that responsible and intelligent leaders are less likely to resort to rash and ill-advised measures than a multitude of ordinary laborers; and that it is the direct interest of the paid officers of a union not to waste its funds in struggles which are likely to end either in defeat or in success which may cripple the trade which is the ultimate source of those funds. Every member of the union, moreover, has a vested interest in the conservation of funds to which he looks for assistance in sickness and when otherwise out of employment. Another impression which prevails widely with respect to trades-unions is, that they are generally adverse to piecework, but this is true only in a small minority of trades, respecting which there is much difference of opinion as to the expediency of piecework. It has been recently stated by Mr. Mundella, M. P., that 90 per cent. of the British exports are the produce of piecework, and that more piecework is done in England, the mother-country of trades-unions, than in any other country. No assumption, he added, could be more devoid of foundation than that trades-unions generally are opposed to piecework. In some of the largest industries, including

the ironworkers, the colliers, the shipbuilders, the printers, painters, and tailors, the stocking and lace manufacturers, the cotton and worsted trades, piecework is the established custom.

It is true that some English trades-unions maintain unreasonable and unjust restrictions on the admission of workmen and the modes of work, but this is no more than may be said of some of the regulations of the legal and medical professions in England. And when we consider the vast improvement which has already taken place in the rules and objects, and still more in the spirit and practice, of English trades-unions, we may reasonably look forward to the removal of all just ground of complaint against their organization and policy. Already the majority in England are normally occupied with objects the usefulness of which is admitted on all sides. They ascertain the requirements for labor in different localities, and distribute it so as to meet the demand; they assist emigration of surplus labor; they act as friendly and insurance societies, and promote some of the best objects of social union by means of reading, libraries, and other means of intellectual improvement. Mr. John Stuart Mill, speaking despondently of the present system of production by capital and hired labor, said that "the conversion of existing businesses into trades-unions would be the euthanasia of trades-unionism." No such transformation of the modern industrial economy is, however, likely to take place within a period for which we can reasonably form anticipations, and meantime the past history of trades-unionism justifies the hope that it may be so transformed in comparison with its earliest phases that not even an euthanasia need be desired for it by economists or even capitalists. (See LABOR, STRIKES, and WAGES.) T. E. CLIFFE LESLIE.

Trade Winds. See WINDS, by PROF. A. GUYOT, PH. D., LL.D.

Tradu'cianism [from Lat. *tradux*, a "vine-layer"], as opposed to CREATIONISM, and the doctrine of PRE-EXISTENCE (which see), the belief that the human soul is derived from the souls of the parents, as the body is from their bodies. Tertullian, Athanasius, Gregory Nazianzen, and the Lutheran Fathers were Traducians, generally holding that the parents are the divinely-appointed means of a divine act of creation. Augustine leans toward this view, although careful not to commit himself to it.

Traer, p.-v., Tama co., Ia., at the terminus of Burlington Cedar Rapids and Northern R. R., contains 2 churches, 2 private banks, 1 newspaper, a handsome park, an extensive flouring-mill, 4 hotels, and fair-grounds. It is in the centre of a fine agricultural region. P. about 1200.
BARNARD MURPHY, ED. "CLIPPER."

Tractto, town of Italy, province of Caserta, about 12 miles from Gaeta, on the southern slope of a fertile hill at the foot of which flows the Garigliano. Near this town are striking ruins of a Roman aqueduct, supposed to have supplied the ancient city of *Minturnæ*. Tractto was a strongly-fortified place during the Middle Ages, and served as a retreat for Pope John VIII. and for various unfortunate princes. It has now a small coasting-trade. P. 7467.

Trafalgar', a low promontory of the south-western coast of Spain, on the Straits of Gibraltar, in lat. 36° 10' N., lon. 6° 1' W. Off its shores was fought, Oct. 21, 1805, the great battle between the English fleet under Nelson and the allied French-Spanish fleet under Villeneuve. The allied fleet was superior both in number of ships and of guns, but was nevertheless completely routed, 19 of its 34 large ships being captured by the English.

Trag'acanth (see GUM), [Lat. *tragacanthum*; Fr. *gomme adragante*; Ger. *Tragant*; It. *dragante*], a gummy exudation from the *Astragalus verus*. The dried gum is slightly translucent, resembling horn in appearance. It is hard, but difficult to pulverize; has no smell, and but very little taste. It does not dissolve in water, but absorbs it, swelling up and forming an adhesive paste. Upon adding an additional quantity of water to this paste, a uniform mixture is formed, from which, however, the greater part of the gum is gradually deposited. It is insoluble in alcohol. Tragacanth appears to consist of two distinct constituents, of which only one is soluble in water. This is very similar to gum arabic, but differs from it in a few chemical properties. The insoluble portion, which is perhaps identical with *bassorine* ($C_6H_{10}O_5$), and is termed *tragacanthine*, is colored blue by iodine, but the coloration is probably owing to the presence of a small proportion of starch. The analysis of tragacanth gave: gum, 53.3; tragacanthine and insoluble starch, 33.1; water, 11.1; the ash forming 2.5 per cent. Gum-tragacanth is used in calico-printing, and also to some extent medicinally. J. P. BATTERSHALL.

Trag'edy [Gr. τραγῳδία], that kind of drama which represents a tragical situation or a tragical character. A tragical situation occurs when two powers, over which the individual has no control, and from which he cannot escape, clash together and crush him by their conflict. A character becomes tragical when he must perish simply because he is such as he is, it being undecided and undecidable how he became thus.

The tragical situation is principally of ethical interest. It is formed when two duties contradict each other in such a manner that the one cannot be fulfilled without a violation of the other. Thus, in the tragedy of Æschylus, Orestes cannot leave the murder of his father unavenged without incurring the wrath of the gods, nor can he kill his mother, who has slain his father, without becoming the prey of the Furies. In the tragedy of Sophocles, Antigone cannot leave the corpse of her brother unburied without committing a crime against his manes, nor can she bury it without offending the authority of the state. In both cases a violation of law takes place, and a punishment will follow. But in such situations of ethical conflict the character of the individual, his peculiar natural disposition and psychological constitution, is of subordinate consequence. With the tragical character, on the contrary, the interest is principally psychological. If a certain event takes place, the individual falls into delusions, despair, crime, miseries, death, simply in consequence of his natural disposition, above which he cannot rise, and in obedience to the necessary laws of his psychological constitution, from which he cannot emancipate himself. Thus, Macbeth might have been the glory of his country if he had not met the witches, but, having met them, he is lost. Lear might have been the happiest king in the world if he had had no daughters, but, having got them, they must kill him. (See Balzac, *Le Père Goriot*.) But in all such cases the interest is almost exclusively psychological; nobody thinks whether Othello does wrong or right in killing Desdemona.

This distinction between the tragical situation and the tragical character constitutes the fundamental difference between the ancient and the modern tragedy. The Greek tragedy always represents tragical situations, and its whole repertory contains hardly any tragical character in the above sense of the word. Medea by Euripides might form an exception. The modern tragedy, on the contrary, represents tragical characters, and every attempt which has been made in modern times to represent tragical situations in the antique sense of the word, as contradictions between duties, has failed. The classical tragedy of France, which in this respect was a true revival of the ancient tragedy, and almost without exception sought the tragical effect in the tragical situation, maintained its supremacy, even in its own day, by the elevation of its tone and the elegance of its form, rather than by any powerful representation of the tragical; and now it is almost impossible to concentrate the attention on the tragical conflicts in Corneille's *Cid*, Racine's *Athalie*, and Voltaire's *Zaïre*, the masterpieces of the school, without a smile. Of all modern tragedians, however, Shakspeare is the only one who exhausts the above given idea of the modern tragedy as a representation of tragical characters. Calderon made a mistake between the simple impulses of human nature and the more or less artificial excitements of the Roman Catholic faith, and his tragedies make an impression somewhat similar to that of the classical French tragedies: there is much to admire, much which touches us, but there is no tragedy. Of the romantic school, Heinrich von Kleist in Germany and Victor Hugo in France have written tragedies on the same principle as Shakspeare, but compared with him Kleist is small and somewhat artificial: Hugo wild, exaggerated, and rather hollow. With the other great modern tragedians, Goethe, Schiller, and Œhlensläger, the tragical, although based as it must be on the character, is not developed, as with Shakspeare, from the psychological constitution alone, but produced by placing the character in conflict with the situation. A character of a certain description is placed in a situation historically necessary, which, on account of the relation which it bears to the character, must prove fatal. Compositions of this kind are neither purely ethical nor purely psychological; they are historical. Striking examples are Goethe's *Götz von Berlichingen* and *Egmont*; Schiller's *Wallenstein* and *Don Carlos*; Œhlensläger's *Hakon Jarl* and *Axel og Valborg*.
CLEMENS PETERSEN.

Tra'gopan, a name given to the birds of the genus *Ceriornis*, members of the family Phasianidæ and most nearly related to the genus *Gallus*. The males, however, instead of a comb, have a crest of soft feathers and a pair of soft horn-like appendages, protractile and retractile at will, above the eyes, as well as wattles in front on the throat; the tail is large, depressed, and rounded at its posterior margin; the tarsi are armed, in the male, with short conic spurs. The generally-recognized species are five in number, and are mostly confined to the pine forests of the

Himalaya Mountains and confluent and neighboring chains of Asia. They are generally solitary in their habits, dwell in the inmost recesses of their native forests, and are difficult of approach. They average about the size of the domestic poultry, or perhaps are a little larger. They feed upon grains, insects, worms, etc., and indeed resemble in this and many other respects the common gallinaceous birds. The most noteworthy feature is the remarkable development of the livery of the male at the pairing season. Then are fully developed the horns and wattles, and when entirely displayed they give him a "gorgeous" appearance. The horns, although rudimentary in the young as well as the females, are only fully developed in the male toward maturity, and the wattles are usually concealed within the rami of the jaw and by the feathers: "deflection and exposure of the wattle follows from its arterial injection, being provided with a rete mirabile whose vessels run chiefly longitudinal and parallel; the occasional rich red hue is a sanguineous effect." The male with these "shows off" in several ways: (1) sometimes, first crouching with tail bent down, he moves his head and neck with vibratory jerks, flaps his wings, erects his horns, spreads out apron-like his wattles, and then draws himself up to his full height; (2) again, he simply erects all his feathers, and elevates one shoulder without moving his head-dress; (3) at other times, standing on a perch, he tosses his head, and displays horns and wattles; and (4) on still other occasions he simply erects his horns. (See Murie in *Proc. Zool. Soc., Lond.*, 1872, pp. 730–736, pl. 60, 61.) THEO. GILL.

Tragul'idæ [from *Tragulus*—diminutive of τράγος, "goat"—the generic name of the type], a family of placental mammals of the order Ungulata and sub-order Artiodactyla, and containing the smallest living representatives of the order. In external appearance they are somewhat intermediate between a deer and hog, but are peculiar in the arching of the back behind and the projection of the buttocks backward; the neck is rather short; the head slender and with a pointed snout; the ears moderate; no horns are developed in either sex; the tail is moderately short; the legs are slender; the feet provided with lateral hooflets; the teeth in the normal ruminant number (M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{0}{3}\times 2$), and form the chief distinctive feature, consisting of the interruption of the incisorial series at the symphysis and the enlargement and expansion of the middle incisors toward their crowns, and the development of the canines of the upper jaw as tusks in the males; the stomach is tripartite, the psalterium being incompletely developed; the placenta is diffuse; the axial vertebra has a conical odontoid process; the outer metatarsals are developed. The family is now peculiar to Asia and Africa. It is specially interesting as exhibiting an intermediate condition in the development of the stomach and some other parts between the typical ruminant ungulates and the omnivorous or hog-like forms. The type is developed under two extreme modifications—viz. (1) *Tragulus*, in which the metacarpals and metatarsals are fused into cannon-bones, as in the ruminants generally, represented by five species in the East Indies and neighboring countries; and (2) *Hyæmoschus*, in which the corresponding bones are distinct, as in the hogs, and of which only a single living species (*H. aquaticus*) is known from Western Africa. In former geological periods the family was much more widely diffused; the still existing genus, *Hyæmoschus*, had members in Southern Europe during the Miocene Tertiary, and other extinct genera were represented by allied species. (See especially an elaborate monograph by A. Milne-Edwards (*Recherches anatomiques, zoologiques et paléontologiques sur la Famille des Chevrotains*) in *Ann. des Scienc. Nat.*, 5me série, t. 2.) THEODORE GILL.

Trail Creek, tp., Harrison co., Mo. P. 1085.

Trailing Arbutus. See ARBUTUS and EPIGÆA REPENS.

Traill, county of Dakota, recently formed, and not included in the census of 1870.

Traill (CATHARINE PARR). See STRICKLAND (AGNES).

Traill (ROBERT), D. D., b. at Lisburn, Ireland, July 15, 1793; graduated at Trinity College, Dublin, about 1817; took orders in the Church of England 1820; became parish minister of Schull, county Cork, 1830, and fell a victim to his incessant labors to relieve his parishioners during the great Irish famine, dying of an epidemic fever in 1847. He had early completed an excellent translation of the *Jewish War* of Josephus, published in parts (1816–47), with elaborate notes by Isaac Taylor, and a remarkable series of views of the Holy Land from original sketches by Tipping, engraved on steel by a process invented by Isaac Taylor. New editions were published 1851, 1861, and 1866, and at Boston, Mass., 1868.

Traill (THOMAS STEWART), M. D., b. at Kirkwall, Orkney Islands, in 1782; graduated at the University of Edinburgh 1801; became a physician, and was professor of medical jurisprudence in that university from 1832 to his death, July 30, 1862. He was editor of the 8th ed. of the *Encyclopædia Britannica* (22 vols., 1853–61), for which he wrote more than 400 articles; wrote for scientific periodicals, and was author of *Lectures on Medical Jurisprudence* (2d ed. 1840; Philadelphia, 1841) and other works.

Train (GEORGE FRANCIS), b. in Boston in 1830; entered upon mercantile business there, and subsequently in Australia; in 1860 went to England, and attempted to introduce street railways into Liverpool and London, but was met by legal opposition; subsequently travelled extensively, wrote considerably, spoke much in public, and developed singular idiosyncrasies. Among his publications are—*An American Merchant in Europe, Asia, and Australia*, and *Young America Abroad* (1857), *Spread-Eagleism*, consisting of some of his public speeches (1859), *Young America on Slavery* (1860), *Union Speeches delivered in England* (1862), *Downfall of England* (1865), *Irish Independency* (1865), *Championship of Woman* (1868).

Trai'na, town of Sicily, province of Catania, beautifully situated on the Traina, has an interesting old monastery, the first ever established on the island. P. 8270.

Train of Thought. See ASSOCIATION OF IDEAS, by C. P. KRAUTH, S. T. D., LL.D.

Tra'jan's Column, "the most beautiful of all the historical columns," the masterpiece of the architect Apollodorus, erected in honor of the emperor Trajan A. D. 114, stands among the remains of Trajan's Forum at Rome. It is a column of white marble 132 feet in height, around and up which runs a scroll of bas-relief sculptures presenting a continuous history of Trajan's achievements. No less than 2500 human figures are delineated, besides horses, fortresses, etc., the whole forming an unequalled record of military antiquities and ancient costumes. A colossal statue of Trajan formerly surmounted it. A bronze statue of St. Peter was placed upon it by Pope Sixtus V. The "Colonne Vendôme" (see VENDÔME, COLUMN OF THE PLACE) is an imitation. J. G. BARNARD.

Trajan's Wall, in the Dobrudscha, European Turkey, extends E. from the Danube at Chernavodi to Kustendji on the Black Sea. It is a double, in some places a triple, earthwork, on the S. side of a natural fosse consisting of a narrow marshy valley. It is even now a strong line of defence. A railroad has been constructed along the route, and it has been proposed to open a ship-canal along the valley.

Traja'nus (MARCUS ULPIUS), Roman emperor A. D. 98–117, b. at Italica, near Seville, Spain, Sept. 18, A. D. 52, of a family of Roman descent; was educated in the camp of his father, and distinguished himself so much in the Parthian and German wars that, although not of Italian birth, he was adopted by Nerva in 97 under the general acclamation of the people; in January of the following year he succeeded him on the throne. His reign is considered, next to that of Augustus, the most brilliant period of the history of imperial Rome. The Roman arms were eminently successful. By two campaigns (101–102 and 104–106) Dacia, the region between the Theiss and the Pruth, comprising the present Transylvania, Moldavia, and Wallachia, was conquered and made a Roman province. It was the first real conquest since the death of Augustus, and the Romanization of the country must have been effected very quickly, as Transylvania is covered with splendid monuments of the time of Trajan. By another campaign (114–116) Armenia and Parthia were conquered, and Trajan was the first and the only Roman emperor who navigated the Persian Gulf. No less successful was his internal government. The vigor and probity of his administration gave rise to the phrase with which afterward a new emperor was first saluted, *Augusto felicior, melior Trajano.* Peculating governors were prosecuted, informers were punished, and Rome saw once more an honest administration of the courts and the finances. Cities were founded, colonies settled, fortresses and harbors constructed, numerous roads, canals, bridges, etc., were built throughout the empire. In Rome the Forum Trajani was erected, containing the famous column in its centre. Gorgeous festivals were given to the people, but large sums were also employed in the education of freeborn Roman children. Libraries, among which was the celebrated Ulpia Bibliotheca, were founded, and the Latin literature experienced its afterbloom in Tacitus, the Younger Pliny, Juvenal, etc. The tenth book of Pliny's letters, containing the correspondence between him and the emperor, is very interesting on account of the information it contains not only with respect to the general character of the administration, but more especially with respect to the social position of the Christians. On his return from the Parthian campaign, Trajan was taken sick at Selinus, in Cilicia, and d. there Aug. 11, 117. His ashes were

brought in a golden urn to Rome and deposited beneath the column which bears his name.

Tralee', town of Ireland, capital of the county of Kerry, Munster, on the Lee, 1 mile from its mouth, is well built, and has an active trade in grain and other agricultural produce. P. 9791.

Trall (Russell Thacher), M. D., b. at Vernon, Ct., Aug. 5, 1812; removed to Western N. Y. in childhood; studied medicine; became a physician in New York City 1840; abandoned soon afterward the use of drugs; substituted the water-cure treatment, opening an establishment for that purpose, and founded in 1853 the "New York Hygeio-Therapeutic College," a medical school for both sexes, subsequently removed to Florence, N. J. Editor of the *Hydropathic Review* and other periodicals, and author of numerous treatises in advocacy of his views on the subject of medicine. D. at Florence, N. J., Sept. 23, 1877.

Tramway. See Railroads, by Col. J. W. Adams, C. E.

Trance [Lat. *transitus*, "a dying state"], a state of abeyance of most of the vital functions, resembling in some cases a profound sleep, in others closely simulating actual death. Some cases of so-called trance are clearly cataleptic, and all are associated with abnormal nervous conditions or perverted nerve-functions. Trance sometimes follows extreme religious excitement. In some cases of real or pretended trance the patient can speak, and even address public audiences, the condition being assumed at will. But in the more profound trance all sensibility and power of motion is lost, and in some no sign of breathing or of heart-beat is apparent. This condition has been known to last for months or even years. (See Catalepsy, Clairvoyance, Mesmerism.)

Tra'ni, town of Southern Italy, province of Bari delle Puglie, on the Adriatic, about 27 miles N. W. of the town of Bari, with which it is connected by railway. It was formerly surrounded by a castellated wall, with towers and bastions, and the three principal gates were defended by draw-bridges, but few traces of these fortifications now remain. The port of Trani was improved by the Normans, but these works have been destroyed, and the present constructions are of a more recent date. This port is well sheltered except on the N. W., in which direction the mouth of the harbor is turned; much, however, has been done at different times to protect it on this side, and during the flourishing period of Italian mediæval commerce with the East, Trani was a very important centre of maritime trade. It has the honor of never having been in subjection to a feudal lord, its relations with its different lines of sovereigns being always direct, and of a character which left its government almost entirely to itself. The cathedral, Byzantine in its architecture, was begun in the twelfth and consecrated in the thirteenth century; the tower is one of the boldest in Italy. The law school established here by Charles V. had a wide reputation. In 1799 the city was taken, sacked, and burned by the French. It is now a place of considerable industry and commerce; about 500 vessels enter the harbor annually, the exports being chiefly oil, wine, and fruits, especially almonds. A very fine calcareous building-stone, known as pietra viva, and found near Trani, is also exported to some extent. The fishermen of Trani are often found plying their craft in the Black Sea, the Sea of Azof, and the North Sea. P. 24,380.

Tranquebar', town of Hindostan, on the Coromandel coast, in the delta of the Cavery, in lat. 41° 17′ N., on a small bay which forms a good harbor, is surrounded with walls, defended by forts, and well built; it is cooler and more healthy than Madras, and carries on a considerable trade. P. about 25,000. The town, with adjacent district, comprising an area of 15 sq. m., with about 250,000 inhabitants, and very productive of rice, cocoanuts, and fruits, was originally a Danish possession, but in 1846 was sold to Great Britain, which change, however, has had no marked influence on its development.

Transcauca'sia, the name generally given to that part of Asiatic Russia which lies S. of the Caucasian Mountains, between the Black Sea and the Caspian. The name has no political signification, however.

Transcendent'al [Lat. *transcendere*]. In mathematics, a quantity is said to be transcendental when it cannot be expressed by a finite number of algebraic terms—that is, by the ordinary operations of algebra, which are addition, subtraction, multiplication, division, raising to powers expressed by constant exponents, and extraction of roots denoted by constant indices. Transcendental quantities are of three kinds—logarithmic, exponential, and trigonometric. Thus, $l(1+x)$ is a logarithmic transcendental, a^x is an exponential transcendental, and $\sin x$ is a trigonometric transcendental. A *transcendental equation* is an equation expressive of a relation between transcendental quantities. A *transcendental line* is a line whose equation is transcendental; thus, the cycloid is a transcendental curve. W. G. Peck.

Transcendental. Kant called "transcendental" all those cognitions or elements of cognitions which are not derived *a posteriori* by experience, but underlie all experience as its necessary *a priori* conditions, and which consequently transcend the whole sphere of experience. Transcendental are all those primary, original, and *a priori* principles of knowledge which, as necessary and universal truths, underlie all contingent and particular truths derived from experience; and in this sense of the word "transcendental" is the opposite of "empirical."

Transforma'tions, in Chemistry. Changes which may be regarded as of a chemical kind, as resulting from chemical operations, are of two species; one, which consists merely of change of state—that is, change from solid to liquid or liquid to gaseous state, or the converse—and which usually results merely from change of temperature, without any alteration in the atomic constitution of the bodies concerned; and the other, resulting also often from simple change of temperature, but which is accompanied by production of bodies differing profoundly in nature, chemical and physical, from the bodies started with. It would be well to apply and to confine the term *transformation* in a chemical sense to the latter alone. Thus, the mere vaporization of water is but a change of state, while the dissociation of steam into its component gases by the heat of incandescence is a transformation. Double decompositions are always transformations, and crystallization of a salt from water, when accompanied by condensation of the water itself into the form of "crystal-water," is a transformation also, both of the salt and of the water. Change of state is usually only change of molecular aggregation and arrangement; while transformations are accompanied by mutations in the potential energies of the atoms inside the molecules. Henry Wurtz.

Transfu'sion [Lat. *trans*, "over," and *fundere*, to "flow"] **of Blood,** a surgical operation in which blood from a strong and healthy person, or from one of the lower animals, is injected into the veins of a feeble or anæmic patient. It is especially employed after severe puerperal hæmorrhage, great care being taken to exclude bubbles of air or clots, either of which are likely to prove fatal. The blood, either defibrinated or not, is usually introduced by means of a suitable syringe. This operation, though long known and at present recognized as a legitimate one, is not as yet very common; but it may be considered as established that in well-selected cases, and when performed with proper skill, transfusion is an extremely useful and successful operation.

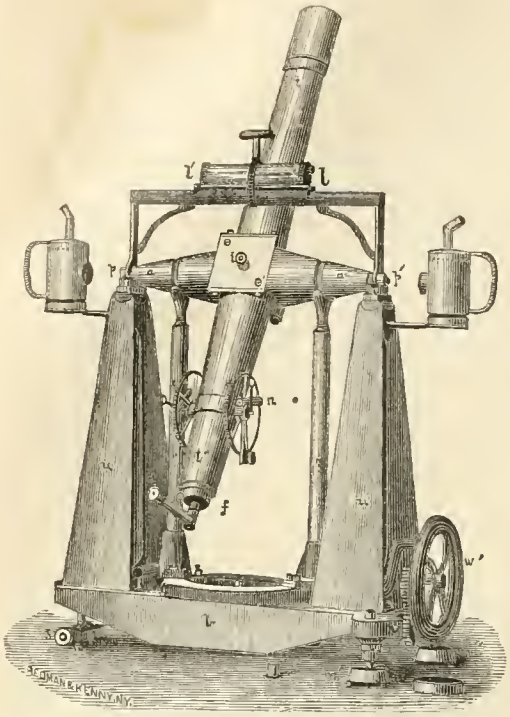
Trans'it [Lat. *transire*, to "go across"], the passage of a planet over the disk of the sun, or, in a broader sense, the passage of any celestial body over an arbitrary point of reference.

Transit Instrument.—An astronomical instrument used to determine the time of a star's passage over a fixed great circle of the heavens, usually the meridian or the prime vertical. In the latter case the instrument is called a prime vertical transit. Roemer seems to have first used a transit instrument for the determination of right ascensions in 1675, and fourteen years after that he uses it in the meridian for the determination of local time. A very excellent form of the most modern construction is shown in Fig. 1, where $t\,t'$ represents a telescope of three inches aperture and forty inches focus, which rotates around a horizontal axis $a\,a'$, and is composed of the frosta of two similar cones firmly secured to the hollow brass cube $c\,c'$ at their larger bases. The axis $a\,a'$ is also composed of the frosta of two similar cones terminating in two faces of the cube $c\,c'$ at right angles to the other two faces. This axis terminates in two pivots $p\,p'$, an inch and a quarter in diameter, made of cast steel, which rest upon V-shaped bearings firmly supported by the cast-iron piers $u\,u'$, which are firmly bolted to a base plate at b, which in turn rests upon three points $m\,m'\,m''$, of which the point m is capable of a slight lateral motion by means of the screw s. The telescope is made conical in order to give it the greatest rigidity of form; it is of brass, and may be elevated to any desired angle by means of the two finding-circles $c\,c'$, which are six inches in diameter and read to minutes of arc. The setting is effected by bringing a vernier, which is attached to the small level n, to the required reading on the small circle, and then rotating the telescope around the horizontal axis till the bubble plays. A sensitive level $l\,l'$, which rests directly on the pivots $p\,p'$, indicates how closely the axis $a\,a'$ approaches horizontality.

For accurate work it is desirable that observations should be made in reversed positions of the axis. For that purpose an apparatus for lifting the telescope from its bearings at $p\,p'$ and for turning the axis through half a revolution is

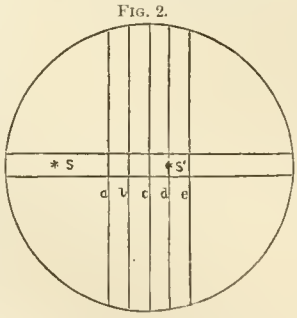
provided; by simply turning the wheel $w\ w'$, the two upright bars $r\ r'$ move vertically and rotate horizontally to accom-

Fig. 1.



plish this purpose. The light from a lamp enters through an aperture in one end of the axis p' and strikes a diagonal reflector, the tint of the reflected light of which is controlled by the milled head i, operating colored glasses, and the reflector is so inclined as to reflect the light downward into the field of view; this is necessary to render visible a reticule of fine lines composed either of the finest spider's web, or ruled on glass and placed in the focus of the object-glass at f, where they are viewed by a diagonal eyepiece d. At night these lines are quite invisible without artificial illumination. The simplest form of this reticule of lines is shown in Fig. 2, where s is a star entering the field between two horizontal lines. The vertical line c is supposed to coincide with the plane in which the instrument rotates: $a\ b\ d\ e$ are four additional lines symmetrically placed, and the time at which the star s is bisected by each of them, as at s', is noted. The mean of these observed times is more nearly correct than the time obtained from the transit across a single wire c would be. Five or seven wires are usually employed when the times are noted by eye and ear; this number is increased when the times are noted with a chronograph. The instrument figured has nineteen vertical wires, and to transit them all requires for an equatorial star seventy-two seconds. The instrument was made by Buff & Berger of Boston, and weighs, complete, about 200 pounds.

Fig. 2.



To determine the local time, the instrument is set up as nearly as may be in the meridian and accurately levelled. The transit of a star which culminates near the zenith is observed, which will give the error of the timepiece employed, set approximately to local time, at least to within a few seconds. With this correction the time of transit of a circumpolar star is computed, and the star is bisected by the middle wire at that instant by moving the whole instrument. The instrument is now sufficiently near the meridian to afford the error of the timepiece employed, to within a fraction of a second by noting the difference between the observed and true times of transit of a star near the zenith. We have supposed the horizontal axis to be approximately level, and that the reticule has been so adjusted as to make the telescope axis pass through the middle wire, and that the system of wires is perpendicular to the horizon.

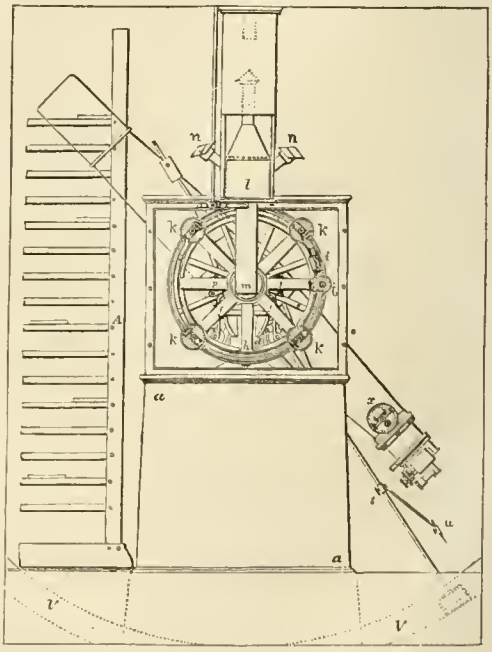
To determine the time for astronomical purposes, it is usual to observe a series of stars at various altitudes, in order to determine the influence of inaccurate adjustments upon the final determination of the time. The corrections, which are usually applied to each star of the series, may be mentioned: *First.* A correction for the variation in the running of the timepiece employed during the time of making the observations. *Second.* A correction for the inclination of the horizontal axis to the horizon. *Third.* A correction for the inequality in the size and shape of the pivots. *Fourth.* A correction to the mean of the wires to reduce it to the true centre of the instrument. *Fifth.* A correction for the deviation of the plane in which the instrument moves from the plane of the meridian. *Sixth.* A correction for the diurnal aberration of light and the personal equation of the observer. Introducing these corrections, the probable error of a time-determination by a skilful observer is usually not far from four one-hundredths of a second.

The transit-instrument rotating in a plane passing through the E. point, the zenith, and the W. point—*i. e.* the prime vertical—is used for the determination of latitude by noting the eastern and western transits of a star, and computing from these data, combined with the star's declination, the position of the observer's zenith. With the Germans and Russians a form of transit-instrument having the eyepiece at one end of the horizontal axis is in favor, on account of its greater convenience. This result is accomplished by interposing a reflecting prism in the cube $e\ e'$, for instance, of Fig. 1.

Transit Circle.—It has been usual until recently to consider the mural circle as a companion to the transit instrument in a fixed observatory: but by attaching a large circle to the horizontal axis of the transit instrument, the results formerly obtained by two instruments and two observers are now more accurately obtained by this single instrument, called the transit or meridian circle; the declination of a star being obtained from the circle reading, while its right ascension is obtained at the same time by observing its transit.

Fig. 3 shows the transit circle of the Harvard College

Fig. 3.

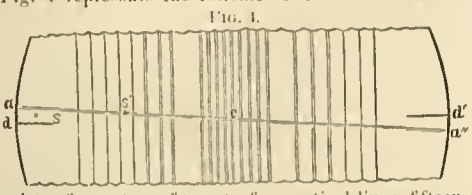


Observatory, built in 1870 by Troughton and Simms. The telescope has an aperture of $8\frac{1}{2}$ inches and a focal length of 9 feet 4 inches. The telescope pivots rest on iron castings imbedded in the solid marble block $a\ a$. Two circles 3 feet in diameter, graduated on silver to five minutes of arc, are attached to the axis, and move with the telescope. Four microscopes, $k\ k\ k\ k$, provided with micrometers, read to tenths of a second of arc the distance of the last five-minute division on the circle beyond which the telescope has been moved to bring a star into the position s of Fig. 4 from the centre of the microscopes. The microscopes are secured to a circular frame, which in turn is attached to the iron casting which supports the bearings for the pivots. A similar arrangement exists with regard to the circle on the other side of the telescope from the one shown in the draw-

ing. Counterpoises at *e e*, working upon the levers *f f*, diminish the amount of the friction of the pivots against their bearings. Glass cases cover both the circles. For the purpose of easily finding an object, the small finding-circles at *x* were provided, but in practice it is found more convenient to use a long arm attached to the axis, which describes the arc indicated in the lower part of the figure *v*. A lantern at *l* throws its light by a system of reflectors upon the circle. The framework at *a* is used for putting the striding-level in position. The instrument differs from the usual form of transit circles in supporting the circles above the piers, in its system of counterpoises, and in the placing of the circles so near to the floor that they may be read without the inconvenience of using steps. These improvements are due to the late Prof. Joseph Winlock, as also the using of collimators having apertures of the same diameter as the observing telescope.

Fig. 4 represents the reticule of this instrument. It

Fig. 4.



consists of a system of twenty-five vertical lines, fifteen of which are double and arranged as shown in the figure. A diagonal double line *a a'* makes an angle of 85° with the vertical system. Fractional parts of a horizontal line *d d'* extend far enough into the field to enable the observer to bring the star *s* between the lines *a a'* and *d d'* when the star enters the field. Since *a a'* would intersect *d d'* at the centre *c*, the star *s* transits the line *a a'* at some point *s'* between *a* and *c*, and by noting the time when the star is at *s'*, it becomes a matter of simple trigonometry to compute the vertical distance of *s'* from the line *d d'*, and consequently from the assumed centre of the field. The reading of the large graduated circle gives us the observed zenith distance of this central line *d d'* in space, and we are thus enabled, without any micrometrical measurements, to obtain the exact observed altitude by adding to the reading of the circle the computed vertical distance *a s'* with its proper sign. These lines were ruled on glass by Mr. W. A. Rogers (see RULING-MACHINE), and in the case of the double ones the instant the star is midway between the two components is noted. The vertical system is for right ascensions, and the components of a single double line are eight one-hundredths of an inch distant from each other.

There are several other large instruments in the U. S.—the one at the U. S. Naval Observatory at Washington, made by Pistor & Martin, of eight and a half inches aperture and twelve feet focus; the one at the Dearborn Observatory, Chicago, of six French inches aperture and six feet focus, made by Repsold, and presented by W. S. Gurnu, Esq.; and the Olcott transit circle at the Dudley Observatory, Albany, of eight inches aperture and ten feet focus, by Pistor & Martin. (For a full discussion of the transit-instrument see W. Chauvenet, *Manual of Spherical and Practical Astronomy*; *U. S. Coast Survey Reports* (1866, appendix No. 9; 1868, appendix No. 10), by Prof. C. A. Schott. For discussions of transit circle see W. Chauvenet (as above); Ph. Carl, *Die Principien der astronomischen Instrumentkunde* (Leipsic); *Description de l'Observatoire astronomique Central de Pulkova*, F. G. W. Struve (St. Petersburg, 1845); *Greenwich Astronomical Observations* (vol. for 1852, Appendix I.; do. 1867); *Washington Astronomical Observations for 1865.*) L. WALDO.

Tran'sit, p.-v. and tp., Sibley co., Minn. P. 424.

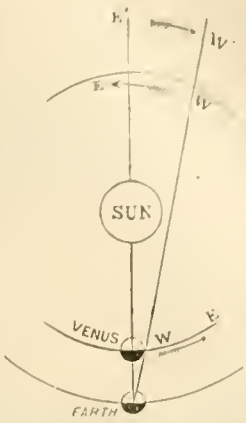
Transit Circle. See TRANSIT.

Transit Instrument. See TRANSIT.

Transits of Venus and Mercury. The word "transit" is from the Lat. *transitus*, a "way," or "passage over." In accordance with this etymology, the term *transit* is applied to denote the apparent passage of a planet across the sun's disk. In order that this should take place, the planet must be between us and the sun, and its orbit, consequently, must be within that of the earth; of all the known planets, Mercury and Venus are alone those to be found in this category. It will be found to be convenient to consider first the conditions under which such a transit can occur; then the intervals after which transits recur; and afterward the principal use to which the observations of such transits and their results are applied.

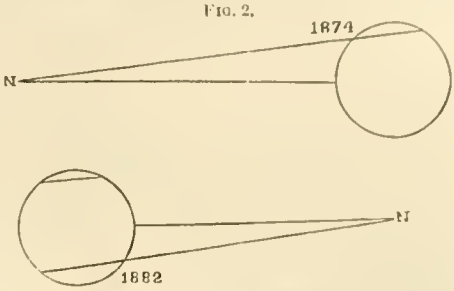
Conditions.—As the planes of the orbits of all the other planets are inclined to that of the earth's orbit (the *ecliptic*), a planet at the time of its transit must not only be nearly in the line drawn from the sun to the earth, as is represented to be true of Venus in Fig. 1; *i. e.* the planet must not merely be in *inferior conjunction* with the sun, or near to

Fig. 1.



that, but also at the same time sufficiently near to one of the points of intersection of its orbit with the plane of the earth's orbit (the ecliptic)—*i. e.* one of the *nodes* of that orbit, such as is represented at N in Fig. 2; and which, the motion of the planet being in the direction indicated by the arrow, is the *ascending* node; that is, the node at which the planet passes to the *north* of the ecliptic. The opposite point to this is the *descending* node, at which the planet passes to the *south* of the ecliptic. The figure represents very nearly the state of things at the time of the transit of Venus in 1874. And it is sufficiently manifest that if the conjunction with the sun had happened somewhat later, the apparent position of the planet would have been too far from the sun's centre to

Fig. 2.



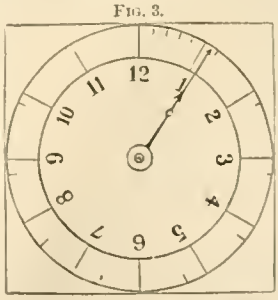
have made it appear on the sun's disk at all; the apparent position on the sun's disk being but slightly modified by the position of the observer on the earth's surface, as will be shown hereafter.

Venus is near to her ascending node in that part of her orbit in which the line drawn from the sun (the *radius vector*) lies very nearly in the same direction with that drawn from the sun to the earth, early in December: and the like will be true for many centuries to come. The direction of the opposite descending node is that of the earth early in June. Hence, transits of Venus, when they happen at all, must for many centuries to come occur only in December or in June.

If, at the time of the inferior conjunction, the distance of Venus from the node in question be greater than about 1¾ degrees, the planet will fail to be projected on the disk of the sun; and there will be no transit observed. It will be observed that while Venus, moving around the sun more rapidly (in the direction W E, as marked in the figure), passes by the earth at the inferior conjunction, that same general direction of the planet carried around will be that of W' E' on the opposite side of the orbit; but the motion from W toward E as seen from the earth and projected on the face of the sun, or on the heavens beyond, will appear to take place in the direction E' W'; *i. e.* from E. toward W., or be retrograde in the direction of the arrow in Fig. 2.

Circumstances which regulate the recurrence of Transits.—These may be illustrated by the coincidences, direction, etc., of the minute-hand and the hour-hand of a clock. The velocities being as 12 : 1, the minute-hand traverses the angular space due to 12 divisions of the dial-plate while the hour-hand traverses but 1; the minute-hand in traversing these 12 divisions thus *gaining* upon the hour-hand 11 divisions out of the 12. Now at 1 o'clock the hour-hand is in advance of the minute-hand the space from 12 to 1, which can be traversed by the minute-hand in 5 minutes. If, then, this 5-minute space be divided into 11 equal parts, we shall have the space due $\frac{5}{11}$ths of a minute for one of those parts; and adding this portion to the 5-minute portion from 12 to 1,

Fig. 3.



we shall have what is due to the motion of the minute-

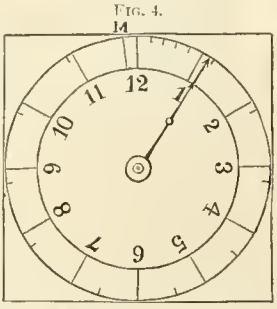
band in $5\frac{5}{11}$ minutes, which it will then have completely accomplished at $5\frac{5}{11}$ minutes after 1. Meanwhile, the hour-hand will have accomplished only the one portion due to $\frac{5}{11}$ths of a minute: *i. e.* the $\frac{1}{11}$th part of the 5-minute portion, or $\frac{1}{12}$th of the $5\frac{5}{11}$th portion due to the minute-hand, which revolves 12 times as fast. The two hands will thus be brought into conjunction at $5\frac{5}{11}$ minutes after 1 o'clock, as they were at 12 o'clock. The time of the next conjunction—viz. that after 2 o'clock—will be found by dividing the *10-minute space* from 12 to 2 by 11, as in the former instance; and we shall find, adding, as before, that this second conjunction will take place at $10\frac{10}{11}$ minutes after 2 o'clock, etc. The successive conjunctions, then, will take place as follows:

1st at	1h.	$5\frac{5}{11}$m.	
2d at	2	$10\frac{10}{11}$	
3d at	3	$15\frac{4}{11}$, or	3h. $16\frac{4}{11}$m.
4th at	4	$20\frac{20}{11}$, or	4 $21\frac{9}{11}$.
5th at	5	$25\frac{25}{11}$, or	5 $27\frac{3}{11}$.
6th at	6	$30\frac{30}{11}$, or	6 $32\frac{8}{11}$.
7th at	7	$35\frac{35}{11}$, or	7 $38\frac{2}{11}$.
8th at	8	$40\frac{40}{11}$, or	8 $43\frac{7}{11}$.
9th at	9	$45\frac{45}{11}$, or	9 $49\frac{1}{11}$.
10th at	10	$50\frac{50}{11}$, or	10 $54\frac{6}{11}$.
11th at	11	$55\frac{55}{11}$, or	12 0.

After 12 o'clock, then, when the minute-hand and the hour-hand are in line, it appears that there will be a series of 11 conjunctions of the minute-hand and the hour-hand; at the conclusion of which series the minute-hand and the hour-hand will again be brought into conjunction at the 12 o'clock hour-mark. At all the other conjunctions the places of meeting will be notoriously different from the exact hour-marks.

Next suppose the rate of motion of the *hour-hand* to be somewhat, though a very little, too slow. Then the minute-hand will overtake the hour-hand at *the 11th conjunction* (at a point such as M in Fig. 4), a little *before* 12 o'clock. Or, if besides, the two hands had at first been set together a little *beyond* 12, but at a *less* distance than that from M to 12, as at Q in Fig. 5, then, with the same somewhat slow rate of the hour-hand already supposed, the point of meeting at *the 11th conjunction* after starting from Q will be at M′, as much behind Q as was M behind 12 in the immediately preceding case.

Fig. 4.



Now if withal the minute-hand were broken off so as to render it shorter than the hour-hand, and a small ball attached at the extremity of the one, and another small ball at the extremity of the other, the ball at the extremity of the short arm circulating more rapidly than the other, and both around a larger ball in the middle of the dial-plate (fastened, if we please, to one of the arbors), we should then have a somewhat adequate representation of the case of Venus and the earth in their motion around the sun; and this yet more perfectly if we besides suppose the arbor of the shortened minute-hand to be somewhat bent, so that in turning the minute-hand would be carried *in front* of the face with an inclination outward in passing from 12 to 6, and, going through a long opening in the dial-plate, pass *behind* the dial-plate from 6 to 12, as represented in Fig. 6. The line from 12 to 6 will represent the line of the nodes of Venus, the ascending node being in the direction of 12, and the descending node in the direction of 6. Then, the hands being, as before supposed, set in conjunction in the direction of Q, and the motion of the hour-hand being, as supposed, a little too slow, the combination of results will be that the shortened minute-hand, passing always in front of the dial-plate from 12 to 6, and behind it from 6 to 12, will, *after a complete series of 11 conjunctions*, be brought into line with the hour-hand not quite in the direction of Q, but that of M′, a little to the other side of 12, in consequence of the somewhat too slow motion of the hour-hand.

Fig. 5.

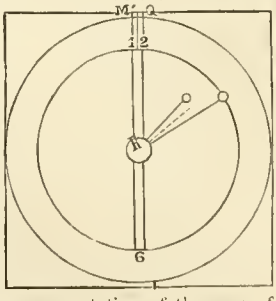
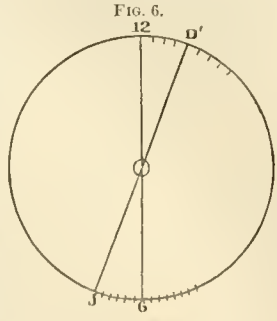


Fig. 6.



Now, as appears from the table of times of conjunctions of the minute-hand and hour-hand, as heretofore stated, the minute-hand, though originally set in conjunction with the hour-hand at 12 o'clock, is not found in conjunction again until 1h. $5\frac{5}{11}$m., so the minute-hand will then have completed an entire revolution, and the space due to $5\frac{5}{11}$m. more than that. This happened with the hour-hand going twelve times as slow as the minute-hand. But if the hour-hand had moved much faster, the conjunction in the series would have been later. And if the velocity of the hour-hand had been one-half that of the minute-hand, then when the minute-hand had completed its circuit, the hour-hand would be found pointing halfway around at 6. And when the minute-hand had completed *two* circuits, the hour-hand would just have completed *one*; and thus the hands be found in conjunction again at 12. But if the minute-hand had moved even somewhat faster than was just now supposed, the next conjunction (the first in the series) would not occur until the minute-hand had *more* than completed *two* revolutions, and the hour-hand *more than one*. And we should then have the analogy of the motions of Venus and the earth well represented, even in *that* respect. For Venus, having been in inferior conjunction with the earth, is not found in inferior conjunction again until she has all but completed two revolutions around the sun, while the earth in the same time has gone *once* around the sun, and nearly three-fifths of a revolution more: *i. e.* 1.6 an entire revolution, which of course will occupy 1.6 years. The series of conjunctions will consequently take place as follows:

	Earth's revolutions.	Distance beyond first position.
1st	1.6 —	0.6 —
2d	3.2 —	0.2 —
3d	4.8 —	0.8 —
4th	6.4 —	0.4 —
5th	8.0 —	0.0 —

It appears, then, that five conjunctions will take place within *very nearly eight years*, and that at the expiration of very nearly eight years the 5th conjunction will occur in a direction a very little *short of* that from which the motions in question were reckoned; but that at all the other intermediate conjunctions the direction of the "conjunction line" will be very different from that. So that if we begin with an inferior conjunction like that in Dec., 1874, at a position like that of Q in Fig. 5, a little beyond the line of the nodes 12 . . . 6 (in the figure), and when, as in Fig. 2, the conjunction was sufficiently near to the ascending node to have a transit, then within the period of all but eight years next succeeding there will be four other conjunctions, but every one of them far from the line of the nodes: as appears from the table positions here given. But at the 5th conjunction, at the end of very nearly *eight years*, the direction will be like that of M′ in Fig. 5, a little *behind* that of Q in position, and *short* of node, but still near enough for a transit in Dec., 1882, as represented in Fig. 2 *bis* (M′ itself being withal a little nearer to the line of the nodes, because that line is found farther back after eight years).

The like results will obtain during the *next period of eight years*; but the "conjunction-line" being at the outset in the direction of M′ instead of that of Q, the 5th conjunction after the *second* period of eight years will take place still farther *back* than M′—too far back, indeed, for a transit, Venus passing below the sun. After another period of eight years the "conjunction-line" will be still farther behind the node, and differing still more from those of a transit.

Thus, then, it will not be until after many periods of eight years each, that the "conjunction-line" will have receded to the direction like that of 6 in Fig. 5, which represents that of the opposite (descending) node, the direction of Venus and the earth from the centre being that which the earth has at the opposite season of the year—viz. in June; and thus, at the end of so long a time, there will ordinarily be two transits, eight years asunder, in June instead of December; as must indeed be the case for a very long time to come.

Pursuing, however, the successive series of changes, we shall find that after another very long period the "conjunction-line" will have gone backward until it arrives very nearly in the original direction of Q; and after that will recur two December transits, eight years asunder, as before. Now, the whole period from the leaving of Q to the return, or rather very near to it, is 243 years; and the

same is true for the entire period from one June transit to a similar one again. Thus, from 1631 to 1874 is 243 years, and so from 1761 to 2004 is 243 years also. Hence, it might seem that from a December transit to a similar one in June (but at the opposite node) the period ought to be the half of 243 years; and from a June transit to a similar one in December, the other half. Yet the interval from a December transit to a similar one in June is several years longer than the other. The reason for this is found in the unequal angular motion of both Venus and the earth in consequence of the respective eccentricities of their orbits, that of the earth being proportionally far greater than that of Venus. Now, when the relative motion of the earth is the most rapid, the point M (at the date of the arrival of Venus in the conjunction line) will be farther *back*, and so the spaces like Q M in Fig. 5 will be wider in the interval short of the eight years to which Q M is due; and if that most rapid motion took place nearly in the direction 12 (in the figure), the spaces such as Q M would become narrower and narrower, to be smallest of all about the direction of 6. And then, the arrangement being nearly symmetrical, the spaces in an inverse order would become wider and wider, to be restored to their original dimensions in the region of 12. Hence, the recess of the "conjunction line" would not indeed be uniform, but the time occupied by the changes from 12 to 6 be, after all, very nearly the same with that of the changes in reverse order, from 6 to 12. Yet, as heretofore stated, the interval from the December to the June transits is veritably several years longer than the other. This finally arises from the fact that the line of the *symmetrical* arrangement of the intervals already described is not that of the nodes, represented by 12 . . 6 in Fig. 5, but approximating the direction to D J in Fig. 6; the spaces heretofore described, but near D, and indeed from D to 12, being the wide ones, while those near J are the narrow ones; and, indeed, more of them. So there will be more periods of nearly eight years included in the interval from 12 to 6 than in that from 6 to 12—*i. e.* a considerably longer interval in all from a December transit to a similar one in June than that from a June transit to a similar one in December. Accordingly, we have—

From Dec., 1631, to June, 1761, 129½ years,
" Dec., 1639, to June, 1769, also 129½ years;
but from June, 1761, to Dec., 1874, only 113½ years,
" June, 1769, to Dec., 1882, also 113½ years;
but from Dec., 1874, to June, 2004, 129½ years,
" Dec., 1882, to June, 2012, also 129½ years.

The respective differences are sixteen years each, equal to the sum of two eight-year periods. Reckoning from the last of one pair of transits to the first of the next pair, we have—from June, 1759, to Dec., 1874, 105½ years; but from Dec., 1882, to June, 2001, 121½ years. The year 1882 being near to the close of the nineteenth century, this whole period of 121½ years, if one may so say, bridges over the entire twentieth century, leaving it without a transit.

Application of the Results of Transit Observations.—It is notorious that transit observations have for their object the more accurate determination of the sun's horizontal parallax, and hence of the earth's distance from the sun, and from that the respective distances from the sun of all the other planets. The relative distances of the planets can be, and have been, accurately determined by Kepler's third law—viz. that as are the squares of the periodic times, so are the cubes of the mean distances. Hence, if the distance of the earth from the sun be taken as 1—*i. e.* made use of as the measuring unit—and the periodic times be also measured in units respectively of the earth's time—viz. 1 year—we shall have (since 1^2 and 1^3 are respectively = to 1):

$$1 : (\textit{planet's periodic time})^2 :: 1 : (\textit{planet's distance})^3,$$

hence, numerical value of $(\textit{dist.})^3 = (\textit{period. time})^2$:

$$\text{or, } \textit{dist.} = \sqrt[3]{\textit{of } (\textit{period. time})^2} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

This result will be very slightly modified when the relative masses are determined, and *that* will require the determination of the earth's distance from the sun in *some terrestrial measure.* For this we need the sun's (equatorial) horizontal parallax (see PARALLAX); and this is what the observations of the *transits of Venus* are fitted very accurately to determine.

For E C in Fig. 7 representing a chord of the terrestrial spheroid, and V the position of Venus projected on the sun's disk at *v* as seen from E, and at P, as seen from C, we have

P V : E V :: *sin. of angle at* E : sin. of angle at P

or, angles being very small,

P V : E V :: angle E : angle P;

that is, very accurately,

$72\frac{1}{2} : 27\frac{1}{2}$ :: angle E : angle P;

the relative distances P E and P V being determined by Eq. (1); and hence also their difference. And from this last proportion, we have—

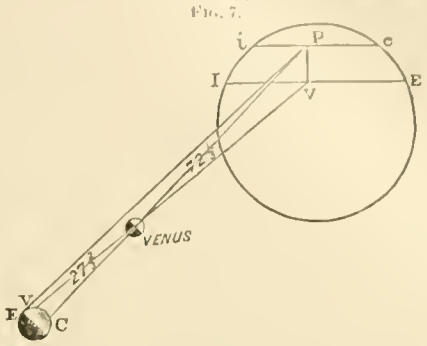
angle at P (subtended by E C) $= \frac{27\frac{1}{2}}{72\frac{1}{2}}$ *angle at* E (subtended by P V),

or *the solar parallax due to* E C $= \frac{27\frac{1}{2}}{72\frac{1}{2}}$ *the displacement* P *v* of Venus on the sun's disk (as measured from E), when the planet is respectively observed (at the same time) from E and from C . . . 2).

The transit observations should therefore determine such displacement. For this purpose three methods are in use.

1. *The "Direct" Method.* This consists, in effect, in determining micrometrically the *apparent distance*, in seconds

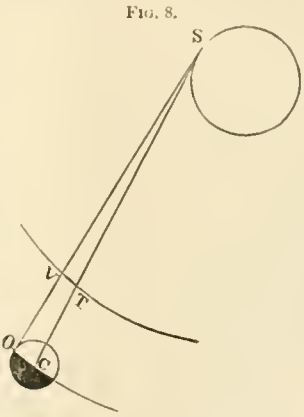
Fig. 7.



of arc, of Venus from the sun's centre, and also the *direction* of that distance as seen from the one station (E), and also as seen from the other station (C); and hence deducing the displacement P *v*.

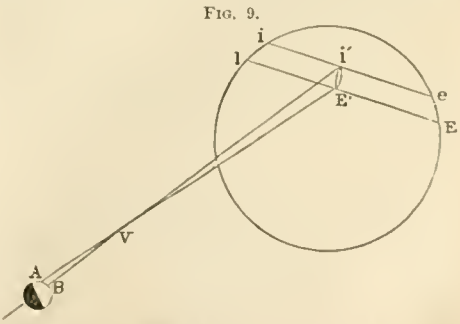
2. *The Method of M. Delisle, styled the Delislean Method.*—This, in effect, consists in determining when, as seen from the observatory O (Fig. 8), Venus appears at the edge of the sun's disk, and then, the relative motions being all known, determining when the like projection would take place on the sun's edge as seen from C, the centre of the earth. The difference between these two times will enable us to compute *accurately* the arc V T apparently described by Venus in the interval. And as the apparent motion of the planet is quite slow (the transit occupying several hours), the arc V T will thus be measured, as it were, by a screw of slow motion, and be sharply determined. And V T itself measures the parallactic angle subtended by O C at S. All this requires not only that the local time be *very accurately known*, but also the difference between that time and time at a first meridian, or the longitude of O must be accurately determined.

Fig. 8.



3. *The Method of Dr. Edmund Halley, known as the Halleian Method.*—In the application of this method the time of the immersion of Venus at I as seen from A (Fig. 9) is carefully noted, and also the time of emersion at E.

Fig. 9.



The interval between the two—that is, the *whole time of transit*—will, as in the second method, afford the means of

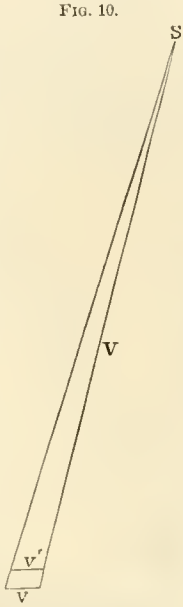
measuring I E, allowance being made for the change of position of the observer by the earth's rotation during the interval. In the same way may be ascertained if the whole duration, in manner as before, be found for the station B. Then the semi-diameter of the sun being accurately ascertained, and I E and *i e* known, the measures of the arcs of which I E and *i e* are respectively the chords, can be ascertained, and hence *i'* E' the difference of versed sines, *on the scale of the sun's semi-diameter;* and from this displacement in the direction *i'* E' the angle of solar parallax due to A B, as in the direct method.

The various positions in question in these several methods may be recorded by the photograph, and were so recorded in 1874.

Our limits will not permit us to trace the history of observations such as those here described nor that of the curious phenomena connected with them: but the learned world have recently become more than ever sensible of their obligations to the young English astronomer, Jeremiah Horrocks, for his invaluable observation of the entrance of Venus on the sun's disk in Dec., 1639 (N. S.). The succeeding transits of 1761, 1769, and 1874 have all been observed with increasing care and accuracy. M. Encke, from a careful discussion of the observations of the transits of 1761 and 1769, concluded the value of the sun's (equatorial) horizontal parallax to be 8.5776″. A rediscussion of the same observations rather seems to indicate a greater value. The same is also shown by the results of various other methods; one of which seems to require a passing notice even here.

In Fig. 10 the angle at S is the displacement in the apparent direction of a star, due to the motion of the eye of the observer combined with the motion of light—a purely optical phenomenon. As the displacement takes place in opposite directions at opposite seasons of the year, the observed positions of the star at those seasons will indicate twice the displacement in question—twice the value of the *annual* aberration of light. Then in the triangle in the figure, the side V will represent the velocity of light, and *v* the velocity of the earth's orbital motion. Now, the value of V, as *ascertained by experiment*, was found to be about $\frac{1}{30}$th less than that previously admitted. The side V being thus $\frac{1}{30}$th less, and the angle S being unaltered, *v v'* must be reduced $\frac{1}{30}$th, the ratio of *v* to V being preserved. But the velocity of the earth in its orbit being reduced $\frac{1}{30}$th, that implies (or rather means) that the space traversed in the orbit in 1 second is reduced $\frac{1}{30}$th. And every space due to 1 second of time being thus reduced $\frac{1}{30}$th of itself, the whole circuit of the orbit must also be reduced $\frac{1}{30}$th of itself, and therefore, finally, the mean distance from the central body, the sun. But the parallax is inversely as the distance; and so, as the result of several methods, the parallax was found by Prof. Simon Newcomb to be very nearly 8.85″. The earth's mean distance from the sun corresponding to this is about 92,000,000 miles.

Fig. 10.



Much has been said of the discrepancy and correction here noticed—much to the supposed disparagement of astronomical science. But with a radius of 200 miles, 1 second of a circle's circumference would be 5.119 feet, and $\frac{1}{3}$ of a second be 1.706 feet, or not quite 1 foot 8½ inches. How accurate the trigonometrical survey which would determine a position within 1 foot 8½ inches by means of an observation taken at the distance of 200 miles! And yet this well represents the error in the determining the solar parallax as it was *at first* concluded. How *very accurate* the science which could discover and correct such an error as that!

The transits of Mercury are of more frequent occurrence than those of Venus, but are of far less interest, as they cannot be used for the same purpose, Mercury being too distant from us, even at the inferior conjunction. During a transit of an inferior planet the position of that planet is affected by parallax, and so also is that of the sun: so that the displacement on the solar disk is due to *the difference* of the parallaxes. But if the apparent distance of a planet from a more remote body, such as has no sensible diurnal parallax, be measured—(*i. e.* the distance from a fixed star when the planet is very near to it), the whole parallax of the planet will be efficient. By such a comparison the parallax of Venus, as well as that of Mars, has been ascertained, and thence that of the sun. S. ALEXANDER.

Tran'sitville, p.-v., Washington tp., Tippecanoe co., Ind., on Toledo Wabash and Great Western R. R. P. 205.

Transleitha'nia is the common name for that part of the Austro-Hungarian monarchy which lies to the E. of the river Leitha, an affluent of the Danube. It comprises Hungary proper, Transylvania, Croatia, and Slavonia, or the Hungarian crown-lands.

Transmigra'tion [Lat. *trans*, "across," and *migrare*, to "migrate"], the doctrine of the repeated existence of the soul in different forms of matter, its form in each successive existence being determined by its merits and demerits in the preceding ones. The most striking fact in connection with this doctrine is its wide prevalence, its profound and permanent hold on certain great nations, its constant reappearance in more or less pronounced forms in all parts of the world. The ancient civilization of Egypt, whose contrasted splendors and horrors awaken astonishment more and more with each step in the progressive decipherment of its mysterious record, seems largely to have grown out of this faith. The swarming millions of India also, through the chief periods of their history, have lain under its spell, suffered their lives, wrought their great works of government, architecture, philosophy, and poetry, meditated, aspired, and exhaled their souls. Ruder forms of it are reported among innumerable barbaric tribes. It played an important part in the speculations of the early Fathers of the Christian Church, and has often cropped out in the works of later theologians. Men of the profoundest metaphysical genius, like Scotus Erigena and Leibnitz, have affirmed it, and sought to give it a logical or scientific basis. And even amidst the predominance of skeptical and materialistic influences in Europe and America at the present time, we constantly meet individuals with independent minds who earnestly believe the alluring dogma; for to a large and varied class of minds the doctrine has a transcendent attraction as well as a manifold plausibility.

Another striking fact connected with this subject is, that it seems to be a native and ineradicable growth of the Oriental world, but appears in the Western world in scattered instances, and rather as an exotic form of thought. The pantheistic tendency which possessed and overwhelmed the Brahmanic mind, shaping and tinging all its views, opened the whole range of sentient existences to an indiscriminate sympathy, and made the idea of transmigration natural, and more pleasing than repugnant. Furthermore, the Brahmanic thinkers and sages are a distinct class of men whose whole lives are absorbed in introspective reveries and metaphysical broodings calculated to stimulate the imagination and arouse to the keenest consciousness all the latent marvels and possibilities of human experience, thus furnishing the most favorable conditions for exactly such a belief as that of transmigration—an endless series of ever-varying adventures for the imperishable soul. And the vast swarms of the common people in the East are the passive followers of this high caste of thinkers, abjectly accepting what they teach. Accordingly, the mysterious doctrine of metempsychosis has held the entire mind, sentiment, and civilization of the East through every period of its history as with an irrevocable spell. On the contrary, in the Western world the characteristic tendencies are all different. Pantheistic theories are rarely held, and the dreams and emotions which those theories are fitted to feed are foreign and repulsive. An impassable barrier is imagined separating humanity from every other form of being. Speculative reason, imagination, and affection are chiefly employed in scientific studies and social pursuits, or personal schemes external rather than internal. This absorption in material things and evanescent affairs engenders in the spirit an arid atmosphere of doubt and denial, in which no efflorescence of poetic and mystic faiths can flourish. Thus, while outward utilities abound, hard negations spread abroad, and living, personal apprehension of God, an all-pervasive providence, and the immortality of the soul in any form dies out either in open infidelity or in a mere verbal acceptance of the established creed of society.

The suggestive or argumentative grounds on which this belief rests are chiefly the following: (1) The various and strong resemblances, both physical and psychical, connecting human beings with the whole family of lower creatures. They have all the senses in common with us, together with the rudiments of intelligence and will. They all seem created after one plan, as if their varieties were the modulations of a single original type. We recognize kindred forms of experience and modes of expression in ourselves and in them. Now the man seems a travesty of the hog, the parrot, the ape, the hawk, or the shark; now they seem travesties of him. As we gaze at the ruminating ox, couched

on the summer grass, notice the slow rhythm of his jaw and the wondering dreaminess of his deep soft eyes, it is not difficult to fancy him some ancient Brahman transmigrated to this, and patiently awaiting his release. Nor is it incongruous with our reason or moral feeling to suppose that the cruel monsters of humanity may in a succeeding birth find the fit penalty for their degradation and crime in the horrid life of a crocodile or a boa-constrictor. (2) The conception of a series of connected lives furnishes a plausible explanation for many mysteries in our present experience. Reference is made to all that class of phenomena covered by the Platonic doctrine of Reminiscence. Faces previously unseen, and localities unvisited, awaken in us a vivid feeling of long familiarity with them. Thoughts and emotions not hitherto entertained come to us as if we had welcomed and dismissed them a thousand times in periods long gone by. Many an experience, apparently novel and untried, makes us start as though the chambers of the soul had often before echoed to its shadowy footsteps. The supposition of forgotten lives preceding the present, portions of whose consciousness reverberate and gleam through the veils of thought and sense, seems to throw satisfactory light on this strange department of experience. (3) Much more weighty and penetrative, however, than the foregoing considerations is the philosophical argument in behalf of transmigration drawn from the nature of the soul. Consciousness being in its very essence *the feeling of itself*, the conscious soul can never feel itself annihilated, even in thought. It only loses the knowledge of its being when it lapses into unconsciousness, as in sleep or trance. The soul may indeed *think* its own annihilation, but cannot realize the thought in *feeling*, since the fainter emotional reflex upon the idea of its destruction is instantly contradicted and overborne by its more massive and vivid sense of its persistent being in immediate consciousness. This incessant self-assertion of consciousness at once suggests the idea of its being independent of the changing and vanishing body in which it is temporarily shrined. Then the conception naturally follows that the soul, as it has once appeared in human form, so it may reappear indefinitely in any of the higher or lower forms of being which compose the hierarchy of the universe. The eternity of the soul, past and future, once accepted by the mind, leads directly to the construction of the whole scheme of the metempsychosis—an everlasting succession of births and deaths, disembodiments and re-embodiments, with their laws of personality and fortunes of time and space weaving the boundless web of destiny and playing the endless drama of providence. (4) But the strongest support of the theory of transmigration is the happy moral solution it seems to give to the problem of the dark and distressing inequality and injustice which otherwise appear so predominant in the experience of the world. To the superficial observer of human life, the whole scene of struggle, sin and sorrow, nobleness and joy, triumph and defeat is a tangled maze of inconsistencies, a painful combination of violent discords. But if we believe that every soul, from that of the lowest insect to that of the highest archangel, composes an affiliated member of the infinite family of God, and is eternal in its conscious essence, perishable only as to its evanescent disguises of unconscious incarnation; that every act of every creature is necessarily followed by its legitimate reactions; that these actions and reactions constitute a law of retribution absolutely perfect; that these souls, with all their doings and sufferings, are interconnected with one another, and with the whole, all whose relationships co-penetrate and co-operate, with mutual influences whose reports are infallible, and with lines of sequence that never, never break,—then the bewildering maze becomes a vindicated plan, the horrible discord a divine harmony.

But, in spite of all that can be said in its behalf, the theory of the transmigration of souls remains, to the average modern mind of the Western world, a mere fancy, although it has a deep metaphysical basis, a strong poetic charm, and a high ethical and religious quality.

WILLIAM R. ALGER.

Transmutation of Force or Energy. See CORRELATION OF FORCES, by PRES. J. H. SEELYE, S. T. D.

Transpiration of Gases. See GAS, by PROF. J. P. COOKE, A. M.

Transpiration of Liquids. See LIQUIDS, by H. WURTZ, A. M.

Transporta'tion [Lat. *transportare*] differs from banishment by being simply a transfer of a person from one part of the dominion to another, while one banished is driven out altogether from the dominion. Transportation was adopted as a means of punishment in England in the middle of the seventeenth century, and the criminals were sent to the plantations of America, where they were treated as slaves. After the American war of independence, Australia was selected by England as the place of transportation, and the first criminals arrived at Sydney in 1787. In 1840 the whole system of transportation was abandoned by England. It is still in use in France and Russia, which latter tries by this means to settle the vast steppes of Siberia.

Transposi'tion [Lat. *trans*, "across," and *ponere*, to "place"], in music, the act of removing a composition into a key different from that in which it is written. By this is not meant a change of *mode* also. A piece of music written in a major key, for instance, cannot be transposed into the corresponding minor (as from C major to C minor), unless its construction has been such as to make such a transfer possible. A composition in any major key may be transposed into any other major key; and the same rule applies to compositions in minor keys. Transposition is not simply the moving of all the notes of a piece one or more degrees higher or lower, for such a change would at once destroy or impair its distinctive character. If the scale consisted of a series of regular and *equal* degrees, this might readily be done, and a composition would suffer no injury by being moved from any key to any other. But, as the scale is not a regular, but an *irregular*, series of sounds, consisting of five whole tones and two semitones arranged in a fixed and invariable order, and as all music is now written on such a scale, and no other, it follows that we cannot transfer a composition without injury into a new key until we have brought the scale of that key into conformity with that in which the piece is written. A composition in C major, for instance, if carried three degrees higher—*i. e.* into the scale of F—would be false on every fourth degree of that scale, because one of the semitones in the series differs in its position from the normal pattern in C. To rectify this, we lower the fourth (or B) by placing at the clef a flat on that degree; and by thus changing every B into B♭ we correct the scale, and transposition from C to F requires nothing more than a change of the places of the notes. Again, if we would transpose from C to G, we shall find a defect of an opposite kind on the seventh degree of the G scale, which must be corrected by changing every F into F♯. On the same principle we proceed in transposition into any other key, correcting by sharps or flats the deviations of any desired key from the model scales of C major or A minor. (For a more detailed examination of the theory of transposition and its application see the article KEY.) WILLIAM STAUNTON.

Transubstantia'tion [from *trans* and *substantia*, "a change of one substance into another"] is a scholastic term introduced by Paschasius Radbertus (831) to signify the change of the substance of the natural elements of bread and wine into the very body and blood of Christ in the Eucharist, while the visible form and the appearance of bread and wine remain. This miracle is supposed to take place in the mass whenever the priest pronounces the words of institution: "This is my body," "This is my blood." The doctrine was more or less clearly suggested by several Greek and Latin Fathers (under different terms, such as *transitio*, *transmutatio*); it was controverted in the Middle Ages by Bertram (Ratramnus) and Berengar, but confirmed by the Lateran Council (1215) and the Council of Trent (Oct. 11, 1551), and learnedly defended by Bellarmin, Bossuet, Möhler, Perrone, and Cardinal Wiseman (in a dissertation on John vi.). It was rejected by all the Reformers and Protestant churches, because it contradicts the testimony of our senses (sight, touch, taste) and the very nature of the sacrament, and leads to gross superstitions. It is based on a literal interpretation of the words of Christ: "This *is* my body." But the majority of biblical scholars understand these words figuratively, on the ground that the disciples could not literally eat the living Christ or his crucified body before the crucifixion. Besides, it is urged that our Lord, in distributing the wine, says, "This *cup* is the new testament in my blood" (1 Cor. xi. 25), using the cup figuratively for the wine contained therein: and that he calls the elements "bread" and "wine" *after* consecration, as does also St. Paul: "The bread which we break, is it not the communion of the body of Christ?" PHILIP SCHAFF.

Trans'vaal ["across the Vaal"] **Republic, The,** in Southern Africa, between lat. 22° and 28° S., and lon. 25° and 31½° E., and comprising an area of 77,964 sq. m., is bounded E. by the Portuguese possessions, the Zwazi and Zulu countries, S. by Natal and the Orange republic, and W. and N. by Hart and Limpopo rivers, which separate it from the country of the Kaffirs. In the valley of the Vaal River, which separates Transvaal from Orange, diamonds were discovered in 1870, and found in so great quantities that the Englishmen seized the territory Oct. 7, 1871, and established an independent colony, Griqua-Land West. This colony, which lies wedged in between Trans-

vaal and Orange, the gold-fields of Tati and Matibele, N. of Transvaal, and the gold-field of Maraba's Town in the north-eastern part of Transvaal, form the principal centres of the traffic of the republic. The country is mostly very thinly peopled, and chiefly used by the inhabitants for hunting and cattle-breeding; and although it contains by nature all conditions of an agricultural development on the grandest scale, it still stands at a low stage of culture. The soil is very fertile, and the surface, generally elevated 6500 feet above the sea-level, presents almost everywhere the aspect of hills and valleys covered with rich vegetation and watered by limpid streams. Two mountain-ranges traverse the country from S. W. to N. E.; other minor elevations are scattered in different directions. The principal rivers are the Vaal and the Limpopo, with their affluents. The country is perhaps richer in minerals than any other country in the world—iron, tin, lead, copper, silver, gold, porcelain-clay, alum, marble, saltpetre, coal, and diamonds. Coffee, sugar, cotton, tobacco, all kinds of cereals, apples, pears, figs, grapes, peaches, almonds, nuts, oranges, bananas, guavas, etc., are produced. Nevertheless, the inhabitants, comprising about 250,000 Kaffirs and 30,000 white, prefer to live by hunting, and by their insatiable passion for destruction they have driven to the N., even beyond the Zambesi River, the numerous herds of elephants, ostriches, buffaloes, giraffes, quaggas, etc., which formerly roamed over the plains. Yet, in 1870, game was still so plentiful that lions, tigers, and other beasts of prey did not attack man. The whites, the so-called Boers, live on widely-scattered farms, where they cultivate a small piece of field and keep large herds, but their favorite occupation is *trekken*; that is, they range around for months hunting, with huge wagons, drawn by sixteen or twenty buffaloes. Some towns have been built, however, such as Potchefstroom, with 300 houses and 1500 inhabitants; Pretoria, the seat of government, with 100 houses and 400 inhabitants; Rustenburg, of the same size; and Nylstroom, a minor settlement. A railway from Pretoria to the nearest harbor on Delagoa Bay is under deliberation. Ostrich-feathers, wool, ivory, cattle, cereals, leather, fruit, tobacco, butter, brandy, etc., are exported; all kinds of manufactured goods are imported, and are sold by strolling peddlers. For the year 1874–75 the finances showed—receipts, £71,897; expenses, £71,871. The principal items of income are direct taxes on real estate, a capitation tax on those who have no real estate, custom-house duties, etc. The public debt consists of two loans at 6 per cent., one of £63,000 and one of £19,000, made respectively in 1873 and 1874 in Cape Town. The government consisted in 1876 of a president as chief of the executive and a legislative assembly. English money and Dutch measures are in use. The Boers were mostly born in Cape Colony or Natal. In order to escape from the control of English law, they retreated into the rich northern wilderness, and here they formed a state in 1858, and gave themselves a constitution. The development of the republic was greatly aided by the explorations of the Englishman Baines, who first accompanied Livingstone, and was afterward agent for the English company which worked the gold-mines in the vicinity of Transvaal, and by the discoveries of gold-fields by the German explorers Mercuski and Mauch, who believed they had rediscovered the ancient Ophir. It was annexed to the British possessions Apr. 12, 1877. AUGUST NIEMANN.

Transylva'nia, county of S. W. North Carolina, bordering on South Carolina; surface mountainous, and containing the source of French Broad River; soil fertile in the valleys, and well adapted for stock-raising. Staples, Indian corn, rye, wool, and tobacco. Cap. Brevard. Area, 475 sq. m. P. 3536.

Transylvania, Grand Duchy of, a crown-land of the Austro-Hungarian monarchy, comprising an area of 21,216 sq. m., with 2,115,024 inhabitants, is mostly mountainous, formed by a plateau which rises to an average height of 1500 feet, and is surrounded on all sides by mountains—S. and E. by the Transylvanian Alps, a range of an average elevation of 4000 feet, extending for a distance of about 80 geographical miles from the Iron Gates to the sources of the Theiss; W. and N. by the Transylvanian Ore Mountains; and S. W. by the mountains of the Banate. The Transylvanian Ore Mountains, whose single chains generally extend from E. to W., contain several high peaks—as the Kuhhorn, 6850 feet, the Bihari, 5671 feet—and form a series of longitudinal valleys through which the rivers of the plateau wind their way, such as the Maros, Szamos, etc. The Transylvanian Alps rise with their bald peaks far above the tree-line, the highest point of the southern range, the Negoi, reaching an elevation of 7830 feet; but in other places dense primitive forests add to the inhospitality of these thinly-peopled mountain-ranges, which are traversed only by a few passes—the Vulcanpass, 4330 feet, Rothethurm, 1280 feet, Tömös, 5569 feet, and Oitosz, 2729 feet. On account of the mountainous character and great elevation of the country, its climate and vegetation resemble those of more northern countries. The vine, however, is still cultivated. In the southern part rainstorms and inundations are of frequent occurrence. Mineral products abound; gold is found in the mines of Nagyag, Szekerembe, Kapnik-Banya, Zalathna, and Köröspatak, and in the sands of many streams; also silver, copper, quicksilver, iron, lead, sulphur, precious stones, valuable pebbles, chalk, graphite, and porcelain-clay. The extensive deposits of peat and coal are not utilized, on account of the country's immense wealth in wood. The salt production is important. The animal kingdom presents a great variation. Cattle-breeding is carried on with energy. Buffaloes are used for draught. Horses of a powerful breed are reared and exported. Sheep are very numerous. Of wild animals, bears, wolves, foxes, and wild-boars abound; also eagles, vultures, quails, prairie-hens, various kinds of wild-geese, ducks, etc. Bees are extensively reared, and much honey and wax are exported.

The country, on account of its being bounded on all sides by high mountain-chains, has always retained a certain independence and seclusion, and was in the oldest time inhabited by the Dacians, the Getæ, but subsequently, between the third and the tenth centuries, numerous tribes drew through it, first the Visigoths in 272, then the Huns, and, after the dissolution of the Hunnic empire in 453, the Ostrogoths, Avars, Slaves, Germans, and finally the Magyars. By these race-inundations of the Carpathian countries the Slaves became settled in the northern and southern parts, and the Magyars in the central plain, while the descendants of the ancient Dacians, the Wallachs, continued to occupy the south-eastern districts, preserving their nationality—as it had been developed in contact with the Romans—with great stubbornness through all vicissitudes; they still form the chief part of the population of Transylvania, and employ the Latin language to a remarkable extent. Besides the Wallachs, Germans, the so-called Saxons, live in the country, in the north-eastern and southern parts, and Magyars and Szechs in the eastern. The Szechs are believed to be a remnant of the first Hunnic immigration; they are allied to the Magyars, and number, together with them, about 570,000, the Saxons 235,000, the Wallachs 1,500,000. The Wallachs are chiefly Greek Catholics and non-united Greeks; the Saxons, Lutherans; the Magyars and Szechs, partly Roman Catholics, partly Calvinists. The number of Roman Catholics in Transylvania is computed to be 858,390; that of non-united Greeks 653,170; of Evangelical, 505,540; of other denominations, 78,610; and of Jews, 248,850. The principal occupations are agriculture and cattle-breeding. About 86 per cent. of the soil is productive—namely, 23 arable, 38 forest, and 25 meadow. The cultivation is poor, and the production of grain is insufficient for the home demand; the largest profit is yielded by the cultivation of the vine, tobacco, hemp, flax, and fruit. Cattle-breeding is important, and the breed of horses is celebrated. Manufacturing industry is very low, though numerous tanneries and breweries are in operation. Coarse linen is everywhere produced, but only for home use; finer fabrics are imported. Much common pottery is produced, also some glass; in Hermannstadt and Kronstadt soap and hats are manufactured, but in many districts even masons, carpenters, and smiths are wanting. The commerce is mostly in the hands of the Greeks and Armenians, who carry on the exportation of the cattle and animal products, and the importation of textile fabrics, colonial ware, and articles of luxury. The interior traffic consists chiefly in the exchange of animal products and wooden-ware, and takes place at annual and weekly fairs. Of railways there are none. In political respects the *Diploma Leopoldinum* forms the basis of the constitution. It guaranties the maintenance of the three nations, the Magyars, Szechs, and Saxons, and accordingly the country is divided into three parts—the country of the Magyars, with the cities of Klausenburg and Carlsburg; the country of the Szechs, with the cities of Maros Vasarhely and Udvarhely; and the country of the Saxons, with the capital of Hermannstadt and the towns of Schässburg, Kronstadt, and Bistritz. The Wallachian nation, which forms the majority, was not guaranteed until 1863. The country belongs to the Hungarian crown, and sends its representatives to the Hungarian Parliament. The highest court of the country is seated in Maros Vasarhely, but from that an appeal can be made to the royal court seated in Buda-Pesth.

In 1003, King Stephan I. incorporated Transylvania with Hungary, and the country was governed by waywodes. In 1421 and 1133 the Turks first invaded the country; subsequently it was frequently the scene of bitter struggles between the Christians and the Moslems. From 1526 to the beginning of the eighteenth century

Transylvania formed an independent state under princes of the house of Zapolya, of whom Bethlen Gabor and Georg Rakoczi were the most celebrated. During this period Transylvania often proved a very dangerous enemy of the house of Austria, especially during the Thirty Years' war, when it allied itself with the Protestant princes of Germany and the Swedes. When the native dynasty became extinct in 1713, the country was united to Austria, and Maria Theresa made it a grand duchy. The revolution which in 1848 shook the whole Austrian state, and brought Hungary into war with Austria, caused also bloody strife in Transylvania, and ended with a complete separation of the country from Hungary by the constitution. Thus, Transylvania forms an independent crownland, though, according the constitution of Dec. 21, 1867, it belongs to the Hungarian division of the Austro-Hungarian monarchy. AUGUST NIEMANN.

Trap, in geology and lithology, a term applied formerly in a vague way to a large variety of rocks which are now often distinguished by other names more or or less significant of their mineralogical composition; the word "trap" being now most generally applied to designate little more than a mode of occurrence, in the form of so-called "dikes" intersecting, or of beds intercalated between beds of, other rocks, and held by most of our geologists and lithologists to be *intrusive* in origin. The word *trap* is Swedish or Danish in derivation, *trappa* in the former and *trappe* in the latter language meaning a "stair," and was applied first, it is thought, to the columnar basaltic traps, which at times occur in ranges of columns rising above each other, like rude stairs; such contour being, however, due in all cases to different kinds of erosive action, chiefly glacial.

It is equally difficult to present a precise definition of *trap* with reference to geological origin, or to geological occurrence, or to mineralogical composition, or to general lithological character. Dikes occur, precisely similar to so-called trap-dikes, which are granitic and porphyritic, and felsitic, and trachytic, and of other types. Conformable beds, supposed intrusive, of so-called trap, occur abundantly in many sedimentary geological formations, which are only distinguishable from those above and below them by their compact crystalline structure and difference in color, bearing a relation to the enclosing strata similar to that between a sedimentary and a crystalline limestone, or between a fragmental or psammitic shale or slate of any kind, and the same in a metamorphic condition. The nearest approach, probably, that can be made to conveying the prevailing ideas of lithologists and geologists regarding traps is to say that they include all *non-volcanic* intrusive rocks which cannot be called granite or porphyry or felsite or by some other distinctive name. By *intrusive* here is not meant necessarily *igneous*, at least not by all lithologists; for few can doubt that the intrusion must in a great number, if not the vast majority, of cases have been in the form of mud or in some pasty or plastic condition not amounting to igneous fusion. Much remains to be done yet, however, in the laboratories of the chemist and the microscopist before these mysteries of modes of genesis of trappean rocks will be understood clearly.

This class of rocks is of great American interest, as some of the most remarkable and extensive formations of so-called trap occur on this continent. Among these are the magnificent Hudson River "Palisades," the Orange Mountain in New Jersey (the barrier which forms the falls of the Passaic), Mount Holyoke, East Rock and West Rock near New Haven, some of the grandest of the Lake Superior rocks (including the wonderful copper-region), many points on the Pacific side of the continent, the Bay of Fundy coast in Nova Scotia, etc. The mineralogical constitution and chemical composition of some of these rocks are now in progress of chemical, mineralogical, and optical examination by Mr. G. W. Hawes of New Haven and other chemists, and important new facts are being brought out, for which the scientific journals must be consulted. As an example of chemical composition of a trap may be cited one of Mr. Hawes's recent analyses of a sample of West Rock, called *doleritic trap*, which should be, mineralogically, a mixture of prismatic crystals of pyroxene with some magnetic iron in a paste of labradorite feldspar:

Silica	51.78
Alumina	14.20
Ferric oxide	3.59
Ferrous oxide	8.25
Manganous oxide	.44
Lime	10.70
Magnesia	7.63
Soda	2.14
Potash	.39
Diphosphurous pentoxide	.14
Water	.63
	99.89

Density = 3.03.

HENRY WURTZ.

Tra'pani, or **Trapani del Vallo,** town of Sicily, province of the same name, on one of the extreme points of the W. coast of the island, lat. 38° 3′ N., lon. 12° 30′ E. This is one of the best built and most active towns in Sicily. It stands on a peninsula, is scythe-like in form, and under the Bourbons ranked as a second-class city in point of strength. Spanish taste is still apparent in its edifices. The churches, the municipal palace, the Giudeca, etc., are worthy of notice, and contain interesting artistic objects, though most of the choice pictures have been recently removed to the Pinacoteca. The celebrated sanctuary of the Madonna of Trapani (finished 1332) is outside the town. The harbor of Trapani, though its entrance is not a little encumbered by small islands, rocks, etc., is most convenient for the coasting trade, and it has lately been made much more safe of access for foreign vessels by a judicious erection of lighthouses on several points. About 3000 vessels enter this port annually, the trade being chiefly in wine, oil, fruits, cotton, semilino, etc. The fisheries are highly productive, and coral is taken in large quantities. Among other local industries should be mentioned works in marble, alabaster, coral, and shell. The art of cutting cameos in shell is said to have been first revived here. Cottons, linens, and woollens are also manufactured. The city of Trapani occupies the site of the ancient *Drepanum*, which Virgil makes the burial-place of Anchises, and which was probably a Carthaginian settlement; in 242 B. C. it became subject to the Romans. In the ninth century it was taken by the Mogrebbins, who were driven out by the Normans in 1077. Charles V. made it a great military station for the defence of this coast against the Saracens, and it was at this time called *Inexpugnabilis*. When Charles V. landed here after his successful campaign against Tunis, he bestowed upon the city many honors and privileges. In 1869 important paleo-ethnological discoveries were made near Trapani, showing that man once dwelt here at the same time with the elephant, the hyena, and the cave-bear. P. 33,630.

Trape'zium [Gr. τραπέζιον], a quadrilateral, no two sides of which are parallel.

Trap'ezoid [Gr. τραπέζιον and εἶδος], a quadrilateral, two of whose sides, and only two, are parallel.

Trap Hill, p.-v. and tp., Wilkes co., N. C. P. 972.

Trap Hill, tp., Raleigh co., West Va. P. 499.

Trappe, p.-v. and tp., Talbot co., Md. P. of v. 272; of tp. 3939.

Trappe, tp., Wicomico co., Md. P. 1288.

Trap'pists, The, a monastic order of the Roman Catholic Church, received their name from La Trappe, an abbey of the Cistercian order, situated in the department of Orne, France, and founded in the middle of the twelfth century. Here Armand Jean le Bouthillier de Rancé, who was consecrated abbot on July 13, 1664, introduced those severe reforms which made the Trappists one of the most austere orders of the Roman Catholic Church. He was at first opposed both by other Cistercian monasteries and by the monks themselves, whose practices had become so disorderly, by neglect of the ecclesiastical authorities and by other unfortunate circumstances, that they were generally called the "brigands of La Trappe." But after some years' persevering exertions, he saw his rules adopted not only in La Trappe, but also in Tamié, a Cistercian monastery near Faverges in Upper Savoy. Twelve hours of the day were given to religious exercises, and several hours to hard labor. Vegetables and water formed the fare; meat, wine, etc., were forbidden, and conversation between the monks themselves or with outsiders was avoided. The whole life tended to concentrate the mind on the sole idea of death. During the Revolution the order was suppressed in France, and it possessed at that time only two monasteries outside of France—one in Germany and one in Tuscany. In 1817, however, La Trappe was reopened, and in the mean time a Trappist colony had settled in 1803 at Pigeon Hill, near Conewago, Pa., whence they removed in 1805 to Kentucky, and finally, in 1813, to Tracadie in Nova Scotia. A second colony settled in 1848 at Gethsemane, Ky., and a third at New Melleray, near Dubuque, Ia. In France the order was dissolved in 1830, though the law of dissolution was not enforced; in Italy it was suppressed in 1870, and in Germany in 1874.

Trap-Rock. See TRAP, by PROF. H. WURTZ, A. M.

Tras, for mortar. See CEMENTS, by GEN. Q. A. GILLMORE.

Trasimenus, Lacus. See PERUGIA, LAKE OF.

Trask (WILLIAM BLAKE), b. at Dorchester, Mass., Nov. 25, 1812; was a cabinet-maker in early life, but devoted his leisure to antiquarian and genealogical studies; in 1851 became a member of the New England Historical and Genealogical Society, and its historiographer in 1862; is

one of the editors of the *New England Historical and Genealogical Register*. He assisted S. G. Drake in collecting materials for the *History of Boston*, aided W. H. Sumner in the preparation of the *History of East Boston*, besides rendering great service to other genealogists; and is one of the authors of the *History of Dorchester*.

Tras-os-Mon'tes, province of Portugal, bounded N. and E. by Spain, S. by the river Douro, and W. by the province of Minho, comprises an area of 4028 sq. m., with 365,833 inhabitants. It is mountainous, and of a rather rugged and wild character, but its valleys are very fertile, and produce, besides more wheat than is demanded for home consumption, excellent fruits, and the famous port wine, whose cultivation is confined to one district, called Alto Douro. The mineral wealth is great, but entirely unused; the mulberry is extensively grown, and silk-culture carried on with success.

Travancore', with Trivandrum on the Malabar coast as capital, one of the best administered feudatory states of the British-Indian empire, on the south-western end of the Indian peninsula, with an area of 6653 sq. m., and a population of 1,262,647 inhabitants, chiefly Hindoos, containing, however, the unusually large number of 100,000 native Christians, members of the Syrian Church, as well as remnants of ancient Jewish colonies. A most turbulent sect are the Mophlas, Mohammedans who inhabit the N. of the state. Owing to a large outlay of state money on public irrigation, works, and roads, the condition of the laboring and agricultural classes has been improved; roads connect the harbors of Quilon and Trivandrum with the interior. The British-Indian penal code, altered to suit the characteristics of the people, has become part of the law of the country. The ruling family of the maharajah is famous for its particular interest in astronomical observations and its promotion of the efforts of philanthropists. In 1875 Rama Varma, first prince of Travancore, published an essay on the infliction of capital punishment under chloroform. The revenues amounted in 1874 to £530,000; a balance is carried to the next year's accounts, which had in 1874 risen to £4,000,000. The palace expenditure is very moderate, the greater part of the revenues being devoted to public works, to religious institutions, to education, and to judicial and police establishments. The Nair subsidiary brigade amounts to 2000 men; to the Indian government is paid an annual subsidy of £80,000. The total value of exports is £7,500,000; of the imports, £4,700,000. Coffee and pepper show considerable increase; cardamoms, areca, cocoanuts were with other articles a monopoly of the rajah, but can now be obtained in open market, being only subjected to a light export duty. E. SCHLAGINTWEIT.

Trav'ellers, Laws as to. The special rules concerning the rights and duties of travellers are so numerous, so important, and have elsewhere been already so fully explained that to state them again in detail would simply involve the unnecessary rewriting of a large amount of matter to be found in other portions of this work. It will be sufficient if the reader is referred to the various articles in which these doctrines have been discussed and elaborated. In relation to the general rights of travellers to use all public means of conveyance, carriage, and transport, see articles HIGHWAY, TURNPIKE, CARRIERS, COMMON, etc. Concerning their liability to pay the legal rates of toll and of fare, and the power of railroads and other transporting companies to make reasonable rules concerning the use and binding effect of their own tickets, see articles TURNPIKE and CARRIERS, COMMON. For the law of the road, and the rules as to turning out and passing in order to avoid collisions when travelling upon highways, see the article ROAD, LAW OF THE. The statutory prohibitions in certain States of travelling upon Sunday, except upon works of necessity and mercy, will be found under the head SUNDAY LAWS. In respect to the innkeeper's liability for loss of or injury to the baggage of travellers while his guests, and his lien upon such baggage for his charges, see the article INNKEEPERS, and for the liability of carriers for the loss of or injury to baggage see the article CARRIERS, COMMON. In regard to the liability for personal injuries to passengers by the parties engaged in transporting them see articles CARRIERS, COMMON, and NEGLIGENCE. For the liability of third persons for personal injuries to travellers upon highways, etc., caused by negligent acts and omissions, see articles NEGLIGENCE, HIGHWAY, and TURNPIKE. In respect to the liability of towns, road-districts, and municipal corporations in certain States for injuries caused through a neglect to keep the roads and streets in repair, see article MUNICIPAL CORPORATIONS.

JOHN NORTON POMEROY.

Trav'eller's Rest, p.-v. and tp., Coosa co., Ala. P. 836.

Trav'erse, county of Western Minnesota, separated from Dakota by Sioux Wood River and Lake Traverse, and crossed in its N. E. corner by St. Paul and Pacific R. R. It was formed in 1862, but in 1870 the pop. was only 13.

Traverse, tp., Grand Traverse co., Mich. P. 1275.

Traverse, tp., Nicollet co., Minn. P. 537.

Traverse City, p.-v., cap. of Grand Traverse co., Mich., on a branch of Grand Rapids and Indiana R. R., at the head of the W. arm of Grand Traverse Bay, has 3 churches, a ladies' library, good schools, 2 newspapers, U. S. land-office for N. W. Michigan, and several mills. P. about 1200.

D. C. LEACH, ED. "HERALD."

Trav'erse-Table, in surveying, a table from which the latitude and departure of any course can be found by inspection. It is a rough table of the sines and the cosines of arcs, computed to each quarter of a degree from 0° to 90°, and for every radius from 1 to 100. In the ordinary tables the computation is only carried out to two places of decimals. If we denote the length of any course by c, its latitude by l, its departure by d, and the angle which it makes with the meridian by ϕ, we have $l = c \cos \phi$, and $d = c \sin \phi$. If we give to ϕ in these formulas successive values advancing by quarter degrees from 0° up 45°, and if for each value assigned to ϕ we give to l every value from 1 to 100 inclusive, and tabulate the results, the table thus found will be the ordinary traverse-table. The computations need not be carried beyond 45°, for the latitude of a course corresponding to any bearing is equal to the departure of the same course corresponding to the complement of that bearing, and the reverse. The table is used in a manner entirely similar to that of using a table of natural sines and cosines. When greater accuracy is required than can be attained by the use of the traverse-table, the latitude and departure may be computed in each case from the formulas given above. W. G. PECK.

Trav'is, county of Central Texas, intersected by Colorado River, which is ascended by steamboats as far as Austin, which is the terminus of a branch of Houston and Texas Central R. R.; surface somewhat hilly, soil fertile. There are breweries and saw-mills, and manufactories of carriages, saddlery, and brick. Horses, cattle, sheep, and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Austin, which is also the capital of the State. Area, about 1000 sq. m. Pop. 13,153.

Travis (Rev. JOSEPH), A. M., b. in Maryland Sept. 13, 1786; entered the itinerant connection of the Methodist Episcopal Church in 1806, and filled important stations as an educator and preacher in the South Carolina, Georgia, Louisiana, and Memphis conferences. D. in Mississippi Sept. 16, 1858. T. O. SUMMERS.

Travnik', town of European Turkey, eyalet of Bosna, on the Lastva, is ill built and unhealthy on account of the swamps which surround it. Its manufactures of sword-blades are quite important. P. about 10,000.

Tra'vo, town of Italy, province of Piacenza, situated among hills on the left bank of the Trebbia. The great tower of the ancient castle remains intact, the rest of the edifice having been converted into a private dwelling. The neighborhood is remarkable for an abundance of game, and for truffles and mushrooms of a superior quality. P. 5280.

Trawl'ing, in the fisheries, sometimes is fishing by means of a trawl, or small bag-shaped net, dragged along the bottom of the sea behind a boat. The name *trawling* is also given to a system of fishing for cod, halibut, and other large fish, by means of a great number of hooks set at intervals along a stout line which lies upon the sea-bottom. From time to time this trawl or ground-line is underrun by men in a boat, and the fish are removed. This system is extensively practised in the American fisheries.

Tray'wick's, tp., Russell co., Ala. P. 1280.

Treacle. See MOLASSES.

Tread'mill, a machine sometimes employed in prison discipline, was invented by Sir William Cubit, and introduced into British prisons in 1817. It is an appliance by which the prisoner's weight gives a revolving motion to a cylinder, somewhat as a horse's weight gives motion to an ordinary horse-power machine. The treadmill is sometimes attached to useful machinery. It is now but little used.

Tread'well (DANIEL), b. at Ipswich, Mass., in 1791; displayed in childhood his mechanical ingenuity by inventing a machine for making wood screws; brought out in 1818 a new printing-press; visited England 1819; invented the "power-press" 1822, in 1826 the system of turn-outs on single-track railroads, in 1829 a machine for spinning hemp, and in 1835 described in a memoir before the American Academy important improvements in the material and method of construction of cannon, resembling the subsequent Armstrong processes; secured a patent and a gov-

ernment contract, and filled from 1834 to 1845 the Rumford professorship of technology in Harvard College. He established with Dr. John Ware the Boston *Journal of Philosophy and the Arts* (1822). D. at Cambridge, Mass., Feb. 27, 1872.

Treadwell (John), LL.D., b. at Farmington, Conn., Nov. 23, 1745; graduated at Yale College 1767; studied law; was a member of the legislature 1776–85, of the Continental Congress 1785–86, county judge 1786–89, member of the council 1785–98; was judge of probate and of the supreme court of errors 1789–1808; was chosen lieutenant-governor 1798, and was governor 1809–11. He was active in establishing and managing the school fund, and was president of the American Board of Commissioners for Foreign Missions from its foundation to his death, at Farmington, Aug. 19, 1823.

Treadwell (John Goodhue), M. D., b. at Salem, Mass., Aug. 1, 1805; graduated at Harvard 1825; studied medicine, and established himself as a physician at Salem 1830, but devoted much of his time to scientific agriculture and gardening, aided by an ample hereditary fortune. D. at Salem Aug. 6, 1856. He bequeathed to the Essex County Agricultural Society his lands at Topsfield for an experimental farm, and to Harvard College his medical library and an estate valued at $75,000 for the foundation of a professorship of physiology and anatomy.

Trea'son. Treason is derived through the Fr. *trahison, trahir*, from *trado, traditio*, and denotes a crime of indefinite and variable limits against the sovereignty of the people or the person of the supreme ruler. The Romans call this crime *perduellio*, and afterward *crimen majestatis*—that is, either hostility to one's own country, such as joining its enemies in war would imply, or afterward hostile attack on the emperor, or, as the latter term denoted, the act of invading the sovereignty of the people. In the expression *lædere majestatem*, to injure the sovereignty of the people or of the state, is found the origin of the term *lèse-majesté*, used by the French to denote treason. The English definition of treason or high treason has included, especially, compassing or imagining the death of the reigning sovereign or his (or her) eldest son and heir; violation of the queen or the king's eldest daughter, being unmarried, or his eldest son's wife; levying war against the sovereign within the realm by a subject; giving aid and comfort in or outside of the realm to the sovereign's enemies; counterfeiting the great or privy seal; importing "false money, counterfeit to the king's money," besides other offences which at any time of excitement it seemed best to comprehend under the same term. The folly of such legislation led to the simple definition of our Constitution that "treason shall consist only in levying war against the U. S. or in adhering to their enemies, giving them aid and comfort." It is implied that the crime can be committed only by one owing allegiance to the U. S.

The States of the Union, to some extent at least, have admitted into their codes a crime of treason against themselves similar to that committed against the U. S. But as treason against a State must always be treason against the U. S., and as war against so limited a sovereignty as that of one of the States is hardly an act deserving the name of war, such treason is as little deserving of the name as it is likely to be frequent. If an invading force from a foreign country should land on the territory of a State and be joined by one of its citizens, he would be amenable to the laws of the U. S.; if it were joined by a man from one of the other States, the same would be true, but in this case the State could not try him for treason, as he is in no sense its subject. A general law against seditious or armed assemblages would answer all purposes equally well, and could not come into conflict by any possibility with the laws and judicial arrangements of the Union. And, on the other hand, if a man were acquitted of treason against a State, he would still be liable to indictment for treason against the U. S. for the same offence.

The law of treason with the growth of monarchy included various offences against the person of the monarch or his rights or appurtenances, and with the growth of arbitrary power stretched its penalties over various crimes or even peccadilloes that lay outside of its original limits. (See on this, and the restrictions which a free government admits into its definition, Lieber's *Civil Liberty*, ch. viii.)

T. D. Woolsey.

Treas'ure City. p.-v., White Pine co., Nev.

Treas'urer of the U. S., an officer of the U. S. treasury department who receives and pays out money on the warrant of the secretary of the treasury, countersigned by the first comptroller and certified by the register, taking receipts for all moneys paid out. Moneys paid to the treasury are charged to the treasurer on covering-warrants, upon which he signs his receipt.

Treasure-Trove ["treasure found," from Fr. *trouvée*, to "find"]. Whenever gold or silver coin, plate, or bullion had been *hidden in* the earth or in some secret spot so long ago that its existence was forgotten and its owner unknown, and should be accidentally found, it was termed "treasure trove." By the common law of England if its owner is discovered it belongs to him; if not, it goes to the Crown. This peculiar doctrine may best be illustrated by a comparison with another analogous case. If valuable articles are found derelict at sea or lying *on* the land, they belong not to the Crown, but to the finder by the title of occupancy (see articles Occupancy, Personal Property), because the leaving goods in the manner last described indicates a purpose to abandon them, while the act of concealment shows an intention of retaining the property. The Roman law contained minute and specific rules concerning this subject, because at various periods of its history such concealment of valuables was necessary and frequent. There must have been a *hiding*; the finding must be purely accidental, and not the result of a search, and not made in a tomb or other "sacred" place. If the finding was by the owner of the land, the property in the whole treasure at once vested in him; if by one person in the land of another, each took equal shares; if in the public land, one-half went to the finder, and the remainder to the treasury (the *fiscus*). The things subject to these rules included not only gold and silver, but other portable articles of peculiar value, such as statues, vases, urns, etc., if not discovered in a tomb. The doctrines of the common law concerning "treasure-trove" were evidently borrowed directly from the Roman law, with the single but most important modification which substitutes the Crown in the place of the finder as the one who acquires property in the treasure thus found.

John Norton Pomeroy.

Treasury of the United States, a department of the executive government of the U. S., having control over the collection, management, and disbursement of the public revenue, and presided over by a secretary, who is, next to the secretary of state, the most important officer of the cabinet. The present office dates from the law of Sept. 2, 1789, drawn up with such precision and comprehensiveness by Alexander Hamilton, the first secretary, that few changes have since been made in its language. The subordinate officers consist of two assistant secretaries, a treasurer, three comptrollers, six auditors, a registrar, commissioners of customs and of internal revenue, a solicitor, and about 16,000 employés, of whom 3000 are in the bureaus at Washington, 5000 in the various custom-houses and sub-treasuries, and 7000 in the internal revenue service. There are 18 bureaus, among which are those of the mint, statistics, the Coast Survey, and the lighthouse board. Most of these multifarious officers are quite independent of their nominal subjection to the head of the treasury department, whose influence is therein confined to the appointing power.

Treat (Robert), b. in England in 1622; emigrated to New England, with his brother Richard, in company with Sir Richard Saltonstall; was one of the first settlers of Wethersfield, Conn.; afterward settled at Milford, where he was soon chosen a judge; was a magistrate 1661–65; became a major of Connecticut troops 1670; marched to Springfield (1675) to the relief of that place against the Indians; drove them from before the town, subsequently routed them at Hadley; participated in the great Indian battle at the Narragansett Fort in December of that year; was chosen lieutenant-governor 1676, and governor 1686–1701. D. at Milford July 12, 1710.—His son Samuel, b. at Milford in 1648, graduated at Harvard 1669, and was minister of Eastham on Cape Cod, Mass., from 1672 to his death, Mar. 18, 1717. He acquired the language of the Nauset Indians, in which he published a "confession of faith;" was successful in the conversion of those Indians, and preached the "election sermon" in 1713.

Treaty. See International Law, by Pres. T. D. Woolsey, S. T. D., LL.D.

Treb'bia, the ancient *Trebia*, a river of Northern Italy, rises in the Ligurian Apennines 15 miles N. E. of Genoa, flows northward, and joins the Po 3 miles above Piacenza. On its banks the Romans under Sempronius were defeated by Hannibal in 218 B. C. and the French under Macdonald by Suwaroff June 17–20, 1799.

Trebi'gne, town of European Turkey, eyalet of Bosna, on the Trebinicza, has many mosques, and was under the first Servian kings an important place. P. about 10,000.

Tre'bitsch, town of Austria, in Moravia, on the Igawa, is well built and beautifully situated; manufactures liqueurs, rosoglio, leather, and cloth, and trades largely in grain, cattle, and horses. P. 6084, of whom 1400 are Jews.

Treb'izond, or **Tarabozan,** town of Asiatic Turkey, on S. E. coast of the Black Sea, in lat. 41° 1′ N., lon. 39°

46′ E., beautifully situated on a slope facing the sea, and surrounded with walls and defended by a citadel on a neighboring hill and forts at the entrance of the harbor. It was founded by a colony from Sinope, and was a flourishing city in the time of Xenophon. Trajan made it the capital of the province of Cappadocia, and in 1204 A. D. Alexis Comnenus established here an independent empire, which stood to 1461, when it was conquered by the Turks. It contains fine edifices, and is well built, especially the suburb which is inhabited by the Christians, and which contains the bazaars. Regular communication by steamers with Constantinople and the mouth of the Danube makes it the centre of a very important traffic. Cotton manufactures, colonial produce, spices, ironware, glass, wine, salt, and corn to the value of about $20,000,000 are annually brought to it from Europe, and exchanged for silk, wool, tobacco, wax, gall-nuts, opium, shawls, carpets, and saffron, which are brought from Persia on camels. Its own manufactures and the products of the immediate neighborhood are insignificant, with the exception of timber. P. between 20,000 and 30,000.

Treca'te, town of Italy, province of Novara, was a place of considerable importance during the Middle Ages, but its old fortifications are in ruins. P. 6906.

Tred'egar, town of England, county of Monmouth, has 9383 inhabitants, mostly employed in the rich coal and iron mines of the vicinity. The celebrated Tredegar ironworks at Richmond, Va., derive their name from this source.

Tred'gold (Thomas), b. at Brandon, near Durham, England, Aug. 22, 1788; was for some years a journeyman carpenter, during which time he diligently studied mathematics and architecture; was for ten years (1813–23) employed at London in the office of Mr. Atkinson, architect to the board of ordnance, extending his studies to embrace chemistry, geology, mechanics, and engineering, and for the last six years of his life practised with great success as a civil engineer, contributing meanwhile scientific articles to the *Philosophical Magazine*, the *Annals of Philosophy*, and the *Encyclopædia Britannica*. D. in London Jan. 28, 1829. Author of *The Elementary Principles of Carpentry* (1820; 5th ed. 1870; Philadelphia, 1837), *A Practical Essay on the Strength of Iron and other Metals* (1821; 6th ed. 1866), *Principles of Warming and Ventilating Public Buildings*, etc. (1824), *Practical Treatise on Railroads and Carriages* (1825), *Remarks on Steam Navigation* (1825), *Description of Iron Suspension Bridges* (1826), and *The Steam Engine* (1827), which was subsequently edited by W. S. B. Woodhouse (2 vols., 1838–40), with 125 plates in atlas folio, and in an enlarged edition (3 vols., 1850–53), with 200 engravings and 160 wood-cuts.

Tredyffrin, tp., Chester co., Pa. P. 1897.

Tree [Ang.-Sax. *treow*], a woody plant with a single trunk rising to more than the height of a man. There are all gradations between shrubs and trees. Some woody-stemmed plants are properly called trees, although of dwarf stature, the branches being elevated upon a single trunk; some, which branch or divide from the ground or near it into a cluster of trunks, reach such a height and magnitude that they must be called trees rather than shrubs. *Exogenous trees*, being the commonest in all countries, may be taken as the type or representative kind. An exogenous tree springs from an embryo having a pair of cotyledons or seed-leaves, and duly develops lateral buds as well as the terminal or primary one, and therefore branches freely. The name *exogenous* denotes that it is an outside-grower—*i. e.* the trunks, and equally the branches, increase in thickness by new wood formed outside the old. The seedling stem, almost as soon as it is formed, is traversed longitudinally by some woody threads (vascular and woody bundles or fibro-vascular bundles), which are so arranged as to surround a central portion that remains destitute of woody matter; and these increase in size and number until they form a cylindrical layer of wood (in cross-section a ring) between the soft central core, the pith, and an outer more or less soft portion, the bark. When this layer of wood in the seedling stem or other shoot of the season is completely formed, no additions are made to its inner portion, but new wood may continue to be formed on its outer surface, between it and the bark, all through the season. This justifies the name of *exogen*, or "outside-grower," from the first. When, after a suspension of growth consequent upon the diminution of temperature in all climates which have a winter, or of moisture where vegetation is arrested or checked by dryness, a second season of growth supervenes, a new layer of wood is formed upon or external to the old one, and so on year after year. Consequently, the section of an exogenous tree-trunk exhibits concentric layers—in all ordinary cases one for each year of its age—the oldest next the pith, the youngest next the bark. As the tree has made annual increments of growth in length as well as in diameter, a cross-section at the base of the trunk exhibits a number of annual layers equal to the whole age of the tree, while one at the summit has only a single layer, interposed between the pith and the bark. Radiating plates—in the cross-section lines more or less conspicuous—traverse this layer of wood from the pith to the bark, dividing it into wedges; these are continued through the succeeding layers, and new ones are interposed between them as the wedges widen; these are the *medullary rays* or *silver grain*. The bark of an exogenous tree is always clearly distinguishable from the wood, and for the most part is readily separable from it, the demarcation between the two being a thin zone of forming or formative matter, called the *cambium*. From this cambium are developed on the one side additions to the wood—on the other to the inner bark. The bark of a young tree is of three layers, different in kind. The inner bark, or *liber*, next the wood, generally contains, and sometimes largely consists of, fibres or fibro-vascular bundles, allied to the components of wood, but more flexible and loosely arranged; these in their most perfect form are called *bast*. The liber grows by thin annual concentric layers, the newer inside of the older, and next the wood. Covering the liber is the green bark, or green layer, wholly cellular and herbaceous, and containing *chlorophyl* or *leaf-green*. It is conspicuous upon young shoots of the season. The third or outer bark remains thin and more or less transparent. The latter, called the *corky layer*, or epidermal layer, consists of tabular cells, which contain no leaf-green, but assume the gray, brownish, or other hue which characterizes the twigs and branches. When it continues to grow and acquires any considerable thickness, it forms cork. While the wood, once formed, remains unaltered except as changing from sap-wood to heart-wood, the bark is subject to distention from within, to which, at length, only the inner liber, annually formed upon an enlarging circle, can continue to adapt itself. The older and outer bark is consequently sooner or later fissured and riven by the enlarging girth within, as well as worn and weathered by exposure to the elements without; so that the bark of old tree-trunks consists of the liber only, and of but a part of that. The port or character of the tree depends much upon its mode of branching, and this primarily upon the arrangement of leaves upon the twigs; for the branches of the spray proceed from lateral buds, of which there is usually a single one in the axil of each leaf. Accordingly, when the leaves are opposite, so will be the branches of the spray, while alternate leaves originate alternate branchlets; but this symmetry, however evident in the branchlets, is usually more or less obscured in the larger branches by the non-development of some of the buds and the destruction of many branchlets. When the main trunk persists and leads throughout, not being rivalled or supplanted by any of the branches, the tree is said to have an excurrent trunk: when the main trunk is lost in or replaced by the main branches, it is said to be deliquescent. Completely excurrent trunks are most common in and characteristic of—

Coniferous trees, in the more extensive sense including cypresses, junipers, and even yews, as well as pines, spruces, and firs. These are a kind of exogenous tree in growth and structure, but with wood composed of homogeneous cells having peculiar markings. Their flowers are also peculiar and greatly simplified, their ovules naked and fertilized by direct application of the pollen, so that they are distinguished by some as a sub-class of exogens, by others as a class, under the name of *gymnosperms*, or naked-seeded plants. They are mostly stately trees, with peculiar narrow, commonly needle-shaped or awl-shaped, leaves, of very simple nervation, mainly evergreen (the larch and our Southern bald cypress, or *Taxodium*, being exceptions), and they are developed more commonly from an embryo with the two cotyledons so completely divided, each into two or three or more leaflets, that they were naturally supposed to have a whorl instead of a pair of cotyledons, and therefore called polycotyledonous. (For an account of trees of this class see Coniferæ, Fir, and especially Pine.)

All coniferæ are woody plants, and nearly all are trees. Exogenous trees of the ordinary sort are distributed among the various natural orders, so that there are few which have not some arboreous representatives, the principal families containing herbs, shrubs, and trees. Some, however, contain herbs only; several (such as the walnut and oak families and the other amentaceous or catkin-bearing orders) are wholly arboreous, or at least woody. Even the families with peculiar port or mode of growth, such as the crassulaceous or house-leek family, with very fleshy herbage, rise to trees in some of their representatives of warm climates. All cactuses are woody as well as fleshy plants; several of them attain great length as climbers; many are erect and become arborescent; some

rise into huge fluted columns, either simple or branched, of several times the height of a man, and one, the *Cereus giganteus* of the Gila River, becomes a strange tree of fifty or sixty feet in altitude.

Cycadeous trees, represented by the *Cycas*, commonly but improperly known as sago palm, are of a peculiar type, being exogenous in structure (though not forming regular annual layers), but with the port and mode of growth of palms—viz. of

Endogenous Trees.—Palm trees are the more common but not the exclusive representatives of this type of arborescent vegetation. They rise by a simple columnar trunk, not tapering as it ascends, terminated with a crown of large and long-stalked leaves, which are either pinnate or plume-like, as in date-palms, or palmate, as in palmetto. This simple and mainly cylindrical trunk comes from their whole vegetation being the development of a single terminal bud. Such axillary buds as they develop form the inflorescence, and therefore do not result in permanent branches. Nevertheless, a few palms branch habitually and normally after a certain age. The doum-palm of Upper Egypt and Nubia is the best-known example. In contrast with the wood of exogenous trees, that of palms, and of endogenous trees in general, has no concentric layers surrounding a central pith, and no proper bark. The wood is made up of separate bundles or threads of fibro-vascular material, longitudinally traversing and separately imbedded in the cellular and softer fundamental tissue which is represented in the exogenous stem by the central pith and the radiating medullary rays. When these wood-bundles can be traced, they are found to have their upper termination in leaf-stalks, their lower in the circumference or rind, in their course describing more or less of an arch or long curvature. The central portion of the trunk contains fewer of the woody bundles: toward the circumference they are more crowded. Consequently, the denser wood is at the circumference, the softer at the centre. The centre sometimes remains pithy, as it were, and sparsely traversed by threads of wood, but in many palm-stems nearly the whole becomes so closely packed with woody bundles as to form a very compact and hard wood. As the wood is thus more largely formed toward the circumference, and gradually fills up within, the name of *endogen* or of endogenous growth—*i. e.* "growth within"—is sufficiently appropriate, though the structure and growth are not so completely the counterpart of the exogenous as was supposed when these contrasted terms were introduced. Exogenous trunks increase indefinitely in diameter; endogenous trunks in general, and in particular those of palms, soon become incapable of further enlargement, except in height. They are accordingly cylindrical up to the crown of leaves. In place of a bark, distinct, separable, and of different layers, endogenous trunks are invested by an inseparable, more homogeneous, and permanent rind, which, along with the more solidified wood of the circumference, restricts and limits distention. Some endogenous trunks, however, notably those of dragon trees and yuccas (of the liliaceous family), continue distensible, and therefore continue to increase in diameter. They also branch when old, usually only after blossoming, which takes place from a terminal bud, thus arresting the vegetative growth, which is resumed from axillary buds. Such stems therefore fork at each flowering or other arrest of the terminal bud, and so in time form a branched head, in some respects imitating that of an ordinary exogenous tree.

Fern trees, or *tree-ferns*, mainly represent arboreal vegetation among *cryptogamous* plants in the present age, although in former periods other vascular cryptogams were largely arborescent. Tree-ferns are restricted to tropical regions of moist climate, or at least to those regions or habitats in which both winter and dryness are unknown. Their port is similar to that of palms, the structure of the wood peculiar, answering neither to the endogenous nor the exogenous type.

Evergreen and deciduous trees differ in that the latter cast off or lose all their leaves at the coming of a cold or of a dry season, while the former hold their old leaves alive, at least until after new ones are produced, some holding them for little over the year, many for two, three, or a considerable number of years. Deciduous trees are mainly if not wholly of the exogenous type.

Trees as to climate and distribution can hardly be here treated of, except to notice that arboreal growth, of any ordinary type, supposes and requires a considerable amount of moisture, and accordingly of rainfall, either through the year or through a growing season. An ordinary tree expands a large extent of evaporating surface, chiefly in its foliage. Leaves dry up and perish if not supplied with moisture to replace that which is evaporated or transpired. Therefore, not only are rainless districts treeless (except as water is supplied by irrigation), but regions of scanty and precarious summer rain are sparsely wooded or without forest, according to the amount of aridity or length of the dry season; or their arborescent vegetation meets the exigency and stress by some special adaptation. Broad leaved evergreens abound where rains fall throughout the year, and especially where winter is unknown. Narrow leaved or needle leaved evergreen trees are chiefly in cooler or cold climates, well supplied with moisture through the year or through the season of activity. Trees with expanded foliage survive the rainless hot season of the drier tropical and subtropical regions only by dropping their leaves, upon which the stress first comes, and thereby reducing the evaporating surface to a minimum. Those which retain their foliage are such as have some peculiar provision—by fleshiness with thick epidermis in the case of succulent foliage, or by firm coriaceous texture superficially or throughout, to which, especially in Australia, is sometimes added a vertical instead of horizontal position of the leaves, which thus present their edges instead of one face to the high sun. This prevails among the Australian acacias and myrtaceous trees, which compose the larger part of the arboreal vegetation. In climates in which vegetable growth and action are arrested by winter, the trees are nearly all deciduous, except the coniferous evergreens, the leaves of which are peculiarly organized for resisting cold, and individually expose a small surface to the elements.

Duration of Trees.—An exogenous tree, renewing annually its twigs and foliage above, its growth of roots beneath, and zone of new wood and bark connecting the two, has no definite limits to its existence. Its actual duration depends upon external circumstances, and upon some inherent liabilities which may practically result in a certain average of life in any particular species, which, however, certain favored individuals may be expected to overpass. Increase of size, height, or spread of branches, and other inevitable consequences of age, however, bring increasing, and at length inevitable, disadvantages and liabilities, so that practically, although most trees, like most men, die an accidental death, the longest survivors may be said to die of old age in the sense in which the oldest of the human race do—that is, of the diseases or accidents which the younger generally resist or recover from, but to which the older succumb in consequence of the disadvantages of age. Various collections have been made of the data respecting the actual longevity of trees. (See De Candolle, *Physiologie végétale* (1832), and article on "Longevity of Trees" in *North American Review*, July, 1844, for a *résumé* up to those dates. See also our article SEQUOIA for a brief account of some of the largest, if not the oldest, of existing trees. To which it may be added that eucalyptus trees are now known in Australia which rival the California redwoods in girth and surpass them in height, but probably not in age, being very fast-growing trees. Indeed, it is probable from the known rates of growth that some of the largest bald cypresses (*Taxodium*) of the Southern Atlantic States, or at least those of Mexico, are older than any of the above, although of far less huge girth and of moderate height.) Suffice it to say, however, that exogenous trees are known, by the actual counting of their layers, throughout or in great part, to have attained the age of from 1200 to fully 2000 years; it is probable that some extant trees are considerably older. The tallest trees known rise little less than 500 feet (*Eucalyptus*, in Australia). The largest in girth are trees of *Eucalyptus*, up to 81 feet; giant redwoods in California, up to 91, and possibly 100 feet; baobab trees of Senegal, some of which have reached the latter circumference, but they are low trees of rapid growth even when old, and probably of no extreme age; and, finally, there is a Mexican *Taxodium* or bald cypress, a slow-growing tree, which measures 112 feet in circumference. If this does not consist of two or more original trunks which have grown into one—of which there are no external indications—it is probably the oldest existing tree known.

Endogenous trees like palms, which do not continue to increase in girth, are more strictly and inherently limited in their duration: perhaps they never live more than 200 or 300 years: and the same may be said of tree-ferns. When an endogenous trunk has a soft living rind, capable of unlimited expansion, and also produces branches, perhaps it may live as long as an exogenous tree. Dragon trees (*Dracæna*) are examples of this. The celebrated great dragon tree of Orotava, Tenerife (now destroyed by a series of storms, but which when Humboldt visited it was in full vigor), was probably as old as any of the existing redwoods of California. ASA GRAY.

Tree'-Ferns, a name applied to large ferns having a tree-like form and size, with much the habit of the palms. Tree-ferns formed an important part of the vegetation of the coal-measures. At present they are mostly tropical or insular, but are abundant in Tasmania, New Zealand, and

parts of Australia and in the Himalayas. A few species yield a useful starchy pith resembling sago.

Tree'-Frog, or **Tree-Toad,** a term employed for those species of anurous amphibians (order Salientia) which are adapted for life among the trees, and which are therefor provided with terminally dilated toes. This character of dilation of the tips of the toes is of mere teleological significance, and is not co-ordinated with true morphological characteristics. By some authors, however, it has been regarded as of considerable systematic importance, and Dr. Günther especially combined all the anurous amphibians—*i. e.* "tree-frogs"—in a single series ("Opisthoglossa platydactyla"), contradistinguished from those opisthoglossate anurans which have pointed toes ("Opisthoglossa oxydactyla"). It has been since, however, amply demonstrated that the tree anurans do not form a natural group, but may to that extent be modified representatives of the most dissimilar families. Dr. Günther distributed the species among nine families, exclusively confined to forms with dilated toes. More recent authors have recombined them with the non-tree forms, and admitted the several generic types as natural allies of the oxydactylous ones. The tree-frogs and tree-toads are now mostly to be found in the families Hylidæ, Cystignathidæ, Engystomidæ, Dendrobatidæ, and Ranidæ. The North American species, however, all belong to the family HYLIDÆ (which see). THEODORE GILL.

Tregelles' (SAMUEL PRIDEAUX), LL.D., b. at Falmouth, England, Jan. 30, 1813, of Quaker parentage; educated at Falmouth Classical School; was for some years in the ironworks at Neath Abbey, Glamorganshire, 1828–34; was in 1835–36 a private tutor at Falmouth; shortly after devoted himself to the task of preparing a critical edition of the text of the New Testament from the most ancient MSS. and versions; studied the Oriental languages, and pursued that object through life; was associated with the small religious sect of the "Plymouth Brethren," though he never joined that organization; was an active philanthropist, a member of the company appointed by convocation for the revision of the Authorized Version of the Old Testament; visited the principal libraries of Europe for the purpose of collating MSS., and in his later years received a pension of £200 from the civil list. D. at Plymouth Apr. 24, 1875. He published—*Passages in the Book of Revelation connected with the Old Testament Scriptures* (1836), *The Englishman's Greek Concordance to the New Testament* (1839), *The Englishman's Hebrew and Chaldee Concordance to the Old Testament* (2 vols., 1843), *The Book of Revelation in Greek, edited from the Ancient Authorities, with a New English Version*, etc. (1844), *Hebrew Reading Lessons* (1845), *Heads of Hebrew Grammar* (1852), *Gesenius's Hebrew and Chaldee Lexicon* (1847), *The Prophetic Visions of the Book of Daniel* (1847; 5th ed. 1864), *The Book of Revelation translated from the Ancient Greek Text* (1848), *On the Original Language of St. Matthew's Gospel* (1850), *The Jansenists* (1851), *Historic Evidence of the Authorship and Transmission of the Books of the New Testament* (1852), *Account of the Printed Text of the Greek New Testament* (1854), *Codex Zacynthius, Greek Palimpsest Fragments of the Gospel of St. Luke obtained in the Island of Zante* (folio, 1861), *Canon Muratorianus, Earliest Catalogue of the Books of the New Testament* (1868), and *The Greek New Testament* (1857–72).

Tre'go, county of W. Kansas, intersected by Saline and Smoky Hill rivers, and crossed by Kansas Pacific R. R.; surface rolling, soil fertile. P. 166.

Tre'ia, town of Italy, province of Macerata, exports a peculiar kind of lace. Treia is of very ancient origin, and many important antiquities have been found. P. 9286.

Tremain (LYMAN), b. at Durham, N. Y., June 14, 1819; studied law; admitted to practice in the supreme court of New York in 1840; joined the Democratic party; was supervisor of Durham, N. Y., in 1842; county district attorney in 1846, and county judge and surrogate of Greene co., N. Y., 1847; in 1853 practised law in Albany, N. Y.; was attorney-gen. N. Y. State in 1857. From the commencement of the civil war he identified himself with the Republican party; was member of New York Assembly from Albany co. 1865, and Speaker in 1866; Congressman at large for N. Y. State 1873–75. D. Nov. 30, 1878.

Trematods [from Gr. τρῆμα, a "hole"], an order of platyhelminths or low worms which are generally parasitic, internally or externally, on other animals. They are more or less depressed and not articulated, and the integuments are not covered with ciliæ in the adult state. They are provided with one or more suckers for adhesion to their enforced hosts. They have a forked alimentary canal, but there is no anus. The vascular system is undeveloped; there are two water-tubes, with a common excretory pore; a double ganglion is developed over the pharynx. They are mostly hermaphrodites, and there is no internal connection between the male and female organs, and consequently a union of two individuals is necessary for impregnation. (See Blumberg (1871) and Bütschli (1872).) The development is diversiform; the most noteworthy is that characteristic of certain species of Distomidæ. (See CERCARIA.) The species are quite numerous, and in some form or other are parasitic on many animals of widely-distinct classes. No less than five distinct developed species, besides four larval or doubtful forms, have been found from time to time in man alone. (See PARASITES.) The various forms have been classified by some of the best authorities (*e. g.* Van Beneden and Schmarda) in two suborders and a number of families. These are: (1) Digenea, or entoparasitic trematods, which develop numerous and small eggs and undergo a long developmental cycle, mostly passing through "alternate generations," including the families Monostomidæ and Distomidæ; and (2) Monogenea, or ectoparasitic trematods, which develop few and large eggs (with thick shells), and whose developmental course is comparatively simple, no "alternation of generations" being passed through, including the families Tristomidæ, Udonellidæ, Polystomidæ, Octocotylidæ, and Gyrodactylidæ. The representatives of these "monogenetic" families are parasitic on aquatic animals, such as fishes, crustaceans, mollusks, etc. Those which attach themselves to fishes are mostly to be found affixed to the gills. THEODORE GILL.

Tre'mont, tp., Solano co., Cal. P. 640.

Tremont, p.-v. and tp., Tazewell co., Ill. P. of v. 437; of tp. 1365.

Tremont, p.-v. and tp., Hancock co., Me. P. 1822.

Tremont, tp., Buchanan co., Mo. P. 1106.

Tremont, p.-v., White Plains tp., Westchester co., N. Y., on New York and Harlem R. R. P. 2025.

Tremont, p.-b. and tp., Schuylkill co., Pa., on a branch of Philadelphia and Reading R. R., 12 miles from Pottsville, contains 6 churches, 1 bank, 1 newspaper, ironworks, schools, waterworks, and 7 hotels. P. of b. 1709; of tp. 754. CHAS. M. WOLFF, ED. "TREMONT NEWS."

Trempealeau', county of W. Wisconsin, bounded S. W. by Mississippi River, and drained by Trempealeau, Black, and Buffalo rivers; surface level, soil productive. Horses, cattle, and sheep are numerous. Staples, wheat, oats, Indian corn, wool, hay, and butter. Cap. Galesville. Area, 684 sq. m. P. 14,992.

Trempealeau, p.-v. and tp., Trempealeau co., Wis., on Trempealeau and Prescott R. R., 12 miles S. of Winona (Minn.), has 4 churches, a fine school, 1 newspaper, a wagon manufactory, 1 planing-mill, and 2 hotels. P. 2086. CHARLES A. LEITH, ED. "REPUBLICAN."

Trench (RICHARD CHENEVIX), D. D., b. at Dublin, Ireland, Sept. 9, 1807; graduated at Trinity College, Cambridge, 1829; spent some years in travel; took orders in the Church of England 1833; was curate at Hadleigh, Suffolk, 1833–35, incumbent of Curdridge 1835–40, curate to Archdeacon Wilberforce at Alverstoke 1840–44, rector of Itchenstoke 1844–45; was appointed examining chaplain to the bishop of Oxford (Dr. Wilberforce) 1845; was Hulsean lecturer 1845–46, and select preacher at Cambridge 1843 and 1856; professor of theology at King's College, London, 1846–58; dean of Westminster 1856–63, and was ordained archbishop of Dublin, as successor to Dr. Whately, Jan. 1, 1864. Author of poems, *The Story of Justin Martyr* (1835), *Sabbation, Honor Neale* (1838), *Poems from Eastern Sources* (1842), *Genevera* (1842), *Elegiac Poems* (1846), *Alma* (1851), of *Notes on the Parables of our Lord* (1841), *Notes on the Miracles of Our Lord* (1846), *Exposition of the Sermon on the Mount, from St. Augustine* (1844), 2 vols. of Hulsean lectures, *The Fitness of Holy Scripture for unfolding the Spiritual Life of Men* (1845), *Christ the Desire of all Nations, The Star of the Wise Men* (1850), *On the Study of Words* (1851; 15th ed. 1874), *On the Lessons in Proverbs* (1853), *Synonymes of the New Testament* (1854; 2d series 1863; 8th ed., recast, 1 vol., 1876), *English, Past and Present* (1855), *Calderon, his Life and Genius* (New York, 1856), *Some Deficiencies in our English Dictionaries* (1857), *The Authorized Version of the New Testament, in Connection with some Recent Proposals for its Revision* (1858), *Select Glossary of English Words used formerly in Senses different from their Present* (1859), *Commentary on the Epistles to the Seven Churches in Asia* (1861), *Studies on the Gospels* (1867), a volume of lectures *On Plutarch* (1874), 3 vols. of *Sermons preached before the University of Cambridge* (1813, 1856, and 1863), *Sermons preached in Westminster Abbey* (1860), *Sermons preached in Ireland* (1873), several single sermons, lectures, and charges to the clergy of Dublin; edited *Sacred Poems for Mourners* (1846), *Sacred Latin Poetry, chiefly Lyrical* (1849), *A Household Book*

of Poetry, selected and arranged, with Notes (London and New York, 1868), and the *Remains of the Late Mrs. Richard Trench* (1862), his mother. A volume of selections from his poems was edited by Rev. Dr. J. A. Spencer (New York, 1856), and another volume of his *Poems, collected and arranged anew*, was issued, probably by himself, in 1865.

Trench'ard (Stephen D.), U. S. N., b. July 10, 1818, in New York; entered the navy as a midshipman Oct. 23, 1834; became lieutenant in 1847, commander in 1862, captain in 1866, commodore in 1871, rear-admiral in 1875; commanded the Rhode Island in both the Fort Fisher fights, and recommended for promotion by Rear Admiral Porter. Foxhall A. Parker.

Trenck, von der (Franz), Baron, b. at Reggio, Calabria, Jan. 1, 1711, descending from a family settled in East Prussia; received a military education, and served first in the Austrian, then in the Russian army, but was both times cashiered, imprisoned, and even condemned to death for his brutal excesses; lived subsequently for some time in retirement on his estates in Slavonia, and was commissioned by Maria Theresa, on the outbreak of the Austrian war of succession, to form, at his own expense, a corps which he called the "Pandours," and at the head of which he fought in the van of the Austrian army. By his audacity and atrocity he achieved an almost European fame. His method of carrying on war was that of the fifteenth and sixteenth centuries; talents and characters like his were very common in those days. But in the eighteenth century such a phenomenon of course made a great sensation. He was suspected, however, of tampering with the Prussians, placed before a court-martial, and put in prison, where he poisoned himself Oct. 14, 1749. His *Autobiography* was at one time very much read.—His cousin, Friedrich von der Trenck, b. at Königsberg Feb. 16, 1726, was a character exactly of the same stamp, but was stopped in his course almost before entering the arena. Having distinguished himself highly in 1744, and gained the favor of Frederick II., he was suddenly imprisoned in 1745 for tampering with the Austrians, escaped, visited Moscow and Vienna, was caught in 1754 by the Prussians, and kept in a dungeon to 1763; wandered through Europe; received back his confiscated estates in 1786, and was guillotined at Paris July 25, 1794, as a Prussian spy. He too has written an *Autobiography*, as full of empty boast and threadbare lies as that of his cousin. Both were disinterred by Carlyle, and form an amusing diversion in his *History of Frederick the Great*.

Tren'delenburg (Friedrich Adolf), b. in Entin, principality of Lubeck, Nov. 30, 1802; educated at the gymnasium in his native town and at the universities of Kiel, Leipsic, and Berlin; was appointed in 1833 a professor *extraordinarius* of philosophy at the University of Berlin; was promoted to a full (or "ordinary") professorship in the same university in 1837, and retained this position until his death, Jan. 24, 1872. In 1846 he was elected a regular member of the Berlin Academy, and from the following year until his death he was secretary of the section for the history of philosophy. During nearly the whole of his life as professor at Berlin, Trendelenburg was a member of the governmental commission for the examination of candidates for positions as teachers in the public schools of Prussia. In this position he wielded a great and salutary influence. From 1849 to 1851, Trendelenburg was a member of the popular house of the Prussian Diet, where he sided with the moderate or patriotic party. As a university professor, Trendelenburg lectured to large classes on psychology, logic, the history of philosophy, ethics, the philosophy of law, and the theory of teaching. He was particularly eminent for his wide knowledge and understanding of the history of philosophy, and also as a philosophical critic. His own system was in a measure eclectic in its basis. The superstructure was more his own independent work.

Trendelenburg's contributions to the history of philosophy are contained chiefly in his *Historische Beiträge zur Philosophie* (3 vols.) and his *Kleine Schriften* (2 vols.). Especially noteworthy among these are his *History of the Doctrine of Categories* (vol. i. of the first-named work) and his monographs on various phases of the doctrines of Spinoza and Leibnitz, on ancient and modern ethics, and on Kant's theory of space and time. His criticism of Kant involved him in a celebrated and somewhat bitter controversy with Kuno Fischer (author of a much-read *History of Modern Philosophy*) on the true interpretation of Kant. In addresses before the Academy, Trendelenburg also made valuable contributions to Prussian history. As a critic, Trendelenburg won great celebrity by his assault upon Hegel, to some of whose lectures he had, as a student, listened. By it he was mainly influential in largely breaking the hold of Hegel's system upon the mass of thinking minds in Germany. His criticism is directed against the famous "Dialectical Method" (*Logische Untersuchungen*, vol. i. ch. iii.). Trendelenburg objects to the beginning with pure thought, on the ground that pure thought, as understood by Hegel, being utterly devoid of content, contains nothing which can impel to further development. He complains further, that the dialectical development, which claims to advance "in the element of pure thought" (*i. e.* non-empirically, or without reference to sensible experience), is in reality not effected without the surreptitious introduction of the experimental idea of motion, which contains in itself, by implication, the whole realm of sensible experience. Other criticisms are directed against the Hegelian application of the principles of identity and contradiction, and especially against the theorem of the identity of contradictories; and various sins against logic, in detail, are charged and pointed out.

The foundation of Trendelenburg's doctrine is essentially Platonic and Aristotelian. The principle for a philosophical deduction and explanation of the sensible universe is found in the Aristotelian conception (*Anschauung*) of motion. From an analysis of this idea are derived the categories which dominate our notions of concrete things (Quantity, Quality, Efficient Cause, etc.). But the principle of motion is treated as subject to a higher one, the (Aristotelian) principle of design, or the (Platonic) Idea, regarded as the finis and the end of motion. In other words, the teleological view is introduced, and is developed with constant reference to the sphere of empirical fact as illustrating and confirming it. The categories of the inferior realm of motion are not supervened, but taken up into the service of the higher realm of purpose or mind. Mechanical causation is the servant, and not the enemy, of teleology. Trendelenburg terms his philosophy the "organic view" of the world; and according to it each lower stage in existence is the basis of the higher stages, and necessarily involved in the higher. The highest stage experimentally known to man is the ethical, or the complete development of man in his totality, where the Idea (the idea of man, his supreme end, the aim of his organic development) is intellectually apprehended and is fully realized by man's own action. The soul is the self-realizing idea of man. God is the unconditioned, not directly demonstrable, but implied, with logical necessity, in the whole fabric of the universe and of human thought.

Trendelenburg's principal works, in addition to those above mentioned, are—*Platonis de Ideis et Numeris Doctrina ex Aristotele illustrata* (1826), *Elementa Logices Aristot.* (6th ed. 1868), *Erläuterungen zu den Elementen der aristotelischen Logik* (2d ed. 1861), *Naturrecht auf dem Grunde der Ethik* (2d ed. 1868). (See also *Journal of Speculative Philosophy*, St. Louis, No. 20, 1871; Nos. 21, 22, 24, 1872.) On the life and philosophy of Trendelenburg see H. Bonitz, *Zur Erinnerung an F. A. Trendelenburg* (Berlin, 1872); Ernst Bratuschek, *Adolf Trendelenburg* (Berlin, 1873); Karl von Prantl, *Gedächtnissrede auf F. A. T.* (Munich, 1873); article on Trendelenburg in the *New Englander* (New Haven, Apr., 1874).

George S. Morris.

Trènt [Ger. *Trient*], town of Austria, in the southern part of Tyrol, on the Adige, is beautifully situated and well built, surrounded with walls and traversed by canals. Its cathedral, built of white marble in 1212, is a magnificent edifice; the palace in which the famous council held its sittings and several other buildings are also remarkable. It manufactures leather, glass, sugar, tobacco, bells, cards, and silks, and carries on an important transit-trade between Italy and Germany. P. 17,073.

Trent, tp., Lenoir co., N. C. P. 761.

Trent, river of England, rises in Staffordshire at an elevation of about 600 feet above the level of the sea, flows in a south-eastern direction, and forms the Humber after joining the Ouse. Its entire length is 170 miles, and it is navigable for about two-thirds of its course.

Trent, a river which rises in Rice Lake, Northumberland co., Ontario, but is the outlet of a large system of northern lakes and rivers, partly navigable. The Trent itself affords good water-power, and large quantities of lumber are floated upon it. It is 100 miles long, and discharges its waters into the Bay of Quinté at Trenton.

Trent, Council of (*Concilium Tridentinum*), the most important synod in the history of the Roman Catholic Church. It produced its highest standards of faith and morals, and fixed its doctrinal character in opposition to Protestantism. It was called forth by the Reformation of the sixteenth century, and demanded by both parties in the contest, but was again and again postponed by the policy of the papal court. Finally, it was convened as an exclusively Roman council by order of Pope Paul III. in the Austrian

city of Trent (*Tridentum*), in the Italian part of Tyrol (at that time a free city of the empire under a prince-bishop), on Dec. 13, 1545, and lasted, with several interruptions, till Dec. 4, 1563. In Mar., 1547, it was transferred to Bologna from fear of the plague, but the emperor Charles V. refused to acknowledge it, and hence it was indefinitely prorogued Sept. 17, 1549. It was reopened at Trent May 1, 1551, by Pope Julius III., but France protested against the continuation and withdrew her bishops. The sudden victory of Elector Maurice of Saxony over the emperor, and his march into Tyrol, scared the assembled Fathers away from Trent Apr. 28, 1552. Pius IV. recalled it for the last time Jan. 18, 1562, when it continued to its final adjournment in Dec. 4, 1563. It closed with "Anathema to all heretics, anathema, anathema."

The decrees and canons of the council were confirmed by a bull of Pope Pius IV. Jan. 26, 1564. This bull enjoins strict obedience upon all Catholics, and forbids, under pain of excommunication, all unauthorized interpretation, reserving this to the pope alone, and threatening the disobedient with "the indignation of Almighty God and of his blessed apostles, Peter and Paul." The number of attending members in the three periods varied considerably; it increased toward the close, but never reached the number of the first œcumenical council at Nicæa (which had 318 members) nor of the last of the Vatican (which numbered 764). The decrees were signed by 255 members, including 4 papal legates, 2 cardinals, 3 patriarchs, 25 archbishops, 168 bishops, two-thirds of them being Italians. Lists of the signers are added to the best editions of the Decrees.

The object of the council was two-fold: (1) To condemn the principles and doctrines of Protestantism, and to define the doctrines of the Roman Catholic Church on all the disputed points. It is true the emperor intended it to be a strictly general or truly œcumenical council, at which the Protestants should have a fair hearing. Melanchthon and Brentius, with some other German Lutherans, actually started in 1552 on a journey to Trent, but they were refused a deliberative voice, and their mission was an entire failure. (2) To effect a reformation of discipline, which was admitted by all honest and earnest Catholics to have fallen into such deplorable decay as to explain, if not to justify, the Reformation. Twenty-five public sessions were held, but about half of them were spent in solemn formalities. The chief work was done in committees or congregations. The entire management was in the hands of the papal delegates. The court of Rome, by diplomacy and intrigue, outwitted all the liberal elements. The council abolished some crying abuses, and introduced or recommended disciplinary reforms as regards the sale of indulgences, the morals of convents, the education of the clergy. In this respect the Reformation produced a salutary effect upon the Roman Church itself, as is admitted by the best historians of that Church. But in regard to the department of doctrine, although liberal evangelical sentiments were uttered by some of the ablest members in favor of the supreme authority of the Scriptures and justification by faith, no concession whatever was made to Protestantism.

The doctrinal decisions of the council are divided into *Decrees* (*decreta*), which contain the positive statement of the Roman dogmas, and into short *Canons* (*canones*), which condemn the dissenting Protestant views with the concluding "*anathema sit.*" They are stated with great clearness, precision, and wisdom. The decree on justification betrays special ability and theological circumspection. The Protestant doctrines, however, are almost always exhibited in an exaggerated form and almost caricatured, or they are mixed up with real heresies which Protestants condemn as emphatically as the Church of Rome.

The following is a list in chronological order of the articles of faith which were settled by the council in favor of the views held ever since by the Roman Catholic Church:

Session III. (Feb. 4, 1546). Decree on the symbol of faith (the Niceno-Constantinopolitan Creed as a basis of the following decrees).

Session IV. (Apr. 8, 1546). Decree on the Scriptures (including the Apocrypha) and church tradition, which are declared to be the joint rules of faith. The Latin Vulgate is put on a par with the original text.

Session V. (June 17, 1546). On original sin.

Session VI. (Jan. 13, 1547). On (progressive) justification by faith and good works, in opposition to justification by faith alone.

Session VII. (Mar. 3, 1547). On the seven sacraments in general, and some canons on baptism and confirmation.

Session XIII. (Oct. 11, 1551). On the sacrament of the Eucharist.

Session XIV. (Nov. 25, 1551). On the sacraments of penance and extreme unction.

Session XXI. (July 16, 1562). On communion under both kinds, and the withdrawal of the cup from the laity.

Session XXII. (Sept. 17, 1562). Doctrine of the sacrifice of the mass.

Session XXIII. (July 15, 1563). On the sacrament of ordination.

Session XXIV. (Nov. 11, 1563). Sacrament of matrimony.

Session XXV. (Dec. 3 and 4, 1563). Decrees approving the scholastic doctrines of purgatory, the invocation, veneration, and the relics of saints and sacred images; also on the selection of food, fasts, festive days, and providing for an index of prohibited books, catechisms, breviary, and missal, to be issued under the direction of the pope.

The council was acknowledged in Italy, Portugal, Spain, France, the Low Countries, Poland, and the Roman Catholic portion of the German Empire, but mostly with a reservation of the royal prerogatives. In France it was never published in form, and was only recognized in its doctrinal part. No attempt was made to introduce it into England. Pius IV. sent the decrees to Mary Queen of Scots, with a letter, dated June 13, 1564, requesting her to publish them in Scotland, but she dared not do it in the face of John Knox and the Reformation.

The *Canons* and *Decrees* of the council were first published by Paul Manutius (Rome, 1564), and often since in different languages. Best Latin ed. by Le Plat (1779) and by Schulte and Richter (Lips., 1853); best English ed. by Rev. J. Waterworth (with a history of the council, London, 1848).

The original acts and debates of the council, as prepared by its general secretary, Bishop Angelo Massarelli, in 6 large folio vols., are deposited in the Vatican Library, and remained there unpublished for more than 300 years until they were brought to light at last, though only in part, by Augustin Theiner (priest of the Oratory, d. 1874) in *Acta genuina SS. Œcum. Concilii Tridentini nunc primum integre edita* (Lips., 1874, 2 vols.). Most of the official documents and private reports, however, which bear upon the council, were made known in the sixteenth century and since. The most complete collection of them is that of Le Plat (*Monum. ad Histor. Conc. Trident.*, Lovan., 1781–87, in 7 vols.). New materials have been brought to light by Mendham (1834 and 1846) from the manuscript history of Cardinal Paleotto, and quite recently by Sickel (*Actenstücke aus österreichischen Archiven*, Wien, 1872), and by Dr. Döllinger (*Ungedruckte Berichte und Tagebücher zur Geschichte des Conc. von Trient*, Nördlingen, 1876, 2 parts).

The history of the council was written chiefly by two able and learned Catholics of very different spirit—the liberal, almost semi-Protestant monk Fra Paolo Sarpi, of Venice (*Istoria del Concilio Tridentino*, first, Lond., 1619, and repeatedly since in Italian, Latin, French, and German; best ed., with notes, by Courayer, Amst., 1751, 3 vols.); and in the interest of the papacy by Cardinal Sforza Pallavicini, who had access to all the archives of Rome (*Istoria del Concilio di Trento*, Rome, 1656–57, 2 vols. fol., and other eds. original and translated). Both accounts must be compared to get a full view. Professor (now Bishop) Hefele intended at first to carry his valuable *History of the Councils* (*Conciliengeschichte*) down to the Council of Trent, but gave it up at last for reasons assigned in his preface to vol. vii. part ii. (1874), and stopped with the councils of Bâle and Florence. Among Protestant historians of the Council of Trent we mention Salig (1741–45, 3 vols.), Danz (1846), Buckley (Lond., 1852), and Bungener (Paris, 1854; Eng. trans., New York, 1855). On the Tridentine standards see the author's *History of the Creeds of Christendom* (1876), vol. i. pp. 90 *seq.*

PHILIP SCHAFF.

Trente-et-Un. See ROUGE ET NOIR.

Tren'ton, port of entry of Hastings and Northumberland cos., Ont., Canada, on the Bay of Quinté, on both sides of the river Trent, and on Grand Trunk Railway, 101 miles E. of Toronto. Immense quantities of timber are rafted down the river and shipped at this place, which has large manufactures and a weekly newspaper. P. 1796.

Trenton, p.-v., cap. of Dade co., Ga., on Alabama and Chattanooga R. R. P. 223.

Trenton, p.-v., Clinton co., Ill., on Ohio and Missouri R. R., has a weekly newspaper. P. 948.

Trenton, v., Blackford co., Ind. P. 80.

Trenton, p.-v. and tp., Henry co., Ia. P. 1435.

Trenton, p.-v., Todd co., Ky., on Evansville Henderson and Nashville R. R., has a private bank. P. 221.

Trenton, p.-v., Ouachita parish, La. P. 429.

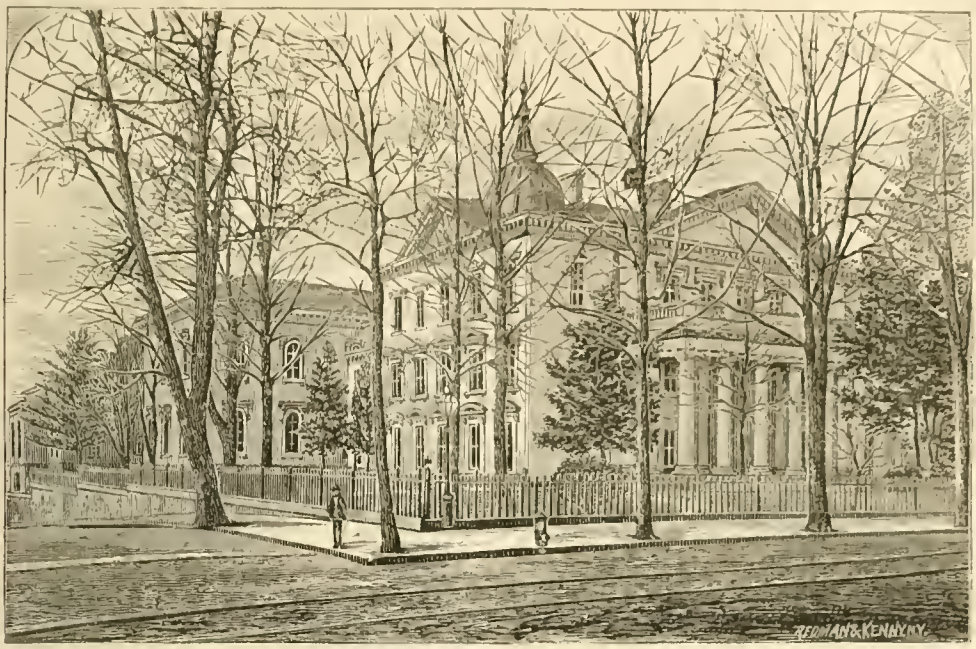
Trenton, tp., Hancock co., Me. P. 678.

Trenton, p.-v., Wayne co., Mich., on Detroit River and on Lake Shore and Michigan Southern R. R.

Trenton, p.-v. and tp., cap. of Grundy co., Mo., on Chicago Rock Island and Pacific R. R. and on Grand River,

has a public school building, 2 banks, 1 woollen factory, 3 flouring and 2 saw mills, 2 newspapers, 6 hotels, marble-works, and railroad repair and machine shops. P. of v. 920; of tp. 2934. W. B. Rogers, Ed. "Republican."

Trenton, city, cap. of Mercer co. and of the State of New Jersey, is at the head of tide-water and steamboat navigation on Delaware River, and is intersected by Delaware and Raritan Canal, one of the most important water-thoroughfares in the country, connecting by continuous inland navigation the cities of New York and Philadelphia, and the latter city with Baltimore. There are two lines of large propellers from Trenton, which transport merchandise and manufactured products to these points. Trenton is also situated on Pennsylvania R. R., is the southern terminus of Belvidere Delaware R. R., and is the centre of an extensive system of local State railroads, which converge here by connection with the above-named roads. It will also have connection by a spur with Delaware and Bound Brook road, the new through railroad between New York and Philadelphia. There is a regular line of steamboats to Philadelphia on the Delaware. Trenton is 27 miles from Philadelphia and 56 from New York. It is connected with Pennsylvania by two fine bridges over the Delaware. The city is mainly built on high ground, and is dry and healthy. Its streets are wide and well shaded, and have a grade which promptly carries off surface drainage to running watercourses. Several picturesque elevations in the suburbs, including a fine eminence along the river, are occupied by handsome mansions surrounded by beautifully laid out grounds. Trenton has 29 churches—8 Methodist Episcopal (2 colored), 6 Presbyterian, 3 Baptist, 3 Episcopal, 3 Catholic, 2 Quaker, 2 Lutheran, 1 Second Adventist, and 1 Jewish synagogue. It has 1 State and 2 national banks, 2 savings banks, a public library (in addition to the State library in the capitol); an opera house with a seating capacity of 1600 and costing $110,000; several public halls; a street railway connecting the dépôt with the principal parts of the city; the oldest and one of the best-equipped volunteer fire departments in the country; a system of public graded schools, with a high-school and several private schools; 4 daily and 5 weekly newspapers, and several benevolent, educational, and charitable institutions, and hospitals, etc., connected with religious organizations. The public buildings in Trenton comprise the



State House, Trenton, N. J.

State capitol, a fine structure beautifully located on an elevation overlooking the Delaware, and surrounded with spacious, well-laid-out, and finely-shaded grounds; the State normal and model schools; the Soldiers' Children's Home; the State prison; the State lunatic asylum; the State reform school for girls; and a large U. S. post-office and court-house, now in process of construction by the Federal government. The principal source of the growth and prosperity of Trenton is its manufactures. It is the seat of the most extensive crockery manufacture in the country, more of this ware being made here than in all the rest of North America. There are also—the extensive rolling-mill of the New Jersey Steel and Iron Co., employing 600 hands and with a capital of $1,000,000; the Trenton Iron Co.; a wire-mill; the American Saw Co.; the Phœnix ironworks; the National ironworks; vise and tool works; and anvil and railroad-joint works, chain-factories, and several other ironworks of lesser magnitude. The capital invested in these is about $4,000,000, and the annual products about $6,000,000. They employ 2000 men, and disburse $1,000,000 a year in wages. There are also 3 large woollen mills, fire-brick and terra-cotta works, rubber-works, zincworks, locomotive and ordnance works (not now in operation), and a multitude of manufactories of different articles and of varied magnitude. There is a large coal dépôt here on the canal, from which hundreds of thousands of tons of coal are annually shipped by large schooners to Boston and other Eastern ports. There is a water-power = 1000 horse-power from the Delaware, and a bill has just passed the legislature allowing the city to appropriate all the water of that river (amounting on an average to 10,000 horse-power) for manufacturing purposes. P. 22,874. On the night of Dec. 25, 1776, Washington, with about 2400 men, crossed the Delaware above Trenton, which city he surprised and captured, together with the garrison of about 1300 Hessians, with their arms and 6 field-pieces. The enemy being in superior force in the vicinity, Washington recrossed the Delaware on the 26th. A few days later, however, he returned to New Jersey and took possession of Trenton, where he concentrated his forces, and whence he moved to Princeton early in Jan., 1777. William Cloke, Ed. "State Gazette."

Trenton, p.-v. and tp., Oneida co., N. Y., on Utica and Black River R. R. P. of v. 294; of tp. 3156.

Trenton, p.-v. and tp., cap. of Jones co., N. C. P. 811.

Trenton, p.-v., Butler co., O., on Cincinnati Hamilton and Dayton R. R. P. 340.

Trenton, tp., Delaware co., O. P. 907.

Trenton, p.-v., Tuscarawas co., O. P. 292.

Trenton, p.-v., cap. of Gibson co., Tenn., on Mobile and Ohio R. R., 59 miles S. of Columbus, Ky., has 6 churches (2 colored), 2 high schools, 1 colored school, several private bankers, 1 newspaper, 2 large flouring-mills, 2 hotels, 2 carriage and 2 wagon factories, Masonic, Odd Fellows, and Temperance lodges, and 1 furniture manufactory. P. 1909.

Holbrook & Wells, Eds. "News-Gazette."

Trenton, tp., Dodge co., Wis. P. 1735.

Trenton, p.-v. and tp., Pierce co., Wis. P. 304.

Trenton, tp., Washington co., Wis. P. 2035.

Trenton Falls, a waterfall of West Canada Creek in the township of Trenton, Oneida co., N. Y. The falls are a favorite place of summer resort, chiefly on account of the remarkable wildness of the surrounding scenery. The stream flows through a ravine or chasm in the Trenton limestone

from 70 to 200 feet deep, and the water descends 312 feet in 2 miles by half a dozen cataracts and cascades. The first fall, lowest down the stream, is 33 feet in perpendicular height. Above this is Sherman's Fall, 35 feet high. Next comes the High Fall, of 109 feet in perpendicular descent. Farther up is the Mill-dam Fall, 14 feet in height. The chasm is a scene of wild and varied beauty. P. 128.

Trenton Falls, p.-v., Trenton tp., Oneida co., N. Y., on Utica and Black River R. R. P. 128.

Trepan and **Trepanning.** See TREPRINING.

Trepassey, port of entry of Newfoundland, 81 miles by road S. W. of St. John's, has a fine harbor and successful agricultural and grazing interests. P. 514.

Trephine. See TREPRINING.

Trephin'ing [Gr. τρυπᾶν, to "bore"], or **Trepanning,** the surgical procedure of removing a "button of bone," or circular section of bone, by means of the circular instrument known as the trepan and trephine. The cutting part consists of a circular saw-toothed edge, different sizes having diameters of half an inch to an inch, the older instruments having a vertical body and smooth sides, the more modern having a slightly conical body and burred, cutting sides. The old instrument, the "trepan," was worked by a "wimble" or curved auger-handle; the modern, the "trephine," has a short handle with crossbar like a gimlet, and is worked by one hand. A "centre-pin" is provided, which acts as a pivot upon which the sawing edge can revolve: this pin is to be raised after the saw has entered the bone. The trephine is used chiefly upon the skull, although sometimes employed in other parts to evacuate pus in bony cavities, as of the face, the ends and shafts of long bones. Trephining the skull was heroically and recklessly practised by the ancients, and especially by empirics, for every fancied brain disease; often at several points, and many times upon the same person. Modern surgery limits it to cases of fracture of the skull, where bone is depressed, and to the evacuation of pus which has formed within the cranium, either the result of injuries and disease of the skull or of acute cerebral abscess. The trephine by its conical shape and rough sides is protected from cutting the brain. So soon as the "inner tablet" of the skull is cut through, the button of bone is pried out or removed by forceps, and the edges of the circular opening are cleared of all spiculæ of bone. The depressed bone is then "elevated" by means of a lever, or the abscess is incised, care being taken never to cut into the great venous sinuses. Trephining is more often performed for the relief of cerebral abscess than formerly, since modern diagnosis of the site of brain lesions is more definite. But for the relief of depressed bone in fractures of the skull it is less often resorted to. Hey's saw obviates the necessity of trephining in many cases. By it the points and angles of bone may be removed, and a point of entrance for the lever or "elevator" secured, without the loss of sound bone, which the trephine involved. Hey's saw consists of a small handle armed at its end with a double-edged saw, one edge curved, the other straight.

Fig. 1.

The Trephine.

Fig. 2.

The ancient Trephine.

Fig. 3.

Hey's Saw.

E. DRAWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Trep'tow, town of Prussia, province of Pomerania, on the Repa, has valuable fisheries and trade. P. 6194.

Tres'cot (WILLIAM HENRY), b. at Charleston, S. C., in 1822; was secretary of legation in England 1852–53, and under-secretary of state of the U. S. 1857–60. Author of *The Diplomacy of the Revolution, an Historical Study* (1852), *An American View of the Eastern Question* (1854), *The Diplomatic History of the Administrations of Washington and Adams* (1857), and other works.

Tres'cott, tp., Washington co., Me. Pop. 603.

Tres Pala'cios, tp., Matagorda co., Tex. P. 226.

Tres'pass [O. Fr. *trespasser*], in law, is a species of tort, consisting in an unlawful act done to the person or property of another by means of direct violence, actual or constructive. The essential feature of this delict in legal contemplation is the direct violence, which may be actual, as in the case of an assault and battery, or constructive, as in the case of an unauthorized entry upon the land of another, and doing thereby mere nominal damage. This notion was expressed in the common-law pleading by the necessary allegation that the act was committed *vi et armis*, "with force and arms." The amount of force used, the intent, and the extent of the injury done are immaterial elements in constituting the tort, and only affect the damages recovered. Trespasses are separated into three classes—to person, to personal property, and to real property. The principal trespasses to the person are assault, battery, false arrest, false imprisonment. Trespass to personal property may consist either in forcible direct injury to the chattel, or in taking and carrying it away from the custody of its owner. Trespass to real property is an unlawful entry upon the land of another—in the old legal language, "the breaking and entering another's close." The damages may be aggravated by wrongful acts done on the land, but such acts do not form the gist of this species of the tort. The commission of a legal act in an illegal manner may be a trespass, as the abuse or wrongful execution of process by an officer, and the like. It is a general doctrine of the law that if one commences to do a legal act in a proper manner, and then in its further prosecution is guilty of wrongs which amount to a trespass, he thereby becomes a trespasser from the beginning (*ab initio*). The remedy in all cases of this tort is the recovery of compensatory damages by the injured party; and if the wrong was wilful, malicious, and without excusing circumstances, exemplary or punitive damages may be added by the jury. The term "trespass" is also the name of the common-law form of action which must be used to recover damages from the wrongdoer when the delict complained of is a trespass. J. N. POMEROY.

Trevel'yan (Sir CHARLES EDWARD), BART., K. C. B., b. in England in 1807; educated at the Charter-house and at Haileybury College, on leaving which he entered the civil service of the East India Company; employed under Lord William Bentinck and Lord Auckland in important posts; made to the vice-regal government at Calcutta elaborate reports on various subjects, one of which led to the abolition of some oppressive imposts; secured the aid of the government to the promotion of European literature and science among the natives of India; in 1840 assistant secretary to the treasury; knighted in 1848 for services in connection with the Irish famine; instrumental in the revision of the civil establishment and in throwing open the civil service to competition; appointed governor of Madras Jan., 1859, but recalled May, 1860, in consequence of having protested against the new taxes proposed by the government; received, along with his recall, the thanks of the government for his services in promoting the queen's policy of conciliation of the princes and people of India; finance minister in India 1862–65; made reforms in the system of accounts, and co-operated in the immense extension given at that time to public works; devoted himself on his return to the question of army purchase, which system he had long opposed; created a baronet 1874, and has taken a leading part in several important charities. He married, in 1834, Miss Hannah More Macaulay, sister of the historian. Author of *Education of the People of Ireland* (1838), *The Irish Crisis* (1848), *The Purchase System in the British Army* (2d ed. 1867), *The British Army in 1868* (1869), and other works.

Trevelyan (GEORGE OTTO), son of Sir Charles Edward, b. at Rothley Temple, Leicestershire, England; educated at Harrow School and at Trinity College, Cambridge; entered the East Indian Civil service by competitive examination, in which he took a distinguished rank; returned from India, and was elected to Parliament from Tynemouth as a liberal 1865; became civil lord of the admiralty under Mr. Gladstone's second administration Dec., 1868; resigned office July, 1870, being opposed to the government education bill, and was, like his father, a prominent advocate of army reform, especially the abolition of the purchase of commissions. Author of *Letters of a Competition Wallah* (1864), *Cawnpore* (1865), *The Ladies in Parliament* (1869), and *The Life of Lord Macaulay* (2 vols., 1876).

Treves [Ger. *Trier*], town of Rhenish Prussia, on the right bank of the Moselle, beautifully situated among the vineclad hills of that river. It is the most ancient city of Germany (a fabulous Latin inscription on the wall of the *Rothen Haus* says it was built *before Rome*). The emperor Augustus established here a Roman colony under the name of *Augusta Trevirorum*. In later days it was the residence of the emperors Constantius, Constantine, Julian, Valentinian, Gratian, and Theodorus, and if not—as Ravenna was a little time afterward—the head of the Western world, at least the head of all the lands beyond the Alps. Almost annihilated during the subsequent barbarian invasions, it arose under the archbishops of Treves to nearly its earlier splendor. It is now a decayed town, but one of high antiquarian interest from its numerous Roman remains. P. 21,000. J. G. BARNARD.

Trevi'glio, town of Italy, province of Bergamo, about 3 miles from the left bank of the Adda and about 20 miles E. of Milan. Our knowledge of Treviglio does not ascend beyond the Lombard rule, and though it became subsequently a place of no small importance and the theatre of bitter mediæval warfare, yet its fortifications are now in ruins, and it is of no interest except as a flourishing agricultural, industrial, and commercial town. It is a great centre of the silk-trade. P. 11,883.

Trevilian's Dépôt, p.-v., Louisa co., Va., on Chesapeake and Ohio R. R.

Trevira'nus (Gottfried Reinhold), b. at Bremen Feb. 4, 1776; studied medicine at the University of Göttingen, and became in 1797 professor of mathematics at the lyceum of his native city, where he d. Feb. 16, 1837. He wrote *Physiologische Fragmente* (2 vols., 1797–99), *Biologie oder Philosophie der lebenden Natur* (6 vols., 1802–22), *Erscheinungen und Gesetze der organischen Lebens* (2 vols., 1831–32).—His brother, Ludolf Christian Treviranus, b. at Bremen Sept. 10, 1779, was appointed professor of medicine at the lyceum of Bremen in 1807, and in 1812 professor of botany and director of the botanical garden in Breslau, afterward in Bonn, where he d. May 6, 1864. He wrote *Vom inwendigen Bau der Gewächse* (1806), *Physiologie der Gewächse* (2 vols., 1835–39), and, in connection with his brother, *Vermischte Schriften anatomischen und physiologischen Inhalts* (4 vols., 1816–21).

Trevi'so [anc. *Tarvisium* or *Taurisium*], town of Italy, province of the same name, in lat. 45° 39′ N., lon. 12° 15′ E., lies in a very fertile region, and is rather an agricultural than a manufacturing town, though cottons, woollens, paper, etc., are made to a considerable extent, and good American machinery has been introduced into the various factories. The cathedral was begun in the twelfth century, was restored in the fifteenth, but has never been finished according to the original plan. Still, it is an imposing building, the five cupolas producing a grand effect, and in its interior, as well as in that of the church of S. Nicolò di Bari, pictures and sculpture of much merit are preserved. Even Bellini, Titian, Giorgione, Bordone, and Pordonone are represented in these and other churches. Treviso was settled before the Roman period, and admitted to the privilege of Roman citizenship in the time of Julius Cæsar. In 1000 A. D. it was an independent commonwealth; in 1108 became a fief of the celebrated Countess Matilda; in 1199 again recovered its municipal liberties, fell under the lordship of the terrible Ezzolino da Romano about 1230, and for the third time resumed its self-government for a short space in 1314. The following centuries were marked by the restless violence of the period, Treviso belonging for the most part to Venice. In 1807, the town having been occupied by the French, Mortier was named duke of Treviso. After having been an Austrian possession for some years, Treviso became a part of the kingdom of Italy in 1866. Considerable advance in prosperity is already noticeable, and much effort is making for popular education. P. 28,290.

Trev'ithick (Richard), b. at Illogan, Cornwall, England, Apr. 13, 1771; was brought up to the business of a mechanical engineer in the Cornish mines; constructed several steam-engines, introducing various improvements, one of which was the introduction of wrought-iron cylindrical boilers; solved the problem of introducing the steam-engine as a motive-power to run on roads and tramways by the introduction of high-pressure steam as a substitute for the condensing action; patented his new engine 1802, ran it upon a public road near Camborne 1803, placed another locomotive on a tramway at Merthyr Tydvil, where it drew a load of ten tons at the rate of 5 miles an hour, Feb. 21, 1804; subsequently made other successful experiments near Bethlehem Hospital, London; but his engine having blown up, popular prejudice was aroused and the practical use of the invention postponed for many years. Trevithick devoted himself anew to engineering work in the Cornish mines, continually inventing and making improvements in machinery; sent to Peru in 1814 nine of his small high-pressure condensing engines, for use in some mines in which he acquired an interest; went thither himself in 1816 as directing engineer; was for some time quite prosperous, but was ultimately a heavy loser by the depredations committed during the war of independence and the subsequent civil wars, in some of which he took part, experiencing many adventures; landed penniless at Falmouth 1827; resumed operations as an engineer; made various inventions and mechanical improvements of widely different kinds, including warming apparatus, iron stowage-tanks, iron buoys, a gun-carriage for single-decked ships, a furnace for purifying silver ores, an hydraulic engine, a salt-water distilling apparatus, and floating docks, some of which were patented by him, but produced him little pecuniary profit, though they added largely to the wealth and prosperity of Great Britain. D. at Dartford, Kent, Apr. 22, 1833. Portlin C. Bliss.

Tre'vor (George), b. in England in 1809; graduated at Magdalen Hall, Oxford, 1836; was a chaplain on the Madras establishment 1836–45; became chaplain to the high sheriff of Yorkshire, rector of All Saints, York, and canon of York minster 1847; was elected chaplain of the parish church at Sheffield 1850, but was refused induction by the vicar, a proceeding which led to suits in chancery and in the court of queen's bench, in which he was successful; became rector of Burton Fidsea 1868, and was the most active promoter of the revival of the house of convocation for the arch-diocese of York, in which body he is actuary of the lower house and synodal secretary to the two houses. Author of *Christ in his Passion* (1847), *Sermons on Doctrines and Means of Grace* (1851), *Origin, Constitution, and Form of Proceedings in the Convocation of the two Provinces of Canterbury and York* (1852), *Types and Anti-types* (1864), *The Story of the Cross* (1866), *The Catholic Doctrine of the Sacrifice and Participation of the Holy Eucharist* (1869), *India, an Historical Sketch* (1858), *India, its Natives and Missions* (1862), *Russia, Ancient and Modern* (1862), *Ancient Egypt* (1863), *Egypt from the Conquest of Alexander to Napoleon* (1866), and *Rome from the Fall of the Western Empire* (1869).

Trevor (Sir John), b. at Brynkinallt, Denbighshire, Wales, about 1637, was a cousin of Chancellor Jeffreys, by whom he was favored in his professional career; was called to the bar at the Inner Temple May, 1661; was knighted Jan., 1671; became king's counsel 1678; was elected to Parliament 1679; chosen Speaker of the new House of Commons May, 1685; became master of the rolls Oct. 20, 1685; sworn of the privy council July 6, 1688; was dismissed from office by William and Mary; was an energetic opponent of the government in the Convention Parliament 1689, but soon made his peace with the court, with the consent of which he was unanimously elected Speaker Mar. 20, 1690; was entrusted by the government with the task of conciliating political opponents by means of promises and rewards; was made first commissioner of the great seal May 11, 1690; was restored to the office of master of the rolls Jan., 1693; was reported by a parliamentary committee guilty of bribery Mar. 12, 1695, and by vote of the House, to which he himself as presiding officer had to put the question, was declared guilty of a high crime and misdemeanor; resigned the Speakership, and was a few days later formally expelled. He retained, however, the high position of master of the rolls for the rest of his life, more than twenty-two years, and seems to have filled that office without reproach, his decisions being still quoted with respect. D. May 20, 1717, and was buried in the Rolls' Chapel.—He must not be confounded with his cousin and contemporary, Sir John Trevor (1626–72), who was envoy to France and secretary of state under Charles II., and son-in-law to the celebrated Hampden.

Tre'vorton, p.-v., Northumberland co., Pa., on Philadelphia and Reading R. R.

Triacanth'idæ [from *Triacanthus*—Gr. τρεῖς, "three," and ἄκανθα, "spine"—the name of the typical genus], a family of teleost fishes of the order Plectognathi and suborder Scleroderma, and the most fish-like of the order. The body is compressed and oblong; the skin covered with small, rough, closely adherent scales; the lateral line diversiform; the head compressed and conical in profile; the eyes lateral; the opercular bones comparatively well developed; the mouth small and terminal; the upper jaw has its elements very imperfectly united; teeth are developed on the jaws in variable form; the branchial apertures are narrow slits in front of the pectoral fins; the branchiostegal rays are completely concealed; the dorsal fins are two in number—(1) aspinous, with from four to six spines, and (2) an oblong soft one, with rather numerous (14–25) rays; the anal is opposite to, and rather smaller than, the second dorsal; caudal well developed and forked or rounded; pectorals also well developed; ventral fins represented mostly by a pair of strong spines articulated with a long and compressed pelvic bone; the air-bladder is closed and simple; the vertebræ are in rather reduced number, there being in typical forms nine dorsal and ten caudal. The family is especially interesting as being, among the Plectognaths, the least aberrant from the typical fishes, while among the Teleocephali they are most nearly related to the Acanthuridæ and Teuthidiæ. The family is composed of three well-marked genera—(1) *Triacanthus*, confined to the Indian and Australian seas; (2) *Triacanthodes*, of which a single species only has been found in Japan; and (3) *Hollardia*, one species of which has been found in Cuba.

Theodore Gill.

Tri'ad, in music, a chord consisting of a bass or root, with a third and fifth. (See HARMONY and MUSIC.)

Triadel'phia, p.-v., Deerfield tp., Morgan co., O. P. 34.

Triadelphia, tp., Logan co., West Va. P. 841.

Triadelphia, p.-v. and tp., Ohio co., West Va., on Hempville R. R. P. of v. 239; of tp. 2141.

Tri'ads, in chemistry, those elements or radicals which are trivalent or equivalent in their combinations to three atoms of hydrogen. (See CHEMISTRY.)

J. P. BATTERSHALL.

Tri'ads, The Welsh, a collection of rhythmical triplets containing historical facts and fancies, traditions, legal, rhetorical, and moral tales, and the like. They exist in the Welsh language. The oldest extant Triads are referred to Edward I.'s time, but probably contain much older fragments. Most of the Triads are of much more recent origin. The so-called historical Triads are regarded as a literary forgery, the work of one Thomas Jones, who probably made them not long before the year 1600.

Triad, The Hindoo. See TRIMURTI.

Tri'al [O. Fr. *Trial*], in law, denotes the formal judicial examination and decision of the issues pending between the parties to an action, preliminary to the judgment which finally determines the rights and liabilities of the litigants. The kinds of forensic trial used in the U. S. may be conveniently separated into three generic classes —the trial of legal actions, the trial of equity suits, and the trial of admiralty causes.

(1) *Legal Actions.*—Anciently, all legal actions were ordinarily tried before a jury. By recent legislation, both in this country and in England, the jury may be waived by the parties, and sometimes even without their consent, and the issues may be submitted to the court or to a referee. Since the proceedings before a court or a referee are in all respects similar to those before a jury, except the selection of the jurors, the judge's charge to them, and their verdict, these three modes may be described together. A cause being called and being ready for trial, the first step in the proceeding is the drawing and empanelling of a jury. From all the names of the jurors, written upon slips of paper and deposited in a box, the clerk selects at random or by lot the twelve who are to act in the particular case. As each one is announced, either party may challenge the person and proceed to ascertain whether he is incompetent for any reason to sit as a juror in that cause. In criminal trials the accused, and in many States the prosecution, are also entitled to a certain number of peremptory challenges; that is, they may exclude a certain number of the jurors drawn without assigning any cause therefor. The twelve men having been obtained, they are sworn by the clerk a true verdict to render upon the issues according to the evidence. The second stage is the production of the proofs in the presence of the jury. The counsel for the party holding the affirmative, who in the vast majority of instances is the plaintiff, briefly explains the nature of his client's claim, and examines his witnesses, who are cross-examined by his adversary. The defendant then proceeds in the same manner to state and prove his version of the case. At the close of the plaintiff's evidence the defendant may move for a nonsuit; and if in the opinion of the court no cause of action has been shown, even assuming the truth of all the facts stated by the witnesses, the motion will be granted and the cause will be at once dismissed. On the other hand, a verdict may be directed for the plaintiff if his right clearly appears from uncontradicted proofs. Generally, however, there is a conflict of evidence which requires a jury. The admission of evidence is wholly regulated by the court; he decides what facts are competent, and what incompetent, to be proved, what questions are proper, and what improper. To his rulings either party may except, and the point of law thus raised will be examined on appeal. When the proofs are closed, the counsel address the jury on behalf of their respective clients. Different rules prevail in the States as to the order of these addresses. In general, the party holding the affirmative closes, and sometimes he also opens the argument, but in several States the right of closing in criminal trials is conferred upon the accused. The next step is the judge's address or charge to the jury. In many of the States the charge is restricted by statute to a simple statement of the legal rules, and in several of them it is even required to be in writing. At the common law the judge may comment upon the facts, and even express an opinion provided the jury are left free to decide. Either party may request particular instructions. Exceptions taken to the charge or to portions thereof, or to a refusal to charge as requested, present questions of law for review by the appellate tribunal. The jury retire to a private room and consider their verdict. When a verdict is agreed upon, they return into court, announce it, and it is recorded by the clerk in his minutes. In the trial before the court or referee, instead of a verdict a written finding is filed by the judge containing his conclusions of fact and of law.

(2) *Equity Suits.*—According to the original practice in chancery, the witnesses were examined before trial by an officer called the master, who reduced their testimony to writing. The trial consisted merely in the reading of these depositions and of the pleadings, with the arguments of counsel, the decision being pronounced by the chancellor at his convenience. This practice still prevails in a few States. In most of them, however, the trial of an equity suit has been made identical in its modes and proceedings with that of a legal action before a judge or referee. Within the past few years the employment of official phonographers has become general in the superior courts of this country and of England, who preserve an accurate transcript of all the proceedings.

(3) *Admiralty Causes.*—The trial of the ordinary civil causes in admiralty substantially resembles the methods which originally prevailed in equity. Wherever admiralty has jurisdiction of criminal offences, and wherever a jury is required by statute, the forms of the jury trial in legal actions are followed.

JOHN NORTON POMEROY.

Tria'na, p.-v. and tp., Madison co., Ala. P. 2540.

Trian'gle [Lat. *triangulum*], a surface bounded by three sides, and consequently having three angles. A triangle may be *plane*, *spherical*, or *spheroidal*.

Plane Triangles.—A plane triangle is a plane surface bounded by three straight lines. These lines are called *sides*, and the points at which the sides meet are called *vertices* of the triangle. Plane triangles may be classified either with respect to their sides or with respect to their angles. When classified with respect to their sides, we have—(1) *scalene* triangles, in which no two sides are equal; and (2) *isosceles* triangles, in which two of the sides are equal: the *equilateral* triangle is a particular case of the isosceles triangle in which all of the sides are equal. When classed with respect to angles, we have—(1) *right-angled* triangles, which have one right angle; and (2) *oblique-angled* triangles, in which all of the angles are oblique; triangles of the latter class may be *acute-angled* triangles, all of whose angles are acute, or *obtuse-angled* triangles, each of which has one obtuse angle. The sides and the angles of a triangle are called *elements*; the side on which it is supposed to stand is called the *base*; and the vertex of the opposite angle is then called the *vertex* of the triangle; the distance from the vertex to the base is the *altitude* of the triangle. The following are some of the properties of plane triangles: (1) The greatest side lies opposite to the greatest angle, the least side opposite the least angle, and the intermediate side opposite the intermediate angle: if two sides are equal, their opposite angles are equal, and the reverse. (2) Any side is less than the sum of the other two, and greater than their difference. (3) The sum of all the angles is equal to two right angles: if one angle is a right angle, the sum of the other two is a right angle; if one angle is obtuse, the sum of the other two is less than a right angle. (4) Any line parallel to a side divides the other sides proportionally; and, conversely, a line that divides two sides proportionally is parallel to the third side. (5) The line that bisects any angle divides the opposite side into segments proportioned to the adjacent sides, and conversely. (6) The bisectrices of the three angles meet at a common point, which is the centre of the inscribed circle: and the perpendiculars which bisect the sides meet at a common point, which is the centre of the circumscribed circle; perpendiculars from the vertices to the opposite sides also meet at a common point. (7) If a line is drawn from the vertex to the middle of the base, the sum of the squares of the other sides is equal to twice the square of the line, *plus* twice the square of half the base. (8) In a right-angled triangle the square of the side opposite the right angle is equal to the sum of the squares of the other sides. (9) Two triangles that have an angle in each equal are proportional to the rectangles of the including sides; if the including sides are proportional, the triangles are similar, and then they are to each other as the squares of any two homologous sides. (10) The area of a triangle is equal to the product of its base by half its altitude; it is also equal to the perimeter multiplied by half the radius of the inscribed circle; it is also equal to $\sqrt{\frac{1}{2}s(\frac{1}{2}s-c)(\frac{1}{2}s-b)(\frac{1}{2}s-c)}$, in which a, b, and c denote the sides, and s their sum. (11) If any three elements are given, one being a side, the remaining elements may be determined either by construction or by computation.

Spherical Triangles.—A spherical triangle is a spherical surface bounded by arcs of three great circles. These arcs are called *sides*, and the points at which the sides meet are

vertices. The diedral angles between the planes of the sides are the angles of the triangles. In most cases of practice the sides of the triangles considered are supposed to be less than semicircles. Spherical triangles are classified in the same manner as plane triangles, and corresponding parts receive corresponding names. There is, however, this difference: a spherical triangle may have two right angles, or it may have three right angles; it may even have three obtuse angles. In addition to the terms common to both plane and spherical triangles, we may add the following, peculiar to the latter class: Two spherical triangles are *polar* when the vertices of each are poles of the opposite sides of the other; in this case any element of either is the supplement of the opposite element of the other. A *quadrantal* triangle is one in which one side at least is a *quadrant.* The following are some of the properties of spherical triangles: (1) The greater of two sides lies opposite the greater of the two opposite angles, and conversely; if two sides are equal, their opposite angles are equal, and conversely. (2) Any side is less than the sum of the other two, and greater than their difference. (3) The sum of the three angles may have any value between two right angles and six right angles. (4) The difference of any two sides is less than two right angles, and the sum of the three sides is less than four right angles. (5) The sum of any two angles is greater than the supplement of the third. (6) If the sum of any two sides is equal to two quadrants, the sum of their opposite angles is equal to two right angles, and conversely. (7) If the angles are all acute, each of the sides is less than a quadrant; if the angles are all obtuse, each of the sides is greater than a quadrant; if the angles are all right angles, each side is a quadrant. (8) The area of a spherical triangle is equal to its spherical excess multiplied by the area of a trirectangular triangle: the spherical excess is found by subtracting 180° from the sum of the three angles and dividing the result by 90°; the area of the trirectangular triangle is equal to one-half of a great circle. (9) If any three elements of a spherical triangle are given, the remaining three may be found by computation.

Spheroidal Triangles.—Spheroidal triangles are triangles taken on the surface of an ellipsoid of revolution. The vertices of such a triangle are any three points on the surface of the ellipsoid, the sides are the shortest lines that can be drawn on the surface of the ellipsoid between the vertices, and the angles are the angles between the tangents to the sides at the vertices. The sides are lines of double curvature, which approach more nearly to arcs of great circles as their lengths diminish. The triangles used in geodesic surveys are spheroidal triangles; within moderate limits—that is, when the sides are small—they may be regarded as spherical triangles. W. G. PECK.

Triangle, p.-v. and tp., Broome co., N. Y. P. of v. 273; of tp. 1911.

Triangle of Forces, a modification of the parallelogram or polygon of forces from whence we derive the inference that "if three forces in one plane be in equilibrium about a point, and if on that plane any three mutually-intersecting lines be drawn parallel to the directions of the three forces, a triangle will be formed, the lengths of whose sides will be proportional to the magnitude of the forces."

Triangulation. See GEODESY and SURVEYING.

Trias. See GEOLOGY, by PROF. J. W. DAWSON, LL.D.

Tribe. See APPENDIX.

Tribe's Hill, p.-v., Mohawk tp., Montgomery co., N. Y. P. 365.

Tribonia'nus, quæstor, consul, and master of the offices to Justinian, who in 528 appointed him one of the ten commissioners to form the first *Codex*, in 530 one of the sixteen to compile the Digest or Pandect, and in 532 one of the three to edit the *Institutes.* He is described as a learned and highly-gifted man, but avaricious and of low moral standing. D. in 545.

Trib'une [Lat. *tribunus*, from *tribus*, a "tribe"] designated originally, in the primitive constitution of ancient Rome, an officer who for some purposes represented one of the tribes of which the Roman people consisted; but the term became, in course of time, a frequently-used title for offices of very different character and very unequal power. Thus, after the time of Diocletian there occurs a *tribunus voluptatum*, who superintended all public amusements, especially all theatrical performances. The two most important offices, however, bearing this title, were those of the *tribuni militum* and the *tribuni plebis.* The number of the *tribuni militum* was twenty-four, six to each legion, and each commanding the legion for two months. They were originally chosen by the consuls, but in 362 B. C. the *comitia tributa* acquired the right of electing six, in 311 sixteen, and in 169 the whole number. The consuls, however, retained the right of choosing all the tribunes for the supernumerary legions. Subsequently, the emperors assumed the right of appointing all the tribunes, and as Cæsar had modified and limited the power of the office considerably, the tribunates were generally given to young men of old and wealthy families, who thus prepared themselves for a military career. The *tribuni plebis* were instituted in 494 B. C., after the secession of the plebs to the Mons Sacer. Their office was to defend the plebeians against the arbitrariness and violence of the patricians. Their persons and houses were sacred and inviolable. Their doors were always open, and any one who sought refuge within their precincts was entitled to protection. But their authority was originally merely prohibitory. They could by personal intervention or by the interposition of their veto stop any action of any magistrate, without giving any reason for so doing or without incurring any responsibility, but they had no power of arraignment or punishment, and no share in the administration or legislation. Nevertheless, the history of Rome shows how this merely negative authority by degrees developed into a most formidable positive power, able not only to stop the whole machinery of the administration at any point, but even to mould legislation at will. Their number was originally two, and they were elected by the *comitia centuriata*, but in 471 B. C. the number was increased to five, and the election transferred to the *comitia tributa*; and finally, in 457 B. C., the number was made ten, which it remained to the end of the Empire. By the remodelling of the Roman constitution by Sulla the authority of the tribunes of the people was restricted to its original limits, but Pompey again restored them to full power. Under the Empire, when the *tribunitia potestas* necessarily became vested in the person of the emperor, the tribunate sank down from a governing power to an administrative organ, but it remained alive till the fall of the Empire.

Tribune, The. See GREELEY (HORACE), by GEORGE RIPLEY, LL.D.

Trica'rico, town of Southern Italy, province of Potenza, on a high hill about 36 miles W. of Matera, is a walled town with towers, and contains some noticeable buildings, among others the cathedral, which is said to have been begun in the tenth century. It suffered severely in the earthquake of 1694. P. 6856.

Trice's, tp., Jackson co., Ala. P. 709.

Trichech'idæ [from *Trichechus*—θρίξ, "hair," and ἔχειν, to "have"—a generic name], or **Manat'idæ** [from *Manatus*, "handed," and the generic name], a family of placentiferous mammals of the order Sirenia, typified by the manatees or sea-cows of tropical and sub-tropical regions. The form is fish-like and elongate; the skin very thick and rugose; the head naked and depressed, and with a truncated snout; the eyes are very small; the nostrils are close together on the upper surface near the end of the snout, and are simple lunate fissures convex backward; the mouth is small; the molar teeth are typically nine (8–10) in each jaw, each provided with two large tuberculate and two smaller external transverse ridges; they have severally three roots, two on the outer and one on the inner side; incisor teeth wanting in the adult; the pectoral limbs are elongate, and oar-shaped, paddles mostly kept flexed at the elbows; rudimentary nails are developed; the tail is broad, depressed, and somewhat fan-shaped, having a convex border with a median notch or groove. The skull is noteworthy, as distinguishable from the other members of the order in that the intermaxillary bones have their branches not prolonged backward, and the anterior portions nearly or quite straight; the last or caudal vertebræ (*i. e.* 5 + *x*) are subcylindrical and destitute of transverse processes. Another peculiarity is the possession of only six cervical vertebræ, instead of seven, as in almost all other mammals; the missing one has been regarded by Murie and Chapman as the third. The family, as already indicated, is represented by the manatees of tropical and subtropical regions; they are found along the coasts of seas and rivers, and live upon the herbage that grows on or near the banks. The species have not yet been certainly eliminated; by most authors, however, at least two species are recognized, one of which (*Manatus americanus*) is found along the eastern coast of North America, and another (*M. nasutus*, etc.) is found upon the western coast of Africa. They attain, when full grown, a length of at least six feet. The most recent memoirs upon these animals have been published by Dr. James Murie (*On the Form and Structure of the Manatee* (*Manatus americanus*) in *Trans. Zool. Soc. London*, viii. 1874, pp. 127–202, pl. 17–26) and Dr. Henry C. Chapman (*Observations on the Structure of the Manatee*, in *Proc. Acad. Nat. Sci. Phila.*, 1875, pp. 452–462, pl. 26). THEODORE GILL.

Trichi'na Spira'lis, a parasitic nematoid worm infesting the muscular tissue of the pig, the rat, and some other animals, and liable to occur also in man. As commonly found, this worm is a quiescent encysted parasite, occupying, often in great numbers, the tissue of the voluntary muscles. The cysts are oval in form, more or less shuttle-shaped, or pointed at the two extremities, lying between and parallel with the muscular fibres, about $\frac{1}{60}$th of an inch long and $\frac{1}{100}$th of an inch wide. When of recent origin, they are quite transparent and colorless, and hardly discernible by the naked eye; after a certain period, they become partly opaque from the deposit of calcareous matter, and are then visible as minute whitish specks scattered through the muscular tissue. The worm lies perfectly free in the cavity of the cyst, coiled upon itself in a spiral manner, from which circumstance its specific name is derived. When stretched out, it is of a tapering, cylindrical form, $\frac{1}{25}$th of an inch long, $\frac{1}{350}$th of an inch thick in its widest portion. Its posterior extremity is blunt and rounded, but the anterior half of the body tapers gradually from behind forward, and is comparatively slender. The mouth and anus are situated respectively at the anterior and posterior extremities, and the intestine runs in a direct line from one to the other. The sexes are separate, different individuals being either male or female: but the sexual organs are incompletely developed, and do not exhibit any functional activity. The worm often moves distinctly while still in the cavity of the cyst, the movements consisting of occasional sluggish, partial flexion and extension of the two extremities. In this imperfect and practically sexless condition the parasite may continue for an indefinite time, retaining its vitality, but undergoing no perceptible change. When, however, a portion of trichinous flesh is devoured in the raw state by man or certain kinds of inferior animals, the muscular tissue and the encysting capsules are liquefied by digestion, and the worms are set free in the cavity of the intestine. Here they at once increase in size, and in about two days become developed into mature and sexually perfect trichinæ. The sexes are now readily distinguishable from each other. The male is $\frac{1}{20}$th of an inch long, with a folded spermatic tube occupying the posterior half of the body, and terminating externally at the anus, where it is provided with two projecting conical copulatory appendages. The female is half as long again as the male, and nearly the whole of its posterior two-thirds is occupied by the ovarian tube, which contains the eggs, and which terminates in an external orifice or vulva, at the anterior fifth of the body. At this time fecundation takes place by union of the sexes, and the female, at the end of seven days from the introduction of the trichinous food, begins to produce living embryos, which are discharged successively from the vulva into the surrounding cavity of the intestine. The production of these embryos is very abundant. According to Pagenstecher, it is often possible to count 500 or 600 at one time, fully formed or in process of development, in the body of a mature female; and as the generative act continues for at least a week or ten days, it is probable that each female trichina gives birth in the intestine to 1000 or 2000 living young.

The embryos, when discharged from the body of the female, are rather less than $\frac{1}{200}$th of an inch in length, nearly straight, and tapering somewhat toward the anterior extremity. They immediately begin to penetrate the walls of the intestine and disperse themselves over the body. They have been found under these circumstances in the substance of the intestinal walls, in the mesentery, the diaphragm, the peritoneal and pleural cavities, and thence outwardly in all the voluntary muscles of the trunk and limbs. Their passage takes place quite rapidly, as they may be found in the diaphragm of the rabbit on the eighth to the thirteenth day after feeding with trichinous food, and on the fifteenth or sixteenth day in the muscles generally. On their first arrival in the muscular tissue they are apparently quite free, and capable of moving slowly from one point to another; but they soon afterward become enveloped in a closed capsule or cyst, and there grow to a larger size. As they increase in length within the confined space of the cyst, they become gradually coiled up, thus assuming the spiral form characteristic of the encysted worm. They are then shut off from immediate contact with the surrounding tissues, and pass at once into the quiescent condition.

This process of the development of adult trichinæ in the intestine and the dispersion of their young throughout the system produces in man and animals a severe and often fatal illness, known as *trichinosis*. Its earliest symptoms are those of intestinal irritation, caused by the growth and activity of the ingested worms—namely, abdominal pains, nausea, vomiting, and diarrhœa. There is also fever and loss of appetite. Then follows an œdematous swelling of the face, body, and limbs, with muscular pains and tenderness, especially on motion; so that the patient lies helpless, with the arms and legs in a semiflexed position, and any attempt at either active or passive movement causes suffering. This corresponds with the period of dispersion of the embryonic worms and their establishment in the muscular tissue. There is also marked difficulty of chewing and swallowing, owing to the invasion of trichinæ into the corresponding muscles; hoarseness or loss of voice, due to their presence in the laryngeal muscles; and even in some cases serious disturbance of respiration, from a similar affection of the diaphragm and the intercostals. The fecundity of the adult worms, and the abundant emigration of their embryos into the muscular system, are fully sufficient to account for these symptoms. In man, after death from trichinosis, there have been found in the same subject in the gastrocnemius muscle of the leg 30,000 young trichinæ to the cubic inch; in the biceps muscle of the arm, nearly 70,000; and in the deltoid muscle at the shoulder, over 90,000 in the same space. The severity of the disease, other things being equal, is in direct proportion to the quantity of trichinous food ingested and the number of living parasites which it contained. In severe cases death may take place within the first two days, from the intensity of the diarrhœa and febrile disturbance. More commonly, the fatal termination occurs in the fourth or fifth week. If the patient survive this period, the chances of recovery are much increased, as the parasites have then become encapsuled and are passing into a state of quiescence. When this is accomplished, the morbid symptoms gradually subside, and the patient is restored to a comparatively healthy condition. The encysted trichinæ, however, remain imbedded in the muscular tissue for very long periods, and it is not known whether they ever entirely disappear. They have been found in a man eighteen years after the attack produced by their invasion.

The source of this infection for man is almost invariably trichinous pork; for although the rabbit, the cat, the rat, the mouse, the sheep, and the calf are all susceptible to the disease, as proved experimentally by feeding them with trichinous flesh, yet in the sheep and calf it is only exceptionally produced under these circumstances, and never shows itself spontaneously either in them or in the rabbit. It could not be produced in any of the birds experimented on by Pagenstecher—namely, the common fowl, the turkey, the pigeon, and the goose—nor in frogs or newts, nor in several species of invertebrates. The only animals in which it occurs spontaneously and frequently are the rat and the pig; and the latter has been the source of infection for man in every instance thus far known. The disease, as affecting the human subject, is most frequent in Germany, owing to the habit among certain parts of the population of eating ham, sausages, and even fresh pork in an uncooked condition. Within twelve years after the first recognized case, which happened in Dresden in 1860, there were eleven recorded well-marked local epidemics, of which the most disastrous was that at Hedersleben in 1865, where, out of 2000 inhabitants, over 300 were taken sick and 101 died. In the U. S. it is rare, occurring mainly in isolated cases or among members of a single family who have partaken of the same food.

The danger of infection by trichinosis consists in taking as food pork which is imperfectly cooked. The *fat* of pork is not injurious in this respect, as the adipose tissue never contains trichinæ. But the muscular *flesh* in any of its varieties, as fresh pork, ham, sausages, or the lean parts of bacon, is liable to produce the disease. The pig from which the meat is taken may have long since recovered from the original attack, presenting a perfectly healthy appearance when brought to the slaughter-house, and the parasitic cysts are usually too minute and transparent to attract the attention of the butcher or the provision-dealer. Neither pickling nor smoking, as ordinarily practised, will destroy the vitality of the trichinæ, and they may be found still living in ham or bacon cured by either process. The only protection is that afforded by thorough cooking. The trichinæ are killed by a temperature of 160° F., and meat which has been subjected for a short time to this temperature is harmless. Care must be taken, however, that *all parts* of the meat used be heated to the requisite point, otherwise it is as dangerous as if the whole of it were taken raw. A ham, if boiled for a short time, may be raised to a much higher temperature than 160° on the outside, while its internal parts are still below that point; and fresh pork which has been roasted or broiled may be thoroughly cooked externally, but still red and juicy within. The only safe rule to follow is that the fresh meat should be broiled or roasted until its color is changed throughout, and that for hams the boiling should be continued until the internal parts are perceptibly softened as well as the exterior. Since, in some instances, trichinæ have been found in pigs slaughtered for the market in so large a proportion as 1

in 50, these precautions are indispensable for protection from the disease.

A further consideration of importance relates to the source of infection for the pig itself. Since this is practically the only animal from which man contracts the disease, if trichinosis could be prevented or extirpated in the pig, the human subject would also be free from it. But as the encysted muscular parasite, whether in man, the pig, or the rat, is always quiescent and sexually unproductive, it is not fully evident how the continuation of its species is provided for. No doubt rats are often contaminated by each other, since they are well known to eat each other's flesh when deprived of ordinary supplies of food; and the cat is naturally infected by devouring rats and mice. But as the pig neither feeds upon human flesh nor habitually upon rats, it is not easy to see why the affection should be so frequent among swine, or how it is perpetuated and transmitted from one to the other. There are probably two modes in which this takes place: First, nearly all slaughter-houses are the abundant resort of rats, which feed upon the refuse material, and thus after a time often become trichinous. During the first period of intestinal irritation in these animals some of the adult worms may be discharged with the evacuations, and accidentally mingled with the food of the remaining pigs. It is possible, also, that pigs may occasionally seize and devour rats dead or dying from trichinosis. Secondly, the waste bits of flesh and the general débris of slaughter-houses are sometimes, when removed by washing, allowed to run into the feeding-troughs; and lastly, the flesh of a pig dead from incidental causes, and therefore not considered as fit for the market, may be used as food for the remainder of the drove. In some or all of these ways a certain number of swine may be annually contaminated, and thus serve to perpetuate the disease. The methods, accordingly, which are most likely to reduce its frequency, and, if possible, to exterminate it altogether, are—first, the maintenance in slaughter-houses of extreme cleanliness, no waste material being permitted to remain over night to serve as an attraction for rats, nor allowed to mingle with the food of the remaining pigs; and secondly, swine should never be fed with the flesh of one of their own species which has died from injury or disease.

J. C. DALTON.

Trichinia'sis, or **Trichino'sis,** a disease induced by eating the trichinous flesh of swine. (See TRICHINA SPIRALIS.)

Trichinop'oly, town of British India, capital of a district of the same name in the presidency of Madras, on the Cavery in lat. 10° 50′ N., is an exceedingly hot place and poorly built, mostly consisting of mud huts, but it is the station of a division of the Madras army, and it has important manufactures of cutlery, jewelry, saddlery, and cheroots; an excellent tobacco is grown in the surrounding district. P. 30,000.

Trichiur'idæ [from *Trichiurus*—Gr. θρίξ, "hair," and οὐρά, "tail"—the name of the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, related to the mackerels, but distinguished by the elongated form and the imperfectly-developed anal fin. The body is more or less elongated and compressed, and terminates in a slender tail, which sometimes is filiform, but generally capped by a caudal fin; the skin is naked; the lateral line continuous; the head compressed, generally conic, rarely with a trenchant arched forehead; eyes lateral; opercular bones unarmed; mouth with a deep lateral cleft; upper jaw not protractile, the supramaxillaries more or less coalescent, and hiding mostly under the suborbital bones; teeth in the jaws and palate; branchial apertures large, and confluent below; branchiostegal rays in seven or eight pairs; dorsal fin long, generally single and uninterrupted, sometimes divided into two, with the spinous portion longer than the soft; anal fin represented by numerous almost concealed spines; no dorsal or anal finlets developed; caudal fin forked or wanting; pectoral fins well developed; ventral fins obsolete, or represented by scale-like spines behind the pectoral region. The pyloric appendages are developed in small or moderate number (*e. g.* 6–24); a simple air-bladder is developed, and pseudobranchiæ are present. The skeleton has very numerous vertebræ (*e. g.* A. 39–43 + C. 57–120). The family is composed of few genera, mostly restricted to the high or deep seas. They represent several quite distinct types of structure of sub-family value—viz. (1) Trichiurinæ, in which the dorsal fin is undivided, the tail filiform and finless, and the pectorals extended (as usual) toward the upper angles, including the genera *Trichiurus* and *Eupleuragrammus;* (2) Lepidopodinæ, in which the dorsal is also entire, but the caudal fin is well developed, and the pectoral fins are produced toward the lower angles, with the genera *Lepidopus* and *Eroxymetopon;* and (3) Aphanopodinæ, in which the dorsal is divided. (See Gill in *Proc. Acad. Nat. Sci. Philo.*, 1863, pp. 221–229.)

THEODORE GILL.

Trichodont'idæ [from *Trichodon*—Gr. θρίξ, "hair," and ὀδούς, "tooth," a generic name], a family of fishes of the order Teleocephali and sub-order Acanthopteri. The body is elongated and compressed, and regularly tapers from the head toward the tail; the skin is naked and smooth; the lateral line continuous; the head subquadrate and compressed; the eyes lateral; the preopercula each armed with five spines; the mouth has a very oblique and lateral cleft; the upper jaw is scarcely protractile; teeth are present on the jaws and palate; the branchial apertures are continuous below; branchiostegal rays five; dorsal fins two, oblong, and of nearly equal length, the first with rather numerous (11) spines, the second with simple branched rays; anal fin very long; caudal separate; pectorals large, and with the lower rays not branched; ventral fins approximated and thoracic, and each with a spine and five rays. The family has been constituted for a single genus (*Trichodon*), which is confined to the western coast of North America. Its affinities have been a matter of dispute, but it is probably most nearly related to the Trachinidæ and Uranoscopidæ.

THEO. GILL.

Trichomycter'idæ [from *Trichomycterus*—Gr. θρίξ, "hair," and μυκτήρ, "nostril"—the typical genus], a family of fishes of the order Nematognathi, peculiar to South America. The body is elongated, and the species much resemble some of the loaches of the Old World, and others the catfishes of North America; the skin is entirely naked; the lateral line imperfect and unarmed; the head depressed and invested in the naked skin; the eyes rather dorsal than lateral; the opercula are unarmed or covered with small prickles; the nostrils remote from each other; the mouth is terminal and mostly transverse; the supramaxillaries are, as usual, invested in barbels; the teeth are diversiform; the branchial apertures generally continuous below, sometimes restricted to the sides; branchiostegal rays moderately numerous (8–12); the dorsal fin is short, and situated above or behind the ventrals; anal short, and behind the dorsal; caudal distinct; pectorals well developed laterally, and with a spine; ventrals more or less far back. The family is not thus well defined, but nevertheless seems to be a natural group, which must be confirmed or negatived hereafter by positive characters derived from anatomical, and especially osteological, modifications. The forms thus appearing to resemble each other have been combined by Dr. Günther in his seventh and eighth sub-families—"Siluridæ opisthopteræ" and "Siluridæ branchicolæ"—of the so-called family Siluridæ; these are again distinguishable into three primary groups—viz. (1) Nematogenyina, in which the dorsal is above the ventrals, including the genus *Nematogenys*, not excluding *Hetapterus;* (2) Trichomycterina, in which the dorsal is behind the ventrals, with the genera *Trichomycterus*, *Eremophilus*, and *Pariodon;* and (3) Stegophilina, in which the dorsal and ventral fins are very far behind and the branchiæ restricted to the sides, including the genera *Stegophilus* and *Vandellia*. The representatives of the first two have apparently essentially the same habits as the catfishes of the U. S., but those of the last seem to be peculiar in some respects. It is, for example, said that the species of *Vandellia* enter the urethra of persons while bathing, and thereby cause inflammation, and sometimes death; the truth of this is, however, extremely doubtful; the small size and elongated form of the fishes may, however, be inferred from the alleged attribute.

THEODORE GILL.

Trichonot'idæ [from *Trichonotus*—Gr. θρίξ, "hair," and νῶτος, "back"], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to the East Indian Archipelago and Australasian seas. The body is elongated and subcylindrical; the scales cycloid and of moderate size; the lateral line continuous; the head depressed and pointed; the eyes dorsal and directed upward; the opercula unarmed; the infraorbital bones small; the mouth has a wide and nearly horizontal cleft, and the upper jaw is longest; teeth are developed in villiform bands on the jaws as well as palate; the branchial apertures are very wide, and the branchiostegal membrane scarcely united below the throat; branchiostegal rays seven; dorsal fin single, long, with articulated but not branched rays, and without a distinct spinous portion; anal fin long; ventrals jugular, each with a spine and five rays; there is no papilla near the anus; the alimentary tract has no pyloric appendages; the air-bladder is suppressed; the vertebral column (in *Hemerocoetes* at least) has the normal number (10) of dorsal, but an increased (37) number of vertebræ. The family has been established for "carnivorous fishes, living near the shores of the East Indian Archipelago and of New Zealand," and their affinities are quite doubtful. Two genera have been recognized, each

with one species—viz. *Trichonotus* and *Hemerocœtes*. (See Günther, *Cat. Fishes Brit. Museum*, vol. iii. pp. 484–485.)
THEODORE GILL.

Tri'color, the French national flag, colored blue, white, and red in vertical divisions. It was first adopted during the First Revolution, and it is stated (though not generally believed) that the colors of the livery of Philippe, duke of Orleans (Citizen Égalité), were selected for the national flag. In point of fact, a large proportion of the flags of civilized nations are tricolors.

Tricou'pis (SPIRIDION), b. at Missolonghi, Greece, in 1791; studied in France and England; served in the army during the Revolution; was sent as ambassador to London and Paris several times during the reign of King Otho, and continued to participate very actively in public life till his death, Feb. 24, 1873. He enjoyed a great reputation as an orator, poet, and historian, his principal work being Ἱστορία τῆς Ἑλληνικῆς Ἐπαναστάσεως ("History of the Greek Revolution"), 1862.

Trident'ine Profession of Faith (*Professio Fidei Tridentinæ*), or the **Creed of Pius IV.,** is a clear and concise summary of the doctrines of the Council of Trent, suggested by that council, prepared by a college of cardinals under the supervision of Pope Pius IV., and issued by him Nov. 13, 1564. It consists of twelve articles, including the Nicene Creed, and is put in the form of an individual profession and solemn oath (*profiteor, spondeo, voveo ac juro*). It is binding upon all Roman Catholic priests and public teachers in seminaries, colleges, and universities. It is also used for Protestant converts to the Roman Catholic Church, and hence called the "Profession of Converts." (For converts from the Greek Church a modified formula was introduced by Pope Gregory XIII. in 1575.) The tenth article reads: "I acknowledge the holy Catholic Apostolic Roman Church as the mother and mistress of all churches, and I promise and swear true obedience to the bishop of Rome as the successor of St. Peter, prince of the apostles, and as the vicar of Jesus Christ." (See the Latin text in the two papal bulls of Nov. 13 and Dec. 9, 1564, and in Denzinger's *Enchiridion*, pp. 292–294.) A history of this creed, with much interesting information, was written by Mohnike, *Urkundliche Geschichte der Professio Fidei Tridentinæ* (Greifswald, 1822).
PHILIP SCHAFF.

Trid'ymite [Gr. τρίδυμοι, "triplets," or "trines," from the crystals being compounds of threes], an allotropic modification of silica, discovered in 1868 by the eminent mineralogist Von Rath as occurring in a volcanic porphyry from Cerro San Cristoval in Mexico. It has since been identified elsewhere, and is possibly a common mineral in some eruptive rocks, having been mistaken for quartz. An eruption of volcanic ashes from Volcano, one of the Lipari Islands, in Sept., 1873, was found by Baltzer to be composed of silica having all the characters of tridymite. Tridymite is hexagonal in crystallization, like quartz, but differs from the latter in possessing double refraction, like calcite, and its density was found by Von Rath to be about 2.3. The writer's new geometric law of condensation makes it (at zero) 2.308, while the same law gives for quartz 2.662. (See *American Chemist* for Mar., 1876, p. 331.)
HENRY WURTZ.

Triest', or **Trieste,** city of the Austrian empire, on the Gulf of Triest, at the N. E. extremity of the Adriatic Sea. The old town, which is surrounded with walls and mostly consists of narrow and tortuous streets, is built on a steep acclivity, at the foot of which the new town extends along the harbor; between the two parts of the town runs the Corso, a broad, elegant thoroughfare, opening into large squares lined with magnificent edifices and ornamented with fountains and monuments. Its manufactures are numerous, and some of them very important; as, for instance, its shipbuilding. White lead, candles, wax, soap, rosoglio, leather, spirits, and earthenware are extensively manufactured. It is from its commerce, however, that Triest principally derives its importance. Its harbor is safe, spacious, and deep, admitting vessels of 300 tons burden close to its quays. The value of the annual imports amounts to about £15,000,000, and that of the exports to about £10,000,000. It has a naval and a mercantile academy and a school of navigation, and it is the headquarters of the Austrian Lloyd's Steam-packet Co., which has magnificent docks and arsenals here. P. 70,271.

Trigem'inus [Lat.], the fifth pair of nerves, which arise from the side of the pons varolii, where its fibres are prolonged into the middle crura of the cerebellum, and are divided within the cranium into the orbital and the superior and the inferior maxillary branches. The orbital branch is divided into the frontal, lachrymal, and nasal nerves; the superior maxillary into the spheno-palatine, posterior alveolar, and infraorbital nerves; and the inferior maxillary into the internal lingual and the inframaxillary. The trigeminal nerve consists of a ganglionic and a non-ganglionic portion. (See also GANGLIONIC NERVOUS SYSTEM, HISTOLOGY, and NERVES.)

Trigg, county of S. W. Kentucky, bordering on Tennessee, bounded W. by Tennessee River and drained by the Cumberland; surface hilly, containing bituminous coal, iron, and limestone; soil fertile in some parts. There are flour-mills, saw-mills, tanneries, currying establishments, and ironworks. Swine, cattle, and sheep are numerous. Staples, tobacco, Indian corn, wheat, wool, leather, lumber, and dairy products. Cap. Cadiz. Area, 530 sq. m. P. 13,686.

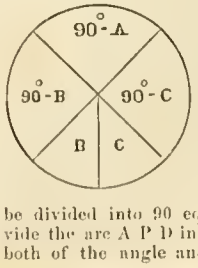
Triggia'no, town of Southern Italy, province of Bari delle Puglie, in a fertile vine and olive bearing district near the Adriatic. P. 7009.

Trig'lidæ [from *Trigla*—an ancient name—one of the genera], a family of fishes of the order Teleocephali and sub-order Acanthopteri, including species popularly known as gurnards, sea-robins, flying-fishes, etc. The body is elongated and coniform from the postcephalic region backward; the scales are diversiform in the several groups; the lateral line is continuous; the head more or less quadrate and angular or parallelopiped; the eyes are lateral; the opercular and suborbital bones naked, and generally more or less sculptured; one of the suborbitals is very large, covering the cheek, and articulates with the preoperculum; the mouth is subterminal, and has a lateral nearly horizontal cleft; the upper jaw is slightly protracted and longest; teeth villiform, on the jaws and generally the palate; branchiostegal apertures continuous below; branchiostegal rays developed in seven pairs; dorsal fins two, the first with spinous rays, and the second with articulated ones; anal fin opposite the dorsal; the caudal distinct and well developed; pectorals more or less enlarged, and with their lower rays simple and generally isolated and distinct from the rest of the fin; ventral fins thoracic, separated by a wide area, and each with a spine and five soft rays; the alimentary canal has pyloric appendages developed in moderate number; an air-bladder is present; the skeleton has the vertebræ generally in slightly increased number (*e. g.* A. 10–15 + C. 15–22). The family has been framed for certain forms distinguished by a peculiar physiognomy. They represent three distinct subfamilies—viz. (1) Triglinæ, in which the three lowermost rays of the pectorals are elongated, enlarged, and entirely free, and the scales are small, including the genera *Trigla*, *Prionotus*, etc.; (2) Peristethinæ, in which the two lowermost rays of the pectorals are enlarged and separate, and the scales large and plate-like, represented only by the genus *Peristethus* or *Peristedion*; and (3) Dactylopterinæ, in which the lowermost rays of the pectorals are mostly united with the others, the whole forming a very large wing-like fin, which enables the animal to fly or skim over the water, and the scales are moderate and carinated, typified by the genus *Dactylopterus*. The family is represented on the eastern American coast by four species of *Prionotus* and one of *Dactylopterus*, and elsewhere, in almost every sea, by one or more generic forms.
THEODORE GILL.

Trigonom'etry [Gr. τρίγωνον, a "triangle," and μέτρον, a "measure"], a branch of mathematics whose primary object is to explain the method of solving triangles; it also treats of the general relations of circular functions. It is divided into three great branches—*plane*, *spherical*, and *analytical*. *Plane trigonometry* treats of the relations between the sides and angles of plane triangles; *spherical trigonometry* treats of the relations between the sides and angles of spherical triangles; and *analytical trigonometry* treats of the general relations between circular functions.

Measure of an Angle.—For the purposes of plane and spherical trigonometry, angles are expressed in *degrees*, *minutes*, and *seconds*, denoted by the symbols °, ′, ″; and in analysis they are expressed in terms of the radius of the arcs which subtend the angles. In the former case the right angle is the *primary* unit; in the latter case the primary unit is the angle whose subtending arc is equal to its radius. In both cases the angle is expressed in terms of the subtending arc. To explain these methods of measurement, let A C D be a right angle; then, with C as a centre, and with a radius C A equal to 1, describe an arc A P D intersecting the sides of the angle at A and D. Let the angle A C D be divided into 90 equal parts by radii; these will divide the arc A P D into 90 equal parts; the equal parts, both of the angle and the arc, are called *degrees*. If

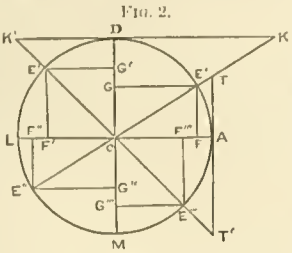
FIG. 1.



we draw any radius, as C P, the intercepted arc A P will contain as many degrees of the quadrant as the angle A C P does of the right angle. It is in this sense, and in this sense only, that we say an angle is measured by an arc. For convenience of expression, each degree is divided into 60 equal parts called *minutes*, and each minute is divided into 60 equal parts called *seconds*. Again, let the arc A P be equal in length to the radius C A; that is, to 1. If we take A C P as the unit angle, any other angle, as A C Q, will contain as many units as there are units in the quotient of the arc A Q by A P. Because the circumference whose radius is 1 is equal to 2π, or 6.2832, the arc A P, in degrees, is equal to $\frac{360}{6.2832}°$; that is, to 57°.3 nearly, or, more exactly, to 206265″. If the arc A Q contains 75.5°, the linear measure of the angle A C Q is equal to 1.3 nearly; that is, it contains the unit angle 1.3 times.

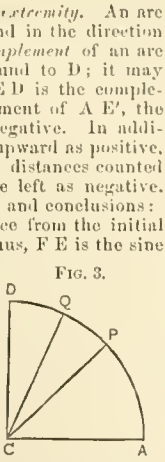
Circular Functions.—Angles are most readily compared by means of certain lines, whose values depend on the values of the subtending arcs, and which are called *circular functions*. The nature of these lines will be most readily explained by the aid of a diagram. Let a circumference be described from C as a centre, and with a radius C A equal to 1. Draw A L and M D, dividing the circumference into four quadrants, and call A L the *initial* diameter. Suppose every arc considered to commence at A, which is then called the *origin of arcs*, and to be estimated around in the direction A D L; let the point where the arc terminates be called its *extremity*. An arc commencing at A, and estimated around in the direction A M L, is said to be *negative*. The *complement* of an arc is the distance from its extremity around to D; it may be either positive or negative; thus, E D is the complement of A E, and E′ D is the complement of A E′, the former being positive, and the latter negative. In addition, we regard all distances estimated upward as positive, all distances downward as negative, all distances counted to the right as positive, and all to the left as negative. We have, then, the following definitions and conclusions:

Fig. 2.



(1) The *sine* of an arc is the distance from the initial diameter to the extremity of the arc: thus, F E is the sine of A E, F′ E′ is the sine of A E′, F‴ E‴ the sine of A E″, and F‴ E‴ the sine of A E‴. Hence, if an arc terminates in either the first or second quadrant—in which case it is said to lie in the corresponding quadrant—its sine is *plus*; if it lies in the third or fourth quadrant, its sine is *minus*.

Fig. 3.



(2) The *cosine* of an arc is the distance from the centre to the foot of the sine: thus, C F is the cosine of A E, and C F′ is the cosine of A E′. If an arc lies in the first or in the fourth quadrant, its cosine is *plus*; if it lies in the second or in the third quadrant, its cosine is *minus*.

(3) The *tangent* of an arc is a portion of a tangent to the arc at the origin, which is included between the origin and the prolongation of the diameter through the extremity of the arc; thus, A T is the tangent of A E, and A T′ is the tangent of A E′. If an arc lies in the first or in the third quadrant, its tangent is *plus*; if in the second or fourth, its tangent is *minus*.

(4) The cotangent of an arc is the tangent of its complement, the origin of the complement being taken at D: thus, D K is the cotangent of A E, and D K′ is the cotangent of A E′. If the arc lies in the first or in the third quadrant, its cotangent is *plus*; if in the second or fourth, it is *minus*.

(5) The *secant* of an arc is the distance from the centre to the extremity of the tangent: thus, C T is the secant of A E, and C K′ is the secant of A E′. The secant, being radial, is said to be positive when estimated from the centre in the direction *toward* the extremity of the arc, and negative when estimated in the direction *from* the extremity. In the first and fourth quadrants the secant is *plus*; in the second and third it is *minus*.

(6) The *cosecant* of an arc is the secant of its complement: thus, C K is the cosecant of A E, and C K′ of A E′. In the first and second quadrants the cosecant is *plus*; in the third and fourth it is *minus*.

(7) The *versed sine* of an arc is the distance from the foot of the sine to the extremity of the arc: thus, F A is the versed sine of A E, and T′ A of A E′. The versed sine is always *plus*.

(8) The *co versed sine* of an arc is the versed sine of its complement: thus, G D is the versed sine of A E, and I G D of A E. The co versed sine is always *plus*.

The general relations between the circular functions of any arc from 0° to 360° are expressed by the following equations, in which x denotes the arc, and this whether the arc is *plus* or *minus*:

$$\sin^2 x + \cos^2 x = 1. \qquad \tan x \cot x = 1.$$

$$\text{ver. } \sin x = 1 - \cos x. \qquad \sec x = \frac{1}{\cos x}.$$

$$\text{co-ver. } \sin x = 1 - \sin x. \qquad \operatorname{cosec} x = \frac{1}{\sin x}.$$

$$\tan x = \frac{\sin x}{\cos x}. \qquad \sec^2 x = 1 + \tan^2 x.$$

$$\cot x = \frac{\cos x}{\sin x}. \qquad \operatorname{cosec}^2 x = 1 + \cot^2 x.$$

Limiting Values of the Circular Functions.—The limiting values are those values which the functions assume when the arc terminates at the extremity of any quadrant. If we follow the arc around from A, through D, L, and M back to A, bearing in mind that what is true of a varying magnitude up to a limit is true at the limit, we shall have the following results: $\sin 0° = 0$, $\cos 0° = 1$; $\sin 90° = 1$, $\cos 90° = +0$; $\sin 180° = +0$, $\cos 180° = -1$; $\sin 270° = -1$, $\cos 270° = -0$; $\sin 360° = -0$, $\cos 360° = 1$. If we now substitute these results in the proper equations of the preceding group, we shall find the limiting values of the different functions, as shown in the following table:

Deg.	Sin.	Cos.	Tan.	Cot.	Sec.	Cosec.	V. sin.	Co-v. sin.
0°	+0	+1	+0	+∞	+1	+∞	+0	+1
90°	+1	+0	+∞	+0	+∞	+1	+1	+0
180°	+0	-1	-0	-∞	-1	+∞	+2	-1
270°	-1	-0	+∞	+0	-∞	-1	+1	+2
360°	-0	+1	-0	-∞	+1	-∞	+0	+1

PLANE TRIGONOMETRY.—Every plane triangle consists of six parts—three sides and three angles. When three of these parts are given, one of which is a side, the remaining parts may be computed. The operation of finding the unknown parts is called the *solution* of the triangle. The solution is made by means of formulas which express the relations between the parts of the triangle.

Solution of Right-angled Triangles.—The following formulas express all the essential relations between the sides and angles of a right-angled triangle. In them the right angle is denoted by A, the acute angles by B and C; the hypothenuse is denoted by a, and the sides opposite B and C are represented by b and c. Because the angles B and C are complementary, either may be found when the other is known by simple subtraction; hence, the formulas only take account of one of them. The symbols $\sin^{-1}$, $\cos^{-1}$, etc., are read, *The arc whose sine is*, *The arc whose cosine is*, etc.:

$$a = \sqrt{b^2 + c^2} = \frac{b}{\sin B} = \frac{c}{\cos B}; \quad . \quad . \quad . \quad . \quad (1)$$

$$b = \sqrt{a^2 - c^2} = a \sin B = c \tan B; \quad . \quad . \quad . \quad (2)$$

$$c = \sqrt{a^2 - b^2} = a \cos B = p \cot B; \quad . \quad . \quad . \quad (3)$$

$$B = \sin^{-1}\frac{b}{a} = \cos^{-1}\frac{c}{a} = \tan^{-1}\frac{b}{c}. \quad . \quad . \quad . \quad (4)$$

In applying these formulas the multiplications and divisions are made by means of logarithms.

Solution of Oblique-angled Triangles.—The solution of every case of oblique triangles may be effected by means of the following formulas, in which A, B, and C denote the angles of a triangle, and a, b, and c the sides lying opposite to them, and $s = a + b + c$:

$$a : b : c :: \sin A : \sin B : \sin C: \quad . \quad . \quad . \quad (1)$$

$$a + b : a - b :: \tan \tfrac{1}{2}(A + B) : \tan \tfrac{1}{2}(A - B) \quad . \quad (2)$$

$$\sin \tfrac{1}{2} A = \sqrt{\frac{(\frac{1}{2}s - b)(\frac{1}{2}s - c)}{bc}} \quad . \quad . \quad (3)$$

The sine of an arc is equal to the sine of its supplement; hence, when an angle is determined by means of its sine, there may be two solutions. Whether there are two or one must be determined by a discussion of the particular case.

SPHERICAL TRIGONOMETRY.—Every spherical triangle contains six parts—three sides and three angles. When any three of these parts are given, the other three may be found.

Solution of Right-angled Spherical Triangles.—A right-angled spherical triangle may be solved when we have given any two parts besides the right angle, by two simple rules called Napier's rules for circular parts. If we denote the angles by A, B, and C, A being the right angle, and the opposite sides by a, b, and c, the sides about the right

angle, the complement of the hypothenuse, and the complements of the angles B and C are called *circular parts*. Let these parts be arranged in order, as shown in the diagram; then each part will be *adjacent* to two other parts, or will be separated from two other parts called *opposite*. When so arranged, the parts are subject to the following rules: (1) *The sine of any part is equal to the rectangle of the tangents of the adjacent parts.* (2) *The sine of any part is equal to the rectangle of the cosines of the opposite parts.*

Solution of Quadrantal Spherical Triangles.—A quadrantal spherical triangle is one in which one of the sides is a *quadrant*. Such triangles may be solved by passing to the corresponding polar triangles, which will be right-angled. These triangles are then solved by Napier's rules for circular parts, and from the results we may find the corresponding parts of the given triangles by the reverse process of passing back to the given triangles.

Solution of Oblique Spherical Triangles.—Let A, B, and C denote the angles of an oblique spherical triangle, and let a, b, and c denote the opposite sides; also let $S = A + B + C$; and $s = a + b + c$; we shall then have the following formulas for solving oblique spherical triangles:

$$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}.$$

$$\cos \tfrac{1}{2} A = \sqrt{\frac{\sin \frac{1}{2} s \sin (\frac{1}{2} s - a)}{\sin b \sin c}}.$$

$$\cos \tfrac{1}{2} a = \sqrt{\frac{\cos (\frac{1}{2} S - C) \cos (\frac{1}{2} S - B)}{\sin B \sin C}}.$$

$$\tan \tfrac{1}{2} (A + B) = \cot \tfrac{1}{2} C \times \frac{\cos \frac{1}{2} (a - b)}{\cos \frac{1}{2} (a + b)}.$$

$$\tan \tfrac{1}{2} (A - B) = \cot \tfrac{1}{2} C \times \frac{\sin \frac{1}{2} (a - b)}{\sin \frac{1}{2} (a + b)}.$$

$$\tan \tfrac{1}{2} (a + b) = \tan \tfrac{1}{2} c \times \frac{\cos \frac{1}{2} (A - B)}{\cos \frac{1}{2} (A + B)}.$$

$$\tan \tfrac{1}{2} (a - b) = \tan \tfrac{1}{2} c \times \frac{\sin \frac{1}{2} (A - B)}{\sin \frac{1}{2} (A + B)}.$$

When any part is determined by means of its sine, there may be one or two solutions. Whether there are one or two can only be determined by a discussion of each particular case.

The solution of a spherical triangle may often be facilitated by the introduction of an auxiliary angle. Thus, if we have two sides and their included angle, we may find the third side by the formulas

$$\cos a = \frac{\cos b \sin (c + \phi)}{\sin \phi}, \text{ and } \cot \phi = \tan b \cos A.$$

In like manner, if we have two angles and their included sides, we may find the remaining angle by the formulas

$$\cos A = \frac{\cos B \sin (C - \phi)}{\sin \phi}, \text{ and } \cot \phi = \tan B \cos a.$$

Formulas of this kind are particularly useful when we wish to determine a single part without completing the solution of the triangle.

Analytical Trigonometry.—Besides the formulas expressing the relation between the functions of a single arc, already given, the following, which express more extended relations, are of continual use in analysis:

$$\sin (a \pm b) = \sin a \cos b \pm \sin b \cos a.$$
$$\cos (a \pm b) = \cos a \cos b \mp \sin a \sin b.$$
$$\tan (a \pm b) = \frac{\tan a \pm \tan b}{1 \mp \tan a \tan b}.$$
$$\sin 2a = 2 \sin a \cos a; \quad \cos 2a = \sin^2 a - \cos^2 a.$$
$$\sin \tfrac{1}{2} a = \sqrt{\tfrac{1}{2} (1 - \cos a)}; \quad \cos \tfrac{1}{2} a = \sqrt{\tfrac{1}{2} (1 + \cos a}.$$

To these we may add the following relations between the parts of a spherical triangle, due to Gauss, and of frequent use in astronomical investigations:

Let $p = \cos \frac{1}{2} c \sin \frac{1}{2} (A + B)$; $P = \cos \frac{1}{2} C \cos \frac{1}{2} (a - b)$:
$q = \cos \frac{1}{2} c \cos \frac{1}{2} (A + B)$; $Q = \sin \frac{1}{2} C \cos \frac{1}{2} (a + b)$:
$r = \sin \frac{1}{2} c \sin \frac{1}{2} (A - B)$; $R = \cos \frac{1}{2} C \sin \frac{1}{2} (a - b)$:
$s = \sin \frac{1}{2} c \cos \frac{1}{2} (A - B)$; $S = \sin \frac{1}{2} C \sin \frac{1}{2} (a + b)$:

Then will the following conditions be satisfied:
$pq = PQ$; $pr = PR$; $ps = PS$; $qr = QR$; $qs = QS$; $rs = RS$.

W. G. Peck.

Tri'kala, or **Tirhala,** town of European Turkey, eyalet of Salonica, has large cotton manufactures, cotton being extensively grown in the surrounding districts. P. about 10,000.

Trilin'ear Co-ordinates. The equation of any right line in Cartesian co-ordinates may be put in the form

$$x \cos \phi + y \sin \phi - p = 0,$$

in which ϕ is the angle made by the lines with the axis of x, and p is length of a perpendicular upon it from the origin. If x' and y' be the co-ordinates of any point whatever, $x' \cos \phi + y' \sin \phi - p$ will express the length of a perpendicular from the point, or the *distance* of the point x' y' from the line. Call this distance α. Let β and γ be in the same manner the distances of the point x' y' from any two other arbitrarily-chosen lines. We may imagine a system of *trilinear* co-ordinates in which the position of a point is defined by its distances from three fixed lines, and in which the position of any right line is defined by a homogeneous equation between these distances of the form

$$l\alpha + m\beta + n\gamma = 0.$$

The advantage of trilinear co-ordinates is, that whereas in Cartesian (or x and y) co-ordinates the utmost simplification we can introduce is by choosing *two* of the most remarkable lines in the figure for axes of co-ordinates, we can in trilinear co-ordinates obtain still more simple expressions by choosing *three* of the most remarkable lines for the lines of reference α, β, γ.

If the equation (Cartesian or trilinear) of any line be $\lambda x + \mu y + \nu z = 0$, then evidently, if λ, μ, ν be known, the position of the line is known; and we may call these three quantities (or rather their mutual ratios, with which only we are concerned) the co-ordinates of the right line. If the line pass through a fixed point x' y' z', the relation must be fulfilled $x'\lambda + y'\mu + z'\nu = 0$; if, therefore, we are given any equation connecting the co-ordinates of a line, of the form $a\lambda + b\mu + c\nu = 0$, this denotes that the line passes through the fixed point (a, b, c), and the given equation may be called the equation of the point. Further, we may use abbreviations for the equations of points, and may denote by α, β, the quantities $x'\lambda + y'\mu + z'\nu$, $x''\lambda + y''\mu + z''\nu$; then it is evident that $l\alpha + m\beta = 0$ is the equation of a point dividing in a given ratio the line joining the points α, β; that $l\alpha = m\beta$, $m\beta = n\gamma$, $n\gamma = l\alpha$, are the equations of three points which lie on a right line; that $\alpha + k\beta$, $\alpha - k\beta$ denote two points harmonically conjugate with regard to α, β, etc. (See Harmonic Ratio.) The system of co-ordinates by which, as above, the position of a line is expressed by co-ordinates, and that of a point by an equation, is that of tangential co-ordinates. (See Pole and Polar, and for fuller exposition see Salmon's *Conic Sections*.)

J. G. Barnard.

Tril'lium [Lat. *trilix*, "triple," so called from the division of its parts], a genus of perennial herbaceous North American plants, now placed in a sub-order of the lily family, embraces a dozen species, all of which grow wild in marshy grounds from Maine to Florida, consist of a naked stem a foot high, surmounted by three ovate netted-veined leaves, a large flower, and a purple three-celled berry. They are cultivated in gardens, highly valued for their beauty, and commonly known by the names of three-leaved nightshade, wake-robin, birth-root, or Indian balm. They have astringent, expectorant, and tonic qualities, and yield resin, tannic acid, and a volatile oil.

Tril'obite [Gr. τρεῖς, "three," and λοβός, a "lobe"], the common name of a group of fossil crustaceans, among the oldest of the Articulata, and were so called from the triple division of the body. They were once among the most abundant forms of animal life. The number of genera and of species is very great, being found in nearly all the older strata throughout the world. Among the American localities most noted for trilobites are Trenton Falls, N. Y., and Lebanon, O. In Adams co., O., a trilobite has been found twenty inches in length. (See Geology.)

Trim'belle, tp., Pierce co., Wis. P. 633.

Trim'ble, county of Northern Kentucky, lying on Ohio River; surface hilly, soil fertile. Staples, tobacco, Indian corn, and wool. Cap. Bedford. Area, 150 sq. m. P. 5557.

Trimble, p.-v. and tp., Athens co., O. P. of v. 81; of tp. 1379.

Trimble (Allen), b. in Augusta co., Va., Nov. 24, 1783; removed to Lexington, Ky., in infancy; settled in Highland co., O., in 1804; was clerk of the courts and recorder 1809–16; commanded a mounted regiment under Gen. Harrison 1812–13; was a member of the State assembly 1816, of the State senate 1817–26, Speaker 1819–26, acting governor 1821–22, governor 1826–30, and president of the first State board of agriculture 1846–48. As governor he promoted educational extension, penitentiary reform, and the encouragement of manufactures. D. at Hillsborough, O., Feb. 2, 1870.

Trimble (Robert), b. in Berkeley co., Va., in 1777; removed to Kentucky when three years old; received a scanty early education, but became a school-teacher; studied law under George Nicholas; was admitted to the bar 1803; settled at Paris, where he was chosen to the legislature; became judge of the court of appeals 1808,

chief-justice of Kentucky 1810, U. S. district attorney 1813; was district judge of Kentucky 1816–26, and justice of the U. S. Supreme Court from 1826 to his death, Aug. 25, 1828.

Trimble (William A.), brother of Col. Allen, b. in Woodford co., Ky., Apr. 4, 1786; educated at Transylvania University; studied law under Judge Robert Trimble, and afterward at Lichfield law school; commenced legal practice at Highland, O., 1811; served in the war of 1812–15, attaining the rank of lieutenant-colonel of U. S. infantry, which he held until 1819; was U. S. Senator 1819–21, and commissioner with Gen. Cass to treat with the Indians at Green Bay, Wis., 1821. D. at Washington, D. C., Dec. 13, 1821.

Trim'mer (Sara **Kirby**), b. at Ipswich Jan. 6, 1741; manifested early capacity, and in 1762 became the wife of Mr. Trimmer. She commenced her career as an authoress in 1780 by the publication of *An Easy Introduction to the Knowledge of Nature*, and continued it to the close of her life, writing especially for the young, and also for a time conducted the *Family Magazine* and the *Guardian of Education*. Among her numerous works are—*Sacred History* (6 vols.), *Outline of Ancient History, Outline of Roman History, Fabulous Histories, History of England, Abridgment of the Old and New Testaments, New and Comprehensive Lessons on the Old and New Testaments, Ladder to Learning, Instructive Tales, History of the Robins, Prayers and Meditations, Companion to the Book of Common Prayer, The Economy of Charity, Teacher's Assistant*, and *View of the New System of Education promulgated by Mr. Joseph Lancaster*. She was strongly opposed to Lancaster's system, and an earnest advocate of that of Dr. Bell. D. at Brentford Dec. 15, 1810.

Trimûrti [Sansk., from *tri*, "three," and *mûrti*, "form"], the Hindoo triad, an expression implying the unity of the creative, preservative, and destructive principles of the primal deity of the Hindoos. The three gods, Brahma, Vishnu, and Siva, together constitute the Trimûrti, which is, says the Matsya Purana, "one person and three gods."

Trincomalee', town of Ceylon, on the north-eastern coast of the island, has the "finest harbor in the world" (an expression of Nelson), but the place is exceedingly hot and unhealthy. P. about 20,000.

Trinidad', the southernmost island of the West Indies, opposite the mouth of the Orinoco, belongs to Great Britain. Area, 1754 sq. m. P. 84,438. A chain of mountains covered with red cedar, palms, and different kinds of trees yielding excellent timber and ornamental woods, extends along the northern shore, and sends out branches toward the S., between which beautiful valleys open into large plains which terminate in swamps along the coast. The island is of volcanic formation. Mud-volcanoes, perpetually boiling, though seldom overflowing, occur, and submarine volcanoes are found on both sides of the island. A curious phenomenon is the pitch lake, 1½ miles in circumference and covered with stiffened bituminous matter, cold and hard except in the centre, where it is still boiling. The soil is exceedingly fertile, and sugar, molasses, rum, cocoa, cotton, and coffee are largely produced. Only a small portion of the ground, however, is under cultivation. Cap. Port of Spain.

Trinidad, p.-v. and tp., Klamath co., Cal. P. of v. 160; of tp. 374.

Trinidad, p.-v., cap. of Las Animas co., Col., 95 miles from the railroad dépôt at West Las Animas, has 2 churches, 3 schools, 2 banks, 1 convent, 2 newspapers, 2 hotels, and 3 grist-mills. It is a great wool and hide market for South Colorado and New Mexico. Rich deposits of bituminous coal abound. Principal business, farming and grazing. P. about 2000. John C. Fitnam, Ed. "Trinidadian."

Trinità'poli [formerly *Casaltrinità*], town of Italy, province of Foggia, made unhealthy by the neighboring salt-pools, which are, however, a source of some income. P. 6662.

Trinitarians. See Redemptionists.

Trinitrocarbol'ic Acid, Trinitrophenol, Trinitrophenic Acid, Carbazotic Acid, Picric Acid ($C_6H_3(NO_2)_3O$), first observed by Hausmann in 1788, afterward examined by Liebig, Dumas, and Laurent. It is produced by the action of hot nitric acid on phenol, salicine, salicylic acid, indigo, aloes, benzoin, resin of *Xanthorrhœa hastilis*, resin of Peru balsam, silk, etc. It is usually prepared from pure crystallized phenol. It crystallizes in beautiful pale-yellow, scaly crystals or needles. It dissolves in 86 parts of water at 60° F., and in much less at 212° F. It is soluble in alcohol, ether, and benzol, and in sulphuric and nitric acids. When heated it melts, and on cooling solidifies to a crystalline mass; at a higher temperature it sublimes; when quickly heated, it explodes. Its taste is very bitter. Its solution in water is yellow, and it imparts a yellow color to the skin and to silk and wool; hence it is used as a yellow dye. By reducing agents, sulphide of ammonium, etc., it is converted into picramic acid, $C_6H_5N(NO_2)_2O$, which has been used as a dye for silk, producing a series of colors like those of catechu. Treated with a hot concentrated solution of cyanide of potassium, it yields a blood red solution of isopurpurate of potassium. This compound has been used to dye wool maroon tints; it is very explosive, and to avoid accident it is generally supplied in the form of a paste containing glycerine. Picric acid is used as a dye for silk and wool; it was suggested by Guinon of Lyons in 1845. By mordanting with argol or alum before dyeing, the color is rendered more stable. It has been common to supply of late for this purpose the picrate of soda, which is very explosive, and has already given rise to serious accidents. A beautiful green dye is made by mixing the picric acid with indigo carmine. This mixture has been imported into New York under the name *viridine*. The Victoria yellow is trinitro-cresol, not picric acid. Leather is dyed with picric acid, particularly alum-tawed leather for belt lacings. Goods dyed with picric acid resist light well, but are liable to suffer on washing with soap. As vegetable fibres do not take picric acid, it affords a ready method for detecting cotton and flax when mixed with silk or wool. It is said to be used as a substitute for hops in making beer. Picrate of ammonia has been recommended as a substitute for quinine in medicine. Hager (*Zeit. An. Chem.*, ix. 110) suggests its use as a reagent for alkaloids. He finds it a very delicate test for some of them, even in solutions containing much sulphuric acid. It precipitates brucine, strychnine, veratrine, quinine, quinidine, cinchonine, and most of the opium alkaloids, but does not precipitate morphine, atropine, pseudo-morphine, caffeine, nor the glucosides. It is also used as a reagent for certain hydrocarbons, with which it forms beautiful crystalline compounds of different colors; *i. e.* naphthalene yellow, retene orange-yellow, anthracene ruby-red, chrysene yellow. (See Watts's *Dict.*, iv. 405; *Suppl.*, 911.) Picric acid is monobasic, and forms bitter crystalline salts, many of which are very explosive. A mixture of 54 parts of picrate of ammonia and 46 of nitrate of potassa has been used as a substitute for gunpowder. Other mixtures are, for gunpowder, picrate of potassa, nitre, and carbon. For explosive powder for torpedoes the carbon is omitted. (See Explosives.) C. F. Chandler.

Trinitrocel'lulose ($C_6H_7(NO_2)_3O_5$), a name given to gun-cotton, indicating its preparation from, and relation to, cellulose. (See Pyroxyline.)

Trinity. See God, by Prof. A. A. Hodge, S. T. D.

Trin'ity, port of entry, cap. of Trinity district, Newfoundland, on Trinity Bay; lat. of harbor, 48° 22′ N., lon. 53° 24′ W. It has an excellent harbor and a jail. The fisheries are the leading pursuit. P. 1431.

Trinity, county of N. W. California, bounded E. by the Coast Range, intersected by Trinity River: surface hilly, and in some parts mountainous, with large forests of pine, fir, and oak, and gold-mines, which are worked to a considerable extent, mining forming the chief industry. Cap. Weaverville. Area, about 1800 sq. m. P. 3213.

Trinity, county of E. Texas, lying between Trinity and Nueces rivers, drained by several creeks, and crossed in its W. part by Houston and Great Western R. R.: surface generally level, soil fertile. Cattle and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Trinity. Area, 945 sq. m. P. 4141.

Trinity, tp., Randolph co., N. C., the seat of Trinity College. P. 1471.

Trinity, p.-v. and cap. of Trinity co., Tex.

Trinity Centre, p.-v., Trinity co., Cal. P. 160.

Trinity College, an institution of learning at Hartford, Conn., known until 1845 as Washington College, was opened in 1824 under the direction of the Protestant Episcopal Church. In 1872 the college grounds within the city were sold as a site for the new State capitol, producing the handsome sum of $600,000. A new structure, a vast quadrangle 1050 feet by 376, enclosing three courtyards and having an aggregate area of 4 acres, is now (1876) erecting on the new grounds (78 acres) purchased for the college, 1 mile S. of the old location. It is of the Early English style of architecture, will have a tower and spire 240 feet high, and when completed will be the most imposing college edifice in America. There are now (1876) 14 instructors and 83 students. The alumni number above 1000, a large proportion having been Episcopal clergymen. The college owns property valued at above $1,000,000, has a library of 18,000 volumes, and a valuable cabinet. The curriculum is thorough, and there is a special scientific course. There are 37 scholarships available for needy

students for the ministry. The theological school was discontinued in 1851. The first president was Bishop Thomas C. Brownell, D. D., 1824–31; the present one, since 1874, is Rev. T. R. Pynchon, D. D.

Trinity College, p.-v., Randolph co., N. C.

Trinity River rises in the N. E. part of Trinity co., Cal., and after a course first to the S. W. and then to the N. W., falls into Klamath River.

Trinity River, in Texas, rises by several forks in the N. part of the State. The W. fork, rising in Archer co., seems to be the largest. Next in importance is the Elm fork. Trinity River is a noble stream, flowing through a fertile, well-timbered country. At its lowest stage it is navigable to Liberty, 90 miles from its mouth in Galveston Bay, and at high water small boats have ascended 500 miles. The whole length of the main stream is 550 miles.

Trinity-Sunday, in the Roman Catholic, Anglican, and other churches (but not the Greek Church), the Sunday next after Pentecost. It was established as a church festival, in honor of the Holy Trinity, by Pope John XXII. in 1320. It had previously been long celebrated in some Western dioceses, but not very generally before 1400.

Tri'no, town of Italy, province of Novara, on the left bank of the Po, about 10 miles S. W. of Vercelli, contains good churches and palaces, but everything has an air of neglect and decay. Trino was a mediæval town of some importance, but its old fortifications are in ruins. P. 9774.

Triodontidæ. See APPENDIX.

Trionychidæ. See APPENDIX.

Trio'ra, town of Italy, province of Porto Maurizio, about 24 miles N. of San Remo. The mediæval wall and other defences are nearly destroyed, and it is now a place of little interest. P. 5100.

Tripe de Roche [Fr. for "rock-tripe"], a name applied by French Canadian *voyageurs* and hunters to several species of *Umbilicaria* and *Gyrophora*, tough and bitter lichens of the barren grounds of British North America. *Tripe de roche* is often used as food when other provisions are exhausted, and, though cathartic and unpalatable, it will sustain life. The genera have representatives growing upon rocks in many high arctic and alpine regions.

Triple Alliance. (1) The league between England, Sweden, and the States General (1668) for the protection of the Spanish Netherlands against Louis XIV. (2) The league of Great Britain, France, and the Netherlands against Spain and the Pretender in 1717. (3) The league of Austria, Great Britain, and Russia, concluded in 1795.

Tri'pod [Gr. τρίπους, "three-footed"], a three-legged table, stool, or vessel; a three-legged stand for a mathematical or other instrument. In ancient Greece and Rome the name was especially applied to the three-legged bronze or stone altars of Apollo, made in imitation of the tripod upon which sat the Pythian priestess during the delivery of the Delphic oracles. Others of the gods also received tripods as votive offerings.

Trip'oli [from *Tripoli* in Barbary, whence it was once imported], a polishing powder consisting of the aggregate fossil frustules of great numbers of diatomaceous plants. Tripoli is brought from Bohemia, Corfù (called Venice tripoli), and other points. It is used for polishing metals, and some red varieties are used in Europe for paint.

Tripoli, the easternmost of the Barbary states, North Africa, dependent of the Turkish empire, is bounded W. by Tunis, N. by the Mediterranean, and E. and S. by Barca, the Libyan desert, and Fezzan. With the exception of the districts around the metropolis, which are very fertile and produce all kinds of fruits, vegetables, and cereals belonging to the Mediterranean territories, the coast-land is an arid and desolate plain, presenting an uninterrupted series of open sandy beaches. In the interior, between the desert coast-land and the desert of Sahara, stretch two chains of low mountains, issuing from the Atlas and enclosing valleys and plateaus of considerable fertility, especially in places where sufficient water can be procured, as drought is the great curse of these regions. Of rivers there are none, and rain falls only between October and March, during which time the water is gathered in large cisterns and tanks. Dates, senna, millet, and barley are the common crops; cotton, tobacco, saffron, and wheat are cultivated, and in many places olive-groves, vineyards, orchards, and gardens yield fruit, wine, and vegetables in abundance and of superior quality. Cattle, sheep, horses, mules, and poultry are abundant; mats, carpets, and earthenware are manufactured. The area of the country is estimated at 100,000 sq. m.; the pop. at 750,000, consisting of Berbers, Moors, and Jews. The government is a complete despotism, and consequently the population and the prosperity of the country are steadily decreasing.

Tripoli, capital of the state of Tripoli, on a rocky promontory in the Mediterranean, has an excellent harbor, the only one along this coast for several hundred miles. The town is most miserably built, but it is strongly fortified, surrounded with massive walls, and defended by forts, and it contains some magnificent though now somewhat decayed edifices; as, for instance, the palace of the pasha, the principal mosque, the triumphal arch of Verus, etc. Leather, carpets, mantels, and tobacco are manufactured, and a great trade with Timbuctoo, Bornu, and other places S. of Sahara is carried on. Both manufactures and trade, however, are said to be rapidly declining. P. 30,000.

Tripoli [Arab. *Tarâbulus*], seaport-town of Syria, some 40 miles N. N. E. of Beyroot, and about the same distance N. W. of Baalbec. The ancient town consisted of three distinct quarters, not quite an eighth of a mile apart, settled by colonists from Aradus, Sidon, and Tyre, and was therefore called *Tripolis* ("the triple city") by the Greeks (Diodorus Siculus, xvi. 41). The principal settlement appears to have occupied a triangular promontory running out into the Mediterranean. N. of this was the harbor, now called *Mina;* and S. of it the other quarter. A wall 18 feet thick, which may still be traced, ran across the broad neck of the promontory nearly N. and S. Westward of this wall the whole promontory is strewn with ruins which have been quarried for centuries. The modern town, solidly built, stands nearly 2 miles from the sea, embosomed in orchards of orange, lemon, apricot, and apple trees. El-Kadisha ("the sacred river"), which starts near the famous grove of cedars on Mount Lebanon, runs through the town, rendering the whole plain exceedingly fertile, but also at times unhealthy. Just S. of the Kadisha, on a hill some 500 or 600 feet above the level of the sea, stands an old castle, built by the crusaders about 1109, and now garrisoned by Turkish troops. As Beyroot advances, the commerce of Tripoli is declining more and more, its harbor being shallow and unsafe. French steamers call here about once a week. P. nearly 20,000, more than half of whom are Mohammedans. The rest are mainly Greek Christians of Greek descent. An American Protestant mission was established here in 1848. R. D. HITCHCOCK.

Tripolit'za, town of Greece, was before 1827 the capital of the Morea, and had over 20,000 inhabitants, but in 1828 it was razed to the ground by the Turks. P. 11,477.

Tripp, county of S. Dakota, intersected by the Keya Paha, and watered in the N. by affluents of White River; surface usually of undulating prairies, but in the N. part is Turtle Hill, 2340 feet high. Area, about 1500 sq. m.

Triqueti', de (HENRI), BARON, b. at Conflans, department of Loiret, France, in 1802; studied at the Academy of Art in Paris; exhibited in 1831 several pictures and a marble group, *Death of Charles the Bold*, which latter attracted much attention; devoted himself subsequently exclusively to sculpture; was for a long time engaged in the interior decoration of the Madeleine. D. at Paris in 1874. The most remarkable of his works are *Dante, Jesus feeding the Birds, Bacchus, The Holy Family*, etc., besides a great number of busts.

Trisec'tion of Angle. The trisection of an angle was a celebrated problem among the ancient geometers. It belongs to the same class of problems as the duplication of the cube and the insertion of two geometrical means between two given lines; but, like them, it has withstood all the attacks of elementary geometry. It may, however, be solved by means of an auxiliary curve called a conchoid; it can also be solved in several ways by the principles of higher geometry.

Trismegistus. See HERMES TRISMEGISTUS.

Trist (NICHOLAS P.), b. in Virginia about 1798; married a granddaughter of Thomas Jefferson; was an intimate friend of Andrew Jackson, by whom he was appointed U. S. consul at Havana, where he became intimately acquainted with Spanish-American history and politics; became chief clerk of the U. S. state department 1845, and negotiated in Mexico (Feb., 1848) the Treaty of Guadalupe Hidalgo, which terminated the Mexican war. D. at Alexandria, Va., 1875.

Tristan' da Cu'nha, the largest of a group of three islets in the Southern Atlantic, in lat. 37° 3′ S., lon. 12° 19′ W., comprises an area of about 40 sq. m. It is mountainous, its centre rising into a volcanic peak 8326 feet high, but fertile, well provided with water, and healthy. It was discovered in 1506 by the Portuguese navigator Tristan da Cunha, and occupied by British troops from Cape Town during the captivity of Napoleon on St. Helena. The inhabitants, about 60 in number, descend from this garrison. The other two islets are Inaccessible Island and Nightingale.

Tri'then (FREDERICK HENRY), b. in Switzerland in Feb., 1820; spent his childhood in Odessa, Russia; was

educated at the University of Berlin, where he studied Sanskrit and comparative philology under Bopp; settled in England 1841; was assistant in the printed books department of the British Museum 1844–45; made a tour through Russia, Turkey, and Egypt for philological purposes 1845–47, and was appointed professor of modern languages at the Taylor Institution, Oxford, 1848—a post from which he retired in 1850 in consequence of an attack of insanity. D. near Odessa, Russia, Apr. 27, 1854. He was one of the writers for the *Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge, and wrote many of the articles on Oriental subjects in the *Penny Cyclopædia*.

Tri'ton [Gr. Τρίτων], in Greek and Roman mythology, a marine deity, sometimes the son of Poseidon and Amphitrite, sometimes a subordinate sea-god, and sometimes even localized as the god of the Libyan Sea. In art he is represented as a young man with the body ending in two fish-tails, and with a trumpet of conch-shells.

Triton, a common name for the aquatic salamanders (water-newts), especially for those of the genus *Triton*. The tritons are strictly aquatic, have a compressed tail, and breathe by lungs, frequently coming to the surface of the water for fresh air. North America abounds in species.—TRITON is also the name of a genus of gasteropod mollusks of family Muricidæ. The tritons afford many of the shells called conchs. (See CONCH-SHELL.) There are about 100 living and 50 extinct species, mostly from warm seas.

Tri'tone, in music, the interval of the superfluous or augmented fourth, which consists of three whole tones, or rather of two whole tones and two semitones, as C—F♯, G—C♯, an interval studiously avoided by the old musicians.

Tritura'tion [Lat. *triturare*], an operation with the mortar and pestle, by means of which a solid substance may be more finely and uniformly divided than in the ordinary process of pulverization. To effect this, it is necessary that a circular motion, accompanied by pressure, should be given to the pestle, which should be brought in contact with all parts of the mortar. J. P. BATTERSHALL.

Trit'yl, or **Prop'yl,** one of the hypothetical "alcohol-radicals," recognized by many, at one time, as having an ascertained existence, but now regarded generally by chemists—with the rest of these mythical radicals—as only representing a certain amount of *equivalence* in compounds, one assumed molecule of trityl, represented by C_3H_7, being deemed equivalent to one molecule of hydrogen, H. Under VOLUMES, MOLECULAR, it is shown by the present writer that this group, C_3H_7, really represents $H.3H_2C$. A compound has been obtained which has been supposed to be ditrityl $(C_3H_7)_2$, for which Schorlemmer gives the density .6769 at 10°, boiling at 136.5° F. It has, however, the real constitution $H_2.6H_2C$, the computed density at melting ice being .685. HENRY WURTZ.

Tri'umph [Lat. *triumphus*], in ancient Rome, a state pageant in which a victorious general or naval commander, preceded by the senate and by the spoils and prisoners, was drawn by four horses along the Sacred Way and followed by his army to the temple of Capitoline Jove, where solemn sacrifice was offered. As a rule, no one who had not held the office of dictator, consul, or prætor could triumph. The war, too, must be one against foreign foes, and one which absolutely extended the power of the state. There were also other conditions, few of which were uniformly observed. The triumphal procession was very brilliant, and sometimes lasted two or three days. It was customary to put to death some of the hostile chiefs during the triumphal march. A slave rode in the chariot with the victor, and, according to Tertullian, from time to time repeated the words, "Look behind thee: remember that thou art a man." The first triumph was probably that of Tarquinius Priscus over the Sabines; the last was that of Belisarius at Constantinople over the Africans, in 534 A. D.

Trium'viri, or **Tres'viri** [Lat. *tres*, "three," and *viri*, "men"], in ancient Rome, a board of three men appointed for some special public duty. A number of kinds of triumviri are specified by Roman authors. In B. C. 60, Julius Cæsar, Pompey, and Crassus formed a coalition for the conduct of public affairs: this is called the "first triumvirate," but the men who constituted it bore no official title of *triumviri*, and exercised only an usurped power. The "second triumvirate," that of Octavian, Mark Antony, and Lepidus, was officially recognized by the senate, and the three magistrates bore the name of *Triumviri reipublicæ constituendæ* ("triumvirs for arranging public affairs").

Trivium. See ARTS, DEGREES IN.

Trivoli, tp., Peoria co., Ill. P. 1234.

Trochilidæ. See APPENDIX.

Trochu' (LOUIS JULES), b. at Le Palais, department of Morbihan, France, May 12, 1815; made his military career chiefly as aide-de-camp and in the ministry of war. He was aide-de-camp to Marshal Bugeaud in Algeria, to Marshal St. Arnaud, and afterward to Gen. Canrobert, in the Crimea, and distinguished himself at the storming of the Malakoff as commander of the 1st brigade of the 1st French corps. On account of his scientific education he was generally considered as the future minister of war, but by his pamphlet *L'armée française en 1867*, which ran through 20 editions in three years, and revealed the weaknesses of the French army, he lost the favor of the emperor Napoleon, and received no more offices of confidence. This circumstance, however, made him a favorite with the opposition, and when in 1870 the French army broke down, he was called to the imperial council and appointed governor of Paris Aug. 17. When the revolution broke out in Paris after the disaster of Sedan, he was also made commander-in-chief of all the forces defending the capital, which position he held up to the surrender of the city.

Tro'zen, or **Troze'ne,** one of the oldest cities of ancient Greece, in a fertile plain (Trœzenia) which occupied the south-eastern part of Argolis. It was founded by Ionian settlers, and was under the authority of Argos at the time of the Trojan war; but although it subsequently, by the conquest of Peloponnesus by the Dorians, received a colony of Doric settlers and became a Doric city, it still maintained its Ionian sympathies and traditions. It early grew into an important maritime place. It founded Halicarnassus and Myndus in Caria, and after the battle of Thermopylæ its harbor was appointed the place of rendezvous for the Greek fleet. It received the Athenians who fled from Xerxes with the greatest kindness, and fought with five ships and 1000 men in the battles of Artimisium, Salamis, Platæa, and Mycale. Up to the Peloponnesian war it was a firm ally of Athens, but after that time it sided with Lacedæmon, and subsequently it became a Macedonian possession. In the second century of the Christian era it was still a splendid city, as seen from the description by Pausanias of its public buildings, of which some ruins are still found near the village of *Damala*.

Trog'lodytes [Gr. τρωγλοδύται, from τρώγλη, a "cave," and δύειν, to "enter"], with the ancient writers the name of races found N. of the Caucasus in Mauritania, but especially along the coasts of the Red Sea, both the Arabian and the African, which region was called *Regio Troglodytica*. Common to these tribes was their low stand-point of civilization. They lived in caves and depended on herds of cattle for their livelihood. The name is now applied in natural history to a genus including the chimpanzee and the gorilla.

Troglodytinæ. See APPENDIX.

Trogonoph'idæ [from *Trogonophis*—τρώγειν, to "eat," and ὄφις, "serpent"—the typical genus], a family of reptiles of the order Sauria and sub-order Amphisbænoidea, characterized by the development of the teeth on the edge of the jaws. The body is elongated and cylindrical; scales or shields oblong quadrangular, and disposed in transverse rings, the lateral line sunken, narrow, covered with a few minute scales; pre-anal pores wanting; the head is oblong and depressed, but rounded below; the nostrils are lateral, and in large nasal shields; the teeth conical, and inserted on the edge (and not on the inner side) of the jaws; the legs are undeveloped; the tail conical and acute. These characters have been attributed to the family by Dr. Gray, who first distinguished it as such. It is based on a single species, *Trogonophis Wiegmanni*, an inhabitant of Northern Africa. THEODORE GILL.

Tro'gus Pompe'ius, a Latin author descending from the Gaulish tribe of the Vocontii. His grandfather received the citizenship of Rome from Cn. Pompeius, his father was private secretary to Cæsar, and he himself wrote, probably about 20 B. C., a work, *Liber Historiarum Philippicarum*, of which there exist a few brief fragments quoted by Vopiscus, Jerome, Augustine, Orosius, Priscian, and others, and a series of excerpts by JUSTINUS (which see; see also Heeren, *Commentationes de Trogi Pompeii ejusque Epitomatoris Justini Fontibus et Auctoritate*).

Tro'ia, town of Italy, province of Capitanata, on the Colone, manufactures coarse woollen cloth. P. 5473.

Troi'na [probably *Trajanopolis*], town of Sicily, province of Catania, on a mountain from which the river Troina takes its rise. The principal church has some features of Norman architecture, and contains two pictures by Velasquez. Troina was one of the first Sicilian towns to declare for the Normans, and Roger and his queen were warmly received here, but, finding their new lord intolerable, the inhabitants called back the Saracens, and with their aid defended the city for four months against the northern invaders, and were then forced by famine to submit. The pasturage in this neighborhood is excellent, and fish and game are abundant. P. 10,193.

Trois Pistoles', p.-v. of Temiscouata co., Quebec, Canada, on Grand Trunk Railway and on the S. side of the St. Lawrence, 160 miles below Quebec. Excellent limestone abounds. The place has a lively trade, a convent, and some manufactures. P. about 650.

Tro'ja, town of Southern Italy, province of Foggia, on a high hill, at the foot of which flows the rapid torrent Celone. It contains churches and other buildings worthy of notice, and the suppressed convents have furnished important additions to the national library at Naples. In 1093, Pope Urban II. here assembled a council for the reform of the clergy, and in 1116 another was held here by Pope Paschal. The bishopric of Troja depends directly on the Holy See. The district is fertile, and well supplied with wood and pasturage. P. 6337.

Trol'lope (ANTHONY), second son of Frances M. Trollope, b. in 1815; was educated at Winchester and Harrow schools, and from 1834 to 1867 was connected with the British postal service, for which he made many voyages, and subsequently travelled extensively in the U. S., the West Indies, and Australia. In 1869 he was an unsuccessful candidate, in the Liberal interest, for Beverly. He has written several books of travel and many novels. Most of his later novels were originally published serially, and simultaneously in British and American magazines. His published works are—*The Macdermots of Ballydoran* (1847), *The Kellys and the O'Kellys* (1848), *La Vendée* (1850), *The Warden* (1855), *Barchester Towers*, his first decided success (1857), *The Three Clerks* (1857), *Doctor Thorne*, one of his best works (1858), *The Bertrams* (1859), *The West Indies and the Spanish Main*, sketches of travel (1859), *Castle Richmond* (1860), *Framley Parsonage* (1861), *Tales of All Countries*, stories which had appeared in various magazines (1861; 2d series 1863), *Orley Farm* (1862), *The Struggles of Brown, Jones, and Robinson* (1862), *North America*, a book of travel (1862), *Rachel Ray* (1863), *The Small House at Allington* (1864), *The Belton Estate* (1864), *Hunting Sketches* (1864), *Can You Forgive Her?* (1865), *Miss Mackenzie* (1865), *Clergymen of the Church of England* (1866), *Travelling Sketches* (1866), *The Claverings* (1867), *The Last Chronicles of Barset* (1867), *Phineas Phinn, the Irish Member* (1869), *He Knew He was Right* (1869), *Sir Harry Hotspur of Humblethwaite* (1870), *The Vicar of Bullhampton* (1870), *Ralph the Heir* (1871), *The Golden Lion of Granpère* (1872), *Phineas Redux* (1873), *Australia and New Zealand*, a book of travel (1873), *The Way we Live Now* (1874), *The Prime Minister* (1875), and a series of *Short Stories*, now (1876) publishing simultaneously in England and America. A peculiarity of many of his novels is that some of the characters figure in several of them, although no novel is strictly a continuation of a preceding one.

Trollope (EDWARD), M. A., b. Apr. 15, 1817, the younger son of a baronet; was educated at Eton and at Christ Church, Oxford, where he graduated in 1839; took holy orders; received successive preferments, becoming archdeacon of Stow and prebendary of Liddington in 1867. He has published several works on architecture and archæology, the principal of which are—*Illustrations of Ancient Art* (1854), *Life of Pope Adrian IV.* (1856), *Introduction of Christianity into Lincolnshire* (1857), *Labyrinths, Ancient and Mediæval* (1858), *Fens and Submarine Forests* (1859), *Monastic Gatehouses* (1860), *Life of Hereward, the Saxon Patriot* (1861), *Battle of Bosworth Field* (1862), *Shadows of the Past* (1863), *The Raising of the Royal Standard at Nottingham* (1864), *Spilsby and other Churches* (1865), *Norman Sculptures of Lincoln Cathedral* (1866), *Grantham and other Churches* (1867), *The Roman Ermine Street* (1868), *The Norman and Early English Styles of Gothic Architecture* (1869), *Boston and other Churches* (1870), and *Sleaford and the Wappentakes* (1872).

Trollope (FRANCES **Milton**), b. probably in 1790, but perhaps ten or twelve years earlier. She was the daughter of a clergyman, and in 1809 contracted an unhappy marriage with Thomas Anthony Trollope, a barrister of good family, by whom she had six children. In 1829 she went to America, and attempted to establish herself in some kind of business at Cincinnati; failing in this, she returned to England, where she published her *Domestic Manners of the Americans* (1831), a broad and rather offensive caricature, which met with great favor in England. She followed up this success by writing a novel, *The Refugee in America* (1832); subsequently travelled on the continent of Europe, publishing narratives of her adventures and observations, and entered upon a career of literary activity, which, commencing late, lasted more than twenty years, the greater part of her works being novels. About 1844 she went to Italy, where her eldest son was residing, and where she passed the remainder of her long life. Her writings comprise more than forty separate works, most of them being in several volumes. Among her novels are—*The Abbess* (1833), *Tremordyn Cliff*, one of her best (1835), *Life and Adventures of Jonathan Jefferson Whitelaw* (1836; republished in 1857 under the title *Lynch Law*), *Life and Adventures of Michael Armstrong, a Factory Boy* (1839), *Charles Chesterfield, the Adventures of a Young Genius* (1841), *The Barnabys in America* (1843), *Father Eustace, a Tale of the Jesuits* (1846), *Lottery of Marriage* (1849), *Petticoat Government* (1850), *Life and Adventures of a Clever Woman* (1854), *Gertrude, or Family Pride* (1855), and *Fashionable Life, or Paris and London*, her last work (1856). D. in Florence Oct. 6, 1863.

Trollope (THOMAS ADOLPHUS), eldest son of Frances M. Trollope, b. Apr. 29, 1810; was educated at Winchester and Oxford; travelled on the Continent; published *A Summer in Brittany* (1840), *A Summer in Western France* (1841), and took up his residence in Florence, which has since been his home. He has been a constant contributor to English literary periodicals, and is now the Italian correspondent of the New York *Tribune*. Most of his writings relate directly to Italian history, life, and manners. Among these are—*Impressions of a Wanderer in Italy* (1852), *The Girlhood of Catharine de' Medici* (1856), *A Decade of Italian Women* (1859), *Tuscany in 1849 and 1859* (1859), *Filippo Strozzi* (1860), *Paul V. the Pope and Paul the Friar* (1860), *La Beata* (1861), *Marietta* (1862), *A Lenten Journey in Umbria and the Marches of Ancona* (1862), *Giulio Malatesta* (1863), *Beppo the Conscript* (1864), *History of the Commonwealth of Florence* (4 vols., 1865), *Gemma* (1866), and *Leonora Cassaloni* (1869). On subjects not Italian he has published—*Lindisfarn Chase* (1864), *Artingdale Castle* (1867), *Dream Numbers* (1868), *The Garstangs of Garstang Grange* (1869), *A Siren* (1870), and *Durnton Abbey* (1871).—THEODOSIA GARROW (married to Mr. Trollope in 1848; d. in 1865) was an artist, musician, and author. She translated into English Niccolini's tragedy, *Arnold da Brescia* (1846), published critiques upon Villari's *Life of Savonarola* and other Italian works; and contributed to the London *Athenæum* a series of letters on *The Social Aspects of the Italian Revolution* (1861).

Trollope (WILLIAM), D. D., of Pembroke College, Cambridge: has published several valuable works in theology and philology, among which are—*Pentalogia Græca* (1825), *Iliad of Homer, with English Notes* (1827), *Critical, Philological, and Exegetical Commentary on the New Testament* (1828), *The New Testament in Greek, with English Notes* (1837), *Greek Grammar to the New Testament* (1841), *Greek Liturgy of St. James, with translation* (1848), and *Commentary on the Liturgy and Ritual of the United Church of England and Ireland* (1861).

Trolls, in the Norse and Teutonic mythologies, and in the folk-lore of the more recent times, a class of powerful spirits, hostile to man, and very often circumvented and defeated by men, since their strength was associated with extreme supineness of understanding. There is a theory that holds that the Trolls represent the Lapps and Finns who were gradually repelled by the Scandinavian race; but thus far this hypothesis has no support save in what inherent probability it may possess.

Trom'bone [It., "great trumpet"], a large brass wind instrument of the trumpet species, supposed to be the same as the sackbut of early writers. Its peculiarity consists in the facility of deepening the tones by means of sliding tubes, making it one of the most effective instruments in an orchestra. There are three kinds, alto, tenor, and bass, besides the double-bass, which is rarely used.

Tromp, van (MAARTEN HARPERTZOON), b. at Briel in 1597; received his education in the Dutch navy, and served with great distinction under Admiral Heijn. In 1639 he was made an admiral, and gained a European fame by his two great victories in the same year over the Spanish fleet off Gravelines and in the Downs. He was less successful in the war between England and Holland, and having been defeated by Blake, he even lost his command for some time in 1652. He was soon reinstated, however, and defeated Blake completely in the Downs, Nov. 29, 1652. On Aug. 6, 1653, he attacked the English fleet between Scheveningen and the Maas. The battle lasted two days, but was finally lost by the Dutch; Tromp himself was killed Aug. 10. He is buried in the church of Delft, where a splendid monument has been erected to him.—His son, CORNELIS VAN TROMP, b. at Rotterdam Sept. 9, 1629, achieved almost an equal fame, held the highest positions in the Dutch navy, and served with great distinction for some time in Denmark. D. at Amsterdam May 29, 1691.

Tro'na [probably from *natron*, Ger. for "soda"], the mineralogical name of a native carbonate of soda, the most common native form of that salt. It has the composition when crystallized $O_8C_3Na_4.4H_2O$, which may possibly indi-

cate the constitution $2(Na_2O.CO_2).(H_2O.CO_2).3H_2O$. This hypothesis, making one-fourth of the hydrogen basylic, obtains strength from the one density-figure on record, 2.11 (cited by Dana), which by the writer's geometric law of volumes will give the sodium the volume it has in the (so-called) hydrate, the sulphide, the sulphates (the heavier allotropes), the anhydrous carbonate, and the bicarbonate, while the basylic hydrogen has also the volume found in the "hydrate." Trona was originally found in soda lakes in Africa; extensive beds are now found in Nevada. The crystals are monoclinic. Another name sometimes given to it is *urao*. HENRY WURTZ.

Trond'hjem, the ancient *Nidaros*, the oldest town of Norway, is beautifully situated on the southern shore of Trondhjemsfjord, in lat. 63° 25′ N. Of its cathedral, which once was the largest church-building in Scandinavia, only the choir remains, in which the kings are crowned. Its breweries and distilleries are extensive and celebrated. Much copper, salt and dried fish, and timber is exported. P. 20,858.

Troop'ial, a name given to several small conirostral birds, mostly Icteridæ. Thus, the BOBOLINK (which see) or rice troopial, the cow bunting or cow troopial (*Molothrus pecoris*), and many others are occasionally called by this vague name. The name seems to have at first belonged to birds of the genus *Cassicus*, and to have been given on account of the vast flocks or *troops* of some of the species.

Troost (GERARD), M. D., b. at Bois-le-Duc, Holland, Mar. 15, 1776; educated at Amsterdam and Leyden; studied medicine and natural science; served in the army, both as a private soldier and afterward as a medical officer; was enabled by Louis Bonaparte, king of Holland, to devote himself to his favorite studies in Paris, where he translated Humboldt's *Aspects of Nature* into Dutch; embarked in 1809 on a scientific mission to the East Indies, but was taken by a French privateer and carried to Dunkirk; resided a year at Paris; proceeded to the U. S. 1810; settled at Philadelphia, where he was one of the founders and the first president of the Academy of Natural History (1812–17); established at Cape Sable, Md., the first alum-factory in the U. S. 1814; was appointed professor of mineralogy in the Philadelphia Museum 1821; settled at New Harmony, Ind., with Owen and McClure 1825; became professor of chemistry and mineralogy in the University of Nashville 1827, and was State geologist of Tennessee 1830–49. D. at Nashville Aug. 14, 1850. His mineral and geological cabinets were the largest in the U. S. Author of geological reports upon Tennessee and upon the environs of Philadelphia (1826), and of numerous contributions to periodicals.

Tropæola'ceæ [Lat. *tropæum*, "trophy"], a botanical order consisting exclusively of the genus Tropæolum, including the NASTURTIUM (which see), the Indian cress, and many other climbing plants, all originally from South America, many of which are highly ornamental and susceptible of cultivation. This genus is of doubtful validity, having been separated from Geraniaceæ, in which many botanists still include it.

Tropæolum. See TROPÆOLACEÆ.

Trope [Gr. τρόπος, "turn," a "change," a "figure of speech"], in rhetoric, the substitution of a literal expression by one imaginative, and thus more striking and impressive. The three principal tropes are metaphor, metonymy, and synecdoche; by some, allegory and personification are also considered tropes.

Trope'a, town of Southern Italy, of ancient but unknown origin, in the province of Catanzaro, on a steep promontory between the Gulf of Sant' Eufemia and that of Gioja. It is a place of considerable industry, and carries on a small coasting-trade by means of its little harbor. The vicinity furnishes a peculiar kind of earth known as *caolino*, or *arena tenera*, which is much used in the manufacture of porcelain, and is even employed in making the Ginori majolica. P. 6337.

Tro'phy [Gr. τρόπαιον, from τρέπειν, to "turn"], among the ancient Greeks a memorial erected on the battlefield by the victors, on the spot where the enemy *turned* to flight or retreat. Originally, trophies were of wood or of simple armor affixed to a tree. It was equally unlawful to destroy or repair a trophy, since it was very justly considered unwise to perpetuate hostile feelings. In later times the Romans adopted the custom of erecting trophies.

Tropic-Bird. See PHAËTONIDÆ.

Tropics. See SOLSTICE, CAPRICORN, CANCER.

Troplong' (RAYMOND THÉODORE), b. at Saint-Gaudens, department of Haute-Garonne, France, Oct. 8, 1795; studied law; practised as an advocate; held various judicial positions; was made a peer of France in 1846, president of the court of Paris in 1848, a senator and president of the court of cassation in 1852. D. Mar. 2, 1869. His principal work is *Code civil expliqué* (28 vols., 1833–58), parts of which—*Des Priviléges et Hypothèques* (4 vols.), *De la Vente* (2 vols.), *De la Prescription* (2 vols.), *Du Contrat de Mariage* (4 vols.), *Des Donations* (4 vols.)—have been published separately, and often reprinted. He also wrote *De l'Influence du Christianisme sur le Droit civil des Romains* (1843) and *Du Pouvoir de l'État sur l'Enseignement* (1844), etc.

Trop'pau, town of Austria, capital of Silesia, on the Oppa, is fortified, contains many palatial edifices, and is generally well built. Its manufactures comprise woollen and linen fabrics, soap, leather, and ironware, and its trade is very active. The famous Congress of Laybach held its first sittings here from Oct. to Nov., 1820. P. 16,608.

Trot'wood, p.-v., Montgomery co., O., on Dayton and Western R. R. P. 42.

Troubadours. See TROUVÈRES.

Troup, county of W. Georgia, bordering on Alabama, intersected by Chattahoochee River, and crossed by Atlanta and West Point R. R.; surface hilly, soil generally fertile. There are saw-mills and manufactories of boots and shoes, cotton goods, machinery, and iron castings. Staples, cotton, Indian corn, oats, wheat, and sweet potatoes. Cap. La Grange. Area, 370 sq. m. P. 17,632.

Troup (GEORGE MCINTOSH), b. in Alabama Sept. 8, 1780; graduated at Princeton 1797; became a lawyer in Georgia; was chosen to the legislature 1800; sat in Congress 1807–15; was U. S. Senator 1816–18, and again 1829–34, and governor of Georgia 1823–27; was an eloquent speaker and an ardent advocate of the doctrines of State rights and State sovereignty. D. in Lawrence co., Ga., May 3, 1856. His *Life* was published by E. J. Harden (Savannah, 1859). (See also UNITED STATES.)

Troup (ROBERT), LL.D., b. in New York City in 1757; graduated at Columbia College 1774; studied law under John Jay; entered the Revolutionary army as lieutenant 1776; became an aide to Gen. Woodhull; was taken prisoner at the battle of Long Island; confined in the Jersey prison-ship and the provost prison, New York; exchanged in 1777; became aide to Gen. Gates at Saratoga; was secretary to the board of war 1778–79; studied law at Princeton under Judge Patterson; was for several years U. S. district judge in New York and member of the legislature; was an intimate friend of Hamilton, and during his later years resided at Geneva, N. Y., as agent of the great Pulteney estate. D. at New York City Jan. 21, 1832. Author of occasional political pamphlets.

Troups'burg, tp., Steuben co., N. Y. P. 2281.

Troupsburg Centre, p.-v., Steuben co., N. Y. P. 100.

Trous'dale, county of Middle Tennessee, intersected in the S. E. part by Cumberland River. Formed from portions of other counties since the census of 1870. Cap. Hartsville.

Trousseau' (ARMAND), b. at Tours, France, Oct. 14, 1801; studied medicine at Paris; was sent in 1828 by the government to investigate endemic and epidemic diseases, at that time prevalent in the central departments of France; gained the grand prize of the Academy of Medicine in 1837 for his work on *Phthisie laryngée*; was appointed professor of therapeutics in the Faculty of Medicine at Paris in 1839. D. there June 23, 1867. He wrote *Traité élémentaire de Thérapeutique et de Matière médicale* (1836), *Nouvelles Recherches sur la Trachéotomie dans la Période extrême du Croup* (1851), besides minor medical essays.

Trout. See APPENDIX.

Trout Creek, p.-v. and tp., St. Clair co., Ala. P. 933.

Trouvères. The earliest example of verse in any of the dialects of *Romance* is the Northern French *Cantilène de Ste. Eulalie*, which, on pretty good grounds, is attributed to the ninth century. Lyrical poetry, however (in the secular sense), seems to have reached its bloom first in the South, and especially in Provence. Fauriel claims for the Provençals also the initiative in epical poetry, but this is more than doubtful, if we may judge by what has come down to us. The *canso* in Provence, like its derivative the Italian *canzone*, was purely lyrical, the mediæval analogue of the classic ode. The *chanson* in Northern France came at last to mean a narrative poem. It was so called because originally chanted, though latterly a measured *recitative* probably took the place of song. Some sort of instrumental accompaniment of a simple kind seems to have been maintained to the last.

The word *trouvère* (of which *troubadour* is the Southern form) means simply a finder or inventor. The *trouvère* was the composer of poems which were sung at public festivals or at the courts of great barons and princes. Sometimes he also composed the accompanying music. If he

lacked skill or voice, he employed a *jongleur* (*joculator*) to sing his verses for him. The *jongleur* (called also in Northern French *jonglerres*, in Provençal *juglar*) was, as his name implies, a sleight-of-hand performer, who at length degenerated into a kind of Jackpudding. If we may judge by their own account of themselves, the jongleurs were the direct ancestors of the modern Bohemian.

The *chanson de geste* (epical) seems to have been a product of the north of France. It was originally a narrative of deeds (*gesta*), but the term afterward came to mean also a race or family. To the *chanson de geste* succeeded the *Roman d'avantures*, which occupied itself more exclusively with the adventures of a single hero, and whose later prose form (as in *Mélusine*) was the first step toward the modern romance. Without being too exact, we may classify under the former head the Carlovingian cycle of poems—under the latter, the Arthurian. The *fabliau* (*fabula*) was a short tale in verse, often humorous. The *lai* was narrative also, but serious, and the name seems originally to have been confined to subjects drawn, or professing to have been drawn, from British sources. In the epical poetry an imperfect assonance preceded rhyme, and verses of ten syllables those of twelve, the Alexandrine of modern French poetry. Even a certain alternation of masculine with feminine rhymes was in use so early as the thirteenth century. A single assonance or rhyme was continued to the end of each *couplet*, which often extended to more than 100 verses. Sometimes a single rhyme (or something very like it) is kept up through the greater part of a long poem, as in *Parise la Duchesse*. In later poems (as *Amis et Amiles*) the couplet closes with a verse of six syllables, with a superfluous unaccented syllable at the end. In the epic verse (perhaps to avoid monotony) such a syllable (without elision) was allowed after the second foot in pentameter, after the third in hexameter measure. The verse of the *fabliau* and *lai* was always the octo-syllabic couplet, with unessential variations, seemingly dependent on the *ictus*, like those which Milton permits himself in the same kind of metre. The *Roman d'avantures*, and sometimes the *chanson de geste*, might be in octo-syllabics; the rhymed *chronique* was generally so. It should be remembered that *Roman* did not mean *romance*, but something written in a dialect of the Romance tongue.

The trouvères left behind them a vast mass of verse, both epical and lyrical. Their productions cover a space of three centuries, though by the middle of the thirteenth a decline is evident in their epical poetry. The greater part of what remains to us of Provençal poetry is lyrical. The best, as also the earliest, of the *chansons de geste* is that of Roland. It has a simple energy of style and a directness of movement that distinguish it from all others of the same kind. The Provençal poem of *Girartz de Rosilho* equals it in everything but its succinctness, and surpasses it as a picture of manners. The Provençal *Chronicle of the Crusade* against the Albigensian heretics is also interesting. Of the other *chansons*, perhaps the best are *Guillaume d'Orange*, *Ogier*, and *Fierabras*. *Partonopeus de Blois* has more fancy and literary merit than any other *Roman d'avantures*, unless it be *Amadas et Ydoine*. Among shorter narrative poems, *Amis et Amiles* and *Jourdains de Blairies* may be mentioned as particularly good. The best lyrists among the troubadours are Arnauld Daniel, Bernard de Ventadour, Giraud de Borneil, Bertran de Born, and Pierre Cardinal. Among the trouvères, Rutebeuf is the most distinguished as a lyrical and Chrestien de Troyes as an epic poet. But there were others nameless who deserve equal praise. As a writer of *lais*, Marie de France is pre-eminent. Of the rhyming chroniclers, Benoit de St. Maur, Wace, and Philippe Mousket are the most noted. Besides subjects from mediæval history or legend, the trouvères versified classic themes, notably the tale of Troy and the adventures of Æneas. Didactic poems, like the *Dolopathos* and the *Sept Sages*, drawn from Eastern sources, were also popular, and the *Roman de Renart*, in which beasts are the actors, had a spirit which has kept it alive to our own day. The trouvères had great gayety and inventiveness, especially in the *fabliau*. Boccaccio took some of his best stories from them; Molière owed them the plot of his *Médecin malgré lui*; and La Fontaine went to them for the coarse humor of his *Contes*. The modern drama begins with their miracle-plays. (See Barbazan et Méon, *Fabliaux et Contes*; Méon, *Nouveau Recueil*; Jubinal, ditto; De la Rue, *Essais historiques*; Leon Gautier, *Les Épopées françaises*; Gaston Paris, *Charlemagne poétique*; Raynouard, *Choix des Poésies*, *Lexique Roman*; Fauriel, *Histoire de la Poésie provençale*, *Anciens Poëtes français*.) J. R. LOWELL.

Trouville', town of France, department of Calvados, is finely situated at the mouth of the Toucques in the English Channel, has considerable fisheries of oysters and herrings, and has of late acquired reputation as a watering-place. P. 5671.

Tro'ver [O. Fr. *trover*], in law, is the common-law form of action by which damages are recovered for the *conversion* of chattels. It was originally designed for the particular case of the defendant's *finding* a thing belonging to another, and appropriating it to his own use; whence the plaintiff's pleading necessarily contained an averment of the loss and finding—in law French, *trouver*. Although in progress of time the action was extended to all instances of conversion, and the notion of finding became utterly fictitious, yet with the devotion to obsolete forms which long characterized the common law the allegation was and still is retained in the declaration wherever the system of procedure prevails, but is of course meaningless and cannot be denied. In order that the action may be maintained, the plaintiff must have either a general property in the article converted, entitling him to its possession as against all persons, or he must be clothed with a special property in it, entitling him to its possession at least as against the wrongdoer. The action lies not only for the conversion of ordinary chattels, but also of written securities or evidences of debt, such as notes, bonds, mortgages, and the like. The recovery is always pecuniary damages, and their measure is ordinarily the value of the article when converted, with interest. (For a description of what constitutes a conversion, see CONVERSION.) JOHN NORTON POMEROY.

Trow'bridge, town of England, county of Wilts, on the Biss, manufactures woollen cloth, cassimeres, kerseys, and tweeds. P. 11,000.

Trowbridge, tp., Allegan co., Mich. P. 1337.

Trowbridge (CHARLES C.), b. in Albany, N. Y., in 1800; removed to Detroit, Mich., in 1819; copied with his own hand all the names given in the census returns of the Territory for 1820; was mayor of Detroit in 1834; was largely engaged in banking as cashier and president until he became president of the Detroit and Milwaukee Railroad Co. in 1863.

Trowbridge (EDMUND), b. at Newton, Mass., in 1709; graduated at Harvard 1728; became a lawyer of great eminence; was appointed attorney-general of Massachusetts 1749; was for several years a member of the council, but lost favor with the popular party in 1766 on account of lukewarmness in resisting British aggressions; became chief-justice of the supreme court 1767; presided with great fairness at the trial of the British soldiers charged with the "Boston massacre" 1770, and resigned his office 1772 in consequence of the impending conflict with England, and remained in seclusion during the Revolution. D. at Cambridge Apr. 2, 1793.

Trowbridge (JOHN TOWNSEND), b. at Ogden, N. Y., Sept. 18, 1827; settled in New York 1846 as a writer for periodicals; removed in 1847 to Boston, where he has since resided; became editor of the *Yankee Nation* 1850; wrote many popular tales over the signature "Paul Creyton;" has been a prominent contributor to the *Atlantic* and other magazines, and has been for several years editor of *Our Young Folks*. Author of *Father Brighthopes* (1853), *Neighbor Jackwood* (1857), *Cudjo's Cave* (1863), *The South* (1866), *The Vagabonds, a Poem* (1864), *Lawrence's Adventures* (1870), and other books.

Trowbridge (WILLIAM PETIT), b. in Oakland co., Mich., May 25, 1828. At the age of sixteen he received an appointment as cadet in the U. S. Military Academy at West Point, where he graduated in 1848, taking the first honors of his class in each year. During the last year of his cadetship he acted as assistant professor in the department of chemistry, the exigencies of the Mexican war rendering it impossible to render available for this purpose the services of any competent graduate of the institution. Soon after his graduation, he was ordered back to the Academy as assistant in the astronomical observatory, where he fully prepared himself for duty on the Coast Survey, to which, at his own request, he was ordered. In this survey he at first acted as assistant to Prof. Bache in the primary triangulation of the coast of Maine, which in 1852 was placed under his immediate charge; but previous to entering upon this duty he executed surveys of Appomattox River, in Virginia, with a view to the improvement of its navigation, and after his return from Maine he made similar surveys of James River near Richmond. Here he made surveys of the "Dutch Gap," and recommended the "cut-off" or canal which was subsequently executed. In 1853 he was ordered to the Pacific coast to conduct a series of magnetic and tidal observations extending from San Diego to Puget Sound, a work which occupied three years. Returning from the Pacific coast in 1856, he resigned his commission in the U. S. engineers to accept an appointment as professor in the University of Michigan, but in the following year, at the solicitation of Prof. Bache, he accepted a permanent situation as assistant in the Coast Survey, and

was for some time specially engaged in preparing for publication the results of the Gulf Stream explorations, and in 1860 was sent to Key West to superintend the erection of a permanent self-registering magnetic observatory. Upon the breaking out of the civil war he was assigned to the duty of preparing minute descriptions of the harbors, inlets, and rivers of the Southern coast for the use of the navy. In 1862 he was ordered to execute a hydrographic survey of Narragansett Bay, where there was a design to erect a navy-yard, but the results of the survey were not favorable to the project. He was subsequently transferred to the war department, and was during the remainder of the war in charge of the branch office of the engineer department in New York. In this capacity he constructed many pontoon bridges, and purchased and forwarded large amounts of material to the armies in the field and to the fortifications along the coast, and also superintended the construction of the fort at Willett's Point, the works on Governor's Island, and the repairs of Fort Schuyler. After the close of the war he became vice-president of the Novelty Ironworks in New York, having direction of their working operations—a position which he occupied for four years. In 1870 he was appointed professor of mechanical or dynamic engineering in the Sheffield Scientific School of Yale College. He has written many papers which have appeared in scientific journals, numerous memoirs for the *Coast Survey Report*, and a book on *Steam Generators*, and is now (1879) professor of engineering in Columbia College, New York.

Troy, Troja, or **Ilium,** the scene of the Homeric poem, was the metropolis of the Troad, the coast-region extending from Cape Lectum on the Ægæan to Dardanus and Abydus on the Hellespont, and comprising a broad, undulating plain sloping from the foot of Mount Ida to the sea, and traversed by the rivers Scamander and Simois. This plain was densely peopled by a mixed race of Pelasgians and Phrygians, and contained many cities (Achilles boasts of having destroyed eleven), of which, however, Troy was by far the most splendid and powerful. It was founded by Ilus, the son of Tros, the grandson of Dardanus, and developed rapidly and magnificently; legend tells how, under Laomedon, the son of Ilus, Neptune himself built its walls. It had a fortified acropolis, called Pergamum, which overlooked the town proper, and contained the temples of the gods and the royal palaces. Under Priam, the son of Laomedon, it reached its highest splendor and experienced its downfall. Priam's son, Paris, carried off Helen, the wife of Menelaus, and in order to punish this outrage a Greek army landed in Troas, besieged Troy for ten years, and finally destroyed it (1184 B. C.), though the Trojan state, the kingdom of Troy, seems to have continued to exist for several centuries after the destruction of its capital. The exact site of the city is disputed. According to the Homeric description it was not situated in the plain, but stood on a hill between the Scamander and the Simois, which united in front of it. In ancient times it was generally believed that New Ilium, a city of little importance on the right bank of the Scamander, and of which some ruins are still extant near the present village of *Hissarlik*, occupied the same site as Old Ilium. When this New Ilium was founded is not known. It stood on a low spur of Mount Ida, separating the basins of the Scamander and the Simois. In the time of Alexander the Great it existed, and by the partiality which Sulla showed for it, it even became prosperous. There were, however, even in antiquity, scholars who doubted the identity of the sites of New and Old Ilium; as, for instance, Strabo, who moved the site of Old Ilium several miles farther inland to a village called Ilium. But these doubts were hardly noticed; by the ancient world it was generally believed that New Ilium stood on the ruins of Old Ilium. But in 1785, Lechevalier discovered at the village of Bunarbashi, on the left bank of the Menderch, 5 miles S. of New Ilium, a hot and a cold spring which corresponded to those mentioned in the *Iliad*, and some ruins on the hill of Balidagh, beyond the springs, which he identified as the remains of the citadel of Pergamum. Although further excavations did not bring to light any marked traces of a great city, the views of Lechevalier were generally accepted by classical scholars. (See Lechevalier, *Voyage de la Troade*, 3 vols.) Of late, however, people seem to have returned to the views of antiquity. From 1871 to 1873 the German traveller Schliemann undertook extensive excavations on the hill of Hissarlik, by which he believes to have laid bare the walls of Neptune and Apollo, the palace of Priam, the Scæan gates, etc. (See Schliemann, *Troy and its Remains*, edited by Dr. Philip Smith (London, 1875).)

Troy, p.-v. and tp., cap. of Pike co., Ala., on Mobile and Girard R. R., 85 miles from Columbus, Ga., contains 4 churches, 1 female college and 2 academies, a court-house, 1 newspaper, 2 hotels, 1 carriage-factory, and steam works. Principal business, cotton planting. P. of v. 1058; of tp. 2630. Sidney Herbert, Ed. "Messenger."

Troy, tp., Mississippi co., Ark. P. 350.

Troy, p.-v., Madison co., Ill., on St. Louis and Indianapolis R. R., has a weekly newspaper.

Troy, tp., Will co., Ill. P. 918.

Troy, tp., De Kalb co., Ind. P. 600.

Troy, tp., Fountain co., Ind. P. 3156.

Troy, p.-v. and tp., Perry co., Ind., on Ohio River. P. of v. 180; of tp. 6086.

Troy, tp., Whitley co., Ind. P. 894.

Troy, tp., Clark co., Ia. P. 426.

Troy, tp., Iowa co., Ia. P. 862.

Troy, tp., Monroe co., Ia. P. 2490.

Troy, tp., Wright co., Ia. P. 248.

Troy, p.-v., cap. of Doniphan co., Kan., on St. Joseph and Denver City and Atchison and Nebraska R. Rs., 13 miles W. of St. Joseph, Mo., has 2 churches, a fine school-house, 1 newspaper, a private banking-house, a pork-packing establishment, 2 hotels, court-house, and a large steam flouring-mill. P. 639.

Sol. Miller, Ed. "Kansas Chief."

Troy, p.-v. and tp., Waldo co., Me. P. 1201.

Troy, p.-v. and tp., Oakland co., Mich. P. 1541.

Troy, p.-v., cap. of Lincoln co., Mo., on St. Louis and Keokuk R. R. (unfinished), 16 miles from Mississippi River, has 6 churches, excellent schools, 1 bank, 1 newspaper, and 2 fine hotels. The vicinity is rich in coal, iron, glass-sand, and other mineral deposits. Good farming section. P. 703. Joseph A. Mudd, Ed. "Herald."

Troy, p.-v. and tp., Cheshire co., N. H., on Cheshire R. R., 10 miles S. E. of Keene, has 2 churches, good schools, 1 newspaper, 1 tannery, pail and tub shops, saw and grist-mills, stone-quarries, and a blanket manufactory. P. 767.

H. C. Newton, Ed. "Home Companion."

Troy, city and cap. of Rensselaer co., N. Y., at the head of navigation on Hudson River, at its confluence with Mohawk River, 6 miles above Albany. It is a centre of extensive manufacturing enterprises in iron, cotton goods, stoves, railroad cars, car wheels, shirts, bells, cable-chain, etc. The first Bessemer steelworks in America was established here. It has large rolling mills, foundries, and blast furnaces. It makes more stoves and shirts than any city of its size in the Union. It has 10 banks, with a capital of $3,000,000, and a savings bank with large deposits. It has 49 churches, a splendid Masonic temple, the celebrated Rensselaer Polytechnic Institute, a Roman Catholic seminary for the education of priests, academies, a female seminary, a fine high school, 3 daily newspapers and 1 Sunday journal, a well-equipped hospital, the Marshall Infirmary, with an insane asylum attached, 2 orphan asylums, with some hundreds of inmates, various benevolent institutions, including church and day homes, etc. A new music-hall, just constructed at a cost of $500,000, the Troy *Times* building, the provincial seminary on a commanding hill, which may be seen at a great distance, with many fine private mansions, are among the architectural boasts of the city. A new iron bridge, costing $250,000, connects Troy with West Troy, which may be properly considered a part of the city, and where is situated the Watervliet Arsenal, with its spacious workshops and elegant grounds, Meneely's celebrated bell-foundry, and other important mechanical and manufacturing industries. Troy is practically the terminus of the Erie and Champlain canals. A daily line of steamers and various lines of barges ply to New York, and lines of propellers to Philadelphia and other points. Troy and Boston *viâ* Hoosac tunnel; Rensselaer and Saratoga, connecting Troy and Whitehall *viâ* Saratoga Springs, whence New York and Canada R. R. will speedily be constructed to Montreal; and New York Central and Hudson River R. R., afford excellent communications to all points. The Rensselaer and Saratoga road is a part of the connections of the Delaware and Hudson Canal Co.'s line, which extends to Rutland on the N. and Binghamton on the S. W. Half-hourly local trains run to Albany, and steam and horse railroad cars connect the city with Cohoes. Horse cars also run to Lansingburg and Waterford every few minutes. Oakwood Cemetery, situate on a high bluff from which a splendid view of the Cohoes Falls is obtained, is becoming famous for its natural attractions and artificial adornments. It contains the remains of Major-Gens. George H. Thomas and John E. Wool. The city has a paid fire department and electric fire-alarm, and has had a steady and healthy if not a very rapid growth, its increase of population being at the rate of about 1000 a year. P. 46,465 (1870).

W. E. Kisselburgh, Man. Ed. "Times."

Troy, p.-v. and tp., cap. of Montgomery co., N. C. P. of v. 67; of tp. 882.

Troy, tp., Ashland co., O. P. 757.

Troy, tp., Athens co., O. P. 1830.

Troy, tp., Delaware co., O. P. 800.

Troy, tp., Geauga co., O. P. 832.

Troy, p.-v., Concord tp., cap. of Miami co., O., on Miami River Canal and on Cincinnati Hamilton and Dayton R.R., has manufactures, 2 national banks, and 2 weekly newspapers. P. 3005.

Troy, tp., Morrow co., O. P. 696.

Troy, tp., Richland co., O. P. 830.

Troy, tp., Wood co., O. P. 1057.

Troy, p.-b. and tp., Bradford co., Pa., half-shire town, on Northern Central R. R., 25 miles S. of Elmira, N. Y., has 5 churches, 1 graded school, 1 newspaper, 1 bank, 2 tanneries, 3 hotels, 2 flouring-mills, 4 carriage-factories, 1 steam fire-engine, 2 large foundries and machine-shops, 1 furniture-factory, and 4 secret societies. P. of b. 1081; of tp. 1479. A. S. Hooker, Ed. "Gazette."

Troy, p.-v. and tp., Crawford co., Pa. P. 983.

Troy, p.-v., cap. of Obion co., Tenn., on Paducah and Memphis R. R., has a weekly newspaper. P. 500.

Troy, p.-v. and tp., Orleans co., Vt. P. 1355.

Troy, p.-v. and tp., Gilmer co., West Va. P. 867.

Troy, tp., St. Croix co., Wis. P. 812.

Troy, tp., Sauk co., Wis. P. 995.

Troy, p.-v. and tp., Walworth co., Wis. P. 1176.

Troyes, town of France, capital of the department of Aube, on the Seine, has many splendid buildings, but is in general an old-fashioned place, partly in a state of decay, partly rebuilding. Its old ramparts have been changed into promenades, and of its many churches, that of St. Urbain and the cathedral are remarkable. Cotton fabrics, cloths, bombazines, calicoes, prints, lace, and hosiery are extensively manufactured; also wax, leather, paper, and sausages. Being the centre of a fertile and well-cultivated district, its general trade is very active. P. 38,113.

Troy Grove, p.-v. and tp., La Salle co., Ill. P. 1501.

Troyon' (Constant), b. Aug. 25, 1810, at Sèvres, near Paris, where his father held a subordinate position in the porcelain-works; studied painting, and began to exhibit in 1833, first landscapes, after 1847 also animals; attracted great attention in 1852 by his *Vallée de la Touque*, and achieved subsequently a great fame as a landscapist and painter of animals. D. at Paris Feb. 21, 1865. Among his most remarkable pictures are *Before the Storm*, *Working Oxen*, *Osier Bed*, *The Pastures of Trouville*, etc.

Troy Weight [from *Troy Novant*, a monkish name for London], a system of weight, employed in England and the U. S. for gold, silver, jewels, and drugs. The troy pound contains 12 ounces. One pound troy is to one pound avoirdupois as 144 to 175. The troy ounce is to the ounce avoirdupois as 192 to 175. (See Weights and Measures.)

Trüb'ner (Nicolas), b. at Heidelberg, Germany, in 1817; settled in early life in England; became a bookseller and publisher in London, in which capacity he has rendered eminent service to American bibliography, as well as to Oriental and comparative philology, and is himself distinguished for linguistic attainments, especially in Sanskrit and Basque. He has translated H. Conscience's *Sketches from Flemish Life* (1845); published a *Bibliographical Guide to American Literature* (1855), an extremely valuable work, in the 2d ed. of which (1859) he was aided by Dr. Hermann E. Ludewig, Hon. Benjamin Moran, and Mr. Edward Edwards; issued many elaborate sale-catalogues containing important bibliographical data; and edited Dr. Ludewig's posthumous *Literature of American Aboriginal Languages* (1858).

Truce. See International Law, Summary of, by Pres. T. D. Woolsey, S. T. D., LL.D.

Truce of God, in the Middle Ages, an institution which sprang up in France and Germany for the repression of private feuds and of the wrongs committed by the strong against the weak, by which nobles and princes bound themselves to keep the peace, to abstain from unlawful wars, and to protect clerics, women, merchants, pilgrims, peasants, and other non-combatants. The Truce of God was first proposed at the Council of Charroux in 989; adopted by the Council of Orleans in 1016, by the Council of Limoges in 1031, and became general, under the name of the Holy Peace, in 1033. In 1034 it was opposed by the bishop of Cambray. In 1041 the clergy of Aquitaine limited it to the time between Wednesday and Monday, not inclusive. It was afterward extended to nearly all the more important fasts, feasts, and holy seasons of the Church. England (1042) and Italy adopted the custom, which was further confirmed by several church councils, among which were the second and third Lateran Councils (1139 and 1179). The final triumph of legal over feudal government did away alike with this institution and with the necessity for it.

Truckee, p.-v., Nevada co., Cal., on Truckee River and on Central Pacific R. R., 120 miles E. N. E. of Sacramento, in the midst of a timbered region, has manufactures and a weekly newspaper. P. about 500.

True (Charles Kittredge), D. D., b. at Portland, Me., Aug. 14, 1809; studied at the Boston High School and Wilbraham Academy, and graduated at Harvard College in 1832; became pastor of Methodist churches in Massachusetts, Rhode Island, Connecticut, and New York; was principal of the Amenia Seminary, and in 1849–60 professor of moral and intellectual philosophy in the Wesleyan University at Middletown, Conn. He has contributed to religious periodicals, and has published *Shawmut, or the Settlement at Boston* (1845), and *Elements of Logic* (2d ed. 1861). D. in Brooklyn, N. Y., June 20, 1878.

True Cross, or **Holy Rood, The.** After his conversion to Christianity, the emperor Constantine the Great determined to build a church on Golgotha, on the very spot where the cross of Christ had stood. The task presented peculiar difficulties, however. Two centuries before, the place had been utterly disturbed by the emperor Hadrian. The Holy Sepulchre had been filled up, a temple erected to Jupiter and Venus, and pagan altars and statues scattered all over the place. But Helena, the mother of Constantine the Great, happened to stay in Jerusalem at this time (326), and by her order the whole place was cleared and extensive excavations were undertaken. The Holy Sepulchre was discovered; the three crosses were also found, the nails, and the tablet of inscription. The latter, however, had been loosened from the cross, and the question now arose, Which of the three crosses was the true one? Bishop Macarius succeeded in solving the question. Upon his advice the three crosses were carried to the bed of a noble lady of Jerusalem who lay sick unto death. Two of the crosses she touched without any effect, but the moment she touched the third she recovered and rose from her bed. Parts of this cross and the nails Helena sent to her son; the rest was framed in silver and placed in the new church as its most precious relic. Pilgrims gathered by thousands to Jerusalem to see the Holy Rood, and splinters of it encased in gold or silver, and borne as amulets, soon became an important article of commerce. Cyrillus says that at his time the whole world was filled with these splinters, and yet, by a miracle, the cross itself remained entire, as stated by Paulinus of Nola. In commemoration of the discovery of the true cross an annual festival was celebrated in Jerusalem even in the time of Constantine. Subsequently, this festival was introduced also into the Western countries as the *Festum Inventionis Sanctæ Crucis*, and by the synod of Cologne (1281) the 3d of May was appointed the day of its celebration.

True Friends. See Sincere Brethren.

True Inspiration, Community of. See Inspired, The.

Truf'fle [O. Fr. *trufle*], a common name for fungi of the genus *Tuber* and other closely-allied genera (*Terfezia*, *Chæromyces*, *Hydnotrya*, etc.). They are nearly all subterraneous in growth, and are from an inch to six inches in diameter. There are several species; one of the best known is *Tuber cibarium* of Europe. The truffle is one of the choicest of the edible fungi. Dogs—or in parts of Europe swine—are employed to scent the truffle, which is dug up by a hoe or fork. Truffles have a rich aromatic taste, and are highly prized in the composition of many sauces and dishes. The culture of truffles has been attempted with some success. Truffles are found to some extent in the U. S.

Truji'llo, or **Truxillo,** town of Spain, province of Caceres, is picturesquely situated, but old and decaying. Rearing of cattle, sheep, and swine is its principal industry. It was the birthplace of Pizarro, and he lies buried here. P. 7858.

Trujillo, or **Truxillo,** town of Peru, lies in lat. 8° 7′ S., 1½ miles from the Pacific. It was founded by Pizarro, and is well built. Its trade, though not great, is increasing. P. about 8000.

Trul'lan Syn'ods, the name of two ecclesiastical councils, the first convened in 680 by the emperor Constantinus Pogonatus for the purpose of reconciling the Monothelites (which see) with the orthodox Church; the second in 692 by the emperor Justinianus II. in order to confirm and enforce the statutes of the fifth and sixth œcu-

medical councils, whence it is also called QUINISEXTUM (which see). The epithet *Trullan* is derived, like that of Lateran, from the place in which the assembly sat—namely, a great hall in the imperial palace of Byzantium, surmounted by an oval dome, τρούλλα.

Trulls, tp., Sanford co., Ala. P. 712.

Tru'mansburg, p.-v., Tompkins co., N. Y., on Geneva and Athens R. R., 2 miles W. of Cayuga Lake, contains 4 churches, 1 academy, 1 bank, 1 newspaper, a mowing-machine manufactory, 1 foundry, and 3 hotels. P. 1246.
OSCAR M. WILSON, ED. "SENTINEL."

Trum'bull, county of N. E. Ohio, bordering on Pennsylvania, watered by Grand and Mahoning rivers, and intersected by Atlantic and Great Western R. R. and its branches, and by Pennsylvania and Ohio Canal; surface undulating, soil fertile and well adapted for grazing. Bituminous coal is found. There are manufactories of iron, machinery, carriages, cooperage, furniture, flax, bagging, and linseed oil; saw-mills, planing-mills, grist-mills, tanneries, currying establishments, and breweries. Cattle and sheep are numerous. Staples, Indian corn, oats, wheat, potatoes, flax, dairy products, wool, leather, and lumber. Cap. Warren. Area, 625 sq. m. P. 38,659.

Trumbull, p.-v. and tp., Fairfield co., Conn. P. 1335.

Trumbull, p.-v. and tp., Ashtabula co., O. P. 1081.

Trumbull (BENJAMIN), D. D., b. at Hebron, Conn., Dec. 19, 1735; graduated at Yale College 1759; was pastor of North Haven church from 1760 to his death; served as a volunteer soldier, and also as a chaplain, in the war of the Revolution; wrote *A Plea in Vindication of the Connecticut Title to the Contested (Western) Lands* (1776), which influenced the decision of Congress upon the validity of the Susquehanna purchase; *A Complete History of Connecticut 1630–1764* (2 vols., 1797–1818), and began a *General History of the United States of America* (vol. i., 1492–1765, Boston, 1810), left incomplete by his death at North Haven Feb. 2, 1820. He also published *Twelve Discourses on the Divine Origin of the Holy Scriptures* (1790) and several single sermons and occasional pamphlets. The MS. collections employed in the preparation of his *History of Connecticut* are in the library of Yale College.

Trumbull (JAMES HAMMOND), LL.D., b. at Stonington, Conn., Dec. 20, 1821; educated at Yale College in the class of 1842; aided Rev. J. H. Linsley in compiling catalogues of the mammalia, reptiles, fishes, and shells of Connecticut 1842–43; was assistant secretary of state of Connecticut 1847–52 and 1858–61; secretary 1861–65; corresponding secretary of the Connecticut Historical Society 1849–63; has been its president, and also librarian of the Watkinson Free Library since 1863; was one of the founders of the American Philological Association 1869, and its president 1874–75, and was appointed in 1873 lecturer in Yale College on the Indian languages of North America, a subject to which he has devoted much time since 1858. Editor of *The Colonial Records of Connecticut 1636–89* (3 vols., 1850–59), Roger Williams's *Key into the Language of America* (Narragansett Club, vol. i., 1866), Lechford's *Plain Dealing* (1867), Pierson's *Some Helps for the Indians* (1873), and of vols. i. and ii. of the *Collections* of the Connecticut Historical Society; author of *The Origin of McFingal* (1868), *The Composition of Indian Geographical Names* (1870), *The Best Method of Studying the Indian Languages* (1871), *Some Mistaken Notions of Algonkin Grammar* (1871), *Historical Notes on the Constitutions of Connecticut* (1872), *Notes on Forty Algonkin Versions of the Lord's Prayer* (1873), *On the Algonkin Verb* (1876); of a narrative of *The Defence of Stonington against a British Squadron in 1814* (1864), and of many other contributions, historical or philological, to literary periodicals and the proceedings of learned societies. He has prepared a glossary to a large portion of Eliot's Indian Bible, being probably the only American scholar now able to read that work.—His brother, HENRY CLAY, b. at Stonington in 1830, was a chaplain in the U. S. army during the civil war, and has since been missionary secretary for New England of the American Sunday-School Union. Author of *The Knightly Soldier, a Biography of Major Henry Ward Camp, 10th Connecticut Volunteers* (Boston, 1865), and other biographical and religious publications.

Trumbull (JOHN), LL.D., b. at Westbury (now Watertown), Conn., Apr. 24, 1750; was admitted to Yale College on account of extraordinary precocity at the age of seven years, but did not pursue the course until some years later, graduating 1767; wrote with Timothy Dwight a series of essays in the style of the *Spectator* (1769); was tutor there 1771–73, during which time he published *The Progress of Dulness* (3 parts, 1772–73), a satire on the methods of education; studied law; was admitted to the Connecticut bar Nov., 1773; continued his studies in the office of John Adams at Boston 1773–74; wrote for the political periodicals; settled as a lawyer at New Haven Nov., 1774; published anonymously his poetical *Elegy on the Times* (1774), and in the following year published in Philadelphia the first canto of his *McFingal*, a Revolutionary satire, in Hudibrastic verse (completed in 4 cantos in 1782), of which more than 30 unauthorized editions were sold. He settled at Hartford June, 1781; was associated with Humphreys, Barlow, and Hopkins in the production of *The Anarchiad*; was State attorney for Hartford 1789–95, member of the legislature 1792 and 1800, judge of the superior court 1801–19, and also judge of the court of errors 1808–19; was several years treasurer of Yale College, and in 1825 removed to Detroit, Mich., where he spent his last years with his daughter, the wife of Gov. Woodbridge. D. at Detroit May 10, 1831. Editions of his *McFingal* appeared in 1850, 1860, and 1864, the latter with notes by Benson J. Lossing. His *Political Works* appeared at Hartford (2 vols., 1820).

Trumbull (JOHN), son of Jonathan, colonial governor of Connecticut, b. in Lebanon, Conn., June 6, 1756; was graduated from Harvard College in 1773; chose art as his profession; joined the army in 1775 as adjutant; turned his skill as draftsman to account in drawing plans of the enemy's works; was promoted to aide-de-camp of Washington; accompanied the army to New York, and went as adjutant-general with Gates, who was appointed to the command of the Northern army; left the service, discontented, in 1777, and returned to his painting; in 1780 went to Paris, thence to London, and studied with West; was suspected as a spy during the excitement caused by the execution of André, and imprisoned eight months; released through West's intercession, he returned to America in 1782, and remained till peace was concluded, then went back to England to resume his studies. His first great historical work, *The Battle of Bunker Hill*, familiar through engravings, was exhibited in 1786, and was followed by *The Death of Montgomery before Quebec* and the *Sortie from Gibraltar*, both well known. In 1789 he returned to America with the purpose to commemorate on canvas the chief persons and events of the Revolution; among the likenesses taken were several of Washington. His preliminary design being completed, he returned to England as secretary to John Jay, and passed nearly ten years, from 1794 to 1804, in diplomatic service. Four years afterward he went once more and for the last time to England, and remained till 1815, painting indifferently and unsuccessfully. The next seven years were devoted to painting four grand pictures for the rotunda of the capitol at Washington—the *Declaration of Independence*, the *Surrender of Burgoyne*, the *Surrender of Cornwallis*, and the *Resignation of Washington at Annapolis*—pictures that did him less honor than his earlier works. The succeeding years were spent in revising and reducing to uniform size his different subjects. But his fame was declining, his expectations were disappointed, and finally he disposed of his whole collection to Yale College in consideration of an annuity of $1000 for the rest of his life. There were fifty-seven pictures in all, making an interesting collection. Trumbull passed the last twenty-seven years of his life mainly in New York; was president of the American Academy, succeeding De Witt Clinton and preceding S. F. B. Morse, till 1825—a working president, who gave instruction in the art of painting to a great number of pupils. D. in New York Nov. 10, 1843, and buried in New Haven. He was an active, hearty, independent man, as his pictures indicate. Their chief artistic merit is their vigor of action; their principal value is their fidelity in portraiture. His gallery may almost be called a national portrait-gallery. O. B. FROTHINGHAM.

Trumbull (JONATHAN), LL.D., b. at Lebanon, Conn., June 10, 1710; graduated at Harvard 1727; studied theology and was licensed to preach, but soon devoted himself to mercantile business, and ultimately to the law; was elected to the assembly 1733; was its Speaker 1739; became an assistant 1740, to which office he was re-elected twenty-two times; was made judge of the county court and assistant judge of the superior court; was chosen lieutenant-governor 1766, thereby becoming *ex-officio* chief-justice of the superior court; became governor 1769; held that office throughout the Revolution, resigning in 1783; was an energetic supporter of the popular cause; was considered a leader of the "Whigs" of New England, and his advice was much valued by Washington. The popular epithet "Brother Jonathan," now applied as a personification of the U. S., is said to have originated from Washington's habit of addressing him by that familiar title when requesting his opinion. D. at Lebanon Aug. 17, 1785. A *Life*, by Isaac W. Stuart, was published in 1857.

Trumbull (Jonathan), son of Gov. Jonathan, b. at Lebanon, Conn., Mar. 26, 1740; graduated at Harvard 1759; was for several years before the Revolution a member of the legislature and Speaker of the house; was paymaster in the army 1775–78; became in 1780 secretary and first aide-de-camp to Gen. Washington, and as such was a member of his family until the close of the war; was a member of Congress 1789–95; Speaker of the House of Representatives 1791–95; U. S. Senator 1795–96; lieutenant-governor of Connecticut 1796–98, and governor from 1798 until his death at Lebanon Aug. 7, 1809.

Trumbull (Joseph), son of Gov. Jonathan, b. at Lebanon, Conn., Mar. 11, 1737; graduated at Harvard 1756; was a member of the Continental Congress 1774–75; was commissary-general of the Revolutionary army from July 19, 1775, to Aug. 2, 1777, and a commissioner for the board of war from Nov. 27, 1777, to Apr. 18, 1778, when he resigned on account of ill-health. D. July 23, 1778. His services were highly eulogized in a report made to Congress 1779, and a commission on the sums disbursed by him was voted to his heirs.

Trumbull (Joseph), LL.D., grandson of Gov. Jonathan, b. at Lebanon, Conn., Dec. 7, 1782; graduated at Yale College 1801; was admitted to the bar in Windham co. 1803; practised for some time in Ohio; afterward settled at Hartford, where for eleven years he was president of the Hartford Bank (1828–39); was several times chosen to the legislature; sat in Congress 1834–35 and 1839–43; was president of a railroad company and an active promoter of internal improvements, and was governor of Connecticut 1849–50.

Trumbull (Lyman), b. at Colchester, Conn., Oct. 12, 1813; educated at Colchester Academy; taught an academy at Greenville, Ga., 1833–36; studied law; was admitted to the bar 1837; settled at Belleville, Ill.; was elected to the legislature 1840; was secretary of state 1841–42, justice of the supreme court 1848–53, member of Congress 1853–55, and U. S. Senator 1855–73; was prominent as a Republican during the war, and became chairman of the judiciary committee 1861; was a delegate to the Philadelphia "Loyalists' convention" 1866, and voted against the impeachment of Pres. Johnson in 1867. Since 1863 he has resided at Chicago.

Trum'pet [Ger. and Span. *trompet*], in acoustics, any instrument used for the conveyance to the ear of articulate sound from a distance. In music, a well-known wind instrument, usually consisting of a brass tube some eight feet in length, expanding at the end into a bell-like shape. By means of slides and keys the inflexions of the trumpet have been of late years largely increased.

Trumpeters, in ornithology. See Agami.

Trum'pet-Fish, a name applied on the North American Atlantic coast to the *Fistularia tabacaria* (family Fistulariidæ), and on European coasts to *Centriscus scolopax* (family Centriscidæ), closely allied families of the order Hemibranchi. The first mentioned is without scales, and has a greatly-elongated snout, with the mouth at the end of a bony tube. The forked tail has one or two long central filaments. The European trumpet-fish has a large and very sharp dorsal spine, and a snout very much like that of the foregoing. (See Bellows-Fish.)

Trumpet-Flower, a popular name for various species of *Bignonia* and *Tecoma*, mostly shrubs and woody vines, though in tropical regions some of the species are large trees. They belong to the order Bignoniaceæ. The native species of the U. S. are *Bignonia capreolata*, *Tecoma radicans*, and *T. stans*. The first and second are fine climbers. *T. capensis* from South Africa, *T. grandiflora* from Japan, and other fine species are often cultivated.

Trunc'ated Cone or **Pyramid,** the portion of a cone or pyramid included between the base and a secant plane oblique to the base. It differs from a frustum in the fact that the secant plane which determines a frustum is parallel to the base.

Trunk'-Fish, a name applied to various fishes of the order Plectognathi and the sub-order Ostracodermi, forming the family Ostraciontidæ. They are so called on account of being encased in an angular case-like development of the integuments, recalling to mind the idea of a trunk. (For further information see Ostraciontidæ.)

Tru'ro, town of England, county of Cornwall, at the junction of the Allen and Kenwyn, is the centre of a rich mining district, and exports large quantities of tin and iron ore. It is situated in a hollow surrounded by hills, has a fine church of the time of Henry VII., a mining college, and a library. Pop. 10,999.

Truro, a handsome town, cap. of Colchester co., N. S., near Cobequid Bay, at the junction of International and Nova Scotia railways, 61 miles N. of Halifax. It contains a provincial normal school, has a weekly newspaper, and manufactures of woollens, boots and shoes, etc. Shipbuilding, fishing, agriculture, and mining are also carried on near Truro, which is a place of much wealth. P. of subdistrict, 3998.

Truro, p.-v. and tp., Knox co., Ill. P. 899.

Truro, p.-v. and tp., Barnstable co., Mass., on Cape Cod Bay. P. 1269.

Truro, tp., Franklin co., O. P. 1866.

Truro (Thomas **Wilde**), Baron, b. in London, England, July 7, 1782; educated at St. Paul's School; studied law under his father, a solicitor; was admitted an attorney 1805; was called to the bar at the Inner Temple 1817; soon became a leader upon his circuit; was a junior counsel in defence of Queen Caroline 1820; became sergeant-at-law 1824, king's sergeant 1827; entered Parliament as a Whig 1831; became solicitor-general, and was knighted Feb. 9, 1840; was attorney-general June to Aug., 1841; bore a very distinguished part in a famous debate on parliamentary privilege; became chief-justice of the common pleas July 7, 1846; was created lord chancellor and Baron Truro by Lord John Russell's administration July 15, 1850, and resigned in Feb., 1852. D. at Southgate, Middlesex, Nov. 11, 1855.

Truss. This word is said to be from the Latin *torquere*, to "twist," whence anything twisted or made into a bundle, as a "truss of hay." The technical meanings diverge far from that of the root: in surgery, a bandage used for hernia (see Hernia); in botany, a tuft of flowers; in engineering, the frame of timbers forming the skeleton of a roof (see Roof), and by extension a framework to which rigidity is given by staying and bracing (as distinguished from the *arch* or *suspension* principle), and used for spanning or bridging an interval. (In this connection see Flexure of Beams and Bridge.) J. G. Barnard.

Trust [Swed. *trost*], in law, denotes a peculiar species of ownership, whereby the legal estate, either in things real or personal, is held by one person, called the "trustee," and an equitable estate or interest of greater or less extent in the same things is held by another person, called the *cestui que trust* or beneficiary, upon a confidence reposed in the trustee that he will do or permit concerning the property whatever is required by the nature of the beneficiary's interest. Two parties are necessary, and two interests—the one legal, vested in the trustee; the other equitable, held by the *cestui que trust*; but the latter may greatly vary in the rights which it confers and the duties which it imposes. The term "trust" properly applies to and describes this entire dual ownership, and not the separate estate of either party. Trusts were first contrived or distinctively named by the courts of equity in the place of the uses which Parliament had attempted to abolish by the statute of 27 Hen. VIII. They were originally confined to lands, but have since been applied to personal property. The general doctrine of trusts has been greatly enlarged and extended with the growth of equity jurisprudence, and has, in fact, become the chief instrument by which its principles are made effective and the observance of good faith is enforced in the various relations and transactions of mankind. Trusts are separated into the following generic classes: *Active trusts* are those in which, from their very nature and from the terms of their creation, the trustee is charged with some active and positive duties toward the beneficiary in relation to the property, such as its possession, control, and management, the receipt and disposition of its rents and profits, and the like. Although the extent of the trustee's powers and duties may greatly vary, his legal possession of the subject-matter must necessarily accompany his title. *Passive trusts*, sometimes termed *pure* or *simple*, are those in which the trustee has no active management of the subject-matter, but merely holds the bare legal title, while the possession, control, rents, and profits are left to the beneficiary. They are identical with the ordinary "uses" prior to the "statute of uses." *Express trusts* arise from the direct and intentional act of the parties, evidenced by some declaration which is generally contained in a written instrument. The most common examples of this class are those created by marriage settlements, by assignments for the benefit of creditors, by deeds of conveyance, and by wills. The statute of frauds enacts that no trust over or concerning lands shall be created, assigned, or declared except by a deed or conveyance in writing, but that this provision shall not affect trusts created by will and those implied by law. *Implied trusts* do not arise from any express declaration of the parties, but are implied from their acts or omissions. There are two subdivisions of this class, termed "resulting" and "constructive." Resulting trusts are created by equity in accordance with an assumed intention of the parties shown by certain acts, while construc-

tive trusts are enforced by equity without, and even contrary to, the intention of the persons regarded as trustees by reason of acts on their part which are violations of good faith or fraudulent. In cases of implied trust the beneficiary is the equitable owner of the land or other subject-matter, and is entitled to a conveyance or transfer thereof, while equity enforces the trust by compelling the holder of the legal title, or trustee, to execute such conveyance. It is impossible to enumerate here the different varieties of implied trusts. The doctrine concerning them is most comprehensive and salutary. It is the most powerful instrument of equity in restraining fraud and protecting the rights of ownership, and has been freely extended to chattels, things in action, and even money. The Revised Statutes of New York have made great changes in the law of trusts which had been built up by the court of chancery. Implied trusts are, with one particular exception, left unaltered. All express passive trusts of land, and all express active trusts of land, except certain classes, are abolished. The express trusts which are permitted are the following: (1) to sell lands for the benefit of creditors; (2) to sell, mortgage, or lease land for the benefit of legatees or to satisfy any charge thereon; (3) to receive the rents and profits of land, and apply them to the use of any person during his life or for a shorter period; (4) to accumulate rents and profits of land for the benefit of minors during the continuance of their minority. The leading object of this statutory system is to prevent all dispositions of property by way of trust which shall create a perpetuity; that is, which shall suspend the power of alienating the subject-matter for a longer time than the life of the beneficiary. Trusts of personal property are not included in the foregoing provisions, which restrict the creation of express trusts in land to certain specified objects, but they are subject to all the statutory rules for the prevention of perpetuities. This legislation has been followed in several other States. (See TRUSTEE and USE.) JOHN NORTON POMEROY.

Trust, Charitable. In the ordinary private trusts (see TRUST) there must be both a known trustee and a certain, determinate beneficiary, although if the trustee should die, resign, or refuse to accept, the court can supply the place by appointment. But property may be given in trust for specified objects where the beneficiaries are completely indeterminate—as, for example, a gift to aid in spreading the gospel or to relieve the poor—or where the beneficiaries constitute a known class, but the individuals are uncertain, as a gift to provide for the poor of a particular town or to support the scholars in a designated school. Dispositions of this form and nature, whether made by deed or by will, are termed "charitable trusts." They first appeared in the Roman empire after it became Christian, and were both legalized and fostered by several constitutions of Christian emperors. The researches of modern jurists have ascertained and established the fact beyond a doubt that the English court of chancery at an early day, by virtue of its own intrinsic authority, assumed jurisdiction over, upheld, and enforced this species of trusts. In the 43d Elizabeth a statute was passed which regulated the whole subject of charitable gifts. It created a new and special jurisdiction of the chancellor, and contained an enumeration of lawful charitable objects. In proceedings under this legislation the chancellor did not act in his ordinary judicial capacity, but as the direct and personal representative of the Crown. In determining what trusts should be upheld as charitable, the doctrine was firmly settled that all objects embraced within the spirit as well as the letter of the statutory enumeration are lawful. As the result of this principle, all trusts created for any one of the following general purposes are charitable: (1) The support, maintenance, or spread of the Christian religion; (2) the relief, aid, or support of the poor, the sick, or those in any manner disabled; (3) the foundation, erection, or support of institutions, organizations, societies, or other means of general beneficence, either for all needy persons or for particular classes, such as asylums, hospitals, dispensaries, reformatories, and the like; (4) the maintenance and promotion of education, learning, literature, science, or art by the establishment, erection, support, or aid of universities, colleges, schools, libraries, reading-rooms, museums, scientific lectures, societies, art schools or galleries, etc.; (5) any and all objects of interest or advantage to the public, as highways, parks, public gardens, water or gas supplies, and the like. These general classes contain a vast number of particular instances which it is impossible to describe or even to name. In administering charitable trusts the English court of chancery exhibited the utmost liberality in carrying out the designs of the donors and in sustaining the gifts. It even invented and applied a special doctrine, known as the principle of *cy pres* ("as near to"), in pursuance of which, when it was found impossible to carry out the design of the donor in the exact manner which he had indicated, the court would contrive and establish another scheme or mode, preserving the same general intent, and differing as little as possible in its details from the original plan. By the statute 9 Geo. II. ch. 36, it was enacted that no lands or money to be laid out on them shall be given for any charitable use unless by deed executed twelve months before the donor's death. The universities of Oxford and Cambridge and the public schools at Eton, Winchester, and Westminster are excepted from the operation of this statute. Recent legislation in England, and especially a statute passed in 1853, has completely readjusted the means and methods of regulating charitable trusts through judicial action. The statute of 13 Elizabeth has not been re-enacted in the U. S. In several of the States, however, the courts have adopted the general doctrines which had been formulated by the English chancery, so that the charitable trusts as above described are, to a certain extent, recognized in their local jurisprudence and upheld by their judiciary. The principle of *cy pres*, however, is entirely repudiated. In other States the whole system has been rejected as inconsistent with our institutions, and especially because it tends to create perpetuities, which are opposed to the policy of our laws. In New York, for example, it has been finally settled, after some vacillation, that charitable trusts were abrogated by the Revised Statutes, and that the only mode of establishing a charity in a legal and permanent manner is through the instrumentality of a corporation, which shall receive and administer the trust. JOHN NORTON POMEROY.

Trustee', in the strict and technical meaning originally given to the word, is one who holds the legal estate or property in lands or things personal for the use and benefit of another who has an equitable interest in the same subject-matter. In a more comprehensive sense the term is applied to any person who is clothed with an interest in, power or authority over, property which, in good faith and according to equitable principles, must be exercised for the benefit of another or others. In this broad view, administrators, executors, guardians, assignees of bankrupts and insolvents, the directors or other supreme managers of corporations—in short, all persons who stand in a fiduciary relation toward others in respect to the possession, use, management, or disposition of property—are trustees, and are so regarded by courts of equity. A trustee may be created by express words, or may become such by reason of his own acts or omissions. Equity in numerous instances imposes the character of trustee upon a person contrary to his intention, and compels him to hold property of which he has acquired the title for the benefit of another who is the equitable owner, and to convert the latter's equitable interest into a legal estate by a conveyance. The office and function of trustees are in the highest degree fiduciary; they must act in perfect good faith, and with the discretion and care at least of ordinary business-men under the same circumstances. The power of courts of equity to enforce these duties is complete. They may remove a trustee and appoint another; may restrain him by injunction; may call him to account and hold him personally responsible for the results of his frauds or neglects, for improper investments, for profits made or which ought to have been made, and for interest; may avoid conveyances made to himself, and those made to third parties in breach of the trust; may follow the property into the hands of such third persons as implied trustees, unless they are purchasers in good faith for a valuable consideration; may, in fact, do anything which will give equitable protection to the rights of the beneficiary. Where there are two or more trustees of land, their estate is joint, and on the death of one the whole interest vests in the survivor or survivors. This rule does not apply to a large class of quasi-trustees: and in New York, upon the death, removal, or resignation of any one or more of several trustees, the court is empowered by statute to fill the vacancy thus made by appointment. The duties and functions of a trustee, being purely fiduciary and personal, cannot be delegated. The power of management, where the trust is active, depends upon its nature and the terms of the instrument by which it is created; where the trust is purely passive, this power is merely nominal. (See TRUST.)
JOHN NORTON POMEROY.

Truxillo. See TRUJILLO.

Trux'ton, p.-v. and tp., Cortlandt co., N. Y., on New York and Oswego Midland R. R. P. of v. 314; of tp., 1618.

Truxton (THOMAS), b. on Long Island, N. Y., Feb. 17, 1755; went to sea at the age of twelve years; was impressed into the British navy; became in 1776 lieutenant of the American privateer Congress; equipped and commanded in 1777 the Independence, with which he made valuable prizes; afterward commanded the St. James (30 guns), with which he disabled a British ship of superior force

after a severe engagement; was engaged in the East India trade for several years after the war; became captain of the U. S. frigate Constellation (June, 1794), with which he captured the French frigate L'Insurgente Feb. 9, 1799; obtained a victory over the Vengeance Feb. 1, 1800, for which Congress voted him a gold medal; was made commander of the West Indies squadron of ten vessels 1801, and appointed 1802 to the command of the naval expedition against Tripoli, which he declined; was consequently dismissed from the service by Pres. Jefferson, and was in 1816–19 high sheriff of Philadelphia, where he d. May 5, 1822. Author of *Remarks, Instructions, and Examples relating to Latitude and Longitude, also the Variation of the Compass* (Philadelphia, folio, 1794).

Truxton (William T.), U. S. N., b. Mar. 11, 1824, in Pennsylvania; entered the navy as a midshipman Feb. 9, 1841; became a lieutenant in 1855, commander in 1866, captain in 1873; commanded the steamer Tacony at the taking of Plymouth, N. C., Oct. 31, 1864, and in both the Fort Fisher fights, and recommended for promotion by Commander Macomb and Rear-Admiral Porter for "coolness, intrepidity, and skilful handling of his vessel."
Foxhall A. Parker.

Trygon'idæ [from *Trygon*—Gr. τρυγών, an ancient proper name—the typical genus], a family of selachians of the order Raiæ, typified by the stingrays. The disk constituted by the union of the pectoral fins with the body is rhomboid or oval, and oblong or transversely expanded; the tail is thin and attenuated toward its extremity, but otherwise variously developed, being mostly very long, but sometimes very short; the skin is generally more or less armed with scattered spines or tubercles; the head is produced into a pointed snout or at least angulated in front; the nasal valves are confluent, and bound to the upper lip by a median frænum, but the hinder margin free and fringed; the mouth is moderate; the teeth mostly transversely elliptical, and ridged or cuspidate; on the back of the tail are generally one or more spines, which, in the typical forms, are compressed from before backward, and armed at their lateral edges with teeth or serrations directed downward, but these are sometimes wanting; there generally are only rudimentary dorsal and caudal fins, or none at all. The species are quite numerous, and disseminated in all seas except the extreme polar ones. They apparently indicate three primary groups—viz. (1) Ellipesurinæ, represented by the genus *Ellipesurus* (1 species); (2) Trygoninæ, with the genera *Trygon* (about 25 species), *Hypolophus* (1 species), *Tæniura* (6 species), *Urolophus* (4 species), *Trygonoptera* (2 species), and *Urogymnus* (1 species); and (3) Pteroplateinæ, with the genera *Pteroplatea* (4 species) and *Ætoplatea* (2 species). Three of these genera have members in the waters of the U. S.—viz. *Trygon centrura* and *Pteroplatea maclura* on the eastern coast, and *Urolophus Halleri* and *Pteroplatea marmorata* on the western. The Trygoninæ have the disk longer than wide, and a long tail; the Pteroplateinæ have the disk much wider than long, and a short tail. The species are to be feared on account of their spines. (See further Stingray.) Theodore Gill.

Try'on, p.-v., Polk co., N. C. P. 640.

Tryon (William), LL.D., b. in Ireland about 1725; received a good education; became a distinguished officer in the British army; married Miss Wake, a relative of the earl of Hillsborough, secretary of state for the colonies, through whose influence he was appointed lieutenant-governor of North Carolina 1764; became governor by the death of Gov. Dobbs July 20, 1765; suppressed the revolt of the "Regulators," treating the prisoners with cruelty; erected at the cost of the province a magnificent residence at Newherne; was advanced to the governorship of New York July 3, 1771; became colonel 1772 and major-general 1777; was detested by the patriots for his many acts of rigor and severity, and especially for the destruction of Danbury, Fairfield, and Norwalk, Conn., by expeditions conducted by him in person; resigned his post Mar. 21, 1778, and returned to England, where he became a lieutenant-general 1782. D. in London Feb. 27, 1788.

Tsars'koe-Se'lo, town of Russia, government of St. Petersburg, contains two magnificent palaces which are used by the imperial family as summer residences. The park and pleasure-grounds of the palaces cover an area 18 miles in circumference, and the palaces, vast and gorgeous buildings, contain many valuable collections. P. 10,233.

Tschauchalova. See Tarki.

Tschu'di (Ægidius), b. in Glarus, Switzerland, in 1505; studied at Bâle, Vienna, and Paris; travelled much in his native country and Italy; served in the French army 1536–44; held various important offices in Baden and Glarus; went in 1559 as ambassador to the emperor Ferdinand I. in Augsburg; was banished in 1562 on account of his strong adherence to the Roman Catholic Church, but recalled in 1564. D. in Glarus Feb. 28, 1572. On his travels and in his various offices he made very comprehensive investigations with respect to the history of Switzerland, and the last years of his life he spent in preparing his rich materials for publication, but only *Die uralt wahrhaftig Rhetia* appeared before his death. His principal work is *Chronicon Helveticum 1000–1470*, written in German and published by I. R. Iselin in 2 vols. (Bâle, 1734–36).

Tschudi, von (Johann Jakob), b. in Glarus, Switzerland, July 25, 1818; studied natural science at Zurich, Leyden, Paris, Berlin, and Würzburg; explored Peru 1838–43, Brazil, La Plata, and other South American states 1857–59; was appointed Swiss ambassador to Brazil in 1860, and to Vienna in 1866, and wrote *Reiseskizzen aus den Jahren 1838–42* (2 vols., 1846; translated into English in 1847 by T. Ross), *Untersuchungen über die Fauna Peruana* (1844–47), *Die Ketschuasprache* (2 vols., 1853), *Reise durch die Andes von Südamerika* (1860), *Reisen durch Südamerika* (5 vols., 1866–69); in connection with Don Mariano Eduardo de Rivera he published *Antiguidades Peruanas* (1851; translated into English by F. L. Hawks, New York, 1854).

Tse'tse, the *Glossinia morsitans* of Westwood, a dipterous insect a little larger than the common fly. It abounds in some parts of South Africa, but is absent from large districts. Its bite, according to Livingstone, is certain death to the ox, horse, and dog, though apparently harmless to man, as well as to goats, asses, mules, and the various wild beasts of the regions it inhabits. Recent authorities assert that the reports of its injurious nature have been exaggerated. Its venom is secreted by a little gland, smaller than a mustard-seed.

T-Square, an instrument used in drawing parallel straight lines. It consists of two arms, one of which is called the *stock*, and the other the *blade*. The blade is attached to the stock at its middle point by a hinge-joint and clamp-screw. The stock projects below the blade, forming a shoulder, which, when used, is pressed firmly against the edge of the drawing-board. To use the instrument, we first set the blade so as to make the desired angle with the stock; we then press the shoulder of the stock firmly against the edge of the drawing-board and slide it along that edge; the blade will move so as to remain parallel to its first position. W. G. Peck.

Tuano, tp., Elko co., Nev. P. 117.

Tu'aricks (*Tawarek*), a race of Mohammedan nomads inhabiting a great part of the Sahara or great African desert, from Fezzan W. to the Atlantic. They are believed to be allied by race to the Berbers. Their hair is straight, their features are Caucasian rather than African, and their physical development is fine. They have a written alphabet, but no literature. The alphabet contains Hebrew, Greek, and Roman letters, with others. The Tuaricks are divided into large tribes, and greatly oppress the Tibboos (Tebu), their neighbors. Their number is estimated at 200,000.

Tubal', tp., Union co., Ark. P. 351.

Tu'ber [Lat.], in plants, a thickened subterraneous portion of the stem, bearing latent buds or "eyes," and usually composed of cellular substance richly stored with starch or some other equivalent principle. Hence, many of the tubers, like that of the common potato, are of great value as sources of human food.

Tu'bercle [Lat. *tuberculum*], a name applied to certain diseased and degenerative products in the animal body, and chiefly interesting in its relation to pulmonary phthisis or consumption. In the remote periods of medicine persons dying of consumption were known to have in their lungs yellow masses of cheesy consistency. These were rudely designated tubercle. By Stark in 1785, by Matthew Baillie in 1794, and Boyle in 1810, a new body was described, termed miliary tubercle; this minute body, about the size of a millet-seed, of gray color, semi-translucent, and of gelatinous consistency, has come to be regarded as true tubercle. The miliary or true tubercle is therefore to be looked for in the acute tuberculosis of children, in tubercular inflammation of the brain, pleura, peritoneum, and wherever in a consumptive and tainted constitution acute marasmus supervenes. The yellow masses, now known as crude tubercle, have been resolved by the microscope into wasted, shrivelled cells and fatty granules, which give the homogeneous cheesy consistency. Hence, so-called "yellow tubercle" may be the second and advanced stage of true tubercle, or the "fatty degenerative," retrograde stage of innocuous material in the body, as when acute inflammation has given rise to plastic lymph, which fails to organize. Under such circumstances, in a

person hitherto healthy, with no tubercular tendency, an unfortunate inflammatory attack may lead to deposits which become fatty or "cheesy;" and these caseous masses liquefy or soften, forming cavities. It is, then, the tendency of abnormal deposits, whether true tubercle or simple cheesy matter, to compress the healthy tissues and cause their waste, and to soften and form cavities, that leads to consumption and death. Yellow tubercle is most liable to develop, following acute sickness, in those who are delicate and ill-nourished. The relation of miliary or true tubercle to the scrofulous or strumous diathesis is unsettled, the opinion steadily gaining that "scrofula is the soil in which tubercle grows." Buhl, Schuppel, and others claim that tubercle develops upon the minute lymphatics which permeate all the structures of the body.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Tubercular Meningitis. See Meningitis, by E. Darwin Hudson, Jr., M. D.

Tu'berose, the *Polyanthes tuberosa*, an *amaryllidaceous* plant, a native of Ceylon, much cultivated in greenhouses for its beautiful and highly-fragrant white flowers, which are extensively employed by perfumers. Some 24,000 pounds of tuberose flowers are yearly produced in the valley of the Var, in France, for perfumers' use.

Tü'bingen, an old but interesting town of Germany, in Würtemberg, is beautifully situated on the Neckar. Its university, founded in 1477, is a celebrated institution, and has a botanical garden, a chemical laboratory, an observatory, and several fine museums and collections connected with it. Reuchlin and Melanchthon were among its first professors, and in the beginning of this century it developed a new school of theology of great influence. The general trade of the town is very lively. P. 9313.

Tübingen School, the title of a group of theological and exegetical writers connected with the University of Tübingen in Germany, who opposed both the old or evangelical and the so-called rationalistic interpretation of the Bible. The founder of the school is Dr. Baur, and its principal pupils are Strauss and Zeller. Strauss, in his *Life of Jesus*, carried out the mythical theory of the gospel history. (See Strauss.)

Tubular Bridge. See Bridge, by Gen. J. G. Barnard, A. M., LL.D.

Tuck (Joseph Henry), b. at Dorchester, Mass., Mar. 12, 1812; was at first a watchmaker, then a candle-manufacturer, and in 1837 went to London, where he established himself as a civil engineer, returning to the U. S. in 1865. The inventions for which he has secured patents number more than fifty, among which are those for a candle-machine, a dredging-machine, a rotary steam-engine, and for steam-engine packing. He established the company which in 1848–49 laid the first submarine cable from Dover to Calais, and furnished the plans for excavating the Suez Canal. His present residence is in Brooklyn, N. Y.

Tuckahoe', the Indian name of a singular vegetable substance found under ground in the Southern States of the U. S., sometimes attaining the size, and having somewhat the appearance, of a loaf of bread, whence it is often called "Indian loaf" or "Indian bread." Its methods of growth and reproduction are unknown, it having neither roots, branches, nor cellular structure, for which reason it has plausibly been considered by Rev. M. J. Berkeley and other distinguished cryptogamists as a secondary product caused by the degeneration of the tissues of some flowering plant. It was eaten by the Indians, and is still sometimes used, when boiled in milk, as a substitute for arrow-root.

Tuckahoe, p.-v., Cape May co., N. J.

Tuckahoe, p.-v. and tp., Jones co., N. C. P. 616.

Tuckahoe, tp., Henrico co., Va. P. 3339.

Tuck'er, county of N. E. West Virginia, partially bordering on Maryland, and drained by Cheat River; surface broken and mountainous, but with fertile valleys. Staples, Indian corn, oats, and wool. Cap. St. George. Area, about 400 sq. m. P. 1907.

Tucker, tp., Wirt co., West Va. P. 540.

Tucker (Abraham), b. at London, England, Sept. 2, 1705; graduated at Merton College, Oxford, about 1725; studied law at the Inner Temple, but was never called to the bar; devoted himself from 1727 to the management of his large estate at Betchworth, Surrey; became blind 1771. D. at Betchworth Nov. 20, 1774. Author, besides other works, of *The Light of Nature Pursued, by Edward Search, Esq.* (1768 and 1778), a remarkable treatise on metaphysics, several times reprinted.

Tucker (George), b. in Bermuda in 1775; emigrated about 1787 to Virginia, where he was educated under the superintendence of his relative, Judge St. George Tucker; graduated at William and Mary College 1797; became a lawyer; was a member of the Virginia legislature; sat in Congress 1819–25, taking a high position as a debater and constitutional lawyer; was professor of moral philosophy and political economy in the University of Virginia 1825–45, after which he lived in retirement, chiefly at Philadelphia. D. at Sherwood, Albemarle co., Va., Apr. 10, 1861. Author of *Letters on the Roanoke Navigation* (1811), *Essays on Subjects of Taste, Morals, and National Policy* (1822), *The Valley of the Shenandoah, a Novel* (2 vols., 1824), *A Voyage to the Moon*, a satirical romance (1827), *The Principles of Rent, Wages, and Profits* (1837), *Life of Thomas Jefferson* (2 vols., 1837), *The Theory of Money and Banks Investigated* (1839), *The Progress of the U. S. in Population and Wealth in Fifty Years, 1790–1840* (1843), *History of the U. S. to 1841* (4 vols., 1856–58), *Political Economy for the People* (1859), *Essays, Moral and Philosophical* (1860), and several other works; also of contributions to numerous periodicals.

Tucker (Henry St. George), LL.D., son of Judge St. George, b. in Virginia Jan. 5, 1781; received a good education; became a distinguished lawyer; was a member of Congress 1815–19; professor of law in the University of Virginia 1824; chancellor of the fourth judicial district; president of the Virginia court of appeals and of the Virginia Historical and Philosophical Society. D. at Winchester, Va., Aug. 28, 1848. Author of *Commentaries on the Laws of Virginia* (Winchester, 2 vols., 1836–37), *Lectures on Constitutional Law* (1843), and *Lectures on Natural Law and Government* (Charlottesville, 1844).—His son, David Hunter, was b. at Winchester, Va., June 18, 1815; educated at the University of Virginia, and in medicine at Philadelphia and Paris; became professor in Jefferson Medical College and in the Medical College of Virginia, and was author of some medical works. D. Mar. 17, 1871.

Tucker (Josiah), D. D., b. at Langharne, Wales, in 1711; educated at St. John's College, Oxford; took orders in the Church of England; was successively curate, minor canon, rector, and prebendary at Bristol; became dean of Gloucester 1758; was distinguished from nearly all his contemporaries by his clear perception of the state of political affairs in the American colonies, and advocated in several pamphlets their peaceable separation. He also wrote a number of tracts upon financial subjects, in which he anticipated to some extent the economic doctrines of Adam Smith. D. at Gloucester Nov. 4, 1799.

Tucker (Luther), b. at Brandon, Vt., in 1802; became a printer; established in 1826 the Rochester *Daily Advertiser*, the first daily paper in New York W. of Albany; founded in 1831 the *Genesee Farmer*, the pioneer agricultural paper of New York, afterward consolidated with the Albany *Cultivator*, and in 1852 established the *Country Gentleman*.

Tucker (Nathaniel Beverley), son of St. George, b. at Matoax, Va., Sept. 6, 1784; graduated at William and Mary College 1801; studied law, which he practised in Charlotte co. 1809–15; resided in Missouri, where he filled a judicial post 1815–30, and was professor of law in William and Mary College from 1834 to his death, at Winchester, Aug. 26, 1851. Author of three novels—*George Balcombe*, *Gertrude*, and *The Partisan Leader, a Tale of the Future* (Washington, 1837); *Lectures on the Constitution of the U. S.* (1845); *Principles of Pleading* (Boston, 1846), and other works; contributed to the *Southern Review*, and left unfinished a biography of his half-brother, John Randolph of Roanoke, whom in character he much resembled. The *Partisan Leader* was a somewhat remarkable work. Written in 1836, it purported to narrate the events of a secession and civil war in the U. S., supposed to occur in the year 1849, during the third Presidential term of Martin Van Buren. It was reprinted in New York in 1861 as *A Key to the Disunion Conspiracy*, and had a large circulation.—Beverley Tucker, Jr., was editor of the Washington *Sentinel* 1854, consul at Liverpool 1856–60, took an active part in the rebellion, and in 1865 settled in Canada.

Tucker (St. George), LL.D., b. at Port Royal, Bermuda, June 29, 1752; graduated at William and Mary College 1772; studied law; was concerned in an expedition against Bermuda, where he aided in the capture of a fortification and of a large amount of stores 1776; commanded a regiment at Yorktown, where he was severely wounded in the knee and rendered lame for life; married Mrs. Frances Bland Randolph, mother of John Randolph, 1778; became a member of the Virginia legislature, professor at William and Mary College, commissioner to revise and digest the laws of Virginia, and a delegate to the convention at Annapolis, Md. (1786), which took the initiative in recommending the formation of a national constitution; was a judge in the State courts of Virginia nearly fifty years, judge of the court of appeals 1803–11, and of the U. S. district court of Eastern Virginia 1813–27, and was

noted for wit, poetical talent, and legal attainments. D. at Edgewood, Nelson co., Va., in Nov., 1827. Author of *A Dissertation on Slavery, with a Proposal for its Gradual Abolition in Virginia* (Philadelphia, 1796), *Letter on the Alien and Sedition Laws* (1799), and of a volume of poems, published under the *nom de plume* of "Peter Pindar," and edited *Blackstone's Commentaries, with Notes of Reference* (Philadelphia, 5 vols., 1803).

Tucker (Samuel), b. at Marblehead, Mass., Nov. 1, 1747; bred to the sea; a captain sailing from Boston to London before the Revolution; commissioned a captain in the new American navy May 15, 1777; commanded the frigate Boston, in which he conveyed John Adams, minister to France, to his destination, Feb., 1778; took several prizes 1779; aided in the defence of Charleston, S. C., but became a prisoner at its capture, May, 1780; was exchanged June, 1781; took command of the Thorn, with which he made many prizes; received the thanks of Congress at the close of the war; settled at Bristol, Me., 1792; was for several years a member of the legislatures of Massachusetts and Maine, and in 1812 captured by stratagem a British vessel which had greatly annoyed the shipping of Bristol. D. at Bremen, Me., Mar. 10, 1833. His *Life* was published by John H. Sheppard in 1868.

Tuck'erman (Henry Theodore), b. in Boston Apr. 20, 1813; studied in the public schools of that city; travelled in Europe, and devoted himself to literature, criticism, and the study of art, and was a frequent contributor to periodicals, many of his papers having been collected in the following volumes: *The Italian Sketch-Book* (1835), *Isabel, or Sicily, a Pilgrimage* (1839), *Rambles and Reveries* (1841), *Thoughts on the Poets* (1846), *Artist Life*, being sketches of 23 American painters (1847), *Characteristics of Literature* (1849 and 1851), *The Optimist* (1850), *Life of Commodore Silas Talbot* (1851), *Poems* (1851), *A Month in England* (1853), *Memorial of Horatio Greenough* (1853), *Leaves from the Diary of a Dreamer* (1853), *Essays, Biographical and Critical* (1857), *Essay on Washington, with a Paper on the Portraits of Washington* (1859), *America and her Commentators* (1864), *A Sheaf of Verse* (1864), *The Criterion* (1866), *Papers about Paris* (1867), *The Book of American Artists* (1867), and *Life of John P. Kennedy* (1871). In addition to these works he edited many others, to which he furnished introductory essays, such as the *Boston Book*, the *Philadelphia Book*, the *Poems of Mrs. Hemans*, Shaw's *Outlines of English Literature*, and Smith's *Smaller History of English and American Literature*. D. in New York Dec. 17, 1871.

Tuckerman (Joseph), D. D., b. at Boston, Mass., Jan. 18, 1778; graduated at Harvard 1798; was pastor of the Unitarian church at Chelsea, Mass., from Nov. 4, 1801, to Nov. 4, 1826; organized the "Benevolent Fraternity of Churches" for the support of a city mission called the "Ministry at Large," to which he devoted himself; was the organizer of the first Seamen's Friend Society in the U. S. 1812, and visited England for the organization of charitable institutions. D. at Havana, Cuba, Apr. 20, 1840. Author of numerous sermons and *Reports*, of eleven tracts for seamen, of a *Prize Essay on the Wages paid to Females* (Philadelphia, 1830), *Gleams of Truth, or Scenes from Real Life* (1835), and *The Principles and Results of the Ministry at Large in Boston* (1838). The Tuckerman Institute in Liverpool commemorates his philanthropic labors in England, which were fully described by Miss Mary Carpenter in a *Memoir of Dr. Tuckerman* (Lond., 1849).

Tuck'erton, p.-v., Burlington co., N. J., on Little Egg Harbor, and at the terminus of Tuckerton R. R., has boat-building and fisheries.

Tuc'son, p.-v., cap. of Pima co. and of Arizona Territory, in Santa Cruz Valley, 70 miles N. of the Sonora line, has 1 church, good public and private schools, 1 newspaper, and 1 hotel. Principal business, stock-raising, mining, and farming. P. about 3500.

John Wasson, Ed. "Arizona Citizen."

Tucuman', town of the Argentine Republic, capital of a province of the same name, in lat. 26° 51′ S., in a fine though not healthy locality, is well built and steadily increasing. Its trade in cattle and mules is considerable. The independence of the Argentine Republic was proclaimed and the first congress held here. P. 17,438.

Tude'la, town of Spain, province of Navarre, on the Ebro, which here is crossed by a stone bridge of seventeen arches and lined with a beautiful promenade. In spite of its gloomy, old-fashioned appearance, the town is lively and carries on a brisk general trade. P. 8925.

Tu'dor, the family name of an English dynasty which occupied the throne from 1485 to 1603, when it became extinct upon the death of Queen Elizabeth. The family was descended from Owen ap Tudor, an obscure Welsh gentleman who about 1423 married Catharine of France, widow of Henry V. of England. Their son, who was created earl of Richmond, married Margaret, daughter and heiress of John Beaufort, duke of Somerset, whose father was a son of John of Gaunt, duke of Lancaster, but born out of wedlock; he was legitimated by act of Parliament, but was expressly excluded from the succession to the crown. But upon the failure of the real Lancastrian line, Henry, the second earl of Richmond, was recognized by that party as their chief. He defeated Richard III. at the battle of Bosworth Field in 1485, and assumed the crown under the title of Henry VII., although without any legitimate right. He married Elizabeth, daughter of Edward IV., and thus united the pretensions of the rival houses of Lancaster and York. The sovereigns of the Tudor line were Henry VII. (1485–1509), Henry VIII. (1509–47), Edward VI. (1547–53), Mary (1553–58), and Elizabeth (1558–1603), all of whom are treated under their respective names.

Tudor (William), b. at Boston, Mass., Mar. 28, 1750; graduated at Harvard 1769; studied law with John Adams; was admitted to the Suffolk bar July 27, 1772; was a colonel and judge-advocate-general on the staff of Gen. Washington 1775–78; afterward a member of both houses of the legislature, secretary of state 1809–10, vice-president of the Massachusetts Cincinnati 1816; was one of the founders of the Massachusetts Historical Society, and delivered several published addresses. D. at Boston July 8, 1819.

Tudor (William), son of Judge William, b. at Boston, Mass., Jan. 28, 1779; educated at Phillips Academy, Andover; graduated at Harvard College 1796; entered the counting-room of John Codman, an enterprising merchant, in whose employ he twice visited Europe (1800 and 1810); spent some time in literary pursuits at Paris, and travelled in Italy; went on a mercantile agency for the exportation of ice to the West Indies 1805; was one of the founders of the Boston Athenæum; was a leading member of the Anthology Club, and editor of and principal writer for its literary organ, the *Monthly Anthology* (10 vols., 1803–11), aided by Ticknor, Buckminster, John Quincy Adams, and others; delivered the Fourth of July oration at Boston 1809, and the Phi Beta Kappa address at Harvard 1810 and 1815; founded the *North American Review* May, 1815; conducted it as a bi-monthly, and wrote three-fourths of its contents, until Dec., 1818, when it was changed to a quarterly and passed into other hands; published *Letters on the Eastern States* (1820), a volume of *Miscellanies* (1821), consisting of selections from his previous magazine articles, and a *Life of James Otis* (1823); was the originator of the Bunker Hill Monument (1823); was U. S. consul at Lima, Peru, 1823–27; became U. S. chargé d'affaires at Rio Janeiro, Brazil, 1827, and wrote while there his last work, *Gebel Teir* (Boston, 1829), an ingenious allegory. D. at Rio Janeiro Mar. 9, 1830. He left numerous MSS., the publication of which has been unsuccessfully urged by Quincy, Duyckink, and Allibone.

Tues'day [Ger. *Dienstag*; Fr. *Mardi*], the third day of the week, named in honor of *Tiu*, the German *Tyr*, god of war. It is from the *Dies Martis* of the later Roman pagans.

Tuesday, Shrove. See Shrove-Tuesday; and for Mardi Gras see New Orleans.

Tufa. See Water, by Prof. C. F. Chandler.

Tuf'tonborough, p.-v. and tp., Carroll co., N. H. P. 949.

Tufts (Cotton), M. D., b. at Medford, Mass., May 30, 1734; graduated at Harvard 1749; became a physician at Weymouth; wrote the instructions to the representatives of Weymouth to oppose the Stamp act 1765; married a daughter of Col. John Quincy, who was aunt of the wife of Pres. John Adams; was a representative of Weymouth in the general court, State councillor and senator for many years, member of the convention for ratifying the Federal Constitution; was one of the founders of the American Academy of Arts and Sciences and of the Massachusetts Medical Society, of which he was president 1787–95. D. at Weymouth, Mass., Dec. 8, 1815.

Tufts College, an institution of learning at Medford, Mass., under the control of the Universalist denomination, was founded in 1853 on lands given by Mr. Charles Tufts, possesses a fine three-story edifice, completed 1854, besides three large dormitories; has an endowment fund of above $1,000,000, 10 professors, 73 students, and a library of 16,000 volumes. A divinity school was opened in 1867. The first president (1854–61) was Rev. Dr. Hosea Ballou; the next was Rev. Dr. Alonzo A. Miner (1861–76), who was succeeded by Rev. Elmer Hewitt Capen.

Tugaloo', tp., Oconee co., S. C. P. 1436.

Tugaloo River, called also **Chattooga,** rises in Jackson co., N. C., and, flowing S., forms for some distance the boundary between Georgia and South Carolina,

and then unites with the Keowee to form Savannah River.

Tuileries [Fr.], a famous palace of Paris, on the right bank of the Seine, between the river and the Rue Rivoli, and between the Place du Carrousel and the Place de la Concorde. The ground was originally occupied by tileworks, whence the name of the palace, and was bought by Francis I. in 1518. In 1564, Catharine de' Medici commenced the erection of the buildings after the plans of Philibert Delorme, who was succeeded as master-architect by Jean Bullant. This, the original palace, which was subsequently much altered, but of which no exact drawing has been preserved, consisted of the central pavilion, Pavillon de l'Horloge, and the adjoining galleries. Under Henry IV. the southern pavilion, Pavillon de Flore, which faces the Seine, and the gallery which, running along the river, connects the Tuileries with the Louvre, were added by Duvercean and Dupérac. Under Louis XIV. the older parts of the palace were heightened, the spherical dome of the Pavillon de l'Horloge was transformed into a quadrangular one, and the northern pavilion, facing the Rue Rivoli, the Pavillon de Marsan, was built. Thus, the front façade, 336 yards long, was completed, and at the same time the garden, occupying an area of 56 acres and situated between the palace and the Place de la Concorde, was laid out by Le Nôtre. Finally, Napoleon III. built the gallery which, running along the Rue Rivoli, connects the Tuileries with the Louvre on the northern side of the Place de Carrousel. After the erection of the palace of Versailles, the Tuileries was seldom used by the French kings until Louis XVI. in 1789 was compelled to remove the royal residence hither, and since that time the palace has been the scene of some of the most stirring spectacles of the history of France. Napoleon I., Louis XVIII., Charles X., Louis Philippe, and Napoleon III. resided here, and the palace was stormed and ransacked by the people Aug. 10, 1792, July 28, 1830, and Feb. 26, 1848. In May, 1871, it was finally destroyed by fire by the Communists.

Tuke (Daniel Hack), M. D., son of Samuel, b. at York, England, about 1820; became visiting medical officer to the York retreat for the insane, and subsequently practised medicine at Falmouth. Author of a *Prize Essay on the Progressive Changes which have taken place since the time of Pinel in the Moral Management of the Insane, etc.* (London, 1854), *The Asylums of Holland, their Past and Present Condition* (1854), *Biography of William Tuke, etc.* (1856), *On the Canon of the New Testament* (Bristol, 1860), and of many articles, chiefly on insanity in its various aspects, in the *Journal of Mental Science* and other periodicals, and was joint author, with Dr. John C. Bucknill, of *A Manual of Psychological Medicine* (London and Philadelphia, 1858; 2d ed., London, 1862), which has become a standard text-book, and been pronounced on high authority "the most comprehensive and practical English work upon insanity now extant."

Tuke (Henry), son of William, b. at York, England, about 1755; was for thirty-five years, from 1780, a minister and distinguished writer of the Society of Friends. D. at York in 1814. Author of *The Faith of the People called Quakers in Our Lord and Saviour Jesus Christ, set forth in various Extracts from their Writings* (1801; 3d ed., enlarged, 1812); *The Principles of Religion as professed by the Society of Christians usually called Quakers, written for the Instruction of their Youth and for the Information of Strangers* (London, 1805; 12th ed. 1852), an authoritative manual, translated into German, French, Danish, and Spanish; *Biographical Notices of Members of the Society of Friends* (2 vols., 1813–15), and other writings collected in his *Works* (4 vols., 1815), which were edited, with a biographical sketch, by the celebrated Lindley Murray.

Tuke (Samuel), son of Henry, b. at York, England, about 1780; became an enterprising and successful tea-merchant; acted occasionally as a minister of the Society of Friends, and was for many years "the philanthropic and sensible director of the York retreat for the insane," founded by his grandfather, William Tuke. D. in 1857. Author of *A Description of the Retreat for Insane Persons of the Society of Friends, etc.* (York, 1813), *Practical Hints on the Construction of Pauper Lunatic Asylums* (1815), *Memoirs of Stephen Crisp* (1824), *Memoirs of George Whitehead* (2 vols., 1830), *Plea on Behalf of George Fox and the Early Friends* (1837), *Review of the Early History of the Retreat* (1846), *Identity of Religion in all Ages* (1847), *Account of the Slavery of Friends in the Barbary States toward the Close of the Seventeenth Century, etc.* (1848), *On the Character and Doctrines of the Early Friends* (1844), and other works; edited the *Annual Monitor* (1842–52), and left autobiographical *Memoirs* (2 vols., 1859), of which 26 copies only were printed for private circulation.

Tuke (William), b. at York, England, in 1732; was a member of the Society of Friends, and the founder in 1793 of the York retreat for the insane, the first institution in England in which lunatics were treated upon humanitarian as well as scientific principles. D. at York June 6, 1822. His *Biography*, by his great grandson, Dr. Daniel H. Tuke, was printed at the York retreat 1856.

Tukuzawa Fukichi, b. in the province of Kiusiu, Japan, about the year 1830; attained the position of a first class scholar in Japanese, to which he added a full knowledge of English; was for years at the head of the bureau of translation under the tycoon's government; devoted his whole attention to the pursuit of literature, and published about 50 different volumes; and was attached to a commission which visited the U. S. in 1867, taking back to Japan many experiences which he made available for the benefit of his countrymen; was formerly a member of the daimian class, but all the privileges connected therewith he resigned, and chose to be considered one of the common people.

F. A. P. Barnard.

Tula. See Toola.

Tula're, county of S. E. California, lying between the Sierra Nevada and Monte Diablo ranges, drained by Kern River and other affluents of Tulare Lake, which is in its S. W. part, and traversed by the Visalia division of Central Pacific and the Tulare division of Southern Pacific R. Rs. The valley of the lake is fertile. Some gold is found, but mining is little carried on, agriculture and grazing being the principal industries. There are flour-mills and saw-mills. Sheep, cattle, and swine are very numerous. Staples, wool, barley, wheat, dairy products, and lumber. Cap. Visalia. Area, about 5600 sq. m. P. 4533.

Tulare, p.-v. and tp., San Joaquin co., Cal. P. 1269.

Tulare (or **Tule**) **Lake**, a shallow lake in Tulare co., Cal., is 30 miles long and 20 miles wide. Area, 500 sq. m. It ordinarily has no outlet, but at high water its surplus flows through a slough into San Joaquin River. It receives Kern, Tulare, and King's rivers and other streams.

Tu'le [Sp. ?], the *Scirpus validus*, a large club-rush or sedge (order Cyperaceæ) which grows to a great height and covers large areas of marshy ground in some parts of California. The same plant is found in nearly all parts of the U. S., but is not elsewhere of as large a size. The "tule-lands" are very fertile when once drained. It has been proposed to utilize the tule itself in the fabrication of matting, etc.

Tule Indian Reservation, Tulare co., Cal. P. 12.

Tule River, tp., Tulare co., Cal. P. 1098.

Tu'lip [Pers. *dulbend*, a "turban," alluding to the form of the flower], the *Tulipa Gesneriana*, a liliaceous herb from Central Asia, now everywhere cultivated for its beautiful flowers. Of this species nearly 1000 varieties are catalogued, but there are hundreds of unnamed varieties. Conrad Gesner brought the tulip from Turkey to Augsburg in 1559. Haarlem in Holland is, and long has been, the principal seat of the production of tulip-bulbs for the European and American markets. The Van Thol or sweet-scented tulips (*Tulipa suaveolens*) are smaller, earlier, and less beautiful than common tulips, but quite fragrant. Some 30 species of *Tulipa* are known, all bulbous Old-World herbs.

Tulipoma'nia, a violent passion for the possession and cultivation of rare varieties of the tulip. The most famous tulipomania was that which raged in Holland 1634–37. The enormous prices then paid for tulip-bulbs of choice varieties led to inordinate speculation in the article—not so much from love of tulips as from the desire to get rich. Tulips were bought and sold on speculation in the same manner that stocks, cotton, and other commodities are often bought at present, no actual goods being delivered. The excitement led finally to severe commercial disasters. A single bulb was often owned in shares, and on one occasion a bulb of the kind called *Semper Augustus* brought 13,000 florins, and three bulbs together brought 30,000 florins.

Tulip-Tree, the *Liriodendron tulipiferum*, a beautiful and noble forest tree of the U. S., belonging to the order Magnoliaceæ. Its bark has active tonic powers, and its wood is valued in house-carpentry and carriage and furniture making. It is often incorrectly called poplar, and sometimes whitewood. It is a fine ornamental tree.

Tull (Jethro), b. in Oxfordshire, England, about 1680; received a good education; studied law; was admitted as a barrister and made the tour of Europe, after which he settled first on his paternal estate, and afterward on Prosperous Farm in Berkshire, near Hungerford, and gave his attention to scientific agriculture; invented the drill-plough, and published a famous work entitled *New Horse-*

Hoeing Husbandry (1733), which long enjoyed great authority in England. The essence of his system consisted in planting in rows and in pulverizing the soil around the plants, but he made the mistake of thinking manure unnecessary, and his own experiments consequently involved him in serious losses. D. Jan. 3, 1740. His work was edited by William Cobbett in 1822, with the addition of some scattered essays on similar subjects.

Tullaho'ma, p.-v., Coffee co., Tenn., on St. Louis and Chattanooga and at the terminus of McMinnville and Manchester R. R., has a weekly newspaper. P. 589.

Tulle, town of France, department of Corrèze, on the Corrèze, is poorly built, but its paper-mills, sugar-refineries, tanneries, and wool-weaving factories are extensive, and its manufactures of arms employ between 600 and 700 men. P. 12,410.

Tullius (Servius). See Servius Tullius.

Tul'loch (John), D. D., b. near Tibbermuir, Perthshire, Scotland, in 1822; educated at the University of St. Andrew's; became in 1845 a minister of the Church of Scotland at Dundee; spent some time in Germany, familiarizing himself with speculative theology as there taught; became in 1849 parish minister of Kettins, Forfarshire, and in 1854 principal of St. Mary's College, St. Andrew's, a post he still holds (1876). Author of *Leaders of the Reformation* (1859), *English Puritanism and its Leaders* (1861), *The Christ of the Gospels and the Christ of Modern Criticism—Lectures on Renan's Vie de Jésus* (1864), and *Rational Theology and Christian Philosophy in England in the Seventeenth Century* (2 vols., 1872). In 1855 he entered the lists with 1200 competitors, and gained the second Burnett prize of £600 for an essay *On the Being and Attributes of God*, which was published under the title *Theism, the Witness of Reason and Nature to an All-Wise and Beneficent Creator* (1855). He has contributed articles of biography and criticism to the *British Quarterly*, *North British*, *Edinburgh*, and *Contemporary* reviews; also to the 8th edition of the *Encyclopædia Britannica*. He visited the U. S. in 1874.

Tul'lus Hostil'ius, according to Roman legends, the third king of Rome (673–641 B. C.). During his reign the combat between the Horatii and Curiatii took place, in consequence of which Alba acknowledged the supremacy of Rome. But subsequently the Albans meditated treason, and when Tullus discovered their foul plans he razed the city and transferred the inhabitants to Rome, where they formed the bulk of the *plebs*.

Tul'ly, p.-v. and tp., Onondaga co., N. Y., on Syracuse Binghamton and New York R. R., has a weekly newspaper. P. 1560.

Tully, tp., Marion co., O. P. 770.

Tully, tp., Van Wert co., O. P. 1064.

Tully. See Cicero.

Tully (William), M. D., b. at Saybrook, Conn., Nov. 18, 1785; graduated at Yale College 1806, at Philadelphia in medicine 1808, and practised in Connecticut 1815–27; held professorships of materia medica at Castleton, Vt., 1827–29, and Yale College, New Haven, 1830–41; in 1851–59 was a prominent collaborator on Webster's *Dictionary*, and wrote *Materia Medica, or Pharmacology* (2 vols. 8vo, Springfield, 1857–58). His studies of materia medica were original, the result of experimental exhibitions of medicines upon himself and a numerous class of enthusiastic and admiring students. He gave special attention to indigenous American plants, especially veratrum and conium. His works involved a new nomenclature, rigidly classical and etymological in its formation: they are not calculated to attract the medical student or general reader of medicine, but are a storehouse of valuable facts and suggestive thought for the special student. Dr. Tully also issued, with Dr. Miner, in 1822, a celebrated *Essay on Fever*. He was instrumental in founding the Retreat for the Insane at Hartford, Conn. D. at Springfield, Mass., Feb. 28, 1859. E. Darwin Hudson, Jr.

Tulpehock'en, p.-v. and tp., Berks co., Pa. P. 2013.

Tul'tcha, town of European Turkey, in Bulgaria, on the Danube, 6 miles above the junction of the Sulina and St. George's arms, has a good harbor, a citadel, and considerable trade in salt fish, wood, and grain. It is the ancient *Ægissus*. P. estimated at 13,000.

Tum'bleston, tp., Scott co., Ark. P. 1084.

Tumeti, tp., Otter Tail co., Minn. P. 139.

Tu'mor [Lat., a "swelling"], in pathology, is defined by Boyer as "any preternatural eminence on any part of the body," but in a narrower sense swellings which are the recognized results of inflammation and extravasation are excluded. Tumors are primarily divided into two great classes, malignant and non-malignant tumors. To the first belong all the numerous varieties of cancer, epithelioma, and the various cancroid diseases. (See Cancer.) To the second class (benign tumors) belong a vast number of varieties, the classification of which is difficult. A convenient mode is that which classes them according to the tissue of which they are composed. They may be arranged as follows: (1) Fibrous, fibroid, and connective tissue tumor, fibroma; (2) fatty tumor, lipoma; (3) cartilage tumor, chondroma; (4) bone tumor, osteoma, exostosis; (5) muscle tumor, myoma; (6) nerve tumor, neuroma; (7) erectile, cavernous, or blood tumor, angioma; (8) the so-called sarcoma, or flesh tumor, which, according to Billroth, consists of developmental connective tissue which does not become perfect bone-cartilage or other tissue, but undergoes some one or more of several peculiar degenerative changes; many varieties are noted: (9) lymphoma, or hypertrophy of the lymphatic and other ductless glands; (10) papilloma, or hypertrophy of skin elements; (11) cystoma, hollow or cystic tumor, containing a fluid or semi-fluid mass. It may be observed that many tumors combine the characters of two or more of the above classes, and also that, according to a prevalent doctrine, many apparently benign tumors approximate and may finally take on malignant characters.

Tun'bridge, town of England, county of Kent, on the Medway, is noted for its manufactures of toys and small inlaid wooden articles called "Tunbridge ware," such as workboxes, desks, etc. P. 8209.

Tunbridge, p.-v. and tp., Orange co., Vt. P. 1405.

Tunbridge Wells, town of England, county of Kent, 5 miles S. of Tunbridge, is celebrated for its chalybeate springs, and resorted to as a watering-place. P. 19,410.

Tung'sten [Swed. *tung sten*, "heavy stone," alluding to the high specific gravity of wolframite], a metal forming quadrivalent and sexvalent compounds, and apparently also quinquivalent. The chief sources are—*wolframite*, a tungstate of iron and manganese, which frequently accompanies native oxide of tin, and is found in Cornwall, England; Saxony; Bohemia; Wertschinsk, Russia; Limoges; Bolivia; Monroe and Trumbull, Conn.; and in several other places; and *scheelite*, tungstate of lime, also a somewhat abundant source of tungsten. Tungsten is found also in the following rarer minerals: tungstate of lead, or *stolzite*; of copper and lime, or *cuproscheelite*; of manganese, or *huebnerite*; and of manganese and iron, or *megabasite*; as well as in the native oxide, *tungstic ochre*, and in small quantities in samarskite, yttrotantalite, tantalite, and columbite. The metal may be obtained most simply from tungstic anhydride (WO_3), by heating it to redness in a stream of hydrogen, or by making it into a paste with oil, and heating it intensely for some hours in a charcoal-lined crucible. Obtained by the latter method, it is an iron-gray metal of the specific gravity of 17.6; very hard and difficult to fuse; not sensibly oxidized in air on heating, unless pulverized. By the action of aqua regia, nitric acid, the alkalies, or nitre it is converted into tungstic acid, and when pulverulent it is oxidized and dissolved on boiling in a solution of the caustic alkalies or their carbonates. It forms a dioxide, WO_2, and a trioxide, WO_3. This is often called tungstic acid, and may be obtained as a straw-yellow, tasteless powder, insoluble in water or acids, but readily soluble in alkaline solutions by heating ammonic tungstate in open vessels. There is another oxide, apparently a compound of these two, W_2O_5, which is produced by reducing tungstic oxide with zinc and hydrochloric acid or otherwise, and is of a fine blue color. Tungstic acid, H_2WO_4, obtained as a yellow powder by adding hydrochloric acid in excess to a boiling solution of tungstic oxide in an alkali, forms acid and normal salts, generally of a complex nature, and yielding a white, sparingly soluble hydrate of tungstic acid, $H_2WO_4.H_2O$, when mixed in the cold with excess of hydrochloric acid. Metatungstic acid, $H_2W_4O_{13}$, furnishes salts which are mostly soluble and crystallizable, and may be prepared by the action of tungstic acid on tungstates, or by removing part of the base by means of an acid. Tungsten yields several chlorides, oxychlorides, bromides, fluorides, sulphides, and phosphides; also silicotungstates and sulphotungstates. Its compounds are not poisonous.

Tungstate of soda, prepared on the large scale in purifying certain tin ores (see Tin), is used in place of stannate of soda as a mordant, and also to render cloth incombustible, a little phosphoric acid or phosphate of soda being added to it sometimes, to prevent its decomposition. Tungsten alloys with iron in almost all proportions, making it excessively hard. Steel containing 9 to 10 per cent. is said to possess unusual hardness, and a magnet of tungsten steel has carried twenty times its weight. Tungstates of lime and of baryta have been used for paints, and tungstate of copper is said to be used successfully in dyeing with aniline black. H. B. Cornwall.

Tungstic Oxide and **Acid.** See TUNGSTEN.

Tungu'ses, a Mongolian tribe, inhabiting the regions of Siberia between the rivers Yenisei and Lena, and mingling W. with the Ostiaks, N. with the Samoyeds, E. with the Lamuts; the Mantchoos to the N. are of Tungusian stock. The Tunguses have flat faces, olive complexion, no beards, straight black hair, and oblique eyes. They are nomads, and generally divided, according to the beast of burden which they principally employ, into reindeer, horse, and dog Tunguses. The southern are Boodhists, the northern Shamanists, but of late Russian missionaries have labored with success among them. Number, about 70,000.

Tu'nica, county of N. W. Mississippi, lying on Mississippi River, which separates it from Arkansas, and drained by Coldwater and other rivers; surface flat, often swampy, soil fertile. Staples, cotton and Indian corn. Cap. Austin. Area, 750 sq. m. P. 5358.

Tu'nicates [from Lat. *tunica*, a "tunic" or "loose coat"], a class of invertebrate animals formerly generally referred to the branch of mollusks, later by many combined with the classes of brachiopods and polyzoans in a branch called Molluscoidea, and now apparently left in a still more undetermined status. The class is of special interest, as it is regarded by many naturalists as being the type nearest the vertebrates, and that which has furnished the progenitors of the latter animals. The tunicates are animals invested in a sac-like integument (often coriaceous) having two apertures at one end—one introferent or oral, and the other excurrent or anal; the oral aperture leads into a wide "pharynx," which is more or less perforated, and from this into a contracted œsophagus, which widens into a stomach, and thence the intestinal tract, by a hæmal flexure, is recurrent forward toward the anal aperture. The anus generally empties into a chamber called the "atrium," which has as its outlet the excurrent aperture. A single ganglion is developed between the pharyngeal and the atrial regions. A heart exists, but is a simple tube, without valves, open at both ends, and operating by alternate persistaltic contractions, periodically reversing the course of the circulation. Most of the species in their embryonic condition have a caudal appendage, which has what is considered to be analogous, and even homologous, with the notochord of vertebrates; but this stage is suppressed in some. This feature, as well as the mode of development in other respects, affords the ground for the belief in the affinity of the tunicates with the vertebrates, and especially with *Branchiostoma* or *Amphioxus*, the lowest and most generalized of the vertebrates. Representatives of the class are found in every sea, and are quite numerous. Some are simple, and some compound. Considerable difference of opinion prevails respecting their classification. THEODORE GILL.

Tu'nis, one of the Barbary states, North Africa, dependent on Turkey, is bounded E. by Tripoli, W. by Algeria, N. by the Mediterranean, and S. by the Sahara, and comprises an area of 75,000 sq. m., with 2,000,000 inhabitants. The coast to the E. of the Bay of Tunis is low and sandy, like that of Tripoli; to the W. it is rocky and bald, forming lofty promontories, among which Cape Bon, in lat. 37° N., is the northernmost point of Africa. The interior is traversed by the Atlas Mountains, whose average height is between 4000 and 5000 feet, and which form several elevated plateaus of great extension. The climate is dry and hot, but healthy, and the soil is, in general, exceedingly fertile, and produces, in spite of the backward state of agriculture, large crops of wheat, maize, dhurra, and barley; cotton, indigo, saffron, and tobacco are also cultivated. Olive and date plantations are very numerous and very remunerative, and all S. European fruits grow abundantly. Oxen, sheep, mules, and camels are the common domestic animals, and they are all of good breed. Salt and lead are produced, though mining, like agriculture, is very carelessly carried on. Some branches of manufactures, such as woollen fabrics, especially the well-known red caps, dyed skins, morocco leather, and coral, are extensively developed. There are about 45,000 Jews among the inhabitants, who else are Mohammedan Berbers and Arabs.

Tunis occupies nearly the territory of ancient Carthage. Together with Sicily it formed the granary of Rome. On the dissolution of the Roman empire it became a province of the Greek empire, from which it was conquered by the caliphs of Bagdad. From the thirteenth to the sixteenth century it formed an independent state, together with Tripoli and Algeria, and became the terror of all the nations around the Mediterranean on account of its piracy, which France and Spain in vain tried to stop, and which did not cease until near the middle of the nineteenth century. In 1574 the country became dependent on Turkey, but the dependency is now merely nominal.

Tunis, capital of the state of Tunis, on the shore of a shallow lake or lagoon which communicates with the Bay of Tunis through a narrow channel, called the Goletta. It is surrounded with a double wall and defended by a citadel. Its streets are narrow, unpaved, and filthy, but its houses, though only one story high and presenting no windows to the streets, are substantially built, and generally the interior is splendidly fitted up in Oriental style. The house is erected in the form of a court, into the yard of which all the rooms open, and this yard is generally paved with marble and provided with a fountain, which is supplied with water from a large tank or cistern on the roof of the building. The palace of the bey and several of the mosques are fine edifices, and the bazaars are large and well stocked. Silk and woollen manufactures are extensively carried on; caps, shawls, burnouses, turbans, and mantles, soap, wax, olive oil, and leather are also manufactured and exported, and the transit-trade between Europe and the interior of Africa is important. P. 120,000, of whom 25,000 are Jews.

Tunj'a, town of New Granada, South America, the capital of the department of Boyaca, in lat. 5° 24′ N., on an elevated plateau, has an excellent climate. Wheat, potatoes, and olives are extensively cultivated in the surrounding districts, and some manufactures of cotton cloth are carried on. P. about 7000, mostly Indians.

Tunkers. See DUNKERS.

Tunkhan'nock, tp., Monroe co., Pa. P. 263.

Tunkhannock, p.-b. and tp., cap. of Wyoming co., Pa., on Pennsylvania and New York Canal and R. R., 32 miles N. of Wilkesbarre, has 3 churches, good schools, 2 banks, 2 iron-foundries, 2 newspapers, and 4 hotels. It is the S. terminus of Montrose Narrow-gauge R. R. P. of b. 953; of tp. 1212. A. F. YORK, ED. "REPUBLICAN."

Tunnel. See FRÉJUS (COL DE), FUCINO, and SAINT GOTHARD, by HON. G. P. MARSH; HOOSAC TUNNEL, by B. D. FROST, C. E.; TUNNEL, CHICAGO, by E. S. CHESBROUGH, C. E.; TUNNELLING, by B. H. LATROBE, C. E.; the Cleveland tunnel in WATERWORKS, by J. P. FRIZELL, C. E.; the Thames tunnel in LONDON.

Tun'nel, Chicago. The city of Chicago, Ill., which obtained its supply of water from the shore of Lake Michigan, about half a mile N. of the mouth of Chicago River, by means of works constructed in 1852, found about ten years after that the lake at the point of supply was so affected by the sewage of the city as to render the water pumped into the mains at times very offensive to the taste and smell, and wholly unfit for domestic use, especially during the prevalence of southerly winds. Various plans were suggested for obtaining a better supply; but as the nearest, the purest, and the most abundant source was immediately in front of the city, it was decided by the city authorities, including the board of public works, to construct a tunnel under the bottom of the lake to a point 2 miles out.

The tunnel consists of a land-shaft at the western and a lake-shaft at the eastern extremity. The tunnel proper is 2 miles in length from the pumping-works, in a northeasterly direction. The lake-shaft is protected by a crib, or hollow pentagonal breakwater, from storms, vessels, and ice. The horizontal diameter of the tunnel was fixed at 5 feet, and the vertical 2 inches greater, for convenience in drawing the centres during construction. This size was determined upon for two reasons: *First*, it was sufficient to deliver a supply for 1,000,000 inhabitants at the rate of 50 gallons a day for each person, the average quantity used at that time. *Second*, experience in Europe had shown that while it was possible to make small tunnels in the most troublesome ground, attempts to make large ones had sometimes failed, and at others had been attended with enormous difficulties. This was particularly the case in works of the kind described by Minard in his *Cours de Construction* and in the earlier and later efforts to construct a tunnel under the Thames. Although there was every reason to expect good ground here, there was a possibility of meeting with deposits of quicksand or other soft material, the formation being drift clay. To remove every doubt of final success, the small size was adopted, in the conviction that whenever it should prove insufficient to supply the demand upon it, the city would be abundantly able to construct another and larger one.

The work was commenced at the land-shaft on Mar. 17, 1864. The first 30 feet, passing through wet running sand, was curbed with three sections of a cast-iron cylinder of 9 feet internal diameter and 1½ inches thick. From the bottom of the iron cylinder the clay was very good, and the shaft was bricked up with a curb 8 feet in diameter and 1 foot thick. The main tunnel proper was lined with two shells of brickwork, in all about 9 inches thick, including cement joints. The upper arch was built on a ribbed centre of boiler iron, which diminished the open space inside of the tunnel only 4½ inches, and thus allowed the cars

which conveyed away the earth to go up to the face of the excavation, usually kept from 10 to 20 feet ahead of the masonry. The iron centre was 30 inches long in the direction of the tunnel. About 2 feet in length of the masonry was usually laid at a time, and as a rule it was found safe to strike the centre within fifteen minutes after the arch was keyed. The arch was built without making the excavation any larger than the space required for the brickwork. The excavation was generally through stiff blue clay, but with the irregularities of character peculiar to the drift. It very seldom required bracing when not left to support itself more than thirty-six hours. Sometimes sand-pockets, sometimes small bodies of quicksand, sometimes clay soft enough for a miner to run his arm into, and sometimes boulders weighing several hundred pounds, were met. The greatest danger encountered was from inflammable and explosive gas. Early in the progress of the work several accidents occurred from this cause, but, fortunately, without fatal results to the workmen, though there were several narrow escapes. Cavities containing gas were detected by sound, and bored into with a small auger. The gas was ignited as soon as it began to escape, and explosions were prevented.

Side-chambers and small turn-tables about 1000 feet apart were resorted to as passing-places for the cars and store-rooms for building materials. The greatest progress made during any one week was 93 feet. Only once was a boulder so large as to require blasting met with. The ventilation of the tunnel was effected by means of tin pipes, through which the foul air was drawn out, and fresh air consequently drawn in through the main opening. Ordinarily, there was so much smoke from the miners' lamps and vapor from the heat of the workmen as to make it impossible to see distinctly enough to run the lines and levels required to keep the tunnel in the right direction. On Sunday nights, however, and on other holidays, the air became so clear as to cause sperm candles to burn with a beautiful silver brightness, visible sometimes 2000 feet.

The crib is 58 feet horizontal measurement on each of the five external sides, and 40 feet high. The inner portion, or well, has sides parallel with the outer ones, 22 feet long each, leaving the thickness of the breakwater 25 feet. Flooring of 12-inch white pine timber was laid close together. The outer and inner vertical faces and the middle wall are of solid 12-inch white pine timber, except the upper 10 feet of the outside, which was of white oak, to withstand better the action of the ice. Across the angles of the outer and middle walls were placed brace-walls about 10 feet long of solid 12-inch timber. All of the wall-timbers were fastened to each other by 1¼-inch square bolts 34 inches long, pointed and driven somewhat slanting into 1¼-inch auger-holes about 5 feet apart. The slant was given in opposite directions to the bolts nearest each other, to avoid the possibility of their being drawn out by the buoyancy of the timber—an accident which once occurred to a somewhat similar structure in the West. Three rectangular openings, each 4 feet wide and 5 feet high, were made through the breakwater at different depths below the surface of the lake, so that water could be drawn from near the bottom, middle, or top as future experience might show to be best. The whole of the outside surfaces of the outer and inner walls was sheeted with 2-inch pine plank carefully jointed, placed vertically, and spiked on. Instead of pine, 3-inch white oak was used for the upper portion of the outside, to resist ice. Apparently excessive care was taken to make the crib strong, but subsequent experience showed that this care was none too great. The crib was built on shore and launched like a ship. After the crib had been launched and towed to its place, and only time had elapsed to throw just sufficient stone into it to hold it in moderate weather, a violent storm set in and drove the vessels loaded with stone into the harbor. This storm continued for three days, and threatened, before it abated, to do serious if not fatal injury to the crib. When the storm was over, two of the inner angle-joints had parted an inch on top, and the entire crib had worked, against wind and waves, 13 feet, and the N. W. angle was 3¼ feet lower than the S. E. The great difficulty there would have been in restoring the crib to its exact position, and the fear there might be another storm in the mean time, prevented any attempt of the kind from being made. Since the crib has been filled with stones no variation whatever in position has been perceived. A tremor is sometimes felt during severe storms and when large fields of ice are passing.

The cast-iron cylinder for the lake-shaft at the E. end of the tunnel consists of seven sections, each 9 feet in length, 9 feet internal diameter, 2¼ inches thick, and in all other respects like the one for the land-shaft, except that the lowest section was turned on the outside to make it penetrate the clay more easily, and the upper end was provided with two gates for the introduction or exclusion of the lake water, each 54 inches high by 32 inches wide, and placed with their tops below the lowest known level of the lake.

The original estimate of the probable cost of the work was $307,552; the actual cost, including all preliminary and other expenses of whatever nature chargeable to the lake tunnel up to Apr., 1867, was $457,844.95. The original estimate was made when common labor was worth $1.25 per day and gold but little above par. Before the completion of the work, labor was much higher and gold rose to $2.50.

The completion of the tunnel has brought about a most gratifying change in the quality of the water supplied. The extraordinary growth of the city, and the increased rate of consumption of water per capita above what was originally estimated, have caused the construction of another and larger tunnel from the same crib, parallel with the first, to the lake shore, and thence in a south-westerly direction about 4 miles farther to a point where new pumping-engines are expected to be in operation in the summer of 1876. Both tunnels have an estimated capacity of 150,000,000 U. S. gallons per diem. Since the completion of the tunnels the old wooden crib has been replaced, from low water up, by a stone building 20 feet high, containing keepers' rooms and surmounted with lighthouse and fog-bell towers.

E. S. CHESBROUGH.

Tunnel Hill, p.-v., Whitfield co., Ga.

Tunnelling. *Tunnels* are subterranean passages through hills and mountains or under lakes and rivers. Of the first class a great many, and of the last but few, have been executed. A tunnel through a hill becomes necessary or advisable when it will cost less to remove only as much of the material as will permit a safe passage, although at a greater expense for like quantities removed, than to make an excavation open at the top. There are occasional cases in which the difference of cost between them would be so little as to leave the choice to other considerations, such as present themselves in passing through cities or very populous vicinities where damage to property and danger to persons would make the tunnel preferable without regard to cost. The cost per cubic yard or other unit of measure is usually *not less* than five or six times as great in a tunnel as in an open cutting, and sometimes the disproportion is vastly greater. The tunnel, however, is generally the only work practicable in the case, and the only question is at what point to end the open cut or "approach" and begin the tunnel. This depends on many circumstances, but the "portals" of the tunnel are usually placed where the depth of cutting is from 50 to 60 feet. Progress within the confined area of the tunnel being comparatively slow, access to it at the earliest moment is sought through shafts sunk from the surface overhead, except in short tunnels with easy approaches. The tunnel being reached through the approaches or shafts, or both, the process of "drifting" is begun; and this operation is twofold—"heading and bottoming," the former being a preliminary work intended to open the way in advance and facilitate the removal of the rest of the material in enlarging the tunnel to its full dimensions. This advanced excavation is carried forward either at the upper or lower part of the sectional area, according to circumstances. If the material is solid rock, undivided by seams or fissures, the tunnel is excavated to its proper shape for permanence without artificial support. If the rock be deficient in hardness and cohesion, temporary props of timber are used as the work proceeds, and walls and arches of masonry are subsequently built to sustain it. Ventilation and drainage must be amply provided for during the progress of the work, the former by blowing-machines which drive fresh air to the headings and expel the smoke of blasts—the latter by pumps which raise the water, often found in copious quantity, through the shafts, except where it can pass by natural flow through the approaches. In blasting rock within the tunnel, gunpowder has been superseded almost wholly by the more recently-discovered and much more powerful explosive nitro-glycerine, combined with inert substances which render it safer in handling without materially impairing its effects. The charges are simultaneously fired by electricity, and with much greater effect than if exploded separately, as was the former method. The drilling of the blast-holes has latterly been greatly improved and cheapened and hastened by the use of tools driven by machinery worked by compressed air, which assists in ventilating the tunnel in its escape after doing its work.

Tunnels in earth do not require the drill or the explosive, but need support at each step, with sometimes more delay and expense than where blasting is required. The mode of temporary propping and subsequent permanent walling and arching could only be shown by detailed drawings.

Very few tunnels in America, although many in Europe, have been driven through such material. The methods of conducting the work in such ground differ only in their particulars, and vary according to the circumstances of the case.

Subaqueous tunnels under the beds of rivers and lakes are executed in the same manner with the preceding, only with special precautions against influx of water. The earliest tunnel noted in history appears to have been a work of this sort, by which the banks of the Euphrates are said to have been joined in the reign of Queen Semiramis. The other ancient tunnels were used as water-conduits, which occasionally perforated hills, although mostly open-air constructions, belonging more properly to the head of *aqueducts*, and were usually of small dimensions. Those designed to drain lakes were of larger area, such as that by which Lake Fucinus (now Celano) was drawn off into the river Liris, and which, becoming obstructed, was recently reopened, and much fertile land reclaimed thereby. Tunnels for *navigation* are wholly of modern origin, and together with those designed for highways and railways, will be classed as (1) *tunnels constructed and in use*, (2) *tunnels in progress*, and (3) *tunnels projected*, and which may sooner or later be executed. (1) As canals preceded railways, the first tunnel for *transportation* in the *commercial* sense was upon a canal, that of Languedoc, constructed in 1666, through the hill of Malpas, and, although but 767 feet long, was considered "something prodigious and worthy of the ancient Romans."

English Canal Tunnels.—The Duke of Bridgewater's and the Trent and Mersey canals come next, about a century later. The *Harecastle* tunnel upon the latter was 8640 feet long, and but 9 feet wide and 12 feet high, passing a boat only 7 feet wide, propelled by men lying on their backs and pushing with their feet against the sides and roof. This tunnel was supplemented or superseded in 1825 by one 11 feet wide and 16 feet high, with a towing-path. Upon the Leeds and Liverpool Canal is a tunnel 4920 feet long, and 17 feet wide by 18 high, showing the gradual enlargement of such works to meet advance in commerce. Thence up to 1826, when the canal-system of England was about completed, numerous tunnels of various lengths were constructed, the longest of them on the Huddersfield Canal, 3.10 miles long, and several others ranging from 2½ miles down to 300 feet, and making a total length of about 39 miles and an average of about $\frac{7}{10}$ths of a mile. These tunnels were through rock and other material of every variety, and met every sort of difficulty from water, foul air, and bad ground, the tools and appliances of more modern tunnelling being then unknown.

French canal tunnels, 23 in number, from 417 feet to 7 miles 2413 feet in length, and aggregating 24½ miles.—The longest of large section, the *Riqueval*, executed in 1803, upon the St. Quentin Canal, is 3¼ miles long and 20½ feet wide. The *Pouilly*, upon the canal of Bourgogne, 2 miles 273 feet long and 20½ feet wide, and some others upon main navigable canals which pass boats of good tonnage. The tunnel of Arschwiller, a mile and 2250 feet long, has a railway tunnel alongside of it and passing *under* it at one end. There are several canals of from 5 to 8½ feet wide and of considerable length, of which that of *Noireau*, of 7½ miles length and 5 feet width, is the longest, but these are feeders and lateral canals of small capacity. Of underground channels and conduits for the supply or the sewerage of cities, the drainage of mines, etc., there are upward of 80 miles in Europe.

Highway Tunnels.—Many of these, under the name of "galleries," occur upon the great roads across the Swiss and Italian Alps in piercing the projecting cliffs of their savage defiles.

Railway tunnels form by far the most numerous class, and the 957 in number and 291 in miles of them constructed to this date (1876) are the growth of but half a century. This total length is divided about thus: *Great Britain*, 140 tunnels and 87½ miles; *France*, 259 tunnels and 82$\frac{6}{10}$ miles; *Belgium*, 20 tunnels and 4.07 miles; *Germany* and *Austria*, 270 tunnels and 51½ miles; *Italy*, 76 tunnels and 19¾ miles; *Switzerland*, 5 tunnels and 4.08 miles; *North America*, 115 tunnels and 33 miles; *South America*, 72 tunnels and 9 miles. This statement is necessarily quite approximate, as it has been impossible to obtain accurate information within the time allowed, and several countries have either been partially heard from or not at all, as Italy, Spain, Russia, and Turkey in Europe. The present object is to give a general idea of the extent to which tunnelling has been carried throughout the world. Of *English tunnels*, the most noted for magnitude and difficulty of construction is the *Kilsby* on the North-western Railway, length 1½ miles, cost $1,500,000, chiefly from nearly a fifth of its length being in quicksand so saturated with water that nine months of hard pumping were required to dry it sufficiently for commencing to drift horizontally from the two enormous shafts of 60 feet diameter sunk to facilitate the removal of material and water, and for ventilation. The *Box* tunnel on the Great Western, 1¾ miles long and costing $1,750,000, met with much trouble from water; it had five shafts the whole breadth of the tunnel. Both of these, as well as the rest of the English tunnels, are for two tracks. The longest tunnel in England is the *Woodhead*, upon the Manchester and Leeds Railway. Its length is 3 miles, and it consists of two parallel tunnels, each for one track, with numerous openings between them, the many shafts required for its construction being midway of the two. The excavations were mostly in solid rock. The *Sydenham* tunnel, on the London Chatham and Dover Railway, 1½ miles long, had its walls and arching pressed out of shape by the swelling of the London clay through which it is carried, and required repeated additions to their thickness before they would resist the pressure. Many other English tunnels deserve description, among them the *Blackingly*, ¾ of a mile, and *Saltwood*, ½ mile long in clay, with copious veins of water. Space does not allow more than this general reference. The English tunnels are uniformly *straight*, as far as is known.

French railway tunnels embrace many works of interest, as the *Nerthe* (Marseilles and Avignon Railway), nearly 3 miles long, through limestone, with twenty-four shafts, cost $2,090,076, lined with masonry for four-fifths of its length; the *Blaizy* (Paris and Lyons Railway), 2½ miles long, twenty shafts, through calcareous rock and marl, and is arched throughout; *Arschwiller* (Paris and Strasbourg), 1¾ miles long, arched end to end, the Marne and Rhine Canal alongside, *under* which the railway passes at one end, the grade descending and the canal diverging so as to permit this, cost $515,328; *Rilly* (Rheims branch of Paris and Strasbourg Railway), 2½ miles long, eleven shafts, through chalk, cost $497,904; *Lumotte* (Paris and Caen Railway), 1$\frac{6}{10}$ths miles long, eleven shafts, through chalk, marl, and greensand, cost $502,820; one-third arched, one-fourth self-supporting, rest walled on sides. All the above for two tracks. Many of the French tunnels are curved, and that of *Fesc* (548 feet long) with 800 feet radius.

German railway tunnels are very numerous, as above stated, but none of them of great length. Particulars in regard to them are not at hand, but the passage of the Sommering, on the Vienna and Triest route, must be noted as exhibiting very bold tunnelling through lofty cliffs, with magnificent viaducts between. The most peculiar examples are, however, on the Black Forest Railway, from Offenburg to Constance, on which the ascent to the summit between the Rhine and the Danube waters, upon a grade of 106 feet per mile, encounters in 15½ miles twenty-nine tunnels of various lengths, the longest (5600 feet) at the summit. Most of the tunnels are curved, with radii of 1000 feet, and one of them forms a complete letter S. The rock is a hard but decomposing granite, mostly requiring protection by masonry.

Belgian railway tunnels are not numerous: the large majority of them occur on the route from Liege to the Prussian frontier, along the narrow winding valley of the Vesdres, on which there are eighteen, of lengths from 65 to 1964 feet, in a distance of about as many miles.

Swiss railway tunnels, of which the longest and most interesting is the *Hauenstein*, on the Swiss Central Railway, 1½ miles long, through limestone, sandstone, and shale, requiring masonry support nearly throughout. Three shafts were projected, but one of them was abandoned before completion, and at one of the others an accident somewhat like that at the deep shaft of the *Hoosac* tunnel occurred by the burning of the timbering, which caused the obstruction of the tunnel and the loss of many lives. The grade through the tunnel is 139 feet per mile, and the width is for two tracks.

Italian Tunnels.—There are accounts at hand of those only in the northern part of the peninsula. The one of chief interest is, of course, that of Mont Cenis or the Col de Fréjus, of which there is a full account in this CYCLOPÆDIA, under FRÉJUS, COL DE, by HON. G. P. MARSH. This great work was fourteen years in progress, its whole length of 7½ miles being driven from the ends. A shaft about 1600 feet deep, 2½ miles from the S. end, might perhaps have expedited the work, but the skilful engineers who planned the tunnel doubtless weighed well this and all other questions connected with it. The next most remarkable are the tunnels on the route of 62 miles across the Apennines from Bologna to Pistoja, on which are forty-six, the longest 1¾ miles. This group resembles that of the Black Forest Railway in the serpentine feature which distinguishes it, many of the tunnels being curved with a radius of 1000 feet, and one of them of a similar S-like shape, and about a mile in length. The grade is 132 feet per mile, and was reduced to even this steep inclination only by developing the line

upon the mountain-slopes, as in the case of the Black Forest route.

Railway Tunnels of the U. S.—These occur upon a variety of roads throughout the Union, and are few or many according to the topography of the region. In New England E. of the Connecticut River there are few or none, the country, although rolling and rocky, rarely presenting such abrupt elevations as invite tunnelling. This deficiency is made up by the great Hoosac Tunnel, through the mountain-range of the same name W. of that river, and of which its resident engineer, Mr. Frost, has given an account under the article HOOSAC TUNNEL in this CYCLOPÆDIA, rendering further notice of it here unnecessary. It may be added, however, that, besides the central shaft of 1030 feet depth (where the accident from fire above referred to occurred), there was another, 318 feet in depth and half a mile from the W. end, between which and that end the chief difficulties in construction occurred, owing to the soft material requiring expensive supports. There are but two or three other tunnels E. of the Hudson, except the nine which are immediately on its bank through rocky spurs on the route from New York to Albany. The comparatively flat country on the New York Central requires none, and the Erie, although traversing a more broken district, meets with passes remarkably favorable for open-work. Farther S., in Pennsylvania, the mountains rising to greater height, the occasions for tunnelling increase, and upon the route from Philadelphia to Pittsburg there are six tunnels, of a total length of $2\frac{1}{10}$th miles, the longest (3750 feet) at the Alleghany Summit, driven through the coal-measures 400 feet below the mountain-crest, with three shafts and no special difficulty of construction. The Philadelphia and Reading R. R. has four tunnels, the longest 2100 feet, and a total length of about a mile. The Delaware Lackawanna and Western R. R. has three tunnels, the longest (4200 feet) through Bergen Hill at its eastern terminus (not far from the Erie R. R. tunnel of about the same length through the same ridge), and one of 3015 feet at another point of its line. The Amboy extension of the Lehigh Valley R. R. has an important tunnel, 4829 feet long, the *Musconetcong*, driven with one vertical and one inclined shaft, both near the W. end, most of the material being removed by drifting from the E. end. Water gave great trouble at the W. end, and was mastered with much skill by the engineers. The *Nesquehoning* tunnel, on the Lehigh Coal and Navigation Co.'s road, pierces Locust Mountain for 3800 feet, and was driven through the anthracite coal-measures and the underlying conglomerate and red shale without shafts. It required protection from masonry throughout. Upon the *low grade-line* of the Allegheny Valley Railway in Western Pennsylvania are five tunnels; the longest, at the *summit*, is 1950 feet in length, through the coal-rocks. Farther S. the Baltimore and Ohio R. R. has forty-four tunnels in all, of which upon its main track (178 miles) to Cumberland there are seven, through granite, breccia, and clay slate, of a total length of 3333 feet; upon its branch of 150 miles to Pittsburg three, making 1.422 miles, the longest of them, the *Sand Patch*, of 4800 feet, through the old red sandstone at the Alleghany Mountain summit, with two others through spurs 1600 and 1000 feet respectively. Upon the branch to Wheeling (201 miles) are twelve, of a total length of 2.04 miles, the longest, the *Kingwood*, 4200 feet long, driven through the coal-measures, with three shafts, each 167 feet deep; tunnel arched throughout. Upon the branch to Parkersburg (103 miles) are 23 tunnels, total length 3.43 miles, the longest 2700 feet, all in the coal-measures. The Chesapeake and Ohio R. R. has seventeen tunnels, from 200 to 6400 feet long, total 4.7 miles. The one through the Blue Ridge is 4200 feet long, through primitive and metamorphic rocks, the rest through the slates, limestones, and sandstones underlying the coal-measures. Two of the longest (1670 and 4033 feet) are at and near the Alleghany summit; the longest (6400 feet) is through the Big Bend of Greenbrier River. There is one of 4000 feet under Church Hill in Richmond through the drift clays, and attended with much difficulty; of course arched throughout. S. of Virginia and W. of the mountains there are but few tunnels constructed and in use, and all of them short. In Eastern Ohio there are some short ones cutting off the bends of creeks in ascending from the river to the table-land of that State. Throughout the Mississippi Valley, after leaving the spurs of the Appalachian range, there is little demand for tunnelling on the rolling prairie-lands, nor is it required upon the ascent of the Rocky Mountain chain from the eastward, the first tunnels, of which there are four, of a total length of but 1792 feet, upon the Union Pacific R. R., occurring on the descent to the great Salt Lake Basin by the cañons which lead to it. The Central Pacific has fifteen tunnels, of a united length of 6213 feet, the longest 1659 feet, in the crossing of the Sierra Nevada. These last tunnels are through granite, trap, trachyte, and conglomerate.

South American Tunnels.—Upon Dom Pedro the II. R. R. in Brazil are twelve tunnels, aggregating 2.84 miles, on a line of 19 miles ascending from Belem to Mendez. The longest, at the summit, is 7040 feet; all are in rock. In Peru, on the Lima and Oroya R. R., there are sixty tunnels on 100 miles of road. The longest, on the summit of the pass through the Cordilleras, is 3839 feet long and 15,648 feet above tide, being doubtless the highest tunnel on the globe by more than 2 miles of vertical altitude, as compared with either the Mont Cenis or the St. Gothard. The extreme rarefaction of the atmosphere made labor painful and ineffective, and the water which gushed into the tunnel through the numerous crevices opened by the earthquakes of that volcanic region greatly increased the difficulties of the work, for the prosecution of which tools, powder, and all other necessaries had to be brought from the lower country on mule-back. This tunnel is not yet completed, financial embarrassment having caused the suspension of the work. The preceding statements embrace all actually-built tunnels of which information could be had in time for this article.

Tunnels in Progress in Europe.—The one of chief interest, the ST. GOTHARD, is fully treated by HON. G. P. MARSH, whose article in this volume is referred to. Its subsequent progress to Dec. 31, 1875, shows an advance in the heading at the N. end to 3074, and the S. 2842 yards, together more than a third of its total length. The enlargement had made proportional progress, yet only 764 yards were fully completed. The original estimates fell short greatly, and an additional $20,000,000 was called for, and a suspension seemed probable. (The perforation was completed Feb. 29, 1880.) Upon the 165 miles between the Swiss and Italian termini of the route there are numerous shorter tunnels, giving a total length of $16\frac{3}{4}$ miles, and with the main one about 26 miles, or a sixth of the whole distance. *In America.*—Few new tunnels are under way. Upon the Cincinnati Southern its twenty-seven tunnels, of a total length of 4.84 miles, the longest 4000 feet, are all so far advanced as to ensure their completion this year (1876). They are driven through limestone, sandstone, and shale, and will all probably require arching ultimately.

Subaqueous Tunnels in Europe.—There are two of these, about $\frac{1}{4}$ of a mile long each, under the Thames at London. The first, at the London Docks, completed in 1842, and seventeen years in progress, is the famous work of the elder Brunel, and involved extraordinary difficulties, which there is no room to describe here. It is a double tunnel, and was never used except by foot-passengers and visitors as one of the sights of London until lately, when it has been made available to connect some of the railways on the two sides of the river. A new cylindrical tunnel or subway of only 7 feet diameter has been since constructed opposite the Tower of London, in a year, by means of a cleverly-contrived iron shield. Passengers are conveyed in a car drawn by stationary power working a chain alternately in each direction. *In America* there are two tunnels side by side, and each two miles long, under the bed of Lake Michigan at Chicago. The first, built in 1864–67 and costing $457,845, was 5 feet in diameter; the second, as an auxiliary, of 7 feet diameter, constructed 1872–74. They connect a hollow crib in the lake with the pumps on the shore, and so draw the surface-water, free from the pollutions of the city and the mud of the lake-bottom, in the clay of which the tunnels were driven 30 feet under its bed. (See TUNNEL, CHICAGO.) The Cleveland tunnel, $1\frac{1}{4}$ miles long, completed in 1874 at a cost of $320,352, for a similar purpose, draws the Lake Erie water for the supply of the city. It is on the same plan, 5 feet in diameter, and met with great difficulty in drifting through the clay bed of the lake. There are two road-tunnels under the Chicago River at that city—one completed in 1869 on the line of Washington street and under the South Branch, where the breadth of the water is 222 feet, and depth of tunnel bottom under low water 32.4 feet. The whole length of the tunnel and approaches is 1605 feet; extreme grade of carriage-ways, 1 in 11.55; cost of work, $512,708. The other is on La Salle street (on the same general plan), finished in 1871; breadth of main river, 300 feet; total length of tunnel approaches, 1890 feet; grade of carriage-ways, 1 in 20; cost of work not stated in published reports. A tunnel under the Detroit River to connect the U. S. and Canada was commenced in 1871, and draining drifts advanced 1220 feet on the Detroit side and 370 feet on the other shore, and suspended on account of influx of water in the latter.

The preceding statements include all the tunnels of magnitude for *commercial* purpose known to the writer as constructed or in progress to this time. Of *mining* tunnels there are many of great length and importance, as (in Germany) the Freiburg, 21 miles; the Georg at Clausthal, $10\frac{3}{4}$ miles; the Joseph II. at Schemnitz, $9\frac{1}{4}$ miles; Rolh-

schenberg (Freiburg), 8 miles; Ernst August, 13½ miles; Victoria, England.

Tunnels Projected.—The union of the Ohio and Atlantic waters has led to the projection of two long tunnels—one at the Alleghany summit-level of the proposed Chesapeake and Ohio Canal extension of 3¾ miles, at a height of 1944 feet above tide; width of tunnel, 42 feet, and height 26; long approach-cuts and two shafts, 700 and 576 feet deep; estimated cost, $6,593,990; water 7 feet deep in tunnel as in canal outside. The *other* through the same watershed upon the line of the James River and Kanawha Canal, 7⅞ miles long; height above tide, 1709 feet; width of tunnel, 31½ feet, height 35 feet, with recesses at short intervals for passage of boats; ten shafts of various depths from 90 to 520 feet; water 11 feet deep in tunnel, 7 feet in canal outside; estimated cost, $16,192,487. The details of the Chesapeake and Ohio Canal tunnel are in the reports of Col. William E. Merrill, U. S. army, and Col. Thomas S. Sedgewick, who made the survey. Those of the James and Kanawha tunnel are in the reports of the commission of engineers, of which Gen. J. G. Barnard, U. S. army, was chairman, whose suggestions led to a valuable improvement in the original location of the tunnel by the late Mr. Lorraine, chief engineer of the canal, with whom the bold idea of so long a tunnel at so great an elevation above the ocean originated.

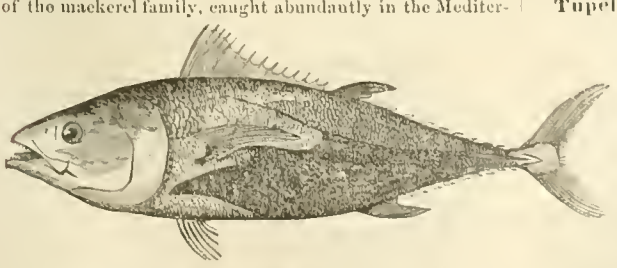
The boldest tunnel of the *subaqueous* class is that of the proposed submarine passage between England and France. The idea of spanning the British Channel by a structure *above* water having been laid aside, it was succeeded by a very ingenious and well-planned mode suggested by Messrs. Bateman & Revet, English hydraulic engineers, of a cast-iron tube upon the bed of the sea. This scheme seems, however, to have given way to that of drifting, in the usual way of tunnel-work, under the bottom of the strait through one of the various strata which compose it, and of which the preference appears properly to be given to the lower or gray chalk, in which trial shafts and drifts are now in progress, so that the project has taken a definite shape, and will, it is presumed, be prosecuted until success is assured or failure demonstrated. The tunnel and approaches would be some 23 miles long under the sea and in the approaches at a grade of some 66 feet per mile, according to the statement of Sir John Hawkshaw, the distinguished English engineer. Many other schemes of subaqueous tunnels, such as that of one under Boston harbor to East Boston, and under the Hudson River at New York, have been planned in detail, and may sooner or later be constructed, and such works between the shores of great commercial ports may receive a large extension in the future as least obstructing navigation.

General Summary of the Tunnels of the World.

Canal tunnels	86,	of a total length of			66¼	miles.
Railway "	957	"	"	"	291	"
Subaqueous tunnels	8	"	"	"	6½	"
Conduits	37	"	"	"	80¼	"
Totals	1088 tunnels				= 444	miles.

This statement is, as already remarked, but an approximation, and could not be otherwise with the time and means at command for obtaining information. It may give a better idea, perhaps, than has been heretofore presented, of the vast extent to which this class of engineering works has reached in modern times. There are tunnels in Mexico, India, Australia, and New Zealand, of which no accounts are at present at hand, and the mining tunnels of Japan are said to be extensive and interesting for the skill and perseverance exhibited in their execution with very inferior tools and appliances. BENJ. H. LATROBE.

Tun'ny [Gr. θύννος], the *Thynnus vulgaris*, a large fish of the mackerel family, caught abundantly in the Mediterranean and Black seas, and sometimes in the Atlantic. It sometimes, though rarely, measures twenty feet in length, and exceeds half a ton in weight. It moves in vast shoals, and is caught by enclosing it in nets and then killing by means of the harpoon. Its flesh is highly esteemed, both fresh and salted. It is reported to have been found on our U. S. coast, where its usual representative is *Thynnus secundo-dorsalis*, the great HORSE-MACKEREL (which see).



Tuns'burg, Chippewa co., Minn. P. 191.

Tuns'tall, town of England, county of Stafford, has extensive manufacture of pottery, tiles, and chemicals. P. 11,207.

Tunstall, or **Tonstall** (CUTHBERT), D. D., LL.D., b. at Hatchford, Yorkshire, about 1475; entered Balol College, Oxford, about 1491; removed thence to Cambridge, where he was chosen fellow of King's Hall, now Trinity College; studied at Padua, where he took the degree of doctor of laws; became vicar general to Archbishop Warham and rector of Harrow on the Hill 1511, prebendary of Lincoln 1514, archdeacon of Chester 1515, and master of the rolls 1516; was sent 1516-17 to Brussels with Sir Thomas More as joint ambassador to Charles I. of Spain (afterward Charles V.), with whom they concluded two treaties; made there the acquaintance of Erasmus; became prebendary of York 1519, prebendary and dean of Salisbury 1521, bishop of London Oct., 1522, lord privy seal May, 1523, ambassador to Spain 1525; accompanied Wolsey to France July, 1527; was a plenipotentiary to negotiate the Peace of Cambray 1529; bought up Tyndale's New Testaments at Antwerp and burnt them in Cheapside 1529; became bishop of Durham by papal bull Feb. 21, 1530; concurred in most of the ecclesiastical reforms of Henry VIII. and those of the first years of Edward VI., but was deprived of his bishopric and sent to the Tower on a charge of treason Oct., 1552; was restored by Mary, and conducted himself with great moderation during her reign, allowing no persecution within his diocese; was again deprived by order of Queen Elizabeth July, 1559, in consequence of having refused to take the oath of supremacy, and was committed to the custody of Dr. Parker, archbishop of Canterbury. D. at Lambeth Palace Nov. 18, 1559. He was described by Erasmus as "a man who outdid all his contemporaries in the learned languages," and was the inventor of a species of technical memory. Author of *In Laudem Matrimonii* (1518); *De Arte Supputandi* (London, 1522), one of the first books of arithmetic printed in England; *De Veritate Corporis et Sanguinis Domini Nostri Jesu Christi in Eucharistica, Libri II.* (Paris, 1551), being an elaborate defence of transubstantiation; *Compendium in X. Libros Ethicorum Aristotelis* (Paris, 1551); *Contra Impios Blasphematores Dei Predestinationis Opus* (Antwerp, 1555); *Certain Godly and Devout Prayers in Latin*, etc. (1558), and *A Letter to Cardinal Pole.*

Tunstall's, p.-v., Pittsylvania co., Va. P. 4621.

Tuol'umne, county of E. California, bounded E. by the Sierra Nevada Mountains, N. by Stanislaus River, and drained by Tuolumne River; surface level in the W. part, mountainous in the E., and covered with excellent timber, which forms an article of large export; soil in the valleys very fertile. It was formerly an important mining district, and mining is still carried on to some extent. There are saw-mills, quartz-mills, and breweries. Sheep are very numerous. Staples, wool, wine, wheat, barley, dairy products, and lumber. Cap. Sonora. Area, 1944 sq. m. P. 8150.

Tuomey (MICHAEL), b. at Cork, Ireland, Sept. 29, 1805; came to the U. S. at an early age; graduated at the Rensselaer Polytechnic Institute 1835; became State geologist of South Carolina 1844, and of Alabama 1848, and filled for several years the professorship of geology, mineralogy, and agricultural chemistry in the University of Alabama. D. at Tuscaloosa, Ala., Mar. 20, 1857. Author of a *Report on the Geology of South Carolina* (1848), *First Biennial Report on the Geology of Alabama* (1850), and was joint author with Prof. F. S. Holmes of *The Fossils of South Carolina* (Charleston, parts I-10, 1855-57).

Tupaiidæ. SEE APPENDIX.

Tupelo. SEE GUM TREE.

Tu'pelo, p.-v., cap. of Lee co., Miss., on Mobile and Ohio R. R., 272 miles from the former city, has 3 churches, good schools, 1 exchange bank, 1 newspaper, 2 mills and steam-gins, and 2 hotels. P. 618. J. M. ECKFORD, ED. "JOURNAL."

Tupi'za, town of Bolivia, South America, in lat. 2° 28' S., near the frontier of the Argentine Republic, carries on a considerable transit trade. Pop. about 5000.

Tup'per (BENJAMIN), b. at Stoughton, Mass., in 1738; was a soldier in the French war 1756-63; became colonel of the 11th Massachusetts infantry early in 1776; served under Gates at Saratoga; was at the battle of Monmouth 1778; was brevetted general before the close of the war; was associated with Gen. Rufus Putnam in forming the Ohio Land Company; was surveyor of Ohio lands 1785; served against the Shays rebellion 1786; settled at Marietta, O., 1787; became judge there 1788. D. in June, 1792.—His son, EDWARD W., was brigadier-general of Ohio volunteers under Gen. Harrison in 1812, and d. at Gallipolis, O., in 1823.

Tupper (Martin Farquhar), D. C. L., F. R. S., b. in London, England, July 17, 1810; educated at the Charterhouse School and at Christ Church, Oxford, where he graduated 1831; studied law, and was called to the bar at Lincoln's Inn, but never practised: published anonymously a volume of poems (1832), and in 1838 issued the work by which he is best known, *Proverbial Philosophy* (second series, 1842; third, 1867). Mr. Tupper has written many other volumes of prose and verse. In 1851 and 1876 he visited the U. S., and in 1875 wrote a drama in honor of the centenary of American independence. He is the owner of a fine country-seat at Albury, Surrey.—His three daughters published in 1864 a volume, *Poems by Three Sisters*, and have contributed to Dr. Rogers's *Lyra Britannica*.

Tupp'ville, tp., Ottawa co., Kan. P. 250.

Turanian Race and Languages. See Language, by Prof. W. D. Whitney, Ph. D., LL.D.

Turbella'ria [from *turbellæ*, plural diminutive of *turba*, a "stir," supposed to have been applied on account of the current created by ciliæ], a group of worm-like animals, by some considered as a peculiar class, and by others as an order of scolecids. They are sometimes broad, sometimes very narrow, but always depressed, and invested in an integument (the ectoderm) covered with minute ciliæ, and never segmented or articulated; the mouth is very variable in position, in some being near the middle, in others toward the anterior end, and in others toward the posterior end of the body; sometimes, too, it is simple, and sometimes proboscidiform; the intestinal canal is excavated in the substance of the body, and not differentiated in a perivisceral space; it is in some forms simple, in others ramified; also in some it has an anal outlet, and in others is closed or cæcal; the nervous system is constituted by two ganglia in the anterior portion of the body, from which extend backward two lateral cords (one on each side), besides smaller branches; the sexes are in some combined, in others separate. These various differences have been employed to separate the various forms into groups. (1) Those with an anus are the Proctucha, represented by the Nemertidæ; (2) those without an anus have been combined under the name Aproctæ; (2*a*) some (Rhabdocœla) have the intestine simple; (2*b*) others (Dendrocœla) are distinguished by an intestine which is ramified, and are known as planarians. Most of the species are marine, but some inhabit fresh water, and some live in damp places on land. Theodore Gill.

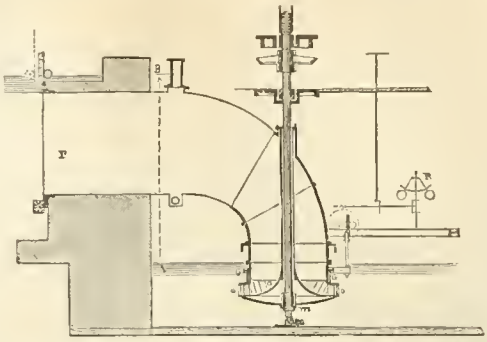
Tur'bervile (George), b. at Whitchurch, Dorsetshire, England, about 1530; was educated at Winchester School and at New College, Oxford, where he obtained a fellowship 1561; studied law at one of the inns of court, London; accompanied Sir Thomas Randolph to Russia as his secretary, and wrote three poetical epistles descriptive of that country, which were printed in Hakluyt's *Voyage* along with Randolph's narrative. D. about 1600. Author of *Epitaphes, Epigrams, Songs, and Sonets* (1565; enlarged in the edition of 1570, and several times reprinted in the present century), *Heroycall Epistles of the learned Poet Publius Ouidius Naso, in Englishe Verse* (1569), *The Booke of Faulconrie, or Hawking* (1575), *The Noble Art of Venerie, or Hunting* (1576), *Tragical Tales, translated out of the Italian* (1576), and left a MS. translation of Tasso's *Jerusalem Delivered*, now in the Bodleian Library.

Tur'bett, tp., Juniata co., Pa. P. 714.

Tur'bine [Lat. *turbo*]. This term is usually applied to a water-wheel revolving upon a vertical axis, as distinguished from those turning on horizontal axes, which are known as vertical water-wheels, or, simply, as water-wheels. There are two radically-different modes of applying water-power. One consists in receiving the water in buckets formed on the periphery of the wheel, in such a manner that the weight of the water causes the wheel to rotate, and overcomes whatever resistance opposes its rotation. In such a wheel the water does not move with a velocity approaching that due the head. In the second the weight or pressure of the head is employed in giving a rapid motion to the water, which by its impulse or reaction communicates motion to the wheel. Wheels with horizontal axes are suited to the first method; those with vertical axes to the second.

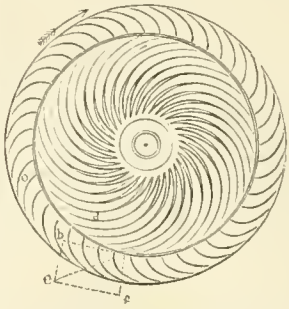
A few preliminary observations are necessary as to the nature of impulse and reaction. The action of water by impulse against a solid surface is the pressure against the surface caused by the change in the direction and velocity of the water's motion. As force is necessary to communicate velocity to water, so force is exerted upon any fixed surface which retards or changes its motion. Impulse against surfaces at rest has been made the subject of experiment. Bidone employed an instrument, indicated at Fig. 4, for a flat vane at right angles to the direction of the stream. In this case, when the surface is at rest, the pressure is double that which the head exerts upon an area equal to the smallest cross-section of the stream. In other

Fig. 1.



words, the pressure exerted by the water when its motion is arrested is double that exerted in putting it in motion. This would appear at first view to indicate that plane floats receiving the direct impact of the water would be a good arrangement for a water-wheel, but such is not the fact. When the float moves, the velocity of the water relatively to the float is diminished. The power developed is greatest when the float moves with one-half the velocity of the stream, and in this case is but half the absolute power of the water. That is, observing the definition of "efficiency" given further on, such a wheel could never have an efficiency greater than 50 per cent. The abrupt change in the velocity of the water caused by these floats is unfavorable to efficiency. Flat vanes inclined to the direction of the stream are more favorable to efficiency then when perpendicular, but there is here an abrupt change in the direction of the stream which causes a loss of power. In order that the stream may exert its full effect, it must not strike the vane, but must meet it by gliding along it. To show how this may be accomplished in a turbine wheel, let *c c* (Fig. 2) represent the direction and velocity with which water enters the wheel. The point *c* is moving for the moment in the direction *c b* with a velocity represented by *c b*. Relatively to the wheel, therefore, the water has the velocity and direction *c f*. This will appear when we reflect that a particle of

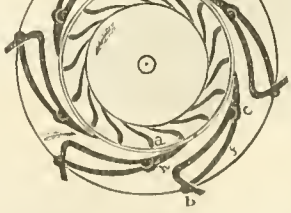
Fig. 2.



water at *c* may be supposed to have two velocities, *c f* and *c b*, which together would give it the velocity and direction *c c*. Now, in order that the water may not strike the bucket, it is only necessary that its inner end should have the direction *c f* equal and parallel to *b c*. If the water leaves the vane with any considerable velocity, it is evident that it has not expended all its energy in giving motion to the vane. This can only occur when it leaves the vane with no absolute velocity; that is, with no velocity as regards a fixed point. It must leave the vane with the same velocity that the latter possesses, and in the contrary direction.

A third requisite of the efficient action of water on vanes is that it should be free from whirls, eddies, and counter-currents while in contact with the vane and while approaching the same. Water exerts reaction when escaping from a vessel or enclosed space. The amount of this force may be estimated by an apparatus represented at Fig. 1. A vessel suspended at *c* is kept filled with water, which escapes at an orifice *f*. The water escaping toward the left, the reaction causes the vessel to tend

Fig. 3.

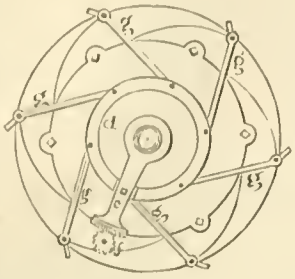


toward the right with an effort which may be exactly weighed by the balance, as indicated. As might be expected, the reaction is exactly equal to the impulse of the same stream on a flat vane perpendicular to its direction. Where water exerts an effort of reaction upon a wheel, it is essen-

tial to efficiency that the direction of the issuing stream should be, as nearly as possible, opposite that of the wheel's motion at the point of discharge. In most turbines the water acts partly by impulse and partly by reaction.

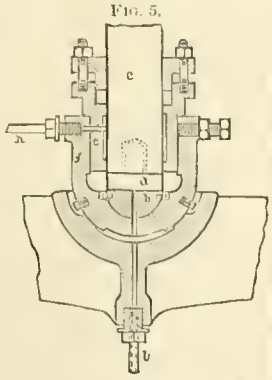
A turbine water-wheel consists of the following parts: (1) a series of fixed vanes, called guides, for giving a suitable direction to the water; (2) a series of vanes attached to a revolving rim to receive the action of the water; (3) a shaft for transmitting the movement; (4) a gate for regulating the quantity of water admitted, and consequently the velocity of the wheel. It also requires an iron or wooden flume or penstock for conveying the water to the wheel under the pressure due to the entire head or fall, and a tail-race for the escape of the water. Modern turbines may be divided into three general classes: (1) outward flow turbines, in which the guides are within the wheel; (2) inward-flow or centre-vent turbines, in which the guides are outside the wheel; (3) parallel-flow turbines, in which the guides are above the wheel.

Fig. 1.



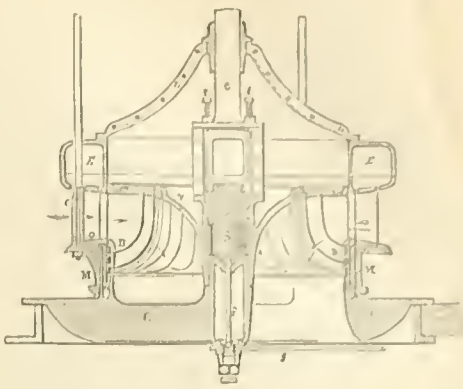
Though the turbine is not a recent discovery, its introduction and use as a motor is comparatively recent. Within the last forty years it has almost entirely superseded wheels with horizontal axes. This result is due to several advantages, among which are—(1) its compactness; (2) its property of working immersed in the water of the tail-race, utilizing the entire head at all stages of the water, and also conducing to its protection from frost, a consideration of no small importance in this latitude; (3) its high velocity, avoiding cumbrous gearing for "bringing up the speed." Its general adoption has stimulated invention in a remarkable degree, more than 1000 patents having been granted by the U. S. government for water-wheels, by far the greater number being for wheels with vertical axes. A great number of models have found their way into the market, and many establishments have been organized for the manufacture of these wheels. The great manufacturing corporations of the East have adhered mainly to wheels of scientific design and careful construction. Among the great body of millers and small manufacturers throughout the country, cheapness is usually a primary consideration. In the utilization of new water-powers it often happens that the volume of water expended is of no consequence, and true economy points to the cheapest wheel that will give the required power. The demand for cheap wheels has opened a wide field for the efforts of inventors and manufacturers, and although an immense amount of ingenuity and capital have been expended upon worthless models which have been discarded after a few years, this great activity has not failed to advance the knowledge of the principles which govern the construction of turbines, and some makers have hit upon designs showing a high degree of efficiency. Several of the leading types in use are illustrated in the accompanying cuts.

Fig. 5.



The wheel indicated in Figs. 1 and 2 may be considered a type of what is known as the Boyden turbine, so called from Mr. U. A. Boyden of Boston, to whom are due the improvements which distinguish it from its prototype, a wheel designed by M. Fourneyron of France, who in 1834 received a prize of 6000 francs from the Society for the Encouragement of the Arts at Paris for the best horizontal wheel upon a large scale. His wheel, again, had its prototype in one of earlier date constructed by Burdin. The illustration is taken from the work entitled *Lowell Hydraulic Experiments*, by Mr. James B. Francis, under whose superintendence this particular wheel was constructed. It is an outward-flow wheel. The water is conducted to the wheel through an iron supply-pipe P. At the bottom of this pipe is the funnel-shaped disk *d* supporting the guides, which direct the water upon the wheel. The disk terminates upward in a pipe within which the wheel shaft revolves; *o m o* is the wheel, consisting of a hub *m*, attached to the shaft and carrying a broad curved plate, on the outer circumference of which are placed the

Fig. 6.



wheel-rims and buckets or floats. These surround the disk and guides, leaving an annular space in which the gate G G descends to partially or wholly stop the flow of the water. The gate is a short cylinder telescoped on the outside of the supply-pipe at the bottom. It is better shown at Fig. 12. Fig. 2 shows the shape of the guides and buckets. R is the regulator, to be described further on. The weight of this wheel is borne at the top of the shaft. To obtain sufficient bearing surface, the upper part of the shaft is formed into a series of collars, fitting corresponding recesses in a cast-iron box. They revolve in a lining of soft metal composed mainly of tin, which ensures uniform distribution of the weight.

Fig. 7.

The fall acting on a turbine is the height of the surface of the water in the supplying canal or basin above that in the wheelpit, A B, Fig. 1. The power expended is the number of pounds of water passing the wheel per second multiplied by the fall in feet. The useful effect of the wheel is the power which it is capable of exerting to drive machinery. It is estimated in pounds raised 1 foot. The efficiency or percentage of useful effect is the ratio of the useful effect to the power expended. Thus, if the wheel discharge 8000 pounds of water per second, and the fall is 12 feet, the power expended is 96,000 pounds raised 1 foot per second. If the power exerted by the wheel is equivalent to 72,000 pounds, raised 1 foot per second, the useful effect is three-quarters of the power expended, and the wheel is said to show an efficiency of 75 per cent. The Boyden turbine, with the gate fully raised, has shown a higher efficiency than any other wheel. Wheels of this class, subjected to very careful and accurate tests, have been found to utilize as much as 88 per cent. of the power expended. It usually

Fig. 8.

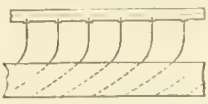
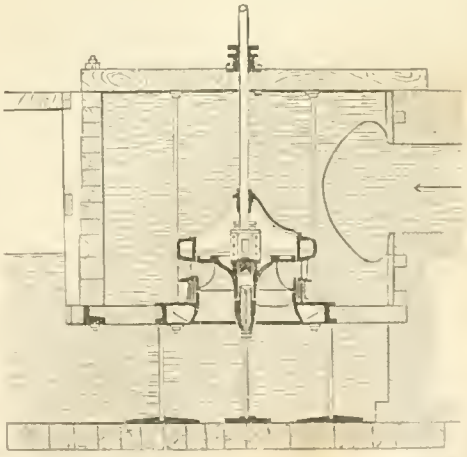


Fig. 9.

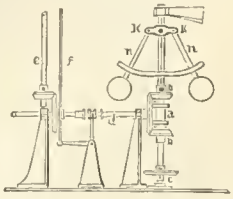


occurs, however, that the quantity of water disposable diminishes materially in dry weather, and it is necessary to run the wheel with the gate partly closed. In this case,

the efficiency of this wheel is very much diminished, owing to the fact that the stream of water does not fill the passages through the wheel, and expends much of its energy in eddies and commotions. The water must be used at great disadvantage at the time when it is most desirable to economize it. The attention of inventors has been largely directed to providing a remedy for this defect, and the two wheels next to be described are the most successful examples of its accomplishment.

Figs. 3 and 4 represent a wheel made at Dayton, O., and much used in the Western States. It is a wheel of the second class, discharging inwardly. *a* is the wheel, *b* one of the gates, of which there are six or more. It turns on a hinge at *c*, opening against the vertical diaphragm *f* and closing against *h*. The gates and diaphragms serve as guides. The gates are moved by an arrangement shown at Fig. 4. The wheel is covered by a casing terminating in a pipe within which the shaft revolves. This pipe passes through a circular disk *d*, carrying an arm *e* and resting upon the casing. The pipe may rise to the surface of the water or terminate in a stuffing-box. A pinion *f* gears with an arch-head on the arm *e*, and gives a rotary movement to the disk, opening and closing the gates by means of jointed bars *g g*. This wheel is stated by James Emerson to have shown an efficiency of 83 per cent. with the gates fully open, and 70 per cent. with the gates half open.

Fig. 10.



Figs. 6, 7, 8, and 9 show the Swain turbine made at North Chelmsford, Mass. This is also a centre-vent wheel. Fig. 6 is a vertical section through the centre of the wheel; Fig. 7, a horizontal section showing a portion of the wheel and guides; Fig. 8 shows the outer edges of several buckets, drawn on the supposition that the outer circumference of the wheel is spread out into a plane surface; Fig. 9 shows the wheel as working in its flume. The wheel, it will be observed, is placed over an opening in the bottom of its flume. This opening is occupied by an annular plate of cast iron supporting a short diverging pipe of the diameter of the wheel, through which the water is discharged. Three arms, one of which appears in section at C, extend across this short pipe and unite at the centre to form a hub, sustaining the weight of the wheel. The short pipe, it will be seen, extends above and below the annular plate. Outside of the short pipe another short cylinder, which we will call the curb, stands on the annular plate. The gate is of peculiar construction. It consists of two cylinders M and N, one outside and one inside the curb. It moves upward in closing. The top G G is a broad flange sustaining the guides, which pass through suitable slots into the chamber E when the gate closes. Three of the guides in Figs. 6 and 7 are thicker than the rest, and receive the rods for moving the gate. The buckets of the wheel are curved horizontally and vertically. If an orange were cut in eight equal and symmetrical parts, the rind of one of the parts would bear some resemblance to one of these buckets. *c* is the shaft, *t t* adjusting screws. The weight of the wheel is borne by the oak step S. A careful test of one of these wheels in 1870 by Mr. Hiram F. Mills of Lawrence, Mass., showed an efficiency of 81 per cent. with full gate, 77 per cent. with gate three-quarters open, and 69 per cent. with gate one-half open. A similar test by Mr. Francis at Lowell in 1875 gave an efficiency as high as 81 per cent. with full gate, 83 with three-quarter gate, 77 with one-half gate, and about 63 with one-quarter gate. The wheel indicated at Figs. 1 and 2 showed an efficiency of 79 per cent. with full gate, 76 with three-quarter, 66 with one-half, and 46 with one-quarter.

Fig. 11.

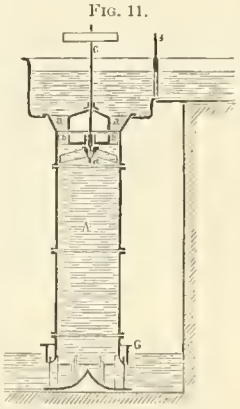
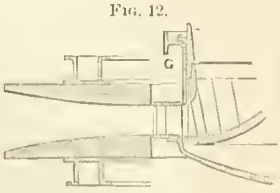
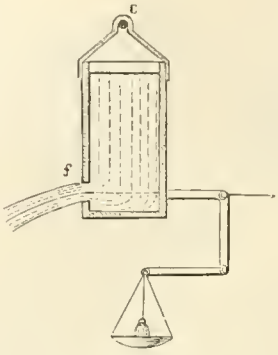


Fig. 12.



Wheels of the third class, in which the water moves parallel to the axis, are rare in this country, though often met with on the continent of Europe. Fig. 11 is the outline of an arrangement common there. *a a* are the stationary guides, *b b* the floats of the wheel, *c* the shaft, *d* the step. The shape of the guides and floats will be better understood from Figs. 15 and 16. Fig. 16 shows the outer edges of two buckets or floats, as they appear in elevation. *g*, Fig. 11, is the regulating gate, *f* the head gate for shutting off the water in order to get access to the wheel. It will be noticed that this wheel is placed above the water of the tail-race, the pipe A opening under water. The head does not act directly upon the wheel. The portion of the head below the wheel acts by diminishing the atmospheric pressure upon the under side of the wheel, and has the same effect as though it were above. This position of the wheel is quite common in the Western States, especially at the Falls of St. Anthony on the Mississippi River, where the geological formation is peculiarly adapted to the arrangement. A pipe is applied to the bottom of the flume in which the wheel is placed, receiving the water passing the wheel and discharging below the surface of the water in the tail-race. Such pipes are called draught-tubes. They do not, in this country, have a gate at the bottom, as in Fig. 11.

Fig. 13.



The processes of manufacture usually require a tolerably uniform speed, however much the amount of machinery in motion may be varied. To avoid the necessity of constant supervision, an automatic device is usually employed to control the quantity of water admitted to the wheel through the gate. Such a device is shown at Fig. 10. It consists of a revolving upright shaft carrying two arms *n n*, to which heavy balls are attached. The arms are attached to the upright shaft by joints or hinges *k k*. The upright shaft carries two bevel gears *b b*, which are fixed as to their vertical position, but do not revolve with the shaft except as described below. These two bevel gears engage with a third, attached to the shaft *d*, which, turning in one direction, raises the gate; in the others, lowers it. *a* is a collar which revolves with the upright shaft, but is capable of moving upward and downward to a slight extent. It carries a small stud at each end. Each of the bevel gears has a similar stud. In a certain position of the collar *a*, it revolves freely, neither of its studs touching those on the bevel gears. In this position the shaft *d* does not revolve. When the collar rises above this position, its upper stud strikes the one on the upper bevel gear, causing it to revolve, and turning the shaft *d*, which raises the gate. When the collar descends, it turns the lower bevel gear in the same manner, causing the shaft *d* to revolve in the opposite direction, lowering the gate. The upright shaft is hollow, and has within it a rod connected with the collar *a*. The two arms *n n* are connected with this rod by branches projecting inward from *k k*, not visible in the drawing. The position of the collar *a*, which leaves the gate at rest, corresponds to the normal speed of the wheel. If the speed exceeds this, the centrifugal force acting on the balls throws them outward, and by means of the internal rod above mentioned lowers the collar *a*, causing the gate to descend as described. When the wheel moves with less than the normal speed, the balls approach the upright shaft, and the reverse action takes place, causing the gate

Fig. 14.

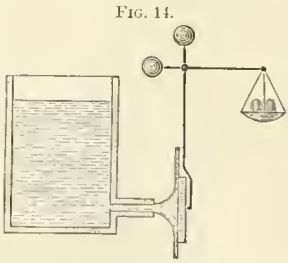
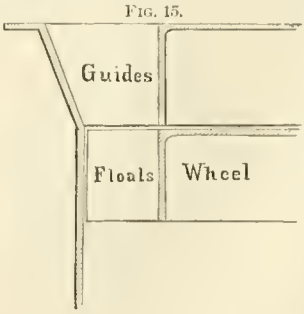


Fig. 15.



to rise. *e* is a shaft for moving the gate by hand; *f* is a rod which, being pressed downward, disconnects the shaft *d* from the regulator; *c*, a bevel gear by which motion is communicated to the upright shaft.

One of the most important accessories of the turbine is the bearing which sustains its weight while in motion. Delays and interruptions result from defects in these bearings as often as from any other cause, since, the bearing surface being necessarily small, they are liable to be destroyed by the great heat generated by friction. The suspension box, Fig. 1, is used to some extent in this country, but a wooden step at the bottom of the shaft is the most common arrangement; S, Fig. 6, is a common form of the step. In this case the constant wetting of the step is ensured by a stream of water forced through a pipe *f* and through a hole in the step. The destruction of such steps by heat is a very common occurrence, especially in wheels provided with draught tubes. The vacuum in the tube is created by the stream of water issuing from the wheel, on the principle of the jet-pump explained under the head of PNEUMATICS. It sometimes happens, in wheels constructed without due consideration of this point, that the step is excluded from the action of the water, and the air lodges around it, leaving it dry. Such wheels require very frequent renewals of the step. Oak and lignum vitæ are used for the steps, but common second-growth maple has been found just as serviceable. On the continent of Europe a form of step prevails which admits of lubrication with oil. Fig. 5 shows such an arrangement. *c* is the shaft; *f* the case; *e* a lining furnished with a stuffing-box to exclude the water; *o* is a steel face revolving on a hemispherical seat of gun-metal. The case *f* is also hemispherical, and rests in a hemispherical socket. Oil is furnished by the pipe *h*, and passes away through *l*. This arrangement secures uniform distribution of pressure horizontally and vertically, and admits of the renewal of parts liable to wear.

FIG. 16.

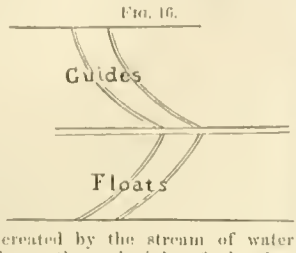


Fig. 12 shows the diffuser, an invention of Mr. Boyden. It is an annular expanding passage surrounding the wheel, and causing the water to escape from it with a gradually diminishing velocity. Its function is to utilize the velocity with which the water leaves the wheel by diminishing the back pressure. (See HYDRODYNAMICS.) J. P. FRIZELL.

Turbot. See PLEURONECTIDÆ.

Turbot, tp., Northumberland co., Pa. P. 1803.

Tur'botville, p.-b., Northumberland co., Pa. P. 417.

Turdinæ, or **Turdidæ.** See APPENDIX.

Turenne', de (HENRI DE LA TOUR D'AUVERGNE), VICOMTE, b. at Sedan, department of Ardennes, France, Sept. 11, 1611, a son of Henry, duke of Bouillon, and Elizabeth, a sister of William I. of Nassau-Orange; was educated by his uncle, Maurice of Nassau, and entered the French army in 1630. During the Thirty Years' war he distinguished himself in subordinate positions in the campaigns in Germany and Italy; received an independent command in 1641; conquered Roussillon in 1642; was created a marshal of France in 1643, and contributed much to the conclusion of the Peace of Westphalia in 1648 by his successful campaigns in Bavaria, the Palatinate, and Flanders. In the wars of the Fronde he first sided with Condé, but having been defeated at Rethel in 1650 and driven out of France, he became reconciled with the court, was appointed commander-in-chief of the royal troops, defeated Condé at Bleneau 1652, the Spaniards at Arras 1654, and in the Dunes 1658, and was made a marshal-general after the Peace of the Pyrenees, Nov. 7, 1659. In the war with Spain (1667) he conquered Flanders in a brilliant campaign on which the king, Louis XIV., accompanied him, and in the war with Holland (1672) his fame reached its culmination by his conquest and devastation of the Palatinate in 1674, and the destruction of two Austrian armies in the battles of Mühlhausen (Dec. 29, 1674) and Türkheim (Jan. 5, 1675). He was preparing for a last and decisive encounter with Montecuculi, when he was killed by a cannon-ball during a reconnoissance near Sarbach, July 27, 1675. He is considered the greatest general France has produced, next to Napoleon, and he was interred, by order of Louis XIV., in the royal vault of St. Denis. During the Revolution his corpse was for some years exhibited in a curiosity-shop in Paris on account of its good preservation. Napoleon ordered it entombed under the dome of the Hôtel des Invalides. Turenne left *Mémoires*, comprising the period from 1643 to 1658, published by Grimoard in 2 vols. (1782). Deschamps, an officer of his staff, published some *Mémoires* in 1687. His *Life* has been written several times—by Ramsay 1733, translated into English 1735, and by Neuber (Vienna, 1869).

Turf. See HORSE RACING, by C. G. LELAND, A. M.

Turgenev', the name of several celebrated authors in Russian literature. (1) ALEXEI TURGENEV, b. in 1785; travelled in Germany, Italy, France, and Denmark to make investigations concerning the mediæval history of Russia, and published *Historiæ Russiæ Monumenta* (2 vols., St. Petersburg, 1841–42), and a *Supplementum* (1848). D. at Moscow Dec. 15, 1845. (2) His brother, NIKOLAI TURGENEV, b. in 1790; studied at Gottingen; was, with Baron von Stein, placed at the head of the administration of those German countries which in 1813 were reconquered from France; studied subsequently the state of the serfs in Russia; was implicated in the conspiracy of 1825 and condemned to death, but escaped, and lived afterward in Paris. D. in Paris Nov., 1871. He wrote *La Russie et les Russes* (3 vols., Paris, 1847). (3) IVAN TURGENEV, b. at Orel Nov., 1818; studied at Moscow, St. Petersburg, and Berlin; was appointed to the ministry of the interior; was for several years banished on account of his liberal ideas, but allowed to return to the capital, and lived subsequently mostly in Paris and Germany. In 1843 his poem *Parasha* attracted much attention, and still more his sketches of rural life in Russia, *Memoirs of a Sportsman* (1852), which was translated into several European languages. His collected works, comprising several highly-appreciated novels, *Smoke*, *Liza*, etc., were published in 5 vols. (1865), and have been translated into German and English.

Tur'got (ANNE ROBERT JACQUES), BARON DE L'AULNE, b. at Paris May 10, 1727; was educated for the Church, and appointed prior of the Sorbonne in 1749, but gave up the ecclesiastical career in 1751; studied law and national economy; became noted by his essays in the *Encyclopédie* and was appointed intendant—that is, governor—of the province of Limosin in 1761. His administration was eminently successful, and although his reforms were crippled by the egotism of the privileged classes and the stupidity of the unprivileged, they proved beneficial. In 1774, Louis XVI. appointed him comptroller-general of France—that is, minister of finance—and he immediately went to work to save, if possible, the state from bankruptcy. His ideas were essentially the same as those subsequently adopted and carried out by the Revolution, and the courtiers, the nobility, the clergy, etc., raised a veritable storm around him. For some time, however, the king supported him faithfully. But in 1775 a scarcity of grain occurred, which almost grew into a famine. The artificial barriers between the various provinces of the realm, which trammelled the free trade in grain in the interior, Turgot abolished by a *lit du justice*; he compelled the Parliament to acknowledge the measure, and the riots of the mob, excited by secret emissaries of the courtiers, were speedily suppressed by military power. But at this point the king failed. Although he said that he himself and Turgot were the only two who loved France truly, yet he suddenly dismissed him in May, 1776. Turgot retired into private life, occupying himself with scientific researches. D. in Paris Mar. 20, 1781. His *Œuvres complètes*, containing his essay on usury, on the best method of taxation, and *Réflexions sur la Formation et la Distribution des Richesses*, etc., were published by Dupont de Nemours in 9 vols. (1808–11), and often reprinted. His *Life* was written by Condorcet (1786) and Tissot (1862). He is the author of the famous line on Franklin: *Eripuit cœlo fulmen sceptrumque tyrannis.*

Tu'ri [probably anc. *Thuriæ Turum*], a town of Italy, province of Bari delle Puglie, on the slope of a rocky hill about 13 miles S. E. of the town of Bari. In the neighborhood, under the church of S. Oronzio, is the grotto in which that saint is said to have hid himself from the persecution of Nero, and whose natural arches, encrusted with stalactites, when illuminated by the sun shining through a rift, glow with a thousand gorgeous colors. The district is fertile, and the town improving in industry and in education. P. 6218.

Tu'rin [It. *Torino*; Lat. *Augusta Taurinorum*], city of Northern Italy, on the banks of the Po, in N. lat. 45° 4', E. lon. 7° 42', at the height of 755 feet above the sea. Turin is said to have been founded by the Ligurian tribe of the Taurini, but can hardly be said to be known in history until its colonization by Rome some time before the Christian era. In the eleventh century it was the capital of a small independent state, but passed by marriage into the family of the dukes of Savoy, of which, with the exception of the period of the Napoleonic occupation (1798–1814) and some previous brief intervals, it has ever

since been a possession. It was the political capital of the dukedom of Savoy, and afterward of the kingdom of Sardinia, until 1861, and then of the kingdom of Italy until 1865, when, in conformity with the stipulations of the convention of Sept. 15, 1864, between Napoleon III. and Victor Emanuel II., the seat of government was transferred to Florence. During the residence of the house of Savoy the population of Turin largely increased, and it was so strongly fortified as to defy the utmost power of France in the memorable siege of 1706. As its limits extended, the new parts of the town were laid out with great regularity, provided with wide streets, ample squares, and very extensive and magnificent porticoes, and abundant provision was made for the accommodation of the royal family and the transaction of public affairs by the erection of suitable palaces and other public buildings. Few European capitals could vie with Turin in convenience as a governmental city, while at the same time its university and its special and common schools, its museums and other public collections, the unsurpassed beauty of its site and its environs, the excellence of its climate, and its facility for communication with all parts not only of Italy, but of Central Europe, rendered it one of the most desirable residences on the Continent. The removal of the seat of government was a severe shock to Turin, but the energy and enterprise of its people have restored its old prosperity, and its population, which hardly exceeded 200,000 in 1861, has, notwithstanding the emigration of many thousand citizens who followed the government on its removal, now risen to 213,000.

Although the private and public buildings of Turin are generally of good design and well constructed, there are no churches or other edifices specially conspicuous for architectural merit, nor are there any important remains of ancient structures. The chapel of the Santa Sindone or Sudario, which is superstitiously venerated as a portion of the shroud of Christ, opens from the cathedral and is constructed entirely of black marble. It is among the richest ecclesiastical boildings of Turin, but in a taste which has found few admirers or imitators. A large church built for the Vaudois in 1851–53, principally with funds contributed by the state, is remarkable as one of the earliest instances of that religious liberality for which the government of Italy is now conspicuous. The church of the Corpus Domini is very profusely ornamented, and that of the Santi Martiri is sumptuous in its decorations. The Turinese churches contain few good works of art, but the cathedral has a *Virgin and Saints* ascribed to Dürer, and San Domenico contains a *Madonna* by Guercino. The Jewish synagogue, not yet finished, is very large and costly. The royal palace, though large, is not of extraordinary magnificence. It contains the king's private library, a valuable collection of 50,000 volumes, with many important manuscripts, and the royal armery, a large, well-arranged, and well-kept collection of ancient, mediæval, and modern arms and armor. Many of these objects are of much historical interest, and there are numerous weapons and pieces of defensive armor of the utmost beauty and perfection of workmanship. In equestrian armor this collection ranks among the finest in Europe. The University of Turin, now in a very flourishing condition, with an able corps of professors in the usual faculties, and 2000 students, occupies a building of plain architecture in the Via Po. Its library contains 150,000 volumes of printed books and many manuscripts of great value, among which some are splendidly illuminated. The Pinacoteca, a royal gallery of pictures, is of comparatively recent formation, but contains remarkable works by Gaudenzio Ferrari, Fra Angelico, Pollajuolo, Guido, Guercino, Paul Veronese, Domenichino, Albani, Vandyke, Paul Potter, Holbein, and other eminent masters, among which a priceless Memling, the *Passion of our Lord*, deserves special mention. The museum of antiquities, including the Egyptian collection of Drovetti, is of great interest and value, and the Museum of Natural History is highly respectable. The gallery of the Academia Albertina contains some good pictures, and the Museo Civico is well worth a visit for its collection of miscellaneous objects, among which a complete series of the editions of the celebrated Bodoni is noticeable. The country around Turin, though not enriched by splendid villas or ornamental gardening, is of the highest natural beauty, and several points in the vicinity of the city command views of the Alps which as *panoramic* prospects are not equalled by any in Switzerland. Under favorable conditions the *morning* winter view of the mountains from the Monte dei Capuccini on the right bank of the Po, 170 feet above the town, embracing the whole range from Monte Rosa to Monte Viso, a distance of 120 miles, with no break visible to the spectator less than 7000 feet above his own level, is indescribably magnificent. Even finer is the prospect from Superga, the royal mausoleum, at a height of 1600 feet above Turin, which includes all that is visible from the Monte dei Capuccini, with many additional peaks, as well as the plains of Piedmont and Lombardy, studded with cities and extending as far as the eye can reach.

In its mean, 51°, and its extreme of cold, −1° F., the temperature of Turin corresponds with that of Paris, but the mercury has not been observed to rise higher than 92°, four degrees below the maximum of heat at the capital of France. The mornings are sometimes obscured by fog from the Po, but in general the sky is clear, the air free from chill, and, notwithstanding the nearness of the Alps, the changes of temperature are extraordinarily gradual and regular, and Turin enjoys an almost total exemption from high winds.

The revival of the prosperity of Turin, temporarily checked by the removal of the seat of government, is due to its position as a convenient centre of trade in the native products of Northern Italy, and to the establishment of many manufactories for cloths, silks, candles, furniture, ironwork, tanned leather, and chemicals, besides numerous small industries in metal and in wood. The extent of some of these establishments may be inferred from the fact that a single manofactory produces 9,000,000 matches per day, and employs 450 laborers. A canal for the supply of water-power has lately been constructed by the municipality, but is not adequate for the wants of these indostries. (See Covino, *Descrizione di Torino*, and especially *Il Panorama delle Alpi*, by the same author, Turin, 1874.)

CAROLINE C. MARSH.

Turin, p.-v. and tp., Lewis co., N. Y. P. of v. 552; of tp. 1493.

Turkestan', or **Toorkistan** [properly, *Turkistan*, "land of the Turks"], formerly by geographers called **Bucharia, Great and Little,** the name of the broad, longitudinal depression between the Karakorum (Mustagh) and Hindoo-Koosh to the S., and the Thian Shan to the N., occupied by the river-systems of the Amoo Darya (Oxus) to the W., and the Tarim (Yarkand) to the E., the watershed between which is situated in the Pamir plateau, "the roof of the world," at an elevation of not less than 13,000 feet. It is bounded N. by Mongolia and the Kirghecz steppes, W. by the Caspian Sea, S. by Persia, Afghanistan, and High Asia, or the mountainous region forming the northern boundary of India, and E. by China proper. Its area has been calculated from maps at 1,576,402 sq. m. The Pamir steppes have always formed a line of separation, politically and ethnographically. Western Turkestan belonged formerly to the Iranians, now to the Russians; Eastern Turkestan was from olden times, and is up to this very day, the arena of Turkish adventurers, whose rule has been suspended, however, every now and then by the emperors of China.

Western or *Russian Turkestan*, the *Transoxania* of the classical, the *Maverannahr* of the Arabian geographers, comprises the government-general of Turkestan, the Trans-Caspian district, the feudatories of Bokhara and Khiva, all Russian dominions, and the Toorkoman steppes and the unexplored hilly tracts of Karategin on the upper course of the Oxus, which are still independent. As regards its physical conformation, the northern part is chiefly a plain extending from the Thian Shan hills, which cover the eastern districts (Ili, Ferghana, or Khokand), and reach Samarcand in its extreme spurs, to the shores of the Caspian, where it sinks down with a rapid declension. With the exception of a few table-lands and some bits of hard clay or loam, the soil consists chiefly of black or yellow sands, and the only land really fit for cultivation is that lying on the slopes of the hills or on the banks of rivers and canals. Two water-lines of ancient renown traverse the country at wide intervals, and in bygone ages they perhaps formed the avenues by which the tribes of Scythia found their way to Poland and Germany, while in our days they have led the Russians in turn to the habitations of the ancestors of the Turks. The largest of these rivers is the Oxus, now known by the name of *Amoo Darya*, which, rising N. of the Hindoo-Koosh in the Pamir steppes, where two of its infant rivers take their origin from noble sheets of water (Sirikul, 15,000 feet, and Karakul), flows along the territories of Afghanistan and Bokhara, and traverses then in a north-western direction the plains and deserts of Khiva, until it empties into the Sea of Aral. Its fall is, in its lower course, 0.15 centimètres in 300 mètres, and it is navigable for steamers from the mouth of the Ulkun arm to Kungrad, and still farther for small vessels; but a convenient road of traffic it can never become, on account of the rapids, 100 miles above Pitnak, and on account of the great changes which take place in its bed. The story that the Oxus formerly used to run into the Caspian, but was turned off by a dam constructed by the Toorkomans, is well known, and there is, indeed, a well-defined bed, called Usboi by Russian geographers, and which can be

traced from Khiva to the Balkan Bay of the Caspian Sea. Prof. Kiepert of Berlin, however, is of the opinion that the river became turned off by volcanic action in the oldest time of our planet, in which case the statements of the ancient and mediæval historians, which, moreover, are very indefinite, must be considered as inferences drawn from the peculiar configuration of the surface. The object of opening a water-communication from the Caspian to the foot of the Hindoo Koosh by means of the Ushoi bed could not be attained without extensive excavations of the sand which has drifted into the old bed, nor without closing the canals which absorb so much of the river water, but which are absolutely necessary to the continuance of cultivation in Khiva. The other great river, the Jaxartes, or *Sir Darya* of modern times, descends from the distant highlands of Ferghana (Khokand), at first to water lands of plenty; but as it tends northward it passes through what is now for the most part a vast desert, until it loses itself in the Sea of Aral in a wild delta of swamps and thickets. The river is navigable for a considerable distance. The main river of Bokhara is the Zerafshan, which has its source at an elevation of 7000 feet above the sea, divides N. E. of Samarcand into many branches, and flows S. W. to the steppe country. Formerly numerous canals branched off from these rivers and were led far into the deserts, where remnants of them still indicate their course; but they have been destroyed at various times, especially in 1570, when Bokhara determined to lay the northern frontier districts waste in order to prevent the predatory invasions of the Kirgheez Cossacks. The same was done at Merv, where formerly a large reservoir, Bend, gathered the waters of the Moorgaub, which now are lost in the sand before they reach the city. The Russian government builds large canals; works which are capable of irrigating 43,200 hectares were finished at Khojend in Nov., 1874. As regards the climate, spring begins in the middle of February. The annual mean temperature of Tashkend, in lat. 41° 8′ N., is 55° F. The winter is not so severe as in Russia; the spring brings abundant rain; the summer is dry and hot, even unpleasantly so, at least to Europeans; terrible sandstorms (*uragan*) occur in the steppes. Mining is still in its infancy. The iron, copper, and lead ores of the Karatau Mountains along the northern frontier of Bokhara have not yet given rise to any vigorous production of metals. Gold is found in the Ili district. The extensive coal-deposits in the Karatau have not yet been utilized, and are said to be of poor quality; layers of rock-salt have been discovered here. Forests are scarce. Peat is used as fuel in the towns. The saksaul, rising in tortuous zigzag lines to a height of 15 feet, and with a stem of a diameter of one and a half feet, occurs in the steppes sometimes as forests, oftener in thickets, and yields a valuable fuel. The high temperature of the summer has a good influence on the cultivation of the soil, which is everywhere sandy, light, and porous. Irrigation is indispensable, and plays a prominent part in agriculture. Only wheat and clover are winter crops; all other cereals, such as millet, barley, maize, pease, and rice (S. of Tashkend), are sown in April and harvested in August. Cotton succeeds in lat. 42½° N., and ripens in October. Bokhara cotton is considered one of the best kinds, and is sold at the fair of Nizhnee-Novgorod at from 12 to 20 rubles a pood; between 1,000,000 and 2,000,000 cwts. are annually brought thither. Grapes are cheaper than potatoes. The vine is chiefly cultivated S. of Tashkend, and the grape yields a good wine. Tobacco is also raised S. of Tashkend; seed from Maryland has succeeded well, and the cultivation seems to have a future. Rearing of silkworms is a favorite occupation, and produces a brilliant, fine, and strong silk, which is sold in the place at 375 marks a pood, 1750 marks for 100 cocoons, and 300 marks for 1 pound of eggs. The fruits and dyes of Bokhara are unrivalled of their kind. All agricultural implements are imperfect; very little iron is employed in their construction. The domestic animals comprise the horse, ass, cow, camel, sheep, goat; also swine, poultry, dogs, and cats. The horses are small, but light, swift, and easily satisfied with respect to fodder. The camel is the Bactrian double-humped; it travels at the rate of 3 miles an hour and carries five cwts. For cattle-breeding the Turks have no taste; the race is small, of an indefinite color, and poorly cared for. Sheep, brown-colored and with pendent ears, are reared for the sake of the flesh. A developed manufacturing industry cannot, of course, be expected, as two-thirds of the inhabitants are nomads and know no wants beyond the most common. All industry is as yet home industry, and employs only hand labor. Among the best articles produced, and which form items of exportation, are strong carpets of wool or goat and camel hair, silks, and cotton fabrics worked on huge looms. The colors are generally indefinite and sombre, and do not correspond with European taste. The whole population is animated by a strong commercial spirit. Merchants from Samarcand and Tashkend have for many centuries visited the trade-centres of Eastern Russia, China, and Persia; and in the interior the towns swarm on all market-days with nomads who are eager to buy. Since the incorporation in 1868 of Turkestan with the Russian toll-dominion, commercial statistics are wanting, but in 1867 the total Russian traffic with the countries S. of the Kirgheez toll line was valued at 29,500,000 rubles, and since that time commerce has increased considerably; every year a greater quantity of Bokhara cotton is used in the Russian factories. The distance from Tashkend to Orenburg is 215 miles; to Troitzk in West Siberia, 1080; to Khiva, 500; to Khokand, and thence across the Terek pass, 12,000 feet high, to Kashgar, 300. Regular postal connections are established on these and several minor lines. On the chief routes the traveller finds *tarantas* (four-wheeled vehicles) or horses and camels, which latter still form the principal means of communication, though much has been done to improve the main lines of roads. The idea which M. Lesseps first broached in 1873 by his proposition of a Central Asiatic railway from Orenburg to Tashkend, and thence through Balkh to Peshawar, is now realizing in the form of a Siberian railway from Nizhnee-Novgorod to Tjumen, and thence through Troitzk to Tashkend; the line to Tjumen was finally determined upon Dec. 30, 1875.

On the basis of a census of the families, the population is estimated at 4,000,000 Russian subjects, including the inhabitants of Ferghana, formerly Khokand, and 3,600,000 in the states of Bokhara, Khiva, Karategin, and the Toorkoman steppes. Turkish blood prevails, and the Oozbeks predominate—a name first occurring in history in the fifteenth century. Like all Turks, the Oozbeks have no sense of social organization, no understanding of the advantages of fixed settlements, no love of home. Most of them are nomads; those who have fixed habitations are called Sartes; in their talent for trade other people surpass them. With respect to religion, they are Mohammedans, and most fanatical members of the Shiitic sect. But their star is now waning; they have given themselves up to their passions, make all roads unsafe, and plunder the caravans in connection with the Toorkomans—Turks with a sprinkling of Iranian blood, and still more inveterate robbers. The Toorkomans, however, are brave and revengeful, while the Oozbeks are cowardly. Only people of the higher classes can read and write. On a still lower stage stand the Kirgheez, a mountain people which by some mistake came to give its name to the Kirgheez steppes, which are inhabited by the Kasaks. On the left bank of the Oxus they have no fixed habitations, but make all passes and fords unsafe; in former times they captured even large cities. The bravest of these mountain-nomads are the Kipchaks, on the south-western slope of the Thian-Shan Mountains. They have played a conspicuous part in all the great movements which took place in this part of the world. They fought with Booddhistic China about the possession of the Mohammedan Turkestan; in Baber's army they founded the Indian empire of the Mogul; and in 1876 the Russians had to make a very difficult winter campaign to their mountain-dens in order to subdue them. Tadshik has been, since the thirteenth century, the name of those who speak Persian, comprising the Iranian part of the population, the productive class, with fixed habitations. Their suppression by the Oozbeks, which has lasted for centuries, has made them cringing, false, and avaricious. They show a great regard for the Koran, but only as long as such a regard may prove advantageous. They live mostly in the towns, and are often considered as Sartes. The language is Tartarian, a branch of the Turkish or Oozbek, interspersed with Persian and Arabic words; Turkish, however (Osmanlee), and Persian are generally understood. The letters are Arabic; the paper of an inferior quality, thick, yellow, looking like parchment. The literature represents a one-sided civilization, built up by dogmas of Mohammedan theology, legends, and some poetry, and fit only to engraft a narrow fanaticism on the Turkish-Tartarian youth, and hedge off all true enlightenment. Original works have not yet been discovered; what have become known are merely translations from the Persian and Arabian. Until the arrival of the Russians education was exclusively in the hands of the fanatical Mohammedan clergy; in their ninth year children were brought to the school (*mekteb*). Subsequently, the Russian schools were opened also for the native population, but the Moslems still prefer the scientific institutions of Samarcand and Bokhara, in which theology, jurisprudence, and medicine are taught in accordance with the Koran and the old traditions. Since 1870 there have appeared one newspaper in Russian, and one Kirgheez periodical. In customs and habits many changes must take place before the Oriental dirt which still sticks even to the best can be

removed. Boys and girls marry before they have reached the age of maturity. The family life is poor. In times of fasting the Tartar abstains during the day, but during the night he eats and drinks so much the more. Superstition regulates everything.

History.—Western Turkestan is the home of the ancient Scythians, who, according to historical and ethnographical researches, were Iranians. They were followed by the Sakæ, a Turkish tribe from Eastern Turkestan, who in the second century B. C. began to threaten them, especially in the northern parts, where they were less densely settled. In the fourth century B. C., Alexander the Great founded Khojend on the Sir Darya. In the first century B. C. the Chinese pushed onward to Khokand (Ferghana); they brought with them the cultivation of silk and the manufacture of iron. The ancient worship of fire and other natural phenomena was suppressed by the Mohammedan conquerors and supplanted by Islam. An Iranian noble converted to Mohammedanism laid in 874 the foundation of a monarchy ruled by the Samanides till 907, with Bokhara as capital, and extending from the sources of the Oxus and Jaxartes to the shores of the Caspian Sea and the Persian Gulf. This most glorious era was followed by centuries of confusion; even in the tenth century an Arabic geographer complains that of all the countries of Islam, none is so filled with the tumult of war as Transoxania. The condition of the fixed population did not improve much afterward. The invasions and campaigns of Genghis Khan in the thirteenth century, of Timur in the fourteenth, to whom Samarcand owes its prosperity, and of Baber in the sixteenth, resulted in the supremacy of the nomads, and up to the arrival of the Russians the history of the country was one uninterrupted series of wars and feuds. In 1847 the Russians took possession of the region between the lakes of Balkash and Issikul, established a military station at the mouth of the Sir Darya, and began to ply the first steamer on the Aral Sea. The reconnoitring expedition under Von Baramberg in 1852 terminated with an audacious and unsuccessful attack on Ak-Meshid on the Sir Darya, but advanced outposts were nevertheless pushed forward—in the W. along this river, and in the E. from Werpoje. In 1860 it was determined to connect the forts on the Sir Darya with those in the E., and the conquest of the cities of Turkestan and Chemkend in 1864 was the immediate result of the operation. With the conquest of the districts of Tashkend, Ura-Tepe, and Fizak from Khokand, and the district of Zerafshan, with the city of Samarcand, from Bokhara, whose army of 40,000 men was utterly routed by 1700 Russians under Cherniayeff, the Russian extension terminated to the S. To the E. the fertile valley of the Ili was conquered in 1870 from the Dunganes, who (see URUMTSI) had expelled the Chinese in 1863. To the W. the right bank of the Oxus was ceded in 1873 by Khiva, and the immediate result of the humiliation of Khiva was the establishment of a Trans-Caspian government comprising the territory on the eastern shore of the Caspian Sea, with Krasnowadsk as capital. The difficulties in conducting large armies through extensive deserts were overcome with rare perseverance. A winter campaign, rich in scenes of brilliant valor, increased in 1876 the Russian empire with the exceedingly fertile kingdom of Khokand, which now bears the name of Ferghana. By an ukase of July $\frac{11}{23}$, 1867, the new conquests were organized into the government-general of Turkestan, with Tashkend for its capital. This city numbers 46,000 inhabitants, is the seat of the administration, and has a gymnasium, a public library, a branch office of the imperial bank, and numerous factories established by Russians; the streets are illuminated at night. The regular army, consisting of Orenburg, East Siberian, West Siberian, and Toorkoman battalions, in which the term of service is seven years, numbered 12,000 men on Mar. 1, 1876. Four battalions of sharpshooters, comprising the choicest troops, are armed with the excellent Berdan gun, the rest with imperfect Terry-Norman breech-loaders, constructed out of old muzzle-loaders. Eight foot batteries carry muzzle-loaders of the La Hitte system. The cavalry forms the principal force, and consists of Cossacks in divisions of 100 men. The equipment is left to each man, and is consequently very various. The reserve consists of an insufficiently armed infantry of Cossacks and militia. Reinforcement of regular infantry is necessary; neither in Khiva (1873) nor in Khokand (1876) have masses of cavalry produced the old effect. In Russian works it is generally acknowledged that the conquests are not yet complete; Russia cannot stop short of the Hindoo-Koosh. Meanwhile, the approach of the Russian frontier toward India caused some uneasiness in England on account of her Indian possessions. Many prophesied an invasion of British India by Russia, and the English government felt it necessary in 1873 to declare Afghanistan and all the countries S. of the Oxus neutral ground, and the transgression of the boundary by a Russian army a *casus belli*. A Russian invasion of India is not very probable, however, but it would by no means be strange if the rapacious nomads of Central Asia, to whom Russian Turkestan now has become closed, threw themselves on Herat and Kelat, and either pushed onward to India themselves or drove other tribes thither. Thus, although any Russophobia may be unfounded, the position of Russia in Central Asia compels England to make great exertions, and it will be necessary for her to make sure of the Iranian states, which she has generally left to themselves since the failure of the Afghan war in 1838.

Eastern Turkestan, called *Nan-ly* by the Chinese, *Alti-shar* ("six towns") by the neighboring Mohammedans, and *Jiti-shar* ("seven towns") by its actual ruler, stretches about 250 miles from N. to S. as a gently undulating plain, shut in to the S. by the great range of mountains, comprising the Künlün and Karakorum, the watershed range between India and Central Asia; bounded W. by the Pamir steppes, and N. by the Thian-Shan range, the outward culminating ridge of the mountain-system in which the great rivers of Siberia take their rise. To the E. lies the Gobi desert, which swallows up alike watercourses and vegetation, and from which long arms of sand and shingle run back into the cultivated region up to the boundaries of the village cornfields. Since Mar., 1876, Eastern Turkestan has connected immediately on the W. with Russian Turkestan. It comprises an area of about 420,000 sq. m., and forms the transition from Western to Eastern Asia, consisting of a plateau of an average elevation of 6400 feet, with a depression in the centre to which all the waters of the plain flow—the Karakash and Yarkend from the S., the Kashgar from the W., and the Kysil-Kungei or Aksu, the Shar-yar-darya, and the Kai-du-gol from the N.—all joining the Tarim and ending in the Lob Lake. In their upper courses these rivers are mere mountain-torrents of no great depth, rushing impetuously over rocky beds; in their lower parts they are navigable when full, and the Tarim is navigable at all seasons and along its whole course. In 1874 the Central Asian Company, starting from Lahore in June, made the chief at Kashgar a present of a miniature steamboat. The climate is distinguished by great dryness; summer rains are rare. The winter is not severe; in January the thermometer sinks only a little below 0° F. Snow seldom falls in the plains; the tanks are frozen and the ice stored for summer. In August and September the maximum of heat during the day is respectively 92° and 65° F. The most remarkable of the minerals is jade or nephrite, a silicate of magnesia, found in the Künlün. In the Stone Age all the cave-dwellers of the Asiatic and European continents were provided from here with jade for their cutting tools; in the Middle Ages the quarries were worked by the Chinese, but at present the works have fallen completely into decay. Agriculture is possible only by means of irrigation; accordingly, all towns and settlements are situated along the rivers or in their neighborhood, and numerous canals and ditches are dug in the fields. In spite of their rude agricultural implements, the inhabitants have generally good crops, with the exception of years in which only a little snow falls in the mountains. Rice, wheat, barley, millet, Indian corn, and sometimes a few peas and beans, are raised in the neighborhood of the towns. Linseed is grown only for the seed, and hemp for the intoxicating extract, *charras* or *bhang*, the use of the fibre not being known. The lower classes are all supplied with cotton clothing from their own fields, but the better classes wear garments made of silk or of English or Russian cotton fabrics. Tobacco is raised in considerable quantities. Carrots, turnips, radishes, onions, cabbages, melons, cucumbers, red pepper, tomatoes, and coriander are raised in every garden; grapes, apricots, peaches, apples, pears, and figs are successfully cultivated. Mulberry and apricot trees of unusual size grow at the very foot of the mountains. Forests are wanting; most of the timber for building is either willow or poplar. Stamping-mills for crushing rice are driven by water-power, but horses and donkeys are used for treading out the corn. Excellent breeds of horses come from Aksu and Khokand; a pony fetches from £1 to £15. The Bactrian double-humped camel is found in a wild state in the swamps around the Lob Lake, but is also reared in large herds; its sure step makes it very useful in crossing the mountain-passes. Of the domesticated animals the broad-tailed sheep is of the greatest importance; the Turfani wool has a world-wide celebrity and forms one of the most important articles of commerce. The manufactures are almost entirely confined to articles required for home consumption; carpets and felts form almost the only exceptions to this rule. The dress consists of a turban or a cap lined with sheepskin, one or more loose robes of cotton cloth, a pair of trousers of cot-

ton or leather made so wide that they go over the loose robe to protect the latter when the wearer is riding or working. Stockings are worn only by the wealthier classes. All wear boots, which usually come up to the knee; they are made of untanned leather, but the better classes have them made of leather imported from India or Russia. Ancient Chinese coins, silver coins that bear the name of the actual ruler, and gold coins in the name of the caliph or sultan of Constantinople, are current. A peculiar article is the yambu (*yamba*), boat-shaped silver ingots melted from worn-out coins, varying in value from £5 to £16. The *tilla* is a Kashgarian gold coin worth about eleven shillings. The weights employed are of iron; the balances are all on the principle of the steelyard. Up to the establishment of the present dynasty in 1865, all commerce went to China, and with India only a very limited traffic took place through Khokand and Bokhara. Now, China is closed, and India and Russian Turkestan are the principal countries to which an exportation takes place. From the English side Sir D. Forsyth has great hopes of the increase of the trade with Yarkand. Before 1865 the total value of imports and exports amounted to £25,000; but after the visit of the first English embassy to the court of Kashgar in 1870, it rose to £154,000, and in 1874–75, after the conclusion of the commercial treaty of Mar., 1874, to £2,600,000. Indeed, the peddlers found the trade so profitable that in 1874 the Central Asian Trading Company was formed at Punjaub, a caravan of 500 beasts of burden organized in the same year, and the fabrics of Manchester actually introduced to the markets of Central Asia. The British-Indian government gives this trade a great support; in Le, the capital of Ladak, a province of Kashmir, it keeps an official who sees that no higher duty is levied than is agreed upon, that along the principal routes the dangerous mountain-paths are transformed into safe mule-tracks, and that provision and fodder are stored at proper places. Russia, too, makes great exertions, and she has the great advantage that for a long distance N. and W. she is the immediate neighbor of the country, and has her Cossacks stationed at a few days' distance from Kashgar; the mountains here are also less difficult and inhospitable than those along the Indian frontier. By the Treaty of Peking (Nov. 2, 1860) Russia acquired the right of keeping a consul at Kashgar, but subsequently the new chief would not acknowledge himself bound by this stipulation. On June 8, 1872, Russia succeeded, however, in concluding an advantageous treaty, and it intends to keep an ambassador at Kashgar from the beginning of 1877. Of the total value of the Russian-Kashgarian traffic no statistics exist, but the caravans still complain of extortions, and the Indian commerce is probably more important. The acquisition of Khokand, however, must have given the Russian commerce with Kashgar a new impulse.

Eastern Turkestan was most probably originally peopled by an Aryan race, mentioned in the old Indian epics as Saka and Tukhara, remnants of which are still found in the mountains and recognizable by their features. In the second century B. C. it came under Chinese authority. In the first century B. C. it was overrun by the Huns, and afterward by other Turkish tribes. At the end of the seventh century A. D. the Thibetans invaded Kashgar, and in 713 the Arabs arrived hither. In 1218, Ghengis Khan, the great Mogul conqueror, overran the country; afterward the Mantchoos came as rulers and governors; and in the last decades Tadshiks and Sartes immigrated from Khokand. Thus, the population of the towns is very much mixed; in the mountain-valleys, however, the various tribes have maintained themselves more pure, but a primitive type is wanting. A Hungarian traveller, Vambery, designates the language as Chinese-Tartarian—that is, a Turkish dialect interspersed with numerous Chinese words. The total number of inhabitants is estimated at 580,000. They are comparatively densely settled between Aksu, Kashgar, and Yarkand, but in other places the settlements are widely scattered along the rivers. A large part of the population is still nomadic. On account of the great dryness of the climate, the houses of the fixed settlers are made of sun-dried bricks.

History.—In antiquity and during the Middle Ages, Eastern Turkestan was constantly the apple of contention between chiefs of Turkish descent and the Chinese emperors, who got a foothold here in the second century B. C. In the eighth century A. D. the people were converted from Booddhism to Islam, and since that time the national creed has strongly influenced the political fortunes of the country. Saints, teachers, and workers of miracles claiming descent from Mohammed, and known as Khwajas, acquired great influence, and the sectaries attached to these chiefs divided the people into rival factions. Later in the seventeenth century, Khwaja or Hoja Appak, the leader of one of these parties called the White Mountain, having been expelled by the ruler of Kashgar, a Turk chief called Ismael Khan, who was a zealous supporter of the opposite party or Black Mountain, sought the aid of the Calmucks of Zungaria, who overran Kashgar, carried off its khan, and established the Khwajas of the White Mountain once more in the country, though with an authority subordinate to their own. Great discords ensued, but the khans of Zungaria continued to exercise their supremacy till 1757. In the next year the Chinese succeeded in bringing also the states of Turkestan under their rule. The Khwajas of the White Mountain took refuge in Khokand, and made more than one attempt to recover what they considered their rights. In 1827, Jehangir Khan Khwaja conquered Kashgar and Yarkand, and occupied these cities for eight months; subsequently, he was forced again to cross the Terek pass, but was surrendered by the khan of Khokand, and was executed in Peking in 1828. An expedition headed by seven Khwajas in 1852 met with even less success than the former. Nevertheless, the attempt was repeated in 1857, and Wali Khan, although repulsed again in 1858, left in Kashgar a name for ferocity and bloodthirstiness which will long remain; he erected a pyramid of human skulls, anxiously watched the gradual rise of a monument so worthy of him, and crowned this ghastly trophy with the head of Adolph Schlagintweit of Munich, the first European who ever reached Kashgar from India. The Chinese ruled Eastern Turkestan through the governor-general at Ili, who in his turn governed through military commanders (*ambans*) appointed by the court of Peking. In 1863 the Dungan Mussulmans overthrew the Chinese authority at Ili, and the Kashgarians, thus freed from their masters, now recalled the Khwajas; in 1864 the gates of Kashgar were opened for Busurg Khan of the White Mountain. He was accompanied by Mohammed Yakoob, a brave and able officer of the emir of Khokand, who in 1852–53 had successfully defended Ak Meshid (Fort Perowski) on the Sir Darya against the Russians, and subsequently often fought against them. In Sept., 1865, he compelled the Chinese garrison of the citadel of Kashgar to surrender, defeated there in a hot contest the Dunganes, led by the head of the Black Mountain, and took the forts of Yangihissar and Yarkand, which were still held by the Chinese. This success gathered numerous partisans around him, and, after Oriental fashion, as soon as he felt himself strong enough he threw Busurg Khan in prison, banished him from the country, and assumed himself the supreme authority. Religious fanaticism was now fomented in every way. Ambassadors were repeatedly sent to Constantinople and Mecca to urge the sultan to assume sovereignty over Kashgar; and although such a combination can have no political consequences, as Russia at any time can easily prevent any joint operation, it is, nevertheless, evident that some kind of alliance has been concluded, from the fact that coins are struck at Kashgar bearing the name of the sultan. Wars and conquests filled the first years of his reign. He subjugated Khotan, Aksu, Turfan—yea, even the Kalmuks N. of the Thian-Shan consented to pay a tribute. Having thus reunited all the old Altishar, he conquered in 1870 the district of Sizikol, the key to the Pamir passes, and gave his kingdom the prouder name of Jitishar. The frontier toward China is not yet regulated, and in 1871 a Chinese army of 130,000 men was sent to reconquer Kashgar. It remained near the Great Wall till 1875, made then an advance, but is said to have been thoroughly defeated in May, 1875. On account of the unsettled condition of the Chinese state it is not probable that any danger to Kashgar will arise from that direction; it is more likely that Yakoob Beg will find a rival in his own country or among the Dunganes on the northern slope of the Thian-Shan. Yakoob is a cruel despot, and governs by terror. His army has been much improved by deserters from the British-Indian army, and contains some regiments of choice troops which are wanting in those of other states of Central Asia. But the administration is miserable. Arbitrariness reigns everywhere. Civil officers and military commanders are allowed to take what they like. Wealth is nowhere found except in distant mountain-valleys, whither the legal robbers seldom come. It is believed, however, that the dynasty is not securely founded. The present state will dissolve or fall into anarchy as soon as Yakoob dies. An annexation by Russia is not probable. Neither the way to China nor that to Hindoo-Koosh leads through Kashgar, and the mountain-passes are easy to close against all disturbances. EMIL SCHLAGINTWEIT.

Turkevi', town of Hungary, on the Beretyo, has a trade in wine, wheat, cattle, and horses. P. 9810.

Turkey. See MELEAGRIDIDÆ.

Tur'key. The Turkish empire extends over parts of Europe, Asia, and Africa, and comprises many different races. The centre of its power is at the point where the

Black Sea flows into the Marmora, through which it connects with the Mediterranean; here is its capital, Constantinople—Stambul.

European Turkey comprises the larger part of the peninsula of the Balkan. The configuration of the coasts of this peninsula, especially that of the E. coast, is extraordinarily rich, and this circumstance formed one of the principal reasons of the high civilization of the nations which formerly inhabited the country. It would have the same effect now, if unfavorable religious and political circumstances did not check the development of the Turkish people. The western boundary, 72 miles long, is formed by the Adriatic and Ionian seas, with the gulfs of Drino, Durazzo, Avlona, and Arta; the southern is formed, for a distance of 23 miles, by Greece, and then, for a distance of 188 miles, by the Ægæan and Marmora seas, with the bays of Salonica, Volo, Monte Santo, Istillar, Orphano, Saros, etc. The peninsula of Gallipoli forms, with the coast of Asia Minor, the Dardanelles, Hellespont, and the Thracian Bosphorus leads into the Black Sea, which, with the two great gulfs of Burgas and Varna, forms the eastern boundary. N. and N. W. the country is bounded by Russia and Austria. The vertical configuration of the peninsula is also exceedingly favorable, especially in the eastern part. The Dinarian Alps, whose highest peaks reach an elevation of about 6000 feet, run in the direction N. W. to S. E. along the Adriatic Sea, and form the watershed between this and the tributaries of the Danube. These ranges are almost entirely destitute of forests, and the soil is not fertile. Cattle-breeding is nearly the only occupation of the inhabitants. To the N. they slope down into gentle hills, sending the Unna, Verbas, Bosna, and Drin to the Save, and the Morava in an eastern direction to the Danube. To the S. they terminate in the Alps of Montenegro, whose highest peak, the Kom, rises 8000 feet. Hence the Schar-Dagh, 8000 feet high, stretches from the S. W. to the N. E. for a distance of about 10 miles, and parallel with it run the Kurbetzka Mountains, 6200 feet high, and farther to the E. the Rilo-Dagh, rising 9000 feet, and forming the watershed between the rivers Strymon (Struma), Nestus (Karasu), Hebrus (Maritza), and Isker. The line of communication between Constantinople and Belgrade passes through the valley of the Isker, and breaks through the mountains between the Isker and the Maritza at Demir Kapi, "the Iron Gate." The city of Philippopolis dominates the entrance to this gate. To the E. of Demir Kapi rise the Balkan Mountains, the ancient *Hæmus*, first as a single range whose westernmost peaks rise more than 5000 feet, then separating, farther to the E., into two parallel ranges, the Little and Great Balkan, with difficult passes, of which the most difficult is guarded by the fortress of Schumla. The Balkan forms an important climatic boundary-line: to the N. reigns the climate of Central Europe, to the S. that of Southern Europe. To the N. extends the Wallachian lowland, traversed by the Danube, on whose banks are the four fortresses, Widdin, Nikopoli, Rustschuk, and Silistria. From the Eastern Balkan, in a south-eastern direction to the peninsula of Constantinople, stretches the Strandscheа-Dagh, and parallel with it runs the Despoto-Dagh, rising over 7000 feet. Most of these mountains consist of crystalline slate; the Balkan belongs to the chalk formation. The population is composed of many different elements. In antiquity the Greek race lived in the peninsula, and worked out a rich civilization; the traveller discovers with astonishment numerous ruins of cities, with their temples and aqueducts and other traces of a former civilization, in places where there is now only scanty pasture for goats. The Greek language still lives outside of Greece in Thessaly, in the Chalcidian peninsula, and in South-eastern Thracia. In the north-western part of the country lived the Illyrians, belonging to the Indo-Germanic race; they were subdued spiritually by the Greeks, materially by the Romans. In the Middle Ages the Slaves penetrated into their territory, the present Dalmatia and Bosnia, and under the name of Albanians or Arnaouts the Slaves still inhabit the mountain-regions S. of Montenegro, as far as the Gulf of Corinth. About 1,300,000 Arnaouts live in Turkey, and about 250,000 in Greece. Thracians, Getes, and Dacians lived E. of Macedonia, in the present Bulgaria, Wallachia, Moldavia, and Transylvania. Their empire was crushed by the emperor Trajan, but, singularly enough, these nations have preserved up to this very day the Roman mark which at that time was stamped on them by violence. In the present Romania they call themselves *Romuni*—that is, Romans. They number about 1,500,000. Of the Goths and Longobards who invaded the country in the early Middle Ages no trace can be found. Then came the Slaves, and afterward a Finnish people, the Bulgarians, whose empire lasted to the time of the Turks. They number now about 4,500,000, are Greek Catholics, and are settled S. of the Danube, in Bulgaria, Macedonia, and Thracia. Beside the Bulgarians live the Servians and Bosnians, a Slavic tribe, which immigrated from Bohemia: the distinction between the Servians and Bosnians is merely political. The Franks conquered Constantinople in 1203, and in the same century the Venetians took possession of Crete and the opposite coast-regions. Next followed the invasion of the Osmanlis from Gallipoli. They live scattered, and their number in the peninsula is not over 1,000,000. Although they are the ruling race, their number must be kept up by immigration from Asia. There are, moreover, about 400,000 Armenians, as many gypsies, 75,000 Jews, 400,000 Tcherkassians, and a minor number of other tribes in European Turkey. The cultivation of the country is very far from corresponding to the exceedingly rich resources, partly on account of the bad administration, partly on account of the indolence of the population. The soil is almost everywhere very fertile, and could produce all kinds of fruits in abundance. About 40 per cent. is in fields and vineyards, 14 in forest, 11 in pastures, 6 in meadows, and 29 is unproductive. Agriculture is carried on in a most primitive manner. Maize, wheat, and buckwheat are the principal cereals, but, with the exception of the Danubian countries, there is nowhere produced a surplus above the home demand. Beans, peas, and lentils are raised; of vegetables, onions, cabbages, beets, and cucumbers; of fruits, especially plums. Almond, lemon, orange, and olive trees are also extensively cultivated. Cattle-breeding is a very important branch of the national industry, especially in the Danubian countries, where the rearing of swine, horned cattle, and horses is carried on with energy. The horses are not equal to the Arabian; in the mountain-regions they are small and even clumsy, but they are strong and useful. The breeds of mules and asses are good. The buffalo plays a considerable part in agriculture. Sheep-breeding is extensively carried on, especially in Albania, and the rearing of bees and silkworms is flourishing, silk being one of the most important articles of export. As large districts still lie waste, wild animals, such as bears, wolves, etc., and game, such as the wild-boar, the stag, the deer, etc., abound, and hunting is a remunerative occupation. Fishing and the gathering of sponges are extensively carried on along the coasts. Mining is much neglected; some gold, silver, iron, lead, copper, sulphur, and quicksilver are produced in Bosnia, Macedonia, and Servia. The circumstance that all trades are still carried on in the old traditional fashion, and no use is made of the inventions and progress of foreign nations, is very characteristic of the state of manufacturing industry. Nevertheless, all the principal manufactures, such as carpets, leather goods, arms, etc., are distinguished both for their excellence of workmanship and their fine taste in form and color. But these good qualities are now rapidly vanishing. Formerly, many costly textile fabrics, arms, etc., were exported from Turkey, but the country has now become inundated by the importation of cheap machine-made goods, and this change has almost crushed its manufacturing industry. Woollen and cotton goods are extensively manufactured. The *abba*, a kind of coarse cloth made at Shumla, Turnova, and Salonica, is peculiar. Much silk is spun and woven in Constantinople and Salonica. The carpets of Scharkoi, Berkeridacha, and Salonica are celebrated. Leather goods, both shoes and saddlery, are good and hold a high rank. Metallic wares, especially arms, are made extensively and of good quality at the foot of the Pindus. The manufactories of guns and cannons which have recently been established have not proved successful. The traffic in the interior suffers much from bad administration and from the want of sufficient means of communication. Good roads are very scarce, and the common roads are suited only for beasts of burden or for vehicles of the most primitive construction. In the more important manufacturing cities, such as Usundschowa, near Adrianople, Nevrocope, and Marassia in Thracia, Scharkoi, Karusa, and Giuma in Bulgaria, Seres in Macedonia, Rumi and Fersala in Thessaly, annual fairs take place, by which the exchange of goods is greatly facilitated. The foreign commerce, both by land and by sea, is exclusively carried on by foreigners, Armenians and Greeks, as the Osmanli is too proud and too lazy to do it himself.

Asiatic Turkey comprises Asia Minor and vast adjacent territories. The western frontier is formed by the Mediterranean; to the S. the Turkish dominion stretches as far as the Isthmus of Suez, extending thence without interruption into Africa, occupying the whole of Egypt, and along the Arabian Gulf to the Strait of Bab-el-Mandeb, occupying the narrow coast-belt, bounded S. E. and E. by Arabia and Persia, N. by Russia (Caucasus) and the Black Sea. For a distance of 100 miles the Mediterranean washes the shores of Syria, flat and harborless above the promontory of Carmel, then steeper and richer in harbors, flourishing by com-

merce in the time of the Phœnicians, but now, for the larger part, desolate, the harbors having become filled up by the North African coast current. Beyroot, which may be considered as the port of Damascus, is here the most important harbor. From the Bay of Iskanderoon the coast turns suddenly to the W., and for a distance of 150 miles it is rocky, but rich in small harbors. The W. coast of Asia Minor, about 50 miles long in a straight line, is much cut up and fringed with numerous islands. Formerly, Greek colonies flourished here, with numerous harbors and cities, but now only Smyrna is of any importance. The Hellespont and Dardanelles lead to the Sea of Marmora, the Thracian Bosphorus to the Black Sea, whose southern coast, about 180 miles long, is rather poorly articulated, but rich in good harbors, of which Sinoob and Trebizond are the most important. The mountains of Koordistan consist of an imposing system, with difficult passes, and form the western border of the plateau of Iran. The highlands of Armenia and Asia Minor are bounded S. by a range which branches off from the mountains of Koordistan, and terminates W. at the Bay of Iskanderoon, separating Armenia from Mesopotamia. To the N. the border range of the plateau continues to the vicinity of Tiflis, and runs along the coast of the Black Sea to Scutari. In the interior of Asia Minor the ranges of Taurus and Anti-Taurus reach a height of 11,000 feet, and form the boundary toward Syria. The Cilician passes afford the only communication between the two countries. Armenia is covered with high mountains, of which Ararat, 16,250 feet high, is the most remarkable. Asia Minor is to some extent steppe-land, in many places exceedingly fertile. To the S. of Asia Minor and Armenia the Lebanon system, consisting of various ranges, runs from N. to S., losing itself to the E. in the Syrian desert. Of the highland desert which forms the peninsula of Arabia, Turkey owns only the narrow coast-belt, called Hedshas, which, however, is more fertile than the rest of Arabia, as the border ranges which it contains attract some moisture. The lowland of Mesopotamia is a desert W. of the Euphrates, and between the Euphrates and Tigris a steppe-land broken up by some ranges of hills; but from the point where the two streams unite to their mouth in the Persian Gulf, a distance of about 100 miles, stretches a flat alluvial plain, which in antiquity was the richest corn-land of Asia. These two rivers are the largest in Asiatic Turkey. The Euphrates rises in the plateau of Armenia, breaks through the southern border range near the sources of the Tigris at Diarbekr, and reaches the Persian Gulf after a course of 350 geographical miles. The Tigris is 220 geographical miles long from its sources to its union with the Euphrates. The region where the two streams approach each other was very rich and densely peopled in antiquity. Here stood Babylon, and over and over again new cities arose on the ruins of the old; now, Bagdad stands near. The plateau of Syria is split by a deep furrow between the Lebanon and Anti-Lebanon ranges, in which the Orontes flows. The Leontes, Jordan, and Kishon water Syria and Palestine; the Kisil-Irmak (Halys), Mæander, and Hermus water Asia Minor. Politically, Asiatic Turkey is divided into—(1) Armenia, with the city of Erzeroom, which carries on the transit-traffic with Persia, the border fortress of Kars, and the city of Van; (2) Koordistan, with the cities of Diarbekr, Nisibin, Masdin, Mosul (in whose vicinity are the ruins of Nineveh), Bagdad (an important commercial place), and Hille (on the ruins of Babylon); (3) Irak Arabi, comprising Southern Mesopotamia, with the city of Basra, the starting-point of the caravans to Mecca; (4) El Dschesireh, comprising the northern part of Mesopotamia, with the cities of Rakka and Orfa; (5) Asia Minor or Anatolia, with the cities of Brusa, at the foot of the Olympus (up to 1458 the capital of the Osmanli empire), Scutari (a suburb of Constantinople), Kjutahia, Smyrna, Sinoob, Angora, Kaisarijeh, Adana, Tarsus, and the island of Cyprus; (6) Syria and Palestine, with the cities of Haleb, Iskanderoon, Antakijah, Damascus, Tadmor, Baalbec, Tripoli, Beyroot, Saide, Zor, Jaffa, Jerusalem, and Gaza, the starting-point of the caravans to Egypt; and, finally, the Arabian possessions, with Mecca and Medina. The larger part of the population belongs to the Caucasian race. Of the Indo-Germanic family of this race, Persians live in the provinces of Bactria and Sogdiana, Koords in the mountains of Koordistan, and Armenians around the sources of the Euphrates and the Koor. The Armenians formerly possessed a large empire, but it has been divided between Persia, Russia, and Turkey, and the greater part of the nation now wanders around the world as peddlers; they are Christians. Of the Shemitic family, the Aramaic branch occupies the plateau of Armenia, Syria, and Mesopotamia. In these regions the Syrians and Chaldæans formerly possessed powerful empires. The Hebrew branch occupied the coast-land of Syria and Palestine. The Turkish people belong to the Tartaro-Finnic family of the Mongolian race. Issuing from the Altai Mountains, their original home, they have spread widely, and they now form the ruling race in the Asiatic part of the Turkish empire. They are most densely settled in Asia Minor, where they distinguish themselves as agriculturists. The total number of inhabitants in Asiatic Turkey is about 14,000,000.

African Turkey consists of the vassal states of EGYPT, TUNIS, and TRIPOLI (which see), which pay a tribute to the Sublime Porte.

The empire consists of immediate possessions and vassal states. The immediate possessions in Europe comprise an area of 6611 geographical sq. m., or 364,037 quadrate kilomètres, with a population of 8,500,000; the vassal states in Europe, Romania and Servia, an area of 2988 sq. m., or 164,528 qu. kil., with a population of 5,850,000; the immediate possessions in Asia, an area of 34,929 sq. m., or 1,927,156 qu. kil., with a population of 14,000,000, inclusive of the island of Samos, which forms a tributary principality; the African vassal states, an area of 59,242 sq. m., or 3,262,032 qu. kil., with a population of 20,072,000, of which Egypt occupies an area of about 2,500,000 qu. kil., with a population of about 17,000,000. The total area of the empire comprises 103,840 geographical sq. m., or 5,717,750 qu. kil., with a population of 47,627,000. European Turkey, exclusive of ROMANIA and SERVIA (which see), is divided into the following eyalets or vilayets:

	Area in qu. kil.	Population.
Constantinople	——	327,750
Adrianople	66,133	1,319,894
Danube	87,109	1,995,243
Salonica	51,649	1,028,141
Janina	35,991	741,259
Prisrend	52,585	1,340,471
Bosnia	60,569	1,337,393
Crete	8,617	200,000

With regard to religion, 4,776,652 are Christians, Jews, etc.; 3,619,353 Mohammedans. All these statistical statements, however, are disputable, and still more so are those referring to Asiatic and African Turkey. Asiatic Turkey is divided into the following eyalets:

	Area in qu. kil.	Population.
Constantinople	12,802	796,000
Brusa	74,792	1,630,244
Aidin	51,688	1,040,570
Archipelago	14,518	431,197
Cyprus	9,537	135,000
Kastamooni	53,659	772,010
Angora	69,379	514,080
Konieh	103,766	775,015
Adana	36,947	335,520
Trebizond	37,256	938,140
Sivas	64,275	571,808
Erzeroom	132,223	792,104
Diarbekr	97,590	708,288
Bagdad	242,277	2,000,000
Aleppo	105,561	535,714
Syria	171,229	518,750
Hedjas and Yemen	567,836	1,134,375
Hedjer	81,328	162,470

The eyalets, whose governors bear the title of *valy*, are divided into sandshaks, at the head of which stand *mutessarifs*; and the sandshaks are again divided into kazas, governed by *kaimakams*, and the kazas into nahies (parishes). The tributary vassal states have their own governments, more or less dependent on the Sublime Porte, but always eager to make themselves independent. The government of the empire is despotic. The sultan is at the head as absolute ruler, as the highest authority not only in political, but also in religious respects, being the chief of all the faithful throughout the whole Mohammedan world. At the head of the administration of the empire is the vizier, whose office was established in 1754 A. D. The ministers are subordinate to him as secretaries of state. Besides him, the sheik ul Islam is the most important person. He is the chief of the Ulema, a body at once judicial and ecclesiastical, whose office it is to explain and apply the law. The ministers preside over departments organized in the same manner as those of the other European governments—namely, for foreign affairs, war, finances, commerce, public education, public buildings and quarantine, justice, and police. Among the ministers are also reckoned the president of the council of state, the president of the supreme court, the intendant of the wkafs—that is, the estates belonging to the mosques and other pious institutions—the minister of the archives, and the musteshar or council of the vizier. Besides the council of the ministers there is another deliberative body at the side of the sultan, the chancellery of the state (menasyb-divanije), generally called the Divan, comprising all those higher and lower offices which collectively are called kalemijé ("the pen"), and which consist of five classes of officials, of whom the highest have the rank of a general of division. In 1868 a council of state (shurai-devlet) was organized, which has to prepare the new laws, discuss

the budget, etc., and consists of five sections—for administration in general, for finances, justice, public education, and commerce. At the same time, a supreme court was established with two sections, one for civil and one for criminal cases. The Sheriat, the civil-religious law, and the Kanun, the political law, form the basis of all legal relations; the former rests on the Koran, the Sunna or tradition, the Idshmai-ummet or commentaries of the first four caliphs, and the Kyas, a collection of judicial decisions from the first three centuries after Hedshra. According to these laws, only the faithful of Islam have perfect legal competency. Under the pressure of Christian Europe, however, the Sublime Porte has promulgated various laws, of which the Hatti-sherif of Gulhane (Nov. 2, 1839) is the most important, and by which the rajah or Christian part of the population has been placed nearly upon an equality with the Mohammedan. The slaves are now the only legally subordinate class of the population. They are the property of their master, though he is not allowed to kill or ill-use them. Else, all subjects are equal before the law. There is no aristocracy. The career of a man depends entirely on his personal ability; and manumitted slaves and the poorest people can reach the highest positions. Although Islam is the religion of the state, there exists general freedom of worship. The Mohammedan clergy comprises five classes—the sheiks or elders, who preach in the mosques; the khatibs, who lead the public prayers in the mosques; the imams, who carry out the common service in the mosques, marriages, burials, etc.; the muezzins, who cry out the hours of prayer from the minarets; and the kaims, simple servants and watchmen in the mosques. Of Christian denominations, the Orthodox Greek and the Armenian are most largely represented; the former has patriarchs in Constantinople, Antioch, Jerusalem, and Alexandria; the latter in Constantinople, Sis, Aktamar, and Jerusalem. The Roman Catholic Church, inclusive of the United Oriental Christians, has 28 patriarchs and archbishops, representing the dioceses of Aleppo, Amadia, Antioch, Antivari and Scutari, Babylon, Cilicia, Constantinople, Damascus, Diarbekr, Durazzo, Jerusalem, Smyrna, Tyre, and Sidon. Education is very low, even in European Turkey, both among Christians and Mohammedans. Of late, however, the government has commenced, after the model of its more civilized neighbor states, to establish, besides the elementary schools which have existed since 1847, middle schools and special schools in the larger cities, and especially in the capital, and higher schools for the training of teachers and officials, among which the most remarkable are the school of the sultana-mother, the normal school, the imperial schools for engineering, artillery, etc., the agricultural and veterinary schools in Constantinople, etc. The finances are in a very bad condition. The budget shows a deficit every year; the public debt is very large, and the bad method has been adopted of covering the interest by new loans. The bad state of the finances dates from the time when the Sublime Porte adopted the practice of civilized states of making loans—a practice which does not work well in a state despotically governed and badly administered. In 1854, during the war with Russia, the government issued the first loan of 75,000,000 francs at 6 per cent., placed at 80, and in 1874 the amount of this loan was still 52,000,000. Loans then followed in rapid succession, as follows, in millions of francs:

Year.	Sum.	Interest.	Issued at.	Amount in 1874.
1855	125	4 per cent.	102½	100
1858	125	6 "	76	96
1860	50.9	6 "	53¾	42.9
1862	200	6 "	68	138.9
1863	150	6 "	72 }	143
1864	50	6 "	68 }	
1865	909.1	5 "	50	882
1866	150	6 "	66	113
1868	150	6 "	83	
1869	555.6	6 "	54	531
1870	792	3 "	45	789
1871	112.5	6 "	68	139
1872	278.2	9 "	98½	278
1873	694	6 "	58½	694

On Jan. 23, 1874, the total debt amounted to 4,335,237,191 francs, of which 331,605,441 were floating debt. A law of Sept. 20, 1874, authorized the minister of finance to issue a new loan of 1,000,000,000 francs at 5 per cent., of which 825 millions were destined for the payment of the floating liabilities of the government. On May 10, 1875, the total debt was estimated at 5,023,860,500 francs, or £202,554,420. In Oct., 1875, the government being unable to pay the interest due, a law determined that for the next five years one-half of the interest should be paid in cash and the rest in new bonds. The budget of 1875–76 gives the following items, reckoning in purses of 500 piasters, equal to 112 francs 50 centimes, or £4½: Receipts, 4,776,588, of which 825,700 was for direct taxes; indirect, 3,373,828; revenues from the salines, domains, forests, mines, etc., 413,516; tributes, 163,544. Expenses, 5,785,819, of which the public debt was 2,973,849; dotations, 398,684, including the civil list of the sultan, 267,551; ministry of finances, 388,771; of the interior, 586,755; of war, 780,582, etc. The deficit amounted to more than £4,500,000. According to the law of June 22, 1869, the recruiting of the army is effected by volunteers and by levies of lot. Military service is compulsory for all Mohammedans; men of other confessions free themselves by the payment of a stipulated sum. The term of service is 20 years—4 in the active army, *nizam*; 2 in the first reserve, *idatyal*; 6 in the second reserve, *redif*; and 8 in the landsturm, *hiyad*. The active army consists of 150,000 men, the first reserve 70,000, and the whole force, comprising regular, irregular, and auxiliary troops, 700,000. The regular army is divided into seven army corps, *ordii*. The army corps are organized on a territorial basis. The first is in Constantinople, and contains 7 regiments of infantry, 7 battalions of sharpshooters, 7 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The second is in the eyalet of Danube, with head-quarters in Shumla, and contains 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The third, Room-Elee, Monastir, 10 regiments of infantry, 8 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The fourth, Anatolia, Erzeroom, 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The fifth, Syria, Damascus, 5 regiments of infantry, 5 battalions of sharpshooters, 4 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The sixth, Irak, Bagdad, 6 regiments of infantry, 5 battalions of sharpshooters, 5 regiments of cavalry, 1 regiment of artillery, and 1 company of engineers. The seventh, Yemen, Samaa, 5 regiments of infantry, 5 battalions of sharpshooters, 2 squadrons of cavalry, 3 batteries, and 1 company of engineers. In all, the infantry numbers 39 regiments of the line, 2 regiments of Bosnians, 1 Greek and 1 Servian frontier regiment, 30 battalions of sharpshooters, 2 battalions of Herzegovinians, or 169 battalions. The cavalry numbers 27 regiments and 6 squadrons, 1 regiment mounted on camels, and 2 independent squadrons, or 170 squadrons. The artillery numbers 6 regiments of field artillery and 12 batteries, 1 regiment of reserve and 3 batteries, or 75 batteries with 450 guns. There are, besides, 10 regiments of fortress artillery and 1 corps of artillery mechanics. The engineer corps forms 1 brigade of 7 companies of sappers and 7 companies of mechanics. The irregular troops consist of 16 regiments of gendarmerie, Spahis, Bedouins, etc. The tributary vassal states furnish the auxiliary troops—Egypt, 15,000 men; Tunis, 4000; Upper Albania, 10,000; Bosnia, 30,000, etc. The actual strength of the army on a war-footing is computed as follows: active army, 203,700; first reserve, 105,600; second reserve, 24,000; gendarmerie, 32,800; *hiyad*, 120,000; total, regular army, 486,100; irregular army, 50,000; auxiliary troops, 50,000; the entire army, 586,100 men. The soldiers are excellent; they distinguish themselves by frugality, perseverance, and a wild valor. But the officers are so rude, and the administration of the army so bad, that the exertions of the soldiers seldom produce any great effect. The fleet consisted in 1873 of 21 iron-clads, with 109 guns—namely, 4 frigates, of 900 horse-power and 15 guns; 5 corvettes, of 400–500 horse-power and 4–6 guns; 6 monitors, 6 gunboats, and 100 transport-vessels. The government spends enormous sums on iron-clads, mostly built in England. But neither the commanders nor the crews understand how to manœuvre such vessels; they lie idle and decay in the harbors. The term of service in the navy is seven years, besides five years in the reserve. The total force numbers about 50,000 men.

Although most of the countries belonging to the Turkish empire have an exceedingly fertile soil and a very favorable maritime location, industry and commerce are nevertheless very little developed, on account of the bad administration. The mountains, especially those of European Turkey and Asia Minor, are richer in metals than the other mountains of Europe. Immense coal-deposits are found in Asia Minor. But the lack of social energy, of means of communication, of justice in the government, etc., causes these sources of wealth to remain undeveloped. Excellent copper, however, lead, bitumen, soda, and meerschaum are exported. Asia Minor possesses immense forests, from which all the countries of the Mediterranean could be provided with timber; the northern regions of European Turkey are almost as rich in forests. The plains S. of the Balkan, the islands, and the coast-regions of Asia produce a great abundance of fruit, on which might be based a large trade in preserved fruits, olive oil, olive-oil soap, figs, raisins, and wine. Tobacco, also a very important commercial article, succeeds

nearly everywhere. The mulberry tree is extensively cultivated, and the export of raw silk, especially from Beyroot and Brusa, is of importance to the silk-market of the whole world. The lowlands of the peninsula of Balkan, the plateaus of Asia Minor and Armenia, the plains of Syria and Mesopotamia, produce wheat, barley, hemp, sesame, and cotton, and grain and cotton form important items of export. Madder, oil of rose, opium, mastix, salep, etc., are also largely produced. The animal kingdom yields excellent fur of the marten, otter, beaver, iltis, and wild-cat; hides, tallow, cheese, bones, horn, etc., which play a considerable part in trade. There are no commercial statistics even approximately exact, but the navigation gives an idea of the state of the commerce of the empire. In the year 1872–73, 250,957 vessels, of 18,159,000 tons burden, entered its harbors, of which 178,143 were coasters, of 1,903,000 tons burden, 33,200 foreign vessels, of 12,738,000 tons burden, and 29,614 Turkish, of 3,518,000 tons burden. At Constantinople alone there arrived in 1874, 20,674 vessels, of 4,606,200 tons burden, of which 4185 were steamers, of 2,697,700 tons burden—namely, 2536 English vessels, of 1,487,800 tons burden; 4810 Turkish, of 677,300 tons; 2515 Greek, of 463,400 tons; 955 Austrian, of 571,600 tons; 790 Russian, of 429,300 tons; 277 French, of 181,100 tons; 1644 from other countries, of 628,000 tons, and 7117 coasters, of 161,300 tons. No exact account exists of the total number of vessels sailing under the Turkish flag. In 1865 it was estimated at 2200 vessels, of 182,000 tons burden, but it was evidently too low. In 1873 the number of sea-going vessels was estimated at 231, of 37,760 tons burden, of which 9 were steamers, of 3049 tons burden. In 1875 the following railway-lines were in operation: Constantinople-Adrianople, 319 kil.; Adrianople-Sarembeg, 244; Tarnova-Jamboli, 80; Kulleli-Dedeaghatsch, 112; Salonica-Uskub, 244; Uskub-Mitrovitza, 122; Banjaluka-Novi, 103; Rustschuk-Varna, 225; Tschernavoda-Kustendsche, 63; total in European Turkey, 1512 kil. In Asia Minor there are lines to Smyrna, 231 kil., and between Scutari and Ismid, 43. In 1874 there were 28,038 kilomètres of telegraph-lines, 46,730 of wires, 393 stations; 910,130 despatches were forwarded. The receipts amounted to 6,729,500 francs, the expenses to 4,808,987. The armorial ensign of the empire is a green shield with a silver half-moon; the colors are a white half-moon on red ground, and the star of Jupiter. The succession is hereditary in the family of Othman, so that the eldest member of the family always becomes sultan. The imperial harem is the birthplace of all princes of the house; the wives are slaves, generally from Circassia; as daughters, sisters, and mothers of sultans they bear the title of imperial princesses, but the title is not hereditary.

History.—The Ottoman tribe which now rules the Turkish empire came originally from the Altai Mountains, and pushed onward to the West in connection with other Turkish tribes. Orkhan, who resided in Brusa, and conquered Nicomedia and Nicæa about 1330, is considered as the founder of the Ottoman power. He called himself *padishah*, and the gate of his palace the *Sublime Porte*, which titles are still in use. He founded the famous guard of the Janizaries and the corps of the Spahis, married a daughter of the Greek emperor Cantacuzenus, and entered into close connection with the Byzantine empire, which by degrees was shattered, and finally crushed, by the Ottomans. In 1365, Sultan Amurath I. made Adrianople his European residence; in 1389 he conquered the whole of Bulgaria, and his son, Bajazet I., called Ilderim, besieged Constantinople for seven years (1391–98), and compelled the Greek emperor to pay a tribute. In 1402 the Mongols under Tamerlane fell upon the Ottoman empire from Armenia, defeated Bajazet, and carried him away in captivity, but under Bajazet's grandson, Amurath II., the empire rose again, and with still greater splendor. He besieged Constantinople in 1422, compelled the Greek emperor to conclude an humiliating peace in 1425, and conquered Salonica. By John Hunyady, prince of Transylvania, he was defeated in seven bloody battles (1442–43), and it was not until after the death of Hunyady (in 1459) that the Ottomans succeeded in conquering Servia; but under Mohammed II. they took Constantinople (May 29, 1453), and made it the capital of their empire under the name of Stambool. Mohammed II. subjugated Greece in 1460, took several harbors in the Black Sea from the Genoese, conquered Sinoob, destroyed the empire of Trebizond in 1461, made the larger part of Bosnia an Ottoman province, waged war for sixteen years, by sea and land, against the Venetians, took Kroja and Scutari from them, conquered the Crimea, and took Moldavia from the Poles. Selim I. (1512–19) conquered Armenia as far as the Tigris, Syria, Egypt, and a large part of Arabia, with the sacred cities of Mecca and Medina. His son, Solyman II. the Magnificent (1519–66), brought the empire to the culmination of its power. In Asia he defeated the Persians and conquered Mesopotamia and Georgia. In Europe he conquered Rhodes in 1522, and half of Hungary in 1526, besieged Vienna, though without effect, in 1527, made a new campaign against the German emperor in 1532, and entertained the plan of subjugating the whole Occident; which plan was baffled, however, by his sagacious and valiant adversaries, the emperor Charles V., the Venetians, the Genoese, and the Knights of St. John. This immense success, the foundation of an empire so vast and so beautiful, the Ottomans owed to their religious enthusiasm and their frugality; but once in the possession of wealth, they gave themselves up to enervating enjoyments, and their power began to decrease. After a number of strong and powerful sultans, Selim II. (1566–74) was the first of a series of weak and voluptuous rulers. He had an able vizier, however, Sokolli, and good and bad luck alternated with each other during his entire reign. A Turkish army, invading Russia and besieging Astrakhan in 1569, was defeated by the Russians; but the islands of Cyprus, Crete, Cerigo, Zante, and Cephalonia, and several districts of the coast-land, were taken from the Venetians. Venice then allied itself with the pope, Spain, Savoy, and the Knights of St. John, and the allied fleet, under Don John of Austria, gained a brilliant victory over the Turkish fleet at Lepanto (Oct. 7, 1571). But next year a new Turkish fleet of 250 vessels appeared in the Adriatic, and compelled Venice to conclude a humiliating peace, and Tunis, which had been conquered by Don John of Austria, was reconquered by the Turks. Selim's son, Amurath III., was an incompetent ruler, the plaything of the harem and the Janizaries, and his successors, Mohammed III., Achmed I., and Mustapha I., were not much better. Osman II. fought unsuccessfully against the Poles, and was deposed in 1622 by the Janizaries. Amurath IV. was a despot, but governed the realm with a firm hand. He took, in 1635, Erivan and Tabreez from Persia; incorporated, in 1638, Bagdad and the whole of Mesopotamia with the empire; defeated the Cossacks in the Black Sea, and waged a successful maritime war against the Venetians. He was succeeded by Ibrahim, a miserable wretch, who was strangled in 1648 by the Janizaries and the Ulemas. The reign of Mohammed IV. (1648–87) was eventful and important by the undertakings of the able viziers who governed the realm. The sultan ascended the throne at the age of seven, and great confusion ensued from this circumstance. In 1651 the Turkish fleet was defeated by the Venetians; in 1653 an unfavorable peace was concluded with Poland; in 1655 an insurrection broke out in Constantinople. In 1654 Capudan-Pasha defeated the Venetians, but on July 16, 1656, the Turkish fleet was completely routed in the Dardanelles. At this moment Mohammed Köprili was placed at the head of affairs as grand vizier, and reconquered Tenedos, Lemnos, and Transylvania, suppressed the insurrection in Asia Minor, and supported successfully the Tartars against Russia. His son, Achmed Köprili, succeeded him as grand vizier, and continued the war against Austria and Venice, the two most dangerous enemies of the empire, with circumspection, and generally with success. In the course of the last century the relations to Austria had changed so that Austria no longer lived in perpetual fear of a Turkish attack, but several times took the offensive against her warlike neighbor. Thus, an Austrian army under the leadership of Montecuculi invaded Transylvania, and defeated the Turks at St. Gothard on the Raab Aug. 1, 1664; Achmed Köprili, however, retained by the Peace of Vesvan the cities of Gran, Neuhäusel, etc., which he had conquered in 1663. In 1669 he reconquered Crete and concluded an advantageous peace with Venice. With Poland the prudent vizier also succeeded in concluding a favorable peace in 1672, though the Turkish army had been defeated by the Poles. The peace did not last long, however. When Sobieski became king of Poland, he attacked the Turks, and defeated them in 1674. Achmed Köprili died soon after, and was succeeded by Kara Mustapha as vizier. Kara Mustapha waged war with Russia, but was compelled to cede Azof by the Peace of Radzin (1681). Then a war with Austria broke out. Kara Mustapha advanced to Vienna and besieged the city from July 14 to Sept. 12, 1683. He would no doubt have taken it had not the Poles under Sobieski come to the rescue and defeated the Turks. The vizier was strangled for this defeat. His successor, Ibrahim, fought against allied Austria, Poland, and Venice, but failed and was deposed, and his successor, Solyman Aindshi, was beheaded, having lost many cities, and finally the whole of Transylvania, to the Austrian general, the duke of Lorraine. In 1687, Mohammed IV. was deposed by the Janizaries, and was succeeded by Solyman III. His vizier, Mustapha Köprili, called out the Mohammedans for a religious war, took the field in 1690 at the head of a large army, conquered Belgrade and several other cities, placed his brother, Achmed II., on the throne on the death of Solyman in 1691, and invaded Hungary, but was defeated

there and killed. Mustapha II., the successor of Achmed II., renewed the war against the neighboring states, and defeated the Venetians and the Russian czar, Peter the Great, but was completely routed himself at Zeutha in 1697 by the Austrian general, Prince Eugene of Savoy. By the Peace of Carlovicz (1699) the empire lost Transylvania and Hungary to Austria, Azof to Russia, Podolia and the Ukraine to Poland, and the Morea to Venice. In 1703 the Janizaries raised Achmed III. to the throne. He concluded an alliance with Charles XII. of Sweden, declared war against Russia, and surrounded Peter the Great on the banks of the Pruth in 1711, but concluded peace on the surrender of Azof. The Morea was reconquered, but the victories of Prince Eugene at Peterwardein and Belgrade cost the empire the most important parts of Servia and Wallachia, which were ceded by the Peace of Passarovitz (1718). Mahmood I. succeeded to the throne in 1730. He distinguished himself by his interest in science and art. He was also an adroit statesman, waged successful wars against Austria and Russia, and procured for his realm a peace of fifteen years, cunningly availing himself of the state of affairs in Europe and forming an alliance with France. He was succeeded in 1754 by Osman III., and Osman III. in 1757 by Mustapha III. He, as well as his successor, Abd-ul-Hamid I. (1773–89), failed signally in his policy toward Russia. At the head of this empire stood Catharine II., and her plans of annexing Poland made the Sublime Porte feel uneasy, while at the same time insurrections in the northern provinces of Turkey seemed to indicate the presence of Russian intrigues. The Porte allied itself with France against the threatening Russian power, and a Turkish army broke through Moldavia across the Russian frontier. But the Russian generals, Romanzoff and Galitzin, defeated this army, a Russian fleet under Orloff appeared in the Archipelago, and the Turkish fleet was nearly annihilated at Tchesme (July 16, 1770). In the Crimea also the Russians were victorious under Dolgoruki, and conquered the whole peninsula. The Turks were compelled to give up the Danube as their line of defence and fall back on the Balkan. Negotiations of peace were opened, but led to nothing, as Catharine demanded too much. The war was renewed, and the Russians were victorious everywhere. Violent insurrections broke out in Egypt and Syria, and the empire was in the greatest danger. Under these circumstances the Porte consented to the humiliating Peace of Kutschuk-Kainardschi (July 21, 1774), by which Russia obtained a kind of protectorate over Moldavia and Wallachia, the important cities of Azof, Taganrog, Yenikale, Kertsch, etc., the right of navigation in all Turkish seas, etc. Not satisfied with what she had got, Catharine took possession of the whole of Crimea, which since the peace stood no longer under the protectorate of Turkey, but belonged to the Tartar empire; and shortly after, she also extended her dominion over the Caucasus. The Sublime Porte recognized the annexation of the Crimea, but the conquest of the Caucasus, by which Russia approached the Turkish frontier in Asia, became the cause of a new war; and as the sultan felt assured that Catharine and the Austrian emperor, Joseph II., had agreed on the division of Turkey, he declared war against both powers at once. At first, the Turks were successful, but shortly after the accession of Selim III. (in 1789) they received a very severe defeat from the Russian general Suworow, and Bessarabia, Wallachia, Belgrade, and Ismail were occupied by the allies. Meanwhile, Prussia and England, afraid of the growing power of Russia, exercised their influence in favor of Turkey, and by the peace with Austria at Szistowa (Apr. 4, 1791), with Russia at Jassy (Jan. 9, 1792), the allied powers surrendered nearly all their conquests. From this time dates the singular position of the Turkish power in Europe, depending more on the jealousy of the other powers than on its own strength, and supported by the Western powers simply from fear lest the Russians should take possession of Constantinople and assume a dominating position in the Black Sea and the Mediterranean. The position became still more complicated by the enmity between England and France, both of which powers were interested in the maintenance of Turkey. When Napoleon invaded Egypt in 1798, the Sublime Porte hesitated long, at the instance of Russia and England, before it declared war against France; and when it received back Egypt, it was easily won over to the French policy. Hence originated a hostile relation to Russia, who occupied the principalities of the Danube in 1806, and to England, whose fleet appeared before Constantinople Feb. 20, 1807, in order to compel Turkey to enter into an alliance against France. The immediate result was a revolution in Constantinople; Selim III. was deposed, and Mustapha IV. raised to the throne. But when the Turkish fleet was defeated by the Russians at Lemnos (July 1, 1807), a new revolution reinstated Selim in July, 1808. Mustapha had him assassinated, but did not come into power himself; Mahmood II. became sultan July 28, 1808. He concluded peace with England Jan. 5, 1809, but continued the war with Russia. The Turkish armies were repeatedly defeated, and when at last the invasion of Russia by Napoleon offered Turkey a most advantageous opportunity, the dexterous Russian diplomats brought about the Peace of Bucharest (May 28, 1812), and the opportunity was lost. The position of the empire continued to be very dangerous. The principal weakness of the empire lay in the circumstance that all its various parts had been brought together by force, and none could be considered as the true home of the Ottoman tribe. Many Christians lived in the empire, whole provinces were Christian, and Russia, steadily pursuing her aim, the conquest of Constantinople, never ceased to use the discrepancies between the Christian subjects and the Mohammedan government as a means of agitation. Thus, one insurrection followed another in the interior history of Turkey, especially after the beginning of the nineteenth century. The Janizaries also often became dangerous to the government. Between 1812 and 1826, Mahmood II. had to fight against insurrections in Servia, in various places of Asia, in Greece, and finally the Janizaries revolted, but were completely and cruelly destroyed. By their annihilation Turkey became almost defenceless, and this condition Russia used to compel her to conclude the treaty of Akjerman (in 1826), by which the political relations of Servia, Moldavia, and Wallachia were changed in favor of Russia. These provinces obtained a certain political autonomy under Russian guaranty, and thereby Russia found an opportunity of perpetually interfering in the interior affairs of Turkey. In 1828 a new and dangerous war broke out. The Porte had fought with the Greeks, and nearly subdued them; then the sympathy of Europe for Greece produced a coolness between the Western powers and the Porte, and finally led to the destruction of the Turkish fleet by an allied French-English-Russian fleet at Navarino, Oct. 20, 1827. This moment the czar Nicholas considered opportune for a vigorous attack on the Ottoman empire. War was declared Apr. 26, 1828, and Russian armies advanced into Turkey, both in Europe and Asia. Paskevitch stormed the fortress of Kars and took Erzeroom; Diebitch crossed the Balkan, and appeared in the neighborhood of Constantinople; the Turkish fleet was burnt at Nicopolis Feb. 18, 1829. The Western powers, alarmed by these successes, and repenting of the readiness with which they had served the plans of Russia at Navarino, now compelled the contending parties to the Peace of Adrianople (Sept. 14, 1829), by which Turkey retained Servia, Moldavia, and Wallachia, but paid large war indemnities and recognized the independence of Greece. New insurrections followed in various places, of which that in Egypt under Mehemet Ali was the most dangerous. He had done the empire great service, especially by aiding it against the Greeks, and he now aspired at independence. A war ensued, and the Egyptian army advanced victoriously to the gates of Constantinople. Then Russia came to the rescue of the Porte, compelled the Egyptians to retreat, and concluded with Turkey the offensive alliance of Hunkiar-Iskelessi (July 8, 1833), which considerably increased her influence in the empire. While manifold intrigues were going on in Europe—France exerting herself to place Mehemet Ali at the head of the Ottoman empire, while England and Austria wished to strengthen the power of the sultan in an anti-Russian direction—a new war broke out with Egypt in 1839. Mahmood died in the same year, and Abd-ul-Medshid, seventeen years old, ascended the throne July 31, 1830. The empire seemed near its dissolution, but Russia, fearing the preponderance of French influence in Egypt, formed the quadruple alliance between Russia, England, Prussia, and Austria, and compelled Mehemet Ali to give up Syria, Cilicia, and Crete, which he had conquered, and content himself with Egypt as an hereditary fief. Redshid Pasha, the minister of the young sultan, tried to strengthen the empire internally, especially by concessions to the non-Mohammedan population. In this respect the Hatti-sherif of Gulhane (Nov. 3, 1839) was a very remarkable document. His reforms, however, met with the most stubborn opposition from the Old Turks. In his foreign policy he leaned upon England, and used the revolutionary movements in Europe (1847–50) to form connections with the liberal powers and strengthen his position against Russia. This caused the czar Nicholas, the most powerful enemy of liberal views, to take up once more his plans of driving the Ottomans out of Europe. He demanded the protectorate over the Christians living in Turkey, and when this was refused, he occupied (in 1853) the principalities of the Danube. The Porte now declared war against Russia, and when the Russian army proved supe-

MAP OF
TURKEY
AND
GREECE
Drawn and Engraved on Copper-Plate
EXPRESSLY
FOR
JOHNSON'S UNIVERSAL CYCLOPÆDIA
Scale of Miles
Longitude East 35 from Greenwich
Longitude East 112 from Washington
BLACK SEA
MEDITERRANEAN SEA
SEA OF AZOF
CRIMEA
CAUCASIA
CAUCASIAN PROVINCES
ASIA MINOR
SYRIA
ARABIA PETRÆA
GREAT SYRIAN DESERT
BADIE EL ARAB
ALGWAF
LIBYAN DESERT
RED SEA
Isthmus of Suez
Mouths of the Nile
Siwah Oasis
Lesser Oasis
CONSTANTINOPLE
ADRIANOPLE
SMYRNA
ALEPPO
DAMASCUS
JERUSALEM
CAIRO
ALEXANDRIA
TRIPOLI
BARCA
SERVIA
ROUMELIA
ROUMANIA
GREECE
CRETE
CYPRUS
ARMENIA
KURDISTAN
DIARBEKIR
KARPOOT
ERZROOM
TREBIZOND
SIVAS
ANGORA
KONIEH
ADANA
MOSUL
BAGDAD
BASSORAH
ARABIA
NEJED
EL ZEOETR
KERMANSHAH
LOORISTAN
IRAK AJEMEE
ARBAIJAN
TURKESTAN
ASTRAKHAN
DON COSSACKS
NOVO TCHERASK
YEKATERINOSLAV
KHERSON
ODESSA
PODOLIA
BESSARABIA
MOLDAVIA
WALLACHIA
BULGARIA
ROUMELIA
ALBANIA
ADRIATIC SEA
IONIAN SEA
ITALY
VIENNA
TRANSYLVANIA
HUNGARY
GALICIA
CRIMEA
KASTAMOONI
TRIPOLI
BARCA
SIDRA
GULF OF SIDRA
Benghazi
Tripoli
Cairo
Alexandria
Damietta
Rosetta
Port Said
Suez
Jerusalem
Jaffa
Beyrout
Tyre
Acre
Tripoli
Aleppo
Antioch
Palmyra
Bagdad
Mosul
Erzroom
Trebizond
Sivas
Angora
Smyrna
Adrianople
Constantinople
Salonica
Athens
Candia
Cyprus
Rhodes
Mecca
Medina
Jeddah
Sana
Muscat
Bassorah
Ispahan
Teheran
Tiflis
Erivan
Kars
Van
Bitlis
Diarbekir
Mardeen
Orfa
Aintab
Iskanderoon
Latakiah
Hamah
Homs
Damascus
Kerkook
Suleimanyeh
Sinjar
Nisibin
Bagdad
Samarrah
Hillah
Bushir
Kermanshah
Hamadan
Khoramabad
Shoosha
Ardahan
Alexandropol
Kutais
Mingrelia
Batum
Trebizond
Erzroom
Bayazid
Mush
Van
Bitlis
Diarbekir
Mardeen
Orfa
Aintab
Iskanderoon
Aleppo
Antioch
Latakiah
Tripoli
Beyrout
Damascus
Palmyra
Bagdad
Mosul
Kerkook
Suleimanyeh
Sinjar
Nisibin

rior to the Turkish, France and England formed an alliance with the Porte in the spring of 1851, and attacked Russia in the Baltic and in the Crimea, while Austria stationed an army of observation along her frontier. The war ended by the Peace of Paris (Mar. 30, 1856), according to which the Black Sea was to be open to merchant vessels, but closed to vessels of war; the Danubian principalities were to pay tribute to the Porte and to be under the protectorate of the great powers of Europe; the lower course of the Danube to be again placed under the authority of the Porte, etc. The interior breach, however, of the state was so great, that in spite of this favorable external position no strong or sound development took place. The race itself seems incapable of development. It shows still the same qualities as when a warlike host of robber nomads. Horrible scenes of religious fanaticism are still enacted, such as the massacre of the Christians in Damascus and the Lebanon in 1860. Reforms bear no results, and the tributary states are steadily engaged in attempts at making themselves independent. In spite of the protests of the Porte, Moldavia and Wallachia united in 1857 into one state, Romania, which since 1866 has been governed by a prince of Hohenzollern. The revolution in Crete beginning in 1866 lasted several years. With Egypt, Turkey has had a continual series of conflicts. June 25, 1861, Abd-ul-Medshid was succeeded by Abd-ul-Aziz, who was as incapable a ruler as the former. The differences with Greece, caused by the revolution in Crete, were adjusted by the Conference of Paris in 1869, but the khedive of Egypt obtained in 1872 the right of increasing his army and fleet and of making independent loans, and in 1873 he was made perfectly independent with respect to the whole internal administration. During the Franco-German war (on Oct. 31, 1870) Russia threw off the treaty of 1856, and the insurrection which broke out in the northern provinces, Bosnia and Herzegovina, in 1874, was evidently encouraged by her. On May 30, 1876, a revolution took place at Constantinople. Abd-ul-Aziz was deposed, and Murad V. proclaimed sultan. Aug. 30, 1876, Murad V. was also deposed, and Abd-ul-Hamid II. was proclaimed the ruler of Turkey. (See TURKEY in FIRST BIENNIAL SUPPLEMENT.) AUGUST NIEMANN.

Turkey, tp., Sampson co., N. C. P. 1167.

Turkey, tp., Williamsburg co., S. C. P. 981.

Turkey-Buzzard. See CATHARTES AURA. See also CATHARTIDÆ, in APPENDIX.

Turkey Creek, tp., Van Buren co., Ark. P. 80.

Turkey Creek, tp., Kosciusko co., Ind. P. 1336.

Turkey Creek, tp., McPherson co., Kan. P. 74.

Turkey Creek, tp., Edgefield co., S. C. P. 959.

Turkey Grove, tp., Cass co., Ia. P. 1166.

Turkey Red. See DYEING.

Turkey Stone. See HONE.

Turkey Town, tp., Etowah co., Ala. P. 685.

Turkistan. See TURKESTAN.

Turkomans, or Toorkomans. See TURKESTAN.

Turks is the name of the principal branch of the Turanian family, allied to the Magyars and Finns in Europe, to the Samoyeds in Northern Asia, and to the Mongols and Mantchoos in China. As a continuous people they inhabit the central part of Asia, from the northern frontier of Persia and Thibet to about lat. 59° N. in Siberia, and from Lake Baikal to the Caspian Sea; as a scattered population they are found in India, China, Siberia, Southern Russia, Egypt, Asia Minor, and European Turkey. They consist of many different tribes, such as the Yakoots on the borders of the Lena; the Uigurs on the frontier of China; the Toorkomans, Oozbeks, and Kirgheez in Turkestan or Turan or Free Tartary, and in Asiatic Russia; the Bashkirs in European Russia; the Ottomans in Asia Minor and European Turkey. The religion of most of these tribes is Mohammedan; the Yakoots are Shamanists; those of China are Booddhists; those of European Russia, Greek Catholics. Also in the language of the race considerable differences have developed, yet the Yakoot from the Lena and the Ottoman from Constantinople are said to understand each other perfectly well. Their history has been like a series of violent thunderstorms. Enormous empires arose suddenly, swept everything before them, and disappeared again as suddenly, leaving no traces behind them but devastation. (For further particulars see the articles on GENGHIS KHAN, MONGOLIA, SELJOOKS, TIMOUR, and TURKEY.)

Turk's and Caicos Islands, a former British colony, annexed in Jan., 1874, to Jamaica. These islands constitute the S. E. portion of the Bahama chain. They lie between 21° and 22° N. lat. and 71° and 72° 30′ W. lon. Until 1848 they were included in the Bahama colony, and from that time till 1874 had a separate government, though attached to Jamaica. The Caicos Islands, the most northwesterly, are the largest, but the least important. They are divided from the Bahamas by the Caicos Passage, and from Turk's Islands by the Turk's Island Passage. The principal of the Turk's Islands, all of which are small keys, are Grand Turk, Turk's Island, Salt Island, and Sand Island. Lat. of Grand Turk, 21° 32′ N., lon. 71° 10′ W. The only export is salt, which is largely sent to the U. S. It is evaporated in lagoons called salt pans by the sun from sea-water. When the crust of salt is sufficiently thick, it is removed by rakes in the hands of barefooted men, who wade into the pans. The quality of the salt is very good, but all West India and Yucatan salt is known in the market as Turk's Island salt. The colony is self supporting, but receives a grant of £300 a year from the British post-office. In 1870 the revenue was £9504, the expenditure, £9726; value of imports (1870), £35,345, of exports, £18,855. Tonnage of vessels entered and cleared (1861), 101,535 tons. The government is vested in a commissioner, a legislative board of four, five, or six members, appointed by the governor of Jamaica, three assistant commissioners, a judge, a queen's advocate, and a prothonotary. The U. S. and Hayti (which is but 60 miles distant) each maintain a consulate here. P. in 1861, 4372; in 1871, 4723, of whom 565 were Europeans.

Tur'meric (*Curcuma*), the root of *Amomum curcuma*, a native of the East Indies and Cochin-China. It contains a volatile oil, a yellow coloring-matter (*curcumine*), starch, cellulose, gum, and a brownish dye. The root of *Canna speciosa*, a plant occurring in West Africa, also possesses the same physical and chemical properties. Tormeric is used in the dyeing of silk and wool, and is extensively employed in pharmacy for coloring ointments, etc. The tincture of turmeric, or unsized paper stained with the aqueous or alcoholic solution ("turmeric paper"), is often used in chemical operations as a test for the alkalies and for boracic acid, which impart a reddish-brown color to them.

J. P. BATTERSHALL.

Turn'back, tp., Lawrence co., Mo. P. 967.

Turn'bridge, tp., De Witt co., Ill. P. 1105.

Turn'bull, tp., Bladen co., N. C. P. 447.

Turnbull (ROBERT), D. D., b. at Whiteburn, Scotland, Sept. 10, 1809; graduated at Glasgow University; was for some years a Baptist preacher in England and Scotland; settled in Danbury, Conn., 1833, at Detroit, Mich., 1835, at Hartford, Conn., 1837, at Boston, Mass., 1839, and was since 1845 pastor of the First Baptist church at Hartford. Author of *Olympia Morata* (1842), *The Genius of Scotland* (1847), *The Genius of Italy* (1849), *Pulpit Orators of France and Switzerland* (1848), *Theophany, or the Manifestation of God in Christ* (1851), *Christ in History, or the Central Power* (1856), and *Life Pictures* (1857); translated Vinet's *Vital Christianity* (1846); edited Sir William Hamilton's *Discussions on Philosophy and Literature* (New York, 1855) and the *Christian Review*. D. at Hartford, Conn., Nov. 20, 1877.

Turnbull (ROBERT JAMES), b. at North Smyrna, Fla., in Jan., 1775, son of an English physician who married a Greek lady of Smyrna, and obtained, in connection with Lord Hillsborough, a grant from the English government in 1772 for settling a Greek colony in Florida, but forfeited his rights by adhesion to the Revolutionary cause, and settled at Charleston, S. C. Robert was educated in England, studied law in Charleston and Philadelphia, and practised at Charleston until 1810, when he devoted himself to the care of his residence on his large plantation; became a leader of the nullification party; was prominent in the free-trade conventions at Columbia and Charleston 1831, and at the South Carolina nullification convention of Nov., 1832, which adopted from his pen an address to the people. D. at Charleston June 15, 1833. A fine monument was erected to his memory by his political associates. Author of *A Visit to the Philadelphia Prison* (London, 1797) and *The Tribunal of Dernier Resort* (1830); wrote much on politics for the Charleston *Mercury* 1827, and a collection of his articles from that paper, republished under the title of *The Crisis*, became the textbook of the nullification party.

Turnbull (WILLIAM), b. in Maryland 1800; graduated at the U. S. Military Academy July, 1819, when commissioned second lieutenant of artillery, but served on topographical duty until 1831, in which year he was transferred to the corps of topographical engineers with rank of captain; major 1838; was chief topographical engineer in construction of the Potomac aqueduct 1832–43. This work, the piers of which are founded by coffer-dams on rock (covered by sometimes 20 feet of mud), from 30 to 40 feet below the water-surface, was one of the earliest of important works of American engineering—the earliest of its type—the successful surmounting of the difficulties of which gives Col. Turnbull a claim to be regarded as one of the fathers of American civil engineering. He was in charge

of improvement of lake harbors 1843–46. In the war with Mexico he served as chief topographical engineer of Gen. Scott's army, from Vera Cruz to the City of Mexico, gaining the brevet of lieutenant-colonel for gallantry at Contreras and Churubusco, and colonel for Chapultepec. In 1848–49 he superintended the construction of the New Orleans custom-house; engaged in the study of the question of bridging the Susquehanna at Havre de Grâce, and expediency of an additional canal around the Falls of the Ohio 1852; on lighthouse duty and in charge of the improvement of Cape Fear River, N. C., at the time of his death, at Wilmington, N. C., Dec. 9, 1857.—His son, CHARLES N., b. at Washington, D. C. 1834; graduated at the U. S. Military Academy in 1854, and attained a captaincy in the corps of topographical engineers in 1862; served throughout the civil war; resigned Dec. 31, 1865. D. at Boston Dec. 2, 1874.

Turnbull (WILLIAM BARCLAY), b. at Edinburgh, Scotland, in 1811; was called to the bar of Scotland 1832, to that of England 1856; was for several years secretary to the Scottish Society of Antiquaries; founded the Abbotsford Club 1833; was its secretary until 1841; edited for it many old MSS. and reprints of rare early publications, and was appointed, although a Roman Catholic, by Sir John Romilly, in 1859, calenderer of the foreign correspondence at the state paper office, which post he resigned in 1861 in consequence of dissatisfaction with his method of presenting the religious transactions of the reigns of Edward VI. and Mary in the *Calendar* issued in February of that year. D. Apr. 22, 1863. Among his other publications were *Legendæ Catholicæ* (1840), Audin's *Life of Luther* (2 vols. 8vo, 1854), *The Poetical Works of Rev. Robert Southwell* (1856), *The Poetical Works of William Drummond of Hawthornden* (1856), and *The Complete Works of Rev. Richard Crashaw* (1858), *An Account of the Monastic Treasures confiscated at the Dissolution of the Various Houses in England* (1836), *The Miscellany of the Abbotsford Club* (1837), and *The Chronicles of Scotland* (3 vols., 1857–58), the latter forming part of the "Rolls Series."

Turnbull's Blue (*Ferrous ferricyanide*). See FERROCYANIDES.

Turn'er, county of S. E. Dakota, intersected by Vermilion River, the surface consisting of fertile prairies and bottom-lands. Cap. Swan Lake. Area, 648 sq. m. P. not given in the census of 1870.

Turner, p.-v., Du Page co., Ill., at the junction of Fox River Sterling and Fulton branches of Chicago and Northwestern R. R. and a branch of Chicago Burlington and Quincy R. R., contains 4 churches, a fine school system, 1 newspaper, 3 hotels, a mill for repairing railroad iron, and a round-house. P. about 1000.

J. RUSSELL SMITH, ED. "NEWS."

Turner, p.-v. and tp., Androscoggin co., Me. P. 2380.

Turner (DANIEL), b. at Newport, R. I., in 1792; entered the U. S. navy as a midshipman Jan. 1, 1808; became lieutenant Mar. 12, 1813; commanded the Caledonia in Perry's victory on Lake Erie, Sept. 10, 1813, rendering services for which the State of New York presented him with a sword of honor; was captured with his vessel while co-operating with Col. Crogban in the autumn of 1814, and carried prisoner to Montreal; became master 1825 and captain 1835. D. at Philadelphia Feb. 4, 1850.

Turner (DAWSON), F. R. S., b. at Great Yarmouth, England, in Oct., 1775; studied at Cambridge, but did not graduate, and became in 1796 manager of the Yarmouth branch of a London bank, a post he filled for more than half a century, devoting his mornings and evenings to literature and science, especially the study of botany and of architecture, and formed an extensive collection of autographs and MSS. illustrative of the history of England, a portion of which he sold in 1853 to the British Museum, and the remainder was ultimately dispersed by auction. D. at Old Brompton June 20, 1858. Among his publications were—*The Natural History of Fuci, or Sea-weeds* (4 vols. 4to, 1808–19), *Account of a Tour in Normandy for investigating Architectural Antiquities* (2 vols., 1820), and a *Stranger's Guide to the Roman Antiquities of the City of Treves* (1839), from the German of Prof. J. H. Wyttenbach.

Turner (EDWARD), M. D., F. R. S., b. in Jamaica in 1797; graduated in medicine at Edinburgh; studied chemistry and mineralogy two years at Göttingen under Stromeyer; lectured on those sciences at Edinburgh 1824, and was professor of chemistry at University College, London, from 1828 until his death, at London, Feb. 12, 1837. He contributed to the *Transactions* of the Royal societies of London and Edinburgh, to scientific periodicals, and to the *Penny Cyclopædia*. His *Elements of Chemistry* (1825) soon became a standard work; a posthumous edition was revised by Liebig and Gregory, and three American rival editions were edited respectively by Profs. Bache, Rogers, and Johnston.

Turner (JOSEPH MALLORD WILLIAM), R. A., b. at Covent Garden, London, England, Apr. 23, 1775, son of a hair-dresser; received a very limited education at school, but acquired some skill in sketching from nature, and was intimate as a schoolboy with Thomas Girtin, afterward the founder of the School for Painting in Water-Colors. The two boys, who displayed the same fondness for drawing and for resplendent colors, obtained from John Raphael Smith, an engraver and painter in Maiden lane, the opportunity to gratify their tastes by coloring prints, and they were afterward employed by an architect to put skies and backgrounds into his designs. They were also patronized by a Dr. Munro, who gave them access to his fine collection of paintings, and employed them to make copies in water-colors. When only twelve years of age Turner exhibited two drawings at the Royal Academy; was an assiduous student there for ten years from 1789, exhibiting no less than 59 pictures, all in water-colors; was employed to make views of English scenery for the *Oxford Almanack*, Walker's *Itinerant*, the *Pocket Magazine*, and as an illustrator of topographical books travelled extensively over England and Wales on foot, making sketches and giving lessons in water-colors; acquired wonderful skill in marine scenery; was in 1799 chosen an associate of the Royal Academy; took a studio in Harley street; exhibited during the two following years 14 pictures; was chosen an academician 1802, being already recognized as the first landscape-painter of his time; gave his attention thenceforth to oil-painting; visited France 1802; afterward made frequent artistic trips to Switzerland and the Rhine-lands, whence he brought home copious sketches and finished pictures; was chosen in 1807 professor of perspective at the Royal Academy, but was unsuccessful as a lecturer, owing to his illiteracy; published in 1808 his famous *Liber Studiorum*, a series of plates from original designs, many of which were engraved by his own hand, and which avowedly challenged comparison with the *Liber Veritatis* of Claude Lorraine, the artist whom he most admired and imitated; began about 1815 to strike out a style of his own, chiefly marked by wonderful accuracy in reproducing the phenomena of nature and by unequalled skill as a colorist, being especially fond of the most brilliant tints and contrasts; visited Italy 1819, 1829, and 1840; was liberally patronized, receiving enormous prices for his slightest sketches; acquired wealth and fame; was noted for his eccentricities, his extreme reserve, and unsocial habits, living alone in penurious style, often under an assumed name, receiving no visits, and allowing no one to enter his studio; gradually changed his style, showing with advancing years increased fondness for representing the diffusion of light in a more and more vertical manner, and with a tendency to a preponderance of blue rays, probably owing to some peculiarity of his eyesight; exhibited at the Academy during the first half of the century no fewer than 250 pictures, most of which he refused to sell at any price, and maintained nearly equal celebrity in another branch of his art by the exquisite finish of the drawings and the engraved designs which he furnished to such works as Dr. Whitaker's *History of Richmondshire*, to illustrated editions of the *Poems* of Rogers, Byron, and Scott, or published in several series *The Scenery of the Southern Coast, England and Wales, The Rivers of England, The Rivers of France, etc.*, and resided for several years, under an assumed name, at Chelsea, where he d. Dec. 19, 1851, and was buried next to Reynolds in St. Paul's cathedral. He was never married, and by his will left most of his pictures to the nation upon the condition of a suitable gallery being provided for them. They now occupy the "Turner Room" of the National Gallery. He left £20,000 to the Royal Academy, and devised the rest of his large property to found an asylum for decayed artists, to be called "Turner's Gift," but owing to the unskilful manner in which his will was drawn, his intentions were defeated and the property (near £200,000) was divided among the next of kin. It is usual to divide the artistic career of Turner into three periods, the first terminating in 1802, the second in 1829, and the third with his death. The first period was one of development, characterized by the employment of water-colors and the successful imitation of the great English landscape-painters. His chief oil-paintings of this period were *The Tenth Plague of Egypt, Dutch Boats in a Gale, The Battle of the Nile* (1799), *Calais Pier* (1802), and *The Falls of the Clyde* (1802). Of his second period, that of imitation of the great continental colonists, his own two favorite pictures, *The Sun rising through a Mist* (1807) and *Dido building Carthage* (1815), which in his will he directed to be hung next to prominent works of Claude Lorraine. Other notable paintings of this time were *The Shipwreck* (1805), *The Falls of Schaffhausen* (1805), *The Blacksmith's Shop* (1807), *The Wreck of the Minotaur, Spithead* (1809), *Mercury and*

Herse (1811), *Hannibal crossing the Alps* (1812), *The Bay of Baiæ* (1828), and *Mortlake* (1826–27). Of the third period, that of entire emancipation from precedent, the masterpieces were *Ulysses deriding Polyphemus* (1829), *Palestrina* (1830), *Caligula's Palace and Bridge* (1831), *Childe Harold* (1832), *The Slave Ship*, and *The Fighting Téméraire* (1839). The last ten years of his life were marked by a "decay and declination" of his genius, and he produced no painting worthy of his fame. But it was precisely during this period of decline that the great critical work of John Ruskin on *Modern Painters* (1844) asserted for him that artistic pre-eminence which has since become generally recognized. Owing to his carelessness in the composition and use of pigments and varnishes many of his oil-paintings are rapidly deteriorating, and it is probable that his reputation will ultimately rest upon the line engravings of his best works which were executed under his own supervision. He was author of a worthless poem in blank verse entitled *The Fallacies of Hope*, from which he frequently appended extracts to the titles of his pictures in the Academy catalogues. A statue of Turner by McDowell was erected in 1863 in St. Paul's cathedral; a biography by Walter Thornbury appeared in 1861. PORTER C. BLISS.

Turner (PHILIP), b. at Norwich, Conn., in 1740; was left an orphan at the age of twelve; adopted by Dr. Elisha Tracy, with whom he studied medicine, and whose daughter he married; was assistant surgeon to a provincial regiment at Ticonderoga 1759; settled at Norwich, Conn., where he became highly distinguished in his profession; was the first surgeon of Connecticut troops before Boston 1775; was present at the battles of Long Island and White Plains 1776; was surgeon-general of the eastern department 1777–82; settled in New York City 1800, and during the second war with England was staff surgeon to the U. S. army stationed at York Island, where he d. in the spring of 1815.

Turner (SAMUEL), b. in Gloucestershire, England, in 1759; became distinguished in the East India military service; was sent by Warren Hastings at the head of a mission to Thibet 1783; took part in the siege of Seringapatam 1799, and was afterward entrusted with a mission to the rajah of Mysore. D. in London Jan. 2, 1802. Author of *An Account of an Embassy to the Court of the (Teshu) Lama in Tibet* (1800), which was translated into French and German, and still remains one of the principal sources of information upon Thibet.

Turner (SAMUEL HULBEART), D. D., b. at Philadelphia, Pa., Jan. 23, 1790; graduated at the University of Pennsylvania 1807; was ordained deacon in the Protestant Episcopal Church 1811, and priest in 1814; was pastor of a church at Chestertown, Md., 1812–17; was elected professor of historic theology in the General Episcopal Seminary, New York, Oct. 8, 1818; removed with that institution to New Haven, Conn., 1820, and returned with it in 1821 to New York, where it was combined with the New York Diocesan Seminary under the title of the General Theological Seminary, in which he was professor of biblical learning and interpretation of Scripture from Dec. 19, 1821, to his death, and also professor of the Hebrew language and literature in Columbia College from 1831. D. in New York City Dec. 21, 1861. Author of *Notes on the Epistle to the Romans* (1824), *Companion to the Book of Genesis* (1841), *Biographical Notices of Distinguished Jewish Rabbis* (1847), *Parallel References Illustrative of the New Testament* (1848), *Essay on our Lord's Discourse at Capernaum* (1851), *Thoughts on the Origin, Character, and Interpretation of Scripture Prophecy* (1852), *Teachings of the Master* (1858), *Spiritual Things compared with Spiritual* (1859), *The Gospels according to the Ammonian Sections and the Tables of Eusebius* (1861), and an *Autobiography* (1862). He translated Jahn's *Introduction to the Old Testament* (1827), in which he was aided by Rev. Dr. W. R. Whittingham, and Planck's *Introduction to Sacred Philology and Interpretation* (1834); edited in Greek and English, with analytical and exegetical commentaries, the Epistles to the Hebrews (1852), to the Romans (1853), and to the Ephesians (1856); published several sermons and addresses; contributed to the *Biblical Repository* and other theological and literary periodicals; wrote the sketch of St. Paul's life and character in Bishop Wainwright's magnificently illustrated volume, *Our Saviour with Prophets and Apostles* (1850), and left several works nearly ready for the press, including an *Exposition of Messianic Texts*, *Notes on the Gospels*, and *Notes on the Epistles to the Corinthians*.

Turner (SHARON), b. in London, England, Sept. 24, 1768; became a successful attorney in London, devoting his leisure to historical, archæological, and philological researches; retired from the practice of his profession 1829, and devoted the remainder of his life to literary pursuits at his seat of Winchmore Hill, and received a pension of £300 from the Crown. D. at London Feb. 13, 1847. Author of *A History of England from the Earliest Period to the Death of Elizabeth*, published in four different instalments, with separate titles, from 1799 to 1829 (9 vols.); *A Vindication of the Genuineness of the Ancient British Poems of Aneurin, Taliessin, etc.* (1803); *The Sacred History of the World* (3 vols., 1832; 8th ed. 1848; New York, 1838); *Richard the Third, a Poem* (1845), and other productions in prose and verse. The most valuable of his writings was the *History of the Anglo-Saxons* (4 vols., 1799–1805; 7th ed., 3 vols., 1853), which was long the standard authority, and has not been entirely superseded by the more recent works of Palgrave, Kemble, Lappenberg, Pauli, and Freeman.—His son SYDNEY, b. Apr. 2, 1811; graduated at Trinity College, Cambridge, 1836; took orders; was for many years resident chaplain to the institution for the reformation of juvenile offenders at Redhill, Surrey; government inspector of reformatories and industrial schools 1857, and rector of Hampstead, near Gloucester, 1867; has edited his father's principal historical works, and written *Reformatory Schools* (1855).

Turner (THOMAS), U. S. N., b. in Virginia Dec. 23, 1808; entered the navy as midshipman Apr. 21, 1825; became lieutenant in 1835, commander in 1855, captain in 1862, commodore in 1863, rear-admiral in 1868; served on the E. coast of Mexico during our war with that country, and commanded the Ironsides in the first attack upon Fort Sumter, Apr. 7, 1863. Highly commended by Rear-Admiral Du Pont in his official report of Apr. 15, 1863.
FOXHALL A. PARKER.

Turner (WILLIAM), M. D., b. at Morpeth, Northumberland, England, about 1515; educated at Pembroke Hall, Cambridge, where he obtained a fellowship about 1531; studied medicine, botany, and theology; took orders in the Church of England; was imprisoned for preaching the doctrines of the Reformation; proceeded on his release to the Continent, and studied natural history at Zurich and Bologna; returned to England on the accession of Edward VI.; became physician to the Protector Somerset; prebendary of York 1550, dean of Wells 1550, and canon of Windsor; resided in Germany during the reign of Mary; was twice deprived of his deanery, and twice restored, 1553 and 1560, and at one time had a seat in Parliament. D. in London July 7, 1568. Author of *The Huntyng and Fyndyng out of the Romish Fox, by Will. Wraughton* (Bâle, 1543), *Avium præcipuarum, quarum apud Plinium et Aristotelium Mentio est, Historia* (Cologne, 1544), *The Rescuyinge of the Romish Fox, etc., by Wuillyum Wraghton* (Winchester, 1545), *The New Herball* (book i. London, 1551; i. and ii. Cologne, 1562; i., ii., and iii., 1568), the first scientific work on botany by an English writer; published a collation of the English Bible with the Hebrew, Latin, and Greek, and wrote the account of British fishes in his friend Johann Gesner's *Historia Animalium*.

Turner (WILLIAM WADDEN), b. in London in 1810; came to the U. S. 1818; was apprenticed to a printer in New York 1829; became distinguished for his attainments in modern and Oriental languages; was successively librarian to the University of New York and instructor in Hebrew in Union Theological Seminary 1842–52; assisted Dr. Isaac Nordheimer in the preparation of his Hebrew manuals; contributed to Bartlett's *Dictionary of Americanisms* (1848); translated Von Raumer's *America and the Americans* (1845), and the greater part of Freund's *Latin-German Lexicon* for Prof. E. A. Andrews; superintended the publication of Dr. S. R. Rigg's *Dakota Grammar and Dictionary* and other linguistic works issued by the Smithsonian Institution; contributed to Ludewig's *Literature of American Aboriginal Languages* (1858), to the *Transactions* of the American Ethnological and Oriental societies, *Iconographic Encyclopædia*, the *Bibliotheca Sacra*, and other periodicals. He was for several years recording secretary of the National Institute for the Promotion of Science, and librarian of the U. S. patent office from 1852 to his death, at Washington, D. C., Nov. 29, 1859.

Turners, p.-v., Orange co., N. Y., on Erie R. R., 46 miles from Jersey City.

Tur'nersburg, p.-v. and tp., Iredell co., N. C. P. 796.

Turner's Falls, p.-v., Franklin co., Mass., at the terminus of a branch of Vermont and Massachusetts R. R., and on Connecticut River, contains 4 churches, 3 large school-houses, 2 banks, 2 extensive paper-mills, the largest cutlery establishment in the world, a cotton-factory, foundry, and machine-shops, 1 hotel, and 1 newspaper. The vicinity is rich in fossil prints, fish, and vegetables. P. about 2000.
CECIL T. BAGNALL, ED. "TURNER'S FALLS REPORTER."

Turnhout', town of Belgium, province of Antwerp, has large paper-mills, tanneries, dyehouses, and manufactures of cotton, flax, hemp, and lace. P. 15,000.

Turning. See LATHE, by PROF. R. H. THURSTON, C. E.

Tur'nip [O. Eng. *turnep*], a biennial plant, abundant throughout the temperate zone, having a swollen fleshy root of great value as food both for man and more especially for cattle. It is of the same genus (*Brassica*) as MUSTARD and of the same species (*B. campestris*) as RAPE (which see), is found growing wild as a weed in Europe and Northern Asia, and is largely cultivated both as a field and as a garden crop, sometimes reaching twenty or twenty-five pounds. The most valuable kinds are the Swedish or Russian turnips, usually called ruta-bagas, of which there are numerous varieties. Turnips, when grown in gardens, must be sown early in spongy soil; when raised in the field, they are sown much later, and thrive best in moist cloudy weather. Though turnip-culture is of comparatively recent origin in England, it has already taken rank there as the most important field-crop, being fed to sheep in the fields, enclosed within hurdles or movable fences. Though an agreeable article of diet for man, it has never assumed great importance in that respect, owing to the enormous proportion of water, 87 to 92 per cent., in its composition. The leading varieties are in England, the white Dutch, white French, sweet German, and Teltow; in the U. S., the improved American and Carter's and Laing's ruta-bagas.

Turnip-Fly, a name common to several insects destructive to turnips. The most common is the small chrysomelian beetle called also turnip-flea (*Altica* or *Haltica nemorum*), from its prodigious leaping powers, a species having an oval body and wide head, long and strong hind legs, large black wings with two yellowish stripes, and claws notched and hooked to enable it to keep firm hold of the cruciferous vegetables which constitute its food. It eats the leaves of the turnip as soon as they appear above ground in the spring, and lays its eggs on the under side of the leaves later in the season. The larvæ thus bred upon the plant are often extremely destructive to the turnip-root, in which they burrow. Other species are the *H. striolata*, or wavy-striped flea-beetle of the U. S., the *Pontia oleracea*, potherb or white butterfly, and the *Anthyomia radicum*, a dipterous insect of the family Muscidæ, of the same genus as the cabbage-fly and the beet-fly, and especially abundant and noxious in Great Britain, where the latter is considered as the turnip-fly proper.

Turn'pike, in law, differs from a common public highway in the fact that it is always constructed and maintained by a board of managers or trustees, or by a corporation acting under some special statutory authority, and also in the fact that tolls are almost always imposed upon the travellers to enable the trustees or corporation to pay the cost of construction and maintenance and to receive a profit upon their investments. In England the previous special statutes were consolidated by the general acts of 13 Geo. III. ch. 64, and 24 Geo. III. ch. 9, and all existing and future turnpikes were brought under the same system of regulations. In the U. S. turnpikes are constructed and maintained by corporations created either under general statutes or by special charters. Although there is a great diversity in the details of the legislation in different States, yet all these corporations are authorized to take lands for their own uses upon payment of compensation to the owners thereof, to appropriate existing highways, and to exercise the same rights of eminent domain under similar restrictions that are held by and imposed upon railroad companies. They are also empowered to lay and collect tolls from travellers, the rates of toll and the number or distances of the gates being frequently determined by the charter itself. As this is the most important of all the franchises granted by the State, its enjoyment is carefully protected, and its use is strictly guarded by penalties enforceable, as the case may be, either against private persons or against the corporations. As concerns its use, a turnpike is in every respect a public highway, free to all upon the sole condition that the legal tolls are paid; as a consequence thereof, the rules of law concerning encroachment upon highways are equally applicable to turnpikes. In return for the franchises conferred by the legislature, the corporations are required to keep the road-bed and all its appurtenances in good repair, in the condition and form prescribed by the statute, so long at least as they do not surrender their franchises by ceasing to demand payment of tolls. If they fail in this duty, they may be made liable in actions for damages brought by persons injured through their neglect, to actions for penalties, to indictment, and to an annulment of their charter at the suit of the people. The plank roads, which have been so common in certain States, are simply a species of turnpikes, required by their charters to be constructed of a particular material. J. NORTON POMEROY.

Turnsol, another name for LITMUS (which see). See also ARCHIL.

Turn'spit, a dog employed for turning the spit upon which meat is roasted. Formerly, the turnspit was almost universally employed in the kitchens of the European gentry and many peasants; but at present, though not quite unknown, it is mostly superseded by less rude appliances. The turnspit is a very intelligent dog, with a long body, short and often crooked legs, long and pendent ears, and a very large head. It has a dash of greyhound blood. Two or more dogs are kept, and relieve each other at the task. The dog stands in a kind of treadmill, his weight giving motion to the spit.

Turn'stone [so called from its habit of overturning stones in search of food], the *Strepsilas interpres*, a wading bird of the family Hæmatopodidæ, allied to the plovers, and common on the shores of the U. S. and in nearly all parts of the world. On our Pacific coast is found *S. melanopus*, the black turnstone.

Tur'pentine [Lat. *terebinthina*; Ger. *Terpentin*; Fr. *terebenthene*; It. and Span. *trementina*], a term applied to certain vegetable oleo-resins which exude from coniferous trees, also to the resin obtained from the *Pistacia terebinthus*. They are obtained by making an excavation, having a capacity of about three pints, in the trunk of the tree, in which the exuded juice accumulates: which is collected, washed with warm water, and purified by straining through straw filters. The several varieties of turpentine are viscid solutions of resin in a volatile oil. American turpentine is chiefly procured from the *Pinus palustris* and the *Pinus tæda*, the principal supply coming from North Carolina and the south-eastern part of Virginia; but recently indications have been given that Georgia and Florida will, in the near future, furnish large amounts of this valuable product. French and German turpentines greatly resemble the American in most of their properties. Venice turpentine, which is obtained from the *Larax europæa*, is a ropy, slightly greenish liquid, having a rather unpleasant odor and taste. Canada turpentine (Canada balsam; see BALSAM) is produced from the *Abies balsamea* growing in Canada and the northern part of Maine. The remaining varieties of turpentine are the Strasbourg, the Hungarian, and the Chian, which differ somewhat in their properties, but are in most respects very similar compounds. The turpentines, as a class, form yellowish viscid liquids, possessing a strong aromatic odor, and a bitter, pungent taste, and are very inflammable. They consist of a volatile oil (or oils) and *colophony* (*rosin*). Upon distilling the crude product with water, the volatile oil is separated, a brittle residue of rosin remaining.

Oil of turpentine (*spirits of turpentine*), ($C_{10}H_{16}$), is obtained by the distillation of crude turpentine, each variety of the crude product furnishing a distinct volatile oil. They all form colorless, mobile liquids of a peculiar disagreeable odor, are insoluble in water, but dissolve in alcohol, in ether, and in bisulphide of carbon. The oils of turpentine are solvents of many resins and oils, of caoutchouc, and of iodine, sulphur, and phosphorus. The chief differences exhibited by the various varieties are in specific gravity, boiling-point, and optical rotatory power. The ordinary turpentine oil of commerce has a sp. gr. of 0.864 and a boiling-point of 320° F. French oil of turpentine consists essentially of a hydrocarbon termed *terebenthene* ($C_{10}H_{16}$), of sp. gr. .8767 at zero Centigrade, at 321° F. (*Riban*). *Australene* is an analogous hydrocarbon obtained from the American oil. The oils of turpentine, on standing, slowly absorb oxygen, a portion of which is converted into ozone. Chlorine, bromine, and iodine are dissolved by them, disengagement of heat and combustion often occurring. Under the influence of heat and of acids turpentine oils assume various isomeric states; when heated to 461° F., *isoterebenethene* and *metaterebenethene* are formed; by the action of sulphuric acid, *terebene* and *colophene* are produced. Two other isomeres, *camphilene* and *terebilene*, have been prepared by treating artificial camphor with quicklime. Artificial camphors are the results of the combination of hydrochloric acid with oil of turpentine; so far, two hydrochlorates, $C_{10}H_{16}.HCl$ and $C_{10}H_{16}.2HCl$, having been obtained. The former, which is termed *hydrochlorate of camphene*, crystallizes in white prisms, which have an aromatic smell and taste, greatly resembling that of ordinary camphor; the latter compound possesses the characteristic odor of the oil of thyme. (See THYME, OIL OF.) A numerous variety of seeds and fruits yield by distillation oils isomeric or polymeric with those of turpentine; these have received the generic name of *camphenes* or *terebenes*. Turpentine is sometimes applied externally in medicine in the shape of salves and plasters; it is also taken internally in the form of pills. The oils of turpentine are extensively used in the preparation of varnishes, and to some extent in medicine as stimulants, diuretics, and anthelmintics.

J. P. BATTERSHALL.

Tur'peth, or **Turbith,** a medicinal cathartic root from India and Australia, *Ipomœa turpethum*. Spirgatis found in it a substance he called *turpethine*, $C_{34}H_{56}O_{16}$, a yellowish resin, which possessed purgative properties. It seems to be a glucoside. H. Wurtz.

Turpeth-Mineral, also **Turbith-Mineral,** an ancient name of what is now known as the basic sulphate of mercuric oxide, O_6SHg_3. It is obtained by boiling with water the neutral mercuric sulphate, O_4SHg. It is a lemon-yellow powder, which is very slightly soluble in cold water. It was formerly used in medicine. Notwithstanding its name, it is not a mineral substance, but is wholly artificial in its origin. H. Wurtz.

Turpin', or **Tylpinus,** archbishop of Rheims (d. Sept. 2, 800), was the reputed author of a Latin chronicle relating the campaigns of Charlemagne against the Saracens in Spain. The book was declared authentic by Pope Calixtus II. in 1122, translated into French in 1206, printed in 1566 in Frankfort, and lately edited by Ciampi (Florence, 1822) and Reiffenberg (Brussels, 1836). The first part of the book was evidently written simply in order to encourage pilgrimages to St. Jago di Compostella, and the rest bears the character of a romance written principally for the purpose of entertainment. Many interior features indicate that the work was produced in the twelfth century, perhaps by Pope Calixtus II. himself. (See Ciampi, *De Vita Caroli Magni et Rolandi Historia, J. Turpino vulgo tributo* (Florence, 1822), and Gascon Paris, *De Pseudo Turpino* (Paris, 1865).)

Turquoise. See Precious Stones, by Prof. H. B. Cornwall, E. M.

Turrecremata. See Torquemada.

Turretin', or **Turretini** (François), b. at Geneva Oct. 17, 1623; studied theology in his native city, in Holland, and in France under Spanheim, Morus, and Diodati; was appointed pastor at Geneva in 1647; removed to Leyden in 1650; returned to Geneva as professor of theology in 1653. Died there Sept. 28, 1687. His principal work is *Institutio Theologiæ Elencticæ* (1679–85). His complete works were published in 4 vols., 1688.—His son, Jean Alphonse Turretin, b. at Geneva Aug. 13, 1671; studied theology; visited Holland, England, and France, and was appointed professor of ecclesiastical history in 1697 at Geneva, where he d. May 1, 1737. His complete works were published in 5 vols. in 1775, and contain *Pyrrhonismus Pontificius*, against Bossuet's *Histoire des Variations*, *Historia Ecclesiasticæ Compendium ad annum 1700*, etc.

Turret-Ships. See Ships, Iron-Clad, by Isaac Newton.

Turtle. See Chelonia.

Tur'tle, or **Turtle-Dove,** a name applied to several small pigeons, especially those of the genus *Turtur*. The *T. auritus*, or common European turtle, is a migratory bird, famed for its gentleness, its strong conjugal affection, and its loud but soft cooing note. The turtle or mourning dove of the U. S. is the *Zenaidura carolinensis*, whose gentle and mournful note is well known. It is thirteen inches in total length, and has a remarkably long tail. Pigeons of the genus *Ænu* are also reckoned as turtles. There are perhaps twenty different species of turtle-dove. That mentioned in the Bible is doubtless *Turtur risorius*, an abundant Eastern species often kept in cages.

Turtle, tp., Rock co., Wis. P. 1274.

Turtle Creek, tp., Shelby co., O. P. 1230.

Turtle Creek, tp., Warren co., O. P. 5560.

Turtle Creek, p.-v., Allegheny co., Pa., on Pennsylvania R. R., 3 miles E. of Pittsburg.

Tuscaloo'sa, county of W. Alabama, intersected by Gipsey and Black Warrior rivers, and traversed by Alabama and Chattanooga R. R.; surface hilly, soil fertile, with iron ore, bituminous coal, and carboniferous limestone. There are manufactories of cotton goods, stone and earthen ware, and iron castings, flour-mills, tanneries, and carrying establishments. Staples, cotton, Indian corn, and sweet potatoes. Cap. Tuscaloosa. Area, 1450 sq. m. P. 20,081.

Tuscaloosa, city and tp., cap. of Tuscaloosa co., Ala., at the head of navigation on Warrior River, and upon Alabama and Chattanooga R. R., contains churches representing five denominations, Alabama University, Tuscaloosa Female College, Alabama Central Female College, Ursuline convent, parish and 2 colored schools, 2 banks, 2 newspapers, the State insane asylum, 1 cotton and woollen factory located in the suburbs, 1 foundry, a tannery, and 1 shoe manufactory. P. of city, 1689; of tp. 3340. John F. Warren, Ed. "Times."

Tuscan Order of Architecture is generally regarded as a Roman simplification of the Doric style, having unfluted columns and no triglyphs. It seems, however, to have been Etruscan rather than Roman, and remains at Axia and other points seem to show that it was a rude attempt at the Doric style. The temple of Jupiter in the Capitol at Rome was of the Tuscan order. The general effect is low and heavy.

Tus'cany, formerly an independent grand duchy of Italy, was between the duchies of Parma and Modena, the Papal States, and the Tyrrhenian Sea, and comprised an area of 8586 sq. m., with 1,801,875 inhabitants. Its territory corresponded nearly to that of the ancient Etruria, and after the fall of the Roman empire it formed at first part of the kingdom of the Goths, then of the kingdom of the Longobards, and then of the empire of Charlemagne. He gave it a somewhat more independent position, erecting it into a marquisate, and giving it away as a military fief. Guelph VI. sold his fief in 1160 to the German emperor Frederick I.; but as the connection with the German empire was somewhat loose from the very beginning, Tuscany was soon broken up into a number of independent republics, of which Florence, Pisa, and Sienna were the most important. Florence conquered Pisa and the greatest part of the Tuscan territory, but was conquered itself in 1532 by Charles V., who appointed Alessandro de' Medici duke of Florence. In 1569, Cosmo I. united the whole of Tuscany into a grand duchy, and from that time and to 1737, when it became extinct, the Medici family ruled the country and made it one of the most prosperous and civilized in Europe. In 1737 it fell to Francis, duke of Lorraine, who had married Maria Theresa and became emperor of Germany, and with exception of a few years, during which Napoleon first made it a part of the kingdom of Etruria, and then annexed it to France, it was ruled by the house of Lorraine until Aug. 20, 1859, when by an almost unanimous vote of the people it annexed itself to the kingdom of Sardinia.

Tuscara'was, county of E. Ohio, intersected by Tuscarawas River, traversed by Ohio Canal and by the Pittsburg Cincinnati and St. Louis and the Tuscarawas branch of Cleveland and Pittsburg R. Rs.; surface undulating, soil fertile, with an abundance of iron ore and bituminous coal. There are manufactures of woollen goods, clothing, agricultural implements, carriages, saddlery, pig-iron, and iron castings, flour-mills, saw-mills, planing-mills, tanning and carrying establishments, and breweries. Horses, cattle, swine, and especially sheep, are numerous. Staples, wheat, Indian corn, oats, potatoes, lumber, leather, wool, and dairy products. Cap. New Philadelphia. Area, 520 sq. m. P. 33,840.

Tuscarawas, tp., Coshocton co., O. P. 2725.

Tuscarawas, tp., Stark co., O. P. 2412.

Tuscaro'ra, tp., Steuben co., N. Y. P. 1528.

Tuscarora, tp., Bradford co., Pa. P. 1224.

Tuscarora, tp., Juniata co., Pa. P. 1492.

Tuscarora, tp., Perry co., Pa. P. 899.

Tuscaroras, one of the "Six Nations" of New York Indians, resided originally in the valleys of Tar and Neuse rivers in North Carolina. With the Pamlicoes they made war (1711–13) on the whites, were severely defeated, fled northward, and were formally received by their kindred, the Hodénosaune, or Five Nations, thenceforth called the Six Nations. At present there are 448 Tuscaroras reported as living on the Tuscarora reservation, which is in the town of Lewiston, Niagara co., N. Y. They own 6249 acres in common, which they purchased with moneys paid them by the U. S. for land in North Carolina claimed by them.

Tuscia. See Etruria.

Tusco'la, county of the E. peninsula of Michigan, lying upon Saginaw Bay, intersected by Cass River and traversed by Detroit and Bay City R. R.; surface level, soil well timbered and fertile. There are saw-mills, flour-mills, woollen-mills, and tanneries. Staples, wheat, oats, potatoes, wool, lumber, and dairy products. Caps. Caro and Vassar. Area, about 850 sq. m. P. 13,714.

Tuscola, p.-v. and tp., cap. of Douglas co., Ill., on Chicago branch of Illinois Central R. R., has a national bank and 2 weekly newspapers. P. 2863.

Tuscola, tp., Tuscola co., Mich. P. 1110.

Tusculum. See Frascati.

Tusculum, tp., Dickinson co., Ia. P. 430.

Tuscum'bia, p.-v., cap. of Colbert co., Ala., on Memphis and Charleston R. R., 150 miles E. of Memphis, Tenn., has 8 churches (3 colored), 1 female institute, a male academy and 2 mixed schools, 2 newspapers, 2 flouring mills, 1 hotel, and a good water-supply. Principal business, cotton-handling. P. 1214. Jos. Shackelford, Pub. "North Alabamian and Times."

Tuscumbia, p.-v., cap. of Miller co., Mo., on Osage River, 35 miles S. W. of Jefferson City, has a brick schoolhouse, 1 newspaper, wagon and blacksmith shops, a courthouse, steam grist and saw mill, a stone jail, and 1 hotel. P. about 300. R. GOODRICH, ED. "MILLER COUNTY VIDETTE."

Tuske'gee, p.-v. and tp., cap. of Macon co., Ala., 5¼ miles from Western R. R., with which it is connected by a branch road, contains a flourishing female college and 4 excellent male schools, 3 churches, broad and level streets, an orphans' home of the synod of Alabama, and 3 newspapers. The soil is very rich and fertile, and a mild and salubrious climate makes it an attractive winter resort for tourists. P. 4392. D. W. MCIVER, ED. "WEEKLY NEWS."

Tusket, p.-v., Yarmouth co., N. S., on Tusket River, 10 miles E. of Yarmouth. Shipbuilding is the leading interest. P. about 450.

Tusquittee, p.-v. and tp., Clay co., N. C. P. 341.

Tus'ser (THOMAS), b. at Rivenhall, Essex, England, about 1515; was singing boy at Wallingford and at St. Paul's cathedral; educated at Eton and at Cambridge; was employed at court under the patronage of Lord Paget: was afterward a schoolmaster, a farmer in Suffolk, and a chorister in Norwich cathedral, and, according to Fuller, never throve in any vocation. D. in London about Apr., 1580. Author of *Five Hundred Points of Good Husbandry, united to as many of Good Housewifery, etc.* (1573), in verse, with a metrical autobiography. Many editions have since appeared, the best being in the series of "Arber's Reprints" (1870).

Tus'ten, tp., Sullivan co., N. Y. P. 1028.

Tut'tle (CHARLES WESLEY), b. at Newfield, Me., Nov. 1, 1829; was assistant observer at the Cambridge Observatory 1850–51; discovered a telescopic comet 1853; was a member of the U. S. expedition to determine the difference of longitude between Greenwich and Cambridge 1854–55; studied law at the Cambridge law school, and was admitted to the Suffolk bar 1856; has contributed professional memoirs to the *Astronomical Journal* and to the *Annals of Harvard Observatory*, and historical articles to the *Genealogical Register*, and is author of a *Life of Capt. John Mason*, the founder of New Hampshire.

Tuttle (DANIEL SYLVESTER), D. D., b. at Windham, Greene co., N. Y., Jan. 26, 1837; graduated at Columbia College in 1857; studied theology in the General Theological Seminary in New York; entered holy orders, and in 1866 was elected bishop of Montana, having jurisdiction in Idaho and Utah; was consecrated in 1867. His residence is at Salt Lake City.

Tut'lingen, town of Germany, kingdom of Würtemberg, on the Danube, has several wool-spinning factories, tanneries, and manufactures of cloth, knives, nails, hosiery, and paper. P. 6397.

Tutuila, one of the Samoan or Navigators' Islands, rises from 1200 to 2000 feet above the surface of the sea, is covered with luxuriant vegetation, and affords several excellent harbors, of which that of Pango-Pango, on the southern side, is the best. By an arrangement between the native chiefs and Com. Meade this harbor was offered to the U. S. as a coaling-station in 1872, and in the following year a special agent was sent by the American government to negotiate the extension of the protectorate over all the islands; but in 1875 a native king was elected, and the special American agent was made prime minister.

Tux'pan, town of Mexico, state of Vera Cruz, on the river Tuxpan, 5 miles from its mouth in the Mexican Gulf, carries on an important trade in cedar logs. P. 5000.

Tuxt'la, town of Mexico, state of Chiapas, carries on a lively trade in cacao and tobacco, and has about 5000 inhabitants.

Tver, or **Twer,** government of European Russia, bounded S. by the government of Moscow, comprises an area of 26,031 sq. m., with 1,521,577 inhabitants. The ground is elevated, but the surface level, covered with forests, and dotted with small lakes; the Volga and several of its affluents rise here. The climate is somewhat severe, and the soil is not very fertile. Rye and oats are produced, sufficient for home consumption; flax and hemp are cultivated. Cattle are neither numerous nor good, but the fisheries are remunerative. Numerous kinds of industry are pursued, but all on a small scale.

Tver, or **Twer,** town of Russia, government of Tver, at the confluence of the Tvertsa and Volga, which latter here becomes navigable for steamers. The town contains an imperial palace, a cathedral, a college, various schools, and barracks, and, situated as it is on the highway from Moscow to St. Petersburg, its trade is considerable. Nails and cotton goods are extensively manufactured. There are several chalybeate springs in the vicinity. P. 29,896.

Tweed, river of Scotland, rises at an elevation of 1500 feet above the sea, flows eastward, and enters the North Sea after a course of 96 miles.

Tweed (WILLIAM MARCY), b. in New York City Apr. 3, 1823, of Scotch descent, and the son of a poor chairmaker; was put at work in his father's shop at an early age, where he remained with little schooling till he was twenty years old; when twenty-eight years old, went into partnership with his brother in the chairmaking business; in 1850 was elected alderman from the Seventh ward, serving two years; in 1853 was elected to Congress; was school commissioner of the Seventh ward 1857–59; in November of the same year he became a member of the board of supervisors of New York co., and was four times elected its president; in 1863 became deputy street commissioner; in 1867 was elected State senator; was re-elected in 1869 and in 1871, but did not take his seat for the latter term; was for many years a member of the Tammany Society, of which he was chosen grand sachem in 1869, holding the office till 1871. His appointment as deputy street commissioner in 1863 may be said to date the foundation of the famous Tammany Ring, of which he was the chief spirit; he became at once the virtual head of the department of streets, afterward the department of public works, and by extending enormously the expenditures for public improvements acquired vast political influence and began to accumulate a fortune; his position as president of the board of supervisors enabled him to increase the city's pay-roll to unprecedented dimensions, giving sinecure positions to an army of political friends. The Ring gradually grew in power and influence till 1868, and at the opening of 1869 found itself master of nearly every department of the State government; Tweed's positions as president of the board of supervisors, head of the department of public works, State senator, and grand sachem of Tammany gave him unsurpassed political influence; every officer in the State, from the judge on the bench of the court of appeals down to the smallest official in New York City, was more or less under his sway and tainted by his corrupting touch; he openly boasted that he was worth $20,000,000. In 1868 the Ring's greatest scheme of robbery, the building of a new county courthouse, was planned; the work was begun under the stipulation that the cost should not exceed $250,000: before 1871 over $8,000,000 was pretended to have been expended on it, and it was still unfinished; it is incomplete at the present time; all of the contractors were forced to pay a commission of from 15 to 65 per cent. to the Ring, and to do this increased their bills accordingly; these bills were passed by the board of supervisors at Tweed's command, and were audited by Auditor Watson, Tweed's tool; in 1870 a new charter was passed by the legislature taking away the power of auditing from the board of supervisors and placing it in a board of audit composed of the mayor, the controller, the commissioner of parks, and the commissioner of public works—Hall, Connolly, Sweeney, and Tweed. Schemes of plunder were now organized on a grand scale. Several contractors for work on the new court-house were directed to make out claims against the county for all manner of imaginary services; these fraudulent bills, amounting to $6,000,000, were passed by the board of audit at its first and only meeting; of this amount, over $1,000,000 were traced to Tweed's private pocket. Instead of meeting again, the board illegally delegated the power of auditing to Auditor Watson, and signed the bills separately, without meeting as a board. Of the whole amount of money paid in this way, the Ring received 65 per cent.; Tweed's share was usually 25 per cent. A secret account of the money thus paid was kept in the auditor's office under the title "County Liabilities." During the winter of 1870–71 a clerk employed in the auditor's office copied by stealth the items in this account and gave them to his patron, James O'Brien, an opponent of the Tammany Society. O'Brien subsequently gave the figures to the New York *Times*, and that journal published them in July, 1871. The excitement created thereby started a popular uprising which resulted in the complete overthrow of the Ring in the elections of Nov., 1871. On Feb. 10, 1872, Tweed was indicted by the grand jury for forgery and grand larceny, and his trial began on Jan. 6, and ended Jan. 31 in a disagreement of the jury; a second trial was begun on Nov. 5, 1873, and ended Nov. 19 in a verdict of guilty on every one of the fifty-one counts in the indictment; he was sentenced on Nov. 22 to twelve years' imprisonment in the penitentiary and to pay a fine of $12,300.18, one year for each of twelve counts in the indictment, and a fine of $250 each for thirty-nine other counts; he remained in the penitentiary on Blackwell's Island till June 16, 1875, when he was released by a decision of the court of appeals, on the ground that the power of the court which sentenced him was exhausted when one sentence was pronounced on one count of the indictment,

and that the cumulative sentence was void. A new warrant was immediately issued against him on an old indictment of 1872, and when he was taken from the penitentiary on June 22 he went at once to court and gave bail to the amount of $18,000 on the criminal indictments, and went to Ludlow street jail in default of the $3,000,000 bail demanded in the civil suit which had been begun in the supreme court in Apr., 1875, for the recovery of $6,198,957.85, the amounts charged in the account called "County Liabilities." On Dec. 1, 1875, Tweed, while out riding with the sheriff, was allowed to visit his wife at her house in Madison avenue, and while there escaped from his custodians and fled to Spain, where he was captured and returned to the city Nov., 1876. On Jan. 13, 1876, proceedings were begun against him in the civil suit; a struck jury was obtained on Feb. 8, and on Mar. 8 the trial ended in a verdict for the damages amounting to $6,537,117.38, of which $4,719,940.35 was for principal and $1,817,117.03 was for interest. Tweed was married in 1844, and had eight children. D. in Ludlow Street Jail, N. Y., Apr. 12, 1878. J. B. Bishop.

Tweed'dale (George Hay), Marquis of, b. Feb. 1, 1787; succeeded his father, the eighth marquis, in the peerage in 1804. During the Peninsular war he served as assistant quartermaster-general on the staff of the duke of Wellington, and was wounded at Vittoria and at Busaco. He also served in the war of 1812–15 between Great Britain and America, when again wounded. Was governor and commander-in-chief of Madras 1842–46. In 1875 he was made a field-marshal in the British army, and was colonel of the 2d Life Guards. In 1867 he was made a knight grand cross of the order of the Bath. The duchess of Wellington and Lady Peel are his daughters. D. Oct. 10, 1876.

Tweeds, a loosely-spun and woven woollen cloth, made principally in Scotland and chiefly used for men's wear. It is not much fulled in the mill, and as a rule contains no shoddy. Cheviot and nearly all other grades of short and middle stapled wools are used in the manufacture. The dyeing is applied to the yarn.

Twelfth, a stop in the organ tuned a twelfth (or an octave and fifth) above the diapasons.

Twelfth Day and **Twelfth Night.** See Epiphany.

Twelve Mile, tp., Madison co., Mo. P. 869.

Twelve Tables, Law of. See Law, The Civil, by Prof. J. N. Pomeroy, LL.D.

Twes'ten (August Detlev Christian), D. D., b. in Glückstadt Apr. 11, 1789; studied at Kiel and Berlin; professor of philosophy and theology at Kiel from 1814; called to Berlin in 1835 to fill the theological chair of the great Schleiermacher, which position he occupied till his death, Jan. 8, 1876, retaining his vigor and faithfully attending to his academic duties to the last. The students called him "the disciple that dieth not." He was also member of the Oberkirchenrath of the Evangelical Church of Prussia from 1850 till 1874. He was a pupil and admirer of Schleiermacher, but more positive and orthodox; as a teacher and writer he was remarkably clear and accurate. He wrote *Lectures on Christian Dogmatics* (vol. i. 1826; vol. ii. 1837, unfinished), *Logik* (1825), *Matthias Flacius* (1844), and an introduction to Schleiermacher's *Ethik*, which he edited (1841). Philip Schaff.

Twesten (Karl), son of August D. C., b. at Kiel Apr. 22, 1820; studied jurisprudence at Berlin and Heidelberg; made a career in the civil service of the Prussian government; became noted in politics as founder of the national liberal party. D. at Berlin Oct. 14, 1870. He wrote *Schiller in seinem Verhältnisse zur Wissenschaft* (1863), *Machiavelli* (1868), and *Die religiösen, politischen und socialen Ideen der asiatischen Culturvölker und der Aegypter in ihrer historischen Entwickelung*, published after his death (1873).

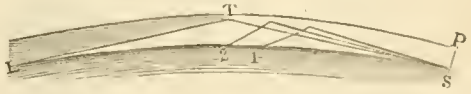
Twick'enham, town of England, county of Middlesex, on the Thames, opposite Richmond, has powder and oil mills, and contains many fine villas and summer residences. It was the residence of Pope. P. 10,533.

Twiggs, county of Central Georgia, bounded W. by Ocmulgee River, and crossed by Georgia Central and Macon and Brunswick R. Rs.; surface somewhat hilly, soil generally fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Jeffersonville. Area, about 400 sq. m. P. 8545.

Twiggs (David Emanuel), b. in Richmond co., Ga., 1790; was appointed captain in the 8th Infantry in 1812, major 28th Infantry Sept. 21, 1814, and served throughout the war with Great Britain; was retained in the peace organization of the army in 1815 as captain 7th Infantry, 1st Infantry 1822, major May 14, 1825, lieutenant-colonel 4th Infantry 1831, colonel 2d Dragoons June, 1836. In the war with Mexico he served in command of the right wing of the army under Gen. Taylor at Palo Alto and Resaca de la Palma; was promoted to brigadier-general June 30, 1846; was brevetted major general for gallantry at Monterey, and Congress presented him with a sword. Transferred to Gen. Scott's army, he commanded a brigade before Vera Cruz, and during subsequent operations resulting in the capture of the City of Mexico was in command of the 2d division of regulars; military governor of Vera Cruz 1848. In Feb., 1861, being in command of the department of Texas, he surrendered his army to Gen. McCulloch of the Confederate service, together with all the government stores, munitions, and material to the value of $1,500,000, for which he was dismissed from the service of the U. S. Mar. 1; he was soon after appointed a major-general in the Confederate army, and commanded for a while at New Orleans. Retiring to his estate upon the Mississippi, he removed thence to Georgia upon the approach of the U. S. forces. D. at Augusta, Ga., Sept. 15, 1862.

Twi'light [Sax. *tweolcoht*; Ger. *Zwielicht*], the light which by its increasing brightness foretokens the rising of the sun in the morning, and which lingers after sunset, becoming fainter and fainter until it disappears as veritable night comes on. The morning twilight in the Latin is distinguished by the term *aurora*, while the evening twilight is called *crepusculum*—terms which, with the usual modification, are retained in the French. But the cause is in both cases the same, and the explanation is perfect which refers twilight to the reflection and refraction of the sun's light by that portion of the atmosphere which is still illuminated by the sun's rays after he has set to us, or a similar portion on which he shines before he rises to us in the morning. Thus, let S T P (in Fig. 1) represent the upper portion of a nearly lenticular section of the atmosphere which is illuminated by the sun's rays in the evening after he has set to an observer at 1 or 2, etc., or L. Then the direction of the rays from S toward T will be somewhat bent from the perpendicular S T as the light passes from the low and dense to the upper and rarer portions of the atmosphere. This light is moreover reflected wherever notable variety of density is found among the various atmospheric strata. And thus (bent a little downward by refraction) the reflected light reaches the observers stationed respectively at 1, 2, etc., until at last it is only the light from the *mere edge* of the lenticular illuminated portion S P T, and that in the high region at T, that reaches the observer at L. Vapor in solution or partially condensed may sometimes aid the reflection of the light. All this will require that twilight immediately after sunset should be comparatively very bright and broadly extensive along the horizon, as the light then, on the hypothesis here dis-

Fig. 1.



cussed, will come from the *broad* and *dense* part of the lenticular segment S T P. Afterward the twilight ought rapidly to *fade* and appear *narrower*, until at length a mere faint line of light be left visible along the horizon. Before sunrise the same varieties must occur, but in inverse order. All this is precisely consonant with fact. The explanation, therefore, as heretofore intimated, is perfect.

The theoretical explanation of twilight is then consistent in its circumstances with fact: one of these circumstances should, however, be more completely exhibited. As, on the one side, the angle of incidence with the plumb-line extended to T is equal to the angle of reflection on the other side, and the reflected ray from these proceeding downward through the atmosphere becomes thus the inversion of the incident ray in its whole course upward, the symmetry thus introduced will require that the reflected ray when it reaches the surface at L should be a *tangent* to the surface there, and so at right angles to the plumb-line there, the earth being supposed to be a perfect sphere—a supposition quite sufficiently near to accuracy for our purpose. All this, moreover, will indicate that we shall have two equal right-angled triangles extending to the centre of the earth, with their right angles at S and L respectively. And so the plumb-line extended from the centre to T will bisect the arc S L.

Limit of Twilight.—This is usually stated at 18°, twilight beginning in the morning and ending in the evening when the sun is 18° below the horizon. In tropical regions the limit is less than this, and in the latitude of mid-Europe has sometimes been found to be greater. The limit, of course, varies withal in consequence of the clearness of the atmosphere or otherwise. Now, when the sun (as we ordinarily say) is *sunk* below the horizon as at L to the twilight limit, then the horizon at L cuts the celestial

sphere *above* the sun to the same extent; that is, above the horizon at S which passes through the sun. This being so, when S is rolled back as far as L after sunset at any place where the whole twilight occurs, or the reverse is true at sunrise, the plumb-line kept at right angles to the horizon will be rolled back just as far as the horizon at L is raised above the sun; that is, the plumb-line through L will be as far *behind* the plumb-line through S as the extent of the limit of twilight. So that if the limit of twilight be admitted to be (in the mean) 18°, that also will mark the extent of the arc S L. The *zone* of twilight will thus extend 18° behind the *terminator* which marks the limit on the earth of sunrise or of sunset. And so the secant from the centre of the earth to T—which, as already shown, bisects the arc S L—will itself be the trigonometric secant of 9°. Hence, if the length of that secant be computed, the radius of the earth being the trigonometric radius, we shall have the distance of H from the centre, and, by subtracting the radius of the earth from that, obtain approximately the height of the atmosphere at H. This would give a result of 49.3 miles. In this computation, however, we have neglected the curvature of the incident and of the reflected ray due to refraction. This, the refraction being away from the perpendicular at S, will depress the limit T. The height is therefore stated to be 45 miles. It must not, however, be concluded that no atmosphere exists in a region higher than T. Indeed, only a small portion of the faint light reflected from T can reach the eye at L, by far the greater part being obstructed by the long extent of increasingly dense atmosphere from T to L. From regions higher than T little light, if any, comes which is sufficiently bright to have any part of it visible through all the intervening atmosphere to the observer below.

Various meteoric phenomena seem to indicate the presence of very rare outer portions of the atmosphere far beyond 45 miles. "A secondary twilight may be traced even beyond the point L, consequent on a re-reflection of rays dispersed through the atmosphere in the primary one. The phenomenon seen in the clear atmosphere of the Nubian desert, described by travellers as the 'After-glow,' would seem to arise from this cause." (Sir J. Herschel, *Outlines of Astronomy* (45).) A *lunar* twilight is visible when the moon is about 6° below the horizon.

Variety in the Duration of Twilight.—Twilight is short in tropical regions, and the duration of twilight increases with the latitude. At the time of the equinox the central ray from the sun falls vertically in the direction S E (Fig. 2) upon the equator at E, and direct sunlight extends from the pole P to the pole P′. All places under the meridian P E P′, then, have noon, and to all under the opposite meridian P *m* P′ it is midnight. At the same time (as heretofore shown) the zone of twilight extends 18° behind the terminator P *b* P′, which is the limit of the region of direct sunlight. In the orthographic projection in the figure E *m* the half of the equator and its parallels L *l* and L′ T′ are all seen edgewise, and appear as straight lines, and the breadths of the twilight zone perpendicular to P P′ are severally sines of 18°, and the plane of rotation, such as L B *l* or L′ B′ T′, is all but coincident with the plane passing through the sun; so that by the rotation of the earth a nearly equal perpendicular breadth is to be traversed from *b* to *t* on the equator, B to T on the parallel L *l*, and not very much more from B′ to T′ on the parallel L′ T′; all on *crossing the twilight zone*. For although the arcs here in question are those that would determine *sidereal* time, the proportions of *solar* time (see TIME) would be the same.

Fig. 2.

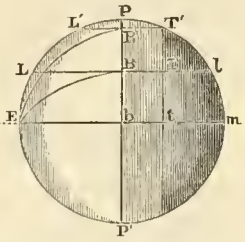
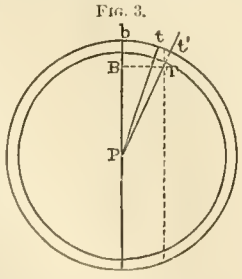
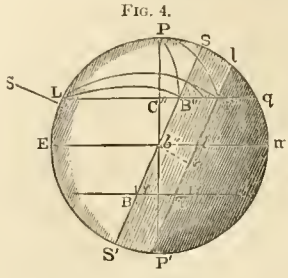


Fig. 3.



In order to discern how the *duration* of twilight will be affected on the several parallels in question, let the plane of projection be changed to one perpendicular to P P″, so that the pole P will be in the middle of the figures, as in Fig. 3. Then, while, as in Fig. 2, the width of the twilight zone *b t* in the plane of the equator is equal to the width B T in the region of the parallel L B *l* of Fig. 2, yet that same width on the *smaller* circle includes a *larger* arc of the whole circumference than the portion represented by *b t* on the equator. To represent the portion due to B T on the circumference of the larger circle, we produce P T to *t′*, and then (on the same scale) *b t′* will represent the arc of rotation passed over *in crossing the zone of twilight* on the parallel L B *l* of Fig. 2, while the part *b t* will represent the arc of rotation in passing over the same zone on the equator. And so far the *relative arc* (and so the *relative time of rotation* across the twilight zone) on the parallel will be to the arc (and consequent time on the equator) in the ratio of *b t′* to *b t*; the fact being that in order to pass over the same breadth of zone, moving in a *smaller* circuit, a *larger* portion of the whole circuit must be traversed. In addition to this, the plane of rotation of the parallel not being strictly the plane passing through the sun (as may be seen in Fig. 2), the motion in the parallel is not as directly *to* or *from* the sun as might be, and so the twilight for that reason also is *longer* on the parallel. The parallel L′ B′ T′ in Fig. 2 being itself but 18° from the pole (*i.e.* in latitude 72°), the position T′ is not reached until *midnight*, T′ being just in the farther edge of the zone of twilight, in the meridian P T′ P′ of midnight; so that even at the equinox twilight in latitude 72° lasts all night.*

Fig. 4.



In so far as the condition represented in Fig. 3 is concerned, we shall have—

$$\frac{\textit{perpendicular}\ \text{B T or } b\ t}{\text{P T}} = \textit{sin}\ \text{of B P T or of } \textit{arc}\ b\ t';$$

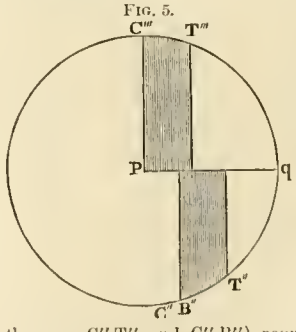
$$\text{also, } \frac{b\ t}{\text{P}\ t} = \textit{sin}\ \text{of } \textit{arc}\ b\ t;$$

$$\text{hence } \frac{\text{P}\ t}{\text{P T}} = \frac{\textit{sin}\ b\ t'}{\textit{sin}\ b\ t};$$

or the sines of the arcs of rotation are inversely as the radii.

At the time of the summer solstice the terminator of direct sunlight extends more than 23° beyond the enlightened pole, as is represented in Fig. 4, and the zone of twilight 18° behind that, the other quantities being represented as in Fig. 2. And as the inclination of the plane of the terminator *s b″ s′* has here arrived at its maximum, the motion of rotation in either the equator or its parallel here is the most oblique to the direction of the perpendicular great circle passing through the sun. In the instance of the equator the motion of rotation is in *b″ t′* instead of in *b″ r*, as was true at the equinox. The time of passing over the twilight zone (the duration of twilight) is therefore increased in both instances by that circumstance. And then on the parallel, such as L *q*, the rotation across the twilight zone does not begin (or end) in the great circle P *b″* P, as is true at *b″* on the equator, but *further back*—viz. at B″ instead of C″. Now, that again increases the arc to be traversed on the parallel. For, looking down (as in Fig. 5) in the direction from the pole P, if the extent across the twilight zone begin (or end) as it does at B″, behind P C″, instead of C‴, in the line C‴ C″, the same width of zone will correspond to extent of arc B″ T″ *greater* than C‴ T‴, precisely because that width of B″ T″ *is* farther back than C″ C‴; on the principle that such a difference (involving that of the *sines* of the arcs C‴ T″ and C″ B″) requires a *greater* difference of arcs than that extending from C‴ to T‴. Indeed, the same width of zone counted still higher up would almost extend from T″ to *q* in the diagram.

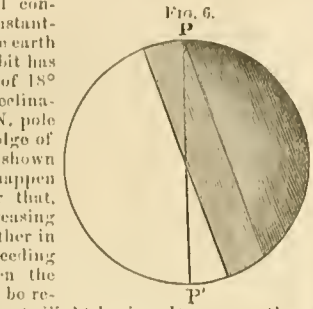
Fig. 5.



These circumstances make the twilight on both the parallel circles in question (the equator and the other) at this date the *maximum of the year*. In the opposite hemisphere, in which it is midwinter (the solstice being the winter solstice), the obliquity of rotation across the twilight band in an equal latitude is as great as the other instance; but B‴ T‴ is *not* thrown behind the terminator *s s′ in the same way*. Hence, although *another maximum* occurs under these

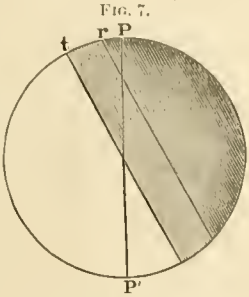
circumstances, the whole arc in question is shorter, after all, and the duration of the twilight at this maximum *not so* great. P *n* in Fig. 4 being at the time of the summer solstice 23° 27′ and *n l* the width of the twilight zone extending 18° farther, the whole polar distance P *l* = 23° 27′ + 18° = 41° 27′ for the co-latitude of *l*; *i. e.* of the limit beyond P to which twilight extends *at midnight* at the time of the summer solstice (on the longest day). The co latitude of *q* being 41° 27′, its latitude = 48° 33′, the latitude of the limit of twilight all night on the longest day. The morning and evening twilights are there combined (but very faint at midnight), from sunset (about 2*m.* before 8 o'clock P. M.) to sunrise (about 2*m.* after 4 o'clock next morning). The (maximum) duration of either the morning or the evening twilight will thus be 1*h.* 2*m.* At the pole itself twilight begins (refraction even aiding to prolong veritable sunlight) almost immediately after the equinox of Sept. 22, which is about to introduce the polar night. And this twilight at the pole will continue, but becoming constantly more feeble, until the earth by its motion in its orbit has acquired a declination of 18° N., and the sun is in declination 18° S., when the N. pole will be in the outer edge of the twilight zone, as shown in Fig. 6. This will happen about Nov. 13. After that, the pole, with the increasing declination, will be farther in the dark until the succeeding 28th of January, when the position in Fig. 6 will be regained, and the morning twilight begin. It appears, then, that the time of absolute night occupies about two and a half months of the six months' period during which the pole receives no direct rays of the sun.

Fig. 6.



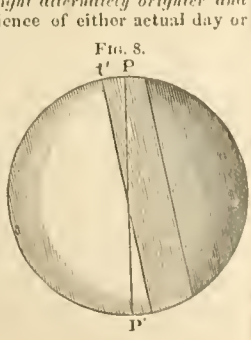
In the extreme case of the winter solstice, the middle of the polar night, the pole is 23° 27′ behind the terminator (behind *t*, Fig. 7), while the breadth of the twilight zone, extending from *t* to *r*, is but 18°. Within the very small circle at the distance of *v* P from the pole is, therefore, the region which has not even twilight at the time of our shortest day, and even that contracted region is diminished immediately thereafter. As 23° 27′ − 18° = 5° 27′, the circumference through *p* is but 5° 27′ from the pole, and is therefore in the very high latitude of 84° 33′.

Fig. 7.



Another and a very peculiar state of things is that which exists (to its largest extent) when the declination of the earth or the sun (such as is here in question) is 9°, and so the pole, as in Fig. 8, is 9° behind the terminator, and is thus in the middle of the twilight belt, and some twilight will exist all around within 9° of the pole. P *t′* (in the figure) being thus 9°, the latitude of *t′* will be 81°, and the time when the limit is thus far extensive around the N. pole is about the 16th of October, with a renewal of the same state of things about the 25th of the succeeding February. All places within this small circle 9° from the pole rotate within *a region of twilight alternately brighter and more faint*, but with no experience of either actual day or actual night. The limit in the case stated is the most extensive possible; for when the pole is not exactly in the middle of the twilight zone, the limit of the circle in question will be contracted toward the one side or toward the other. Hence, the state of things in question will not continue as low down as lat. 81° for any length of time together. In lat. 85° this brightening and diminishing twilight during all the twenty-four hours will show itself for about 22 days.

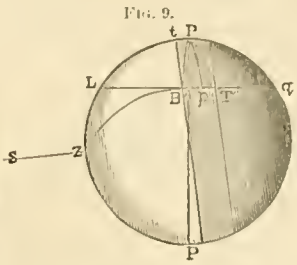
Fig. 8.



The very peculiar state of things here described was (it would seem) first noticed by the author of this article in a communication to the American Philosophical Society, and is recorded in their *Proceedings*.

To determine the Duration and the Time of Shortest Twilight in a given Latitude.—This problem is said to have, in some way or other, employed the two celebrated mathematicians John and James Bernoulli for five years. The solutions given of it are indirect. The following is one of those given by M. Delambre, with the exception that here the *true* motion of rotation is made use of instead of the *apparent*. As represented in Fig. 4, the evening twilight begins on the parallel L *q* at B″, and it lasts until B″ has rotated to the position T″. The sidereal time of this rotation will be expressed by "changing the measure of the angle B″ P T″ into time" at the rate of 15° to an hour; and a like rule will apply to solar time *i. e.* to the time of duration of the twilight in question. Hence, when *the angle* B P T″ *is as small as possible* the twilight will be as short as possible; and this is condition (1). Then let B″ and T″ be united by an arc of a great circle. Then in the spherical triangle B″ P T″ the two sides P B″ and P T″ will under all circumstances be constant, they being in the one position, and the other always the co latitude of the place in question. With these constant, then when [condition (1)] the B″ P T″ is as small as possible, the base B″ T″ will be as short as possible; which is condition (2). But in the spherical triangle, such as B″ Z T″, Z B″ is always = to 90°, as Z T″ is always = 90° + 18° = 108°. With these two sides constant, then when the base B″ T″ [condition (2)] is the shortest possible, the angle B″ Z T″ will be the smallest possible. But that angle cannot be less than nothing: so when the base B″ T″ is the shortest possible, the angle B Z T″ will be reduced to *zero*; and then the planes of the great circles Z B″ and Z T″ will coincide, and an arc of the same great circle pass through Z B″ T″; and this is condition (3). So that when, in accordance with condition (1), the angle B″ P T″ is the least possible, that will involve condition (2), that the base B″ T″ shall be the shortest possible; and that, again, condition (3), that Z B″ and T″ shall lie in the arc of the same great circle is what the *shortest twilight requires*; bringing with that also conditions (2) and (3). The shortest twilight, then, will be found when the planes of the circles Z B″ and Z T″ coincide, and Z B″ and T″ are thus all in the arc of the same great circle. This state of things is represented in Fig. 9, Z being the place at which the sun is vertical, and *t′* in the terminator. Then as Z″ B″ T″ are now all in the same great circle, the whole arc Z B″ T = 108°, the part Z B″ = 90°, and the part B″ T″ = 18°. Then, P B″ and P T″ being both the co-latitude of the place of observation, P B″ T″ is an isosceles triangle, and the perpendicular P *p*, therefore, will bisect the base B″ T″ at right angles. B″ *p* and *p* T″ will then each be equal to 9°.

Fig. 9.



So in the right-angled triangle P T″ *p* we shall have the two sides P T″ (the co-latitude) and T″ *p*, which = 9°, to solve the triangle P T″ *p*. Then in the right-angled triangle P Z *p*, Z *p* = Z B″ + B″ *p* = 90° + 9° = 99°, and the value of P *p* is known by the previous solution. Hence we can find P Z, the distance from the pole to Z where the sun is vertical, or, on the larger scale in the heavens, the polar distance of the sun itself. The solution will show that for any such place in the northern hemisphere the sun's polar distance at the time of the shortest twilight will be greater than 90°, and his declination be S. by the excess. Then, by consulting an ephemeris, we can ascertain at what time of the year the sun has the resulting declination. Here, in accordance with what has already appeared in the previous discussion of twilight in this article, it appears that the shortest twilight occurs when the place rotates (as from B″ to T″) as near as may be on a great circle, *directly toward or directly from the sun.*

At the equator the shortest twilight occurs at the time of the equinox, for then (see Fig. 2) the rotation is a great circle, the plane of which passes directly through the sun. In several other latitudes in the northern hemisphere the dates of shortest twilight are as follows:

Lat. 30°.....Morning of Mar. 9, and Oct. 4.
Lat. 40°..... " Mar. 5, and Oct. 7.
Lat. 50°.....Mar. 2, and morning of Oct. 11.

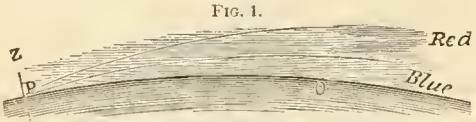
	Maximum duration in summer.	Duration of shortest twilight.	Maximum duration in winter.
At the equator....	1*h.* 18¾*m.*	1*h.* 12*m.*	1*h.* 18¾*m.*
In lat. 30°.....	1 41	1 29¼	1 30
In lat. 40°.....	2 8¼	1 34¼	1 42¼
In lat. 50°.....	All night, duration 3*h.* 5¼*m.*	1 52⅔	2 6 +

In lat. 50° there is still twilight remaining at midnight (at

the time of maximum duration), as the place in that latitude is then within the belt of twilight; and so the ½ duration (for morning or for evening) is but 3*h*. 5½*m*. But at the limit in lat. 48° 33′, as heretofore shown, where the farther edge of the twilight zone is reached, the ½ duration is 4*h*. 2*m*. (A very exhaustive discussion of the subject of twilight in many of its aspects is found in the *Astronomische Nachrichten*.) S. ALEXANDER.

Twilight Bow. This is a phenomenon in some measure resembling a widely-expanded rainbow; the conspicuous colors, however, are only the red and the blue; and it is often the most conspicuous when the weather is uncommonly clear and serene. The middle of the twilight bow, like that of the rainbow when complete, is directly opposite to the sun, and the whole phenomenon is most conspicuous in the evening at the very time of sunset, and in the morning just at sunrise. The twilight bow is very fully described by Prof. Samuel F. B. Morse in the *American Journal of Science and the Arts*, vol. xxxviii. p. 389. Prof. Morse states that "the bow in the morning begins to be defined in the W. about half an hour before sunrise. The height of the arch is about 15° above the horizon, and spans nearly, perhaps quite, 180°. Its first aspect is that of a blue; the red next appears like a faint blush above the blue, producing the purple as it mingles with the blue. Then appears the yellow above the red, producing the orange as it mingles with the red. As the sun advances toward his rising, the bow descends to coincide with the horizon, and at an angle of 8° above the horizon, or about 15 minutes before sunrise, the colors are most distinct and concentrated. At sunrise the bow coincides with the horizon." Prof. Morse adds that the "bow is best seen in the clearest atmosphere," and proceeds to speak of another bow in which a second series of fainter colors is apparent. The date of his communication is Dec. 1, 1839. He seems to be inclined to attribute the whole phenomenon to actions on light similar to those which produce the corona around the moon, etc. Some of the secondary phenomena may be thus modified. But the more distinct conspicuous appearances in the twilight bow are "best seen in clear weather," and the explanation of these would seem to be as follows: The first "blue aspect" occurs when the sun is yet some

FIG. 1.

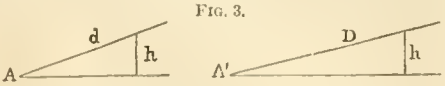


distance below the horizon of the observer. Then the tangent rays of the sun, and those immediately above them at P, are refracted *from* the perpendicular P Z, and in their passage onward the *blue* rays, being *more* refrangible than the red, are more bent, as in Fig. 1; and those blue rays reflected are bent *downward* in their passage to the observer at O, while the reflection of the red rays passes over his head. Thus only the blue is at first seen. Later, when the state of things nearer to sunrise is that in Fig. 2, the reflections of the blue from a region comparatively near, and those of the red from a region more remote, both reach the

FIG. 2.

observer at O, the red appearing above the blue. In the reverse process, after sunset, the phenomena of Fig. 1 *succeed* those of Fig. 2; and it is quite consistent to find the bow apparently rising and the ruddy parts disappearing almost overhead, having been reflected more and more too high, to be any longer noticed. The materials from which the reflected light reaches us are nearest in the direction opposite to the sun. And so the apparent altitude of the middle of the bow is greater than that of the sides, though

FIG. 3.



the actual height of the one portion and the other may not be very different. And with *h* for the height and *d* or D for the distances, we have one for the middle of the bow, the other for the side.

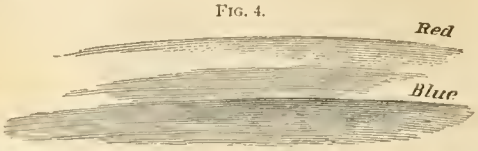
$$\frac{h}{d} = \sin A, \text{ and } \frac{h}{D} = \sin A';$$

so

$$\frac{\sin A'}{\sin A} = \frac{d}{D}.$$

The bow should then seem lower at the sides, and appears nearly in form represented in Fig. 4.

FIG. 4.



The editors of the journal already referred to add in a "*Note:* The twilight bow has, we believe, been often observed, but we do not know that any description of it is to be found in print. The blue portion of the arch appears to lie within the earth's shadow." (P. 390.) It is rather the part *below* the blue, which part does not show till just after the sun has disappeared (in the evening), of which that last remark is true: shadow—viz. *on the vapor, etc.* S. ALEXANDER.

Twillingate, a port of entry, on the two Twillingate Islands, off the N. E. coast of Newfoundland, 100 miles by steamer from St. John's; lat. 49° 42′ N., lon. 54° 44′ W. The islands are connected by a bridge, and the harbor is not very good. The town is the capital of Twillingate and Fogo district, N. F., and has a jail. P. 2790.

Twin, tp., Darke co., O. P. 1998.

Twin, tp., Preble co., O. P. 1799.

Twin, tp., Ross co., O. P. 2263.

Twi'ning (ALEXANDER CATLIN), LL.D., b. at New Haven, Conn., July 5, 1801; graduated at Yale College in 1820; was tutor at Yale 1824–26; professor of mathematics and natural philosophy at Middlebury College 1838–49; has been civil engineer on various canals and railroads, and invented the first practical method of producing ice by artificial means in commercial quantities.

Twin Lakes, tp., Carlton co., Minn. P. 21.

Twins'burg, p.-v. and tp., Summit co., O. P. 729.

Twiss (HORACE), K. C., b. in England in 1786, son of Francis Twiss, Esq. (1758–1827), author of the *Complete Verbal Index to the Plays of Shakespeare*, and of Frances, daughter of Roger Kemble; was called to the bar at the Inner Temple; sat in Parliament 1820–32 and 1835–37; favored Roman Catholic emancipation and law reform, but opposed the parliamentary reform bill; king's counsel 1827, counsel for the admiralty, judge-advocate under Lord Liverpool, and under-secretary for the colonies 1828; wrote leaders and parliamentary summaries for the *Times*, and contributed to other periodicals; vice-chancellor of the duchy of Lancaster 1844. D. May 4, 1849. Author of various poems and political treatises, and of *The Life of Lord Chancellor Eldon, including his Correspondence and Selections from the Anecdote-Book written by himself* (3 vols., 1844).

Twiss (Sir TRAVERS), D. C. L., F. R. S., b. in Westminster, London, about 1810; graduated at University College, Oxford, 1830; became fellow and tutor of his college; was public examiner at Oxford in classics and mathematics 1835–39; professor of political economy in the University of Oxford 1842–47, of international law in King's College, London, 1852–55, and regius professor of civil law at Oxford 1855–70; admitted an advocate in Doctors' Commons 1840; commissary-general of the city and diocese of Canterbury 1849, vicar-general of the archbishop of Canterbury 1852, chancellor of the diocese of London 1858, advocate-general Aug., 1867; knighted Nov., 1867. In 1872 he resigned all his appointments. Author of *An Epitome of Niebuhr's History of Rome* (1837), *The Oregon Question examined, etc.* (1846), *Progress of Political Economy in Europe since the Sixteenth Century* (1847), *Relation of the Duchies of Schleswig and Holstein to the Crown of Denmark and the German Confederation* (1848), *Letters Apostolic of Pope Pius IX., with reference to the Law of England and the Law of Europe* (1851), *Lectures on the Science of International Law* (1856), *The Law of Nations* (1861; new ed. 1876), and *The Law of Nations in Times of War* (1863); edited *The Black Book of the Admiralty* (vol. i., 1874), *Monumenta Juridica* (3 vols., 1875 *seq.*), and published in 1840–41 a revised text of Livy.

Twis'tleton (EDWARD TURNER BOYD), b. in 1809, son of Rev. Dr. Thomas J. Twistleton, archdeacon of Colombo, Ceylon, and brother of the thirteenth Lord Say and Sele; educated at Winchester School; graduated at Trinity College, Cambridge, as first class in classics 1829; became a fellow 1830; was called to the bar at the Inner Temple 1835; was commissioner of poor laws in England, Scotland, and Ireland, and civil service commissioner 1862–70. D. at Boulogne, France, Oct. 5, 1874. Author of *The Handwriting of Junius professionally investigated by Mr. Charles Chabot,*

Expert (1871), in which he defends the authorship of Sir Philip Francis; and of *The Tongue not essential to Speech* (1873).

Two Creeks, tp., Manitowoc co., Wis. P. 472.

Two Mountains, county of Quebec, Canada, bounded S. by Ottawa River and the Lake of the Two Mountains. Cap. Ste. Scholastique. P. 15,615.

Two Rivers, tp., Morrison co., Minn. P. 436.

Two Rivers, p.-v. and tp., Manitowoc co., Wis., on Lake Michigan, at terminus of the Two Rivers branch of Lake Shore and Western R. R., has an extensive lumber-trade and a weekly newspaper. P. of v. 1365; of tp. 2765.

Tyaskin, p.-v. and tp., Wicomico co., Md. P. 2691.

Tybee' Island, in Chatham co., Ga., lies off the entrance to Savannah River. The island is 6 miles long and 3 wide, and is separated from the other coast islands by Lazaretto Creek. At its N. E. end stands Tybee light-house, 134 feet high, of brick, and showing at a height of 150 feet above the sea a fixed white dioptric light of the first order, visible for 18 nautical miles; lat. 32° 1′ 20″ N., lon. 80° 50′ 31″ W. Tybee Island has become historic as the site of the batteries by which Gen. Gillmore breached Fort Pulaski on Cockspur Island, Apr. 11, 1862. (See BOMBARDMENT.)

Tyche. See FORTUNA.

Tycho Brahe. See BRAHE.

Tycoon. See SHIOGOON.

Tydings (Rev. RICHARD), b. in Maryland June 16, 1783. His father, Keely Tydings, served four years under Washington in the war of the Revolution. Richard joined the Baltimore conference of the Methodist Episcopal Church, South, in 1809, and the Kentucky conference in 1825; labored in many important fields, and was held in high esteem for his talents and usefulness; his work on *Apostolical Succession* was favorably received; was a member of the Louisville conference at the time of his death, in Kentucky Oct. 3, 1865. T. O. SUMMERS.

Tyler, county of E. Texas, lying upon Neches River; surface level, soil fertile and well timbered. Cattle and swine are numerous. Staples, cotton, Indian corn, sweet potatoes. Cap. Woodville. Area, 1130 sq. m. P. 5010.

Tyler, county of N. W. West Virginia, lying on Ohio River, and intersected by Middle Island Creek; surface rolling, soil productive. Iron ore, bituminous coal, and limestone are abundant. There are saw-mills and woollen-factories. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, tobacco, hay, wool, and dairy products. Capt. Middlebourne. Area, 396 sq. m. P. 7832.

Tyler, tp., Hickory co., Mo. P. 1285.

Tyler, p.-v., cap. of Smith co., Tex., on International and Great Northern R. R., 270 miles N. of Galveston, has 4 churches, 2 academies, 1 tannery, 1 foundry and machine-shop, 3 hotels, 3 newspapers, 2 sash, door, and blind factories, 1 bank, and the office of collector of internal revenue. The U. S. district and circuit courts and State supreme court hold sessions here twice each year. P. about 3000.
A. F. HUNT, FOR "NATIONAL INDEX."

Tyler, tp., Charles City co., Va. P. 1919.

Tyler (BENNET), D. D., b. at Middlebury, Conn., July 10, 1783; graduated at Yale College 1801; studied theology; was pastor of the Congregational church at South Britain, Conn., 1808–22; president of Dartmouth College 1822–28, and pastor of the Second Congregational church at Portland, Me., 1828–33; was the leader of the opposition to the theological views taught at Yale Theological Seminary known as the "New Divinity" (see TAYLOR, NATHANIEL WILLIAM, D. D.), and in 1834 became president and professor of Christian theology at the new seminary founded at East Windsor, Conn., by the "Pastoral Union" of churches in Connecticut—a post he retained until his death, at South Windsor May 14, 1858. Author of *A History of the New Haven Theology, in Letters to a Clergyman* (1837), *A Review of Day on the Will* (1837), *Memoir of Rev. Asahel Nettleton, D. D.* (Hartford, 1844), *The Sufferings of Christ confined to his Human Nature* (1845), *The Doctrine of Perseverance of the Saints, The New England Revivals* (1846), *Letters to Dr. Horace Bushnell on Christian Nurture* (2 series, 1847–48), besides a number of sermons and controversial pamphlets, and was editor of the *Remains of Dr. Nettleton* (1845). His posthumous *Lectures on Theology* (1859) were preceded by a *Memoir* from the pen of his son-in-law, Rev. Nahum Gale, D. D.

Tyler (DANIEL), b. at Brooklyn, Conn., Feb. 22, 1799; graduated at the U. S. Military Academy July, 1819, when commissioned second lieutenant light artillery; retained in the 5th Infantry June 1, 1821; transferred to 1st Artillery June 12, 1821; served at the artillery school of practice 1821–27, on ordnance duty 1830–34; resigned from the army May 31, 1834, and became a civil engineer, being president and constructing engineer of various railroads until the outbreak of the civil war, when appointed (Apr. 23, 1861) colonel 1st Connecticut Vols., which regiment he led to Washington, and the next month was appointed brigadier general of Connecticut Vols., and in command of division at the action of Blackburn's Ford, July 18, and battle of Bull Run, July 21. Mustered out Aug. 11, 1861. Reappointed brigadier general U. S. volunteers Mar. 13, 1862. Resigned Apr. 6, 1864.

Tyler (JOHN), tenth President of the U. S., b. in Charles City co., Va., Mar. 29, 1790, son of Judge John (1748–1813), who was governor of Virginia 1808–11; graduated at William and Mary College 1806; studied law; was admitted to the bar 1809; was a member of the State legislature 1811–16 and 1823–25, and of Congress 1816–21; voted for the resolutions of censure on Gen. Jackson's conduct in Florida; opposed the U. S. Bank, the protective policy, and internal improvements by the national government; was governor of Virginia 1825–27, U. S. Senator 1827–36; opposed the administration of Adams and the tariff bill of 1828; made a three-days' speech against a protective and in favor of a revenue tariff 1832; sympathized with the nullification measures of South Carolina in that year; was the only Senator who voted against the Force bill for the repression of that incipient secession; afterward voted for Clay's Compromise bill, and his resolutions censuring Pres. Jackson for the removal of the deposits 1835, as being an unwarrantable act, although at the same time believing the U. S. Bank unconstitutional; resigned his seat in the Senate Feb., 1836, in consequence of the vote of the Virginia legislature instructing him to vote for expunging those resolutions from the Senate journal; took up his residence at Williamsburg; was regarded as a martyr to the Whig cause, and being in consequence supported in the campaign of 1836 for the Vice-Presidency by many Whigs, received 47 electoral votes; sat in the Virginia legislature as a Whig 1839–40; was a member of the national Whig convention which met at Harrisburg, Pa., Dec. 4, 1839, by which he was nominated for the Vice-Presidency on the ticket headed by Gen. Harrison; was elected Vice-President Nov., 1840; inaugurated Mar. 4, 1841; succeeded to the Presidency on the death of Gen. Harrison Apr. 4; retained in office the cabinet of his predecessor; issued an inaugural address satisfactory to his political supporters; removed from office a large number of Democrats, filling their places with Whigs; convoked Congress to an extra session May 31, 1841; expressed in a message his approval of the establishment of a national bank; instructed his secretary of the treasury, Hon. Thomas Ewing, to submit to Congress, in response to a joint resolution, a bill for the incorporation of a "fiscal bank of the U. S.," which was passed Aug. 6; returned that bill without his approval on account of an amendment concerning branch banks, which in his veto message he pronounced to be unconstitutional; incurred thereby the resentment of the Whigs throughout the country, who accused him of desertion of their principles—a sentiment which was aggravated by his veto in September of another bill for the same purpose, to which he had privately given his assent; was abandoned by the members of his cabinet (with the exception of Daniel Webster), and severely condemned in a collective manifesto published by them; filled their places with reputed Whigs—Walter Forward, John C. Spencer, Abel P. Upshur, C. A. Wickliffe, and Hugh S. Legaré—but did not satisfy the Whig members of Congress, who published a manifesto Sept. 13 breaking off political relations; was abandoned by Mr. Webster in the following year as soon as the delicate negotiations with Great Britain concerning the N. E. boundary were terminated by the Ashburton Treaty (Aug. 9, 1842); reorganized his cabinet by the admission of three Democrats, July, 1843, followed by the appointment of John C. Calhoun and John Y. Mason as successors of Messrs. Upshur and Gilmer, killed by the accident on the Princeton Feb. 28, 1844; concluded through Mr. Calhoun a treaty for the annexation of Texas (Apr. 12, 1844), which was rejected by the Senate, but effected his object in the closing days of his administration by the passage of the joint resolutions of Mar. 1, 1845; was nominated for the Presidency by an informal Democratic convention held at Baltimore in May, 1844, but soon withdrew from the canvass, perceiving that he had not gained the confidence of the Democrats at large; was succeeded Mar. 4, 1845, by James K. Polk, and lived in almost complete retirement from politics until Feb., 1861, when he was a member of the abortive "peace convention" held at Washington, and was chosen its president; renounced soon afterward his allegiance to the U. S., and was elected to the Confederate Congress. D. at Richmond Jan. 17, 1862. Besides those above mentioned, the leading measures of his administration were the uniform system

of proceedings in bankruptcy enacted Aug., 1841, and the protective tariff of 1842. He married in 1813 Letitia Christian, who died at Washington in 1842, and contracted a second marriage (June 26, 1844) with Miss Julia Gardner of New York. By his first wife he had three sons and three daughters. One son, JOHN, has taken a prominent part in politics. PORTER C. BLISS.

Tyler (MOSES COIT), b. at Griswold, Conn., Aug. 2, 1835; graduated at Yale College 1857, at Andover Theological Seminary 1860; was pastor of a Congregational church at Poughkeepsie, N. Y., 1860–62; withdrew from the ministry on account of ill-health; resided in England 1863–67, engaged in study, lecturing, teaching, and writing for American periodicals; has since been professor of the English language in the University of Michigan; is a popular lecturer, a frequent contributor to the New York *Independent* and other periodicals, and author, among other works, of *The Brownville Papers* (1862), a volume of essays on physical culture.

Tyler (ROBERT OGDEN), b. in Greene co., N. Y., Dec. 22, 1831; graduated at the U. S. Military Academy July 1, 1853, when commissioned brevet second lieutenant of artillery. After a year passed in garrison he joined Col. Steptoe's command, which marched from St. Louis to Washington Terr., 1854–55, Tyler taking post at San Francisco; engaged in the Yakima (1856) and the Spokane (1858) expeditions, participating in the actions of the Four Lakes, Spokane Plains, and Spokane River. Transferred to Fort Ridgely, Minn., 1859, and New York harbor 1860. Engaged in the civil war on the expedition for relief of Fort Sumter Apr., 1861; in reopening communications with Washington *viâ* Baltimore May, 1861; as dépôt quartermaster at Alexandria May–Sept., when appointed colonel 4th Connecticut Vols., and in command of his regiment (known as the First Connecticut Heavy Artillery after Jan., 1862) in the defences of Washington until the spring of 1862; in the Virginia Peninsular campaign in command of siege batteries before Yorktown; in battles of Hanover Court-house, Gaines's Mill, and Malvern Hill. Promoted to brigadier-general of volunteers Nov. 29, 1862, and engaged in the battle of Fredericksburg, Dec. 13, in command of the artillery of Sumner's grand division; of the artillery reserve of the Army of the Potomac at Chancellorsville, Gettysburg, and subsequent operations, until Jan., 1864; of division of 22d army corps, covering Washington and lines of communications of the Army of the Potomac, Jan.–May, 1864; of division of heavy artillery, 2d corps, in the Richmond campaign of 1864, from the Wilderness battles to Cold Harbor, where severely wounded June 1, and disabled for further duty in the field. Commanded various departments Dec., 1864–June, 1866, when resumed quartermaster duty, in which department he became lieutenant-colonel and deputy quartermaster-general July, 1866. Brevetted from major to major-general for gallantry in action. D. at Boston, Mass., Dec. 1, 1874.

Tyler (ROYALL), b. at Boston, Mass., July 18, 1757; graduated at Harvard 1776; studied law under John Adams; was for a short time during the war of the Revolution aide to Gen. Lincoln, which post he also filled during the Shays rebellion 1786; settled at Guilford, Vt., 1790; was judge of the Vermont supreme court 1794–1800, and chief-justice 1800–06; published *Reports of Cases in the Supreme Court of Vermont* (New York, 2 vols., 1809–10). D. at Brattleborough, Vt., Aug. 16, 1826. He was one of the earliest American dramatists, enjoyed a high reputation as a wit, and was quite successful in the introduction in comedy of Yankee dialect and of humorous stories. Among his pieces were *The Contrast* (1790), produced Apr., 1786; *May-Day, or New York in an Uproar*, produced May, 1786; and *The Georgia Spec, or Land in the Moon*, produced 1797. He was a leading contributor of humorous verse and prose to Joseph Dennie's papers, *The Farmer's Weekly Museum* (Walpole, N. H., 1795–99) and *The Portfolio* (Philadelphia, 1801 *seq.*); wrote also for the *New England Galaxy*, the *Columbian Centinel*, the *Polyanthos*, and other literary journals, and was author of a Crusoe-like novel, *The Algerine Captive, or the Life and Adventures of Dr. Updike Underhill, Six Years a Prisoner among the Algerines* (Walpole, 2 vols., 1797). He left some unpublished dramatic productions.

Tyler (SAMUEL), LL.D., b. in Prince George's co., Md., Oct. 22, 1809; educated at Dr. Carnahan's seminary at Georgetown, D. C., where he acquired an unusually extensive acquaintance with Greek; graduated at Middlebury College, Vt., 1827; studied law; admitted in 1831 to the bar at Frederick City; in 1850 appointed a commissioner to simplify the pleadings and practice in all the courts of the State, and prepared a highly-esteemed *Report*; resided for some years in Washington, D. C.; was connected as professor with the law department of the Columbian University; wrote chiefly on metaphysics, in which branch his labors received commendation from Sir William Hamilton and other competent critics. Author of *A Discourse on the Baconian Philosophy* (1844), *Burns as a Poet and as a Man* (1848), *The Progress of Philosophy in the Past and in the Future* (1859; 2d ed. 1868), and a *Memoir* of Chief-Justice Taney (1872). D. at Georgetown, D. C., Dec. 15, 1877.

Tyler (WILLIAM SEYMOUR), D. D., b. at Harford, Pa., Sept. 2, 1810; graduated at Amherst College 1830; taught classics in Amherst Academy 1830–31; was tutor in Amherst College 1831–33; studied theology at Andover Seminary, where he graduated 1836; was in that year licensed to preach by the third presbytery of New York City, but not ordained until many years later (1858), in consequence of his acceptance of the professorship of Greek and Latin at Amherst College; became Graves professor of Greek (1847) on the division of the professorial chair; visited Europe and the East 1855, and Greece and Egypt 1869. He has published *The Germania and Agricola of Caius Cornelius Tacitus* (1847), with notes and a *Life*; *The Histories of Tacitus* (1849), *Prayer for Colleges* (1855), a prize essay, *Memoir of Rev. Henry Lobdell, M. D., Missionary at Mosul* (1859), *Plato's Apology and Crito* (1860), *The Theology of the Greek Poets* (1867), *The History of Amherst College* (Springfield, 1873), *Demosthenes de Coronâ* (1874), *The Olynthiacs and Philippics of Demosthenes* (1875), and has contributed to several theological reviews and to the *Transactions* of the American Philological Association.

Tyler's, tp., Shelby co., Ala. P. 383.

Ty'lor (EDWARD BURNETT), LL.D., F. R. S., b. at Camberwell, London, England, Oct. 2, 1832; educated at the Quaker school at Grove House, Tottenham; devoted himself to ethnological and antiquarian researches, in furtherance of which he visited Mexico in 1860, and has been one of the founders of the new science sometimes called "comparative ethology" (Gr. ἔθος, "a custom"), or the investigation of the manners, customs, religions, and social rites and superstitions of savage nations, many traces of which, called by him "survivals," he finds in the institutions of the most highly-civilized modern societies. He has lectured on this subject at the Royal Institution. Author of *Anahuac, or Mexico and the Mexicans, Ancient and Modern* (1861), *Researches into the Early History of Mankind and Development of Civilization* (1865), and *Primitive Culture, Researches into the Development of Mythology, Philosophy, Religion, Art, and Customs* (2 vols., 1871), and is understood to be now (1876) engaged upon a work on *Primitive Morals*, some portions of which have appeared in the English magazines. He is a contributor to the *Academy*, a weekly literary review, and wrote articles on anthropology, etc. in the 9th ed. of the *Encyclopædia Britannica* (1875 *seq.*).

Tymochtee, tp., Wyandot co., O. P. 1631.

Tympanum. See EAR, ANATOMY OF, by PROF. H. HARTSHORNE, A. M.

Tyn'dale, or **Tindale** (WILLIAM), b. at Hunt's Court, North Nibley, Gloucestershire, England, about 1484; studied at Magdalen Hall, and afterward at Christ Church, Oxford, where he was for some time tutor; removed to Cambridge, probably on account of having embraced the principles of the Reformation; took orders in the Church of England; resided as tutor in the family of Sir John Welch, near Bristol, incurring danger by his advocacy of the doctrines of Luther, then recently proclaimed, on which account he was cited before the chancellor of the diocese of Worcester 1522; translated into English the *Enchiridion Militis*, or *Soldier's Manual*, of Erasmus; went to London 1523; made an unsuccessful application for admission into the household of Bishop Tunstall; was protected for some months in the family of Alderman Humphrey Monmouth, who gave him £10 per annum to prosecute his theological studies in Germany, on condition of praying at stated periods for the souls of the alderman's parents; went to Hamburg Jan., 1524; resided there nearly a year, engaged in the translation of the New Testament into English, with the aid of John Frith and William Roye, the printing of which at Cologne in the office of Peter Quentell (quarto, 1525) was interrupted by the vigilance of Cochlæus; completed the printing at Worms in the office of Peter Schoeffer; issued, either at Worms or at Wittenberg, in 1526, a new octavo edition of the whole work, which obtained a wide though secret circulation in England, being prohibited by an edict of Tunstall, bishop of London, who bought up the remainder of the edition at Antwerp and burnt them at Cheapside 1529; removed to Marburg, and published there his *Obedience of a Christian Man* (1528); had an interview with Coverdale at Hamburg, and issued a 5th ed. of the *Testament* 1529; published his translation of the Pentateuch, "emprented at Marlborow [Marburg] in the Land of Hesse," 1530; had a bitter con-

troversy with Sir Thomas More, who in a witty and abusive pamphlet denounced the translation and its author 1530–31; was treacherously invited to return to England in order to seize his person—an artifice to which his assistant, John Frith, fell a victim, being burned at the stake 1533; brought out a revised and corrected edition, the first to which he put his name, 1534; wrote several doctrinal treatises and introductions, expositions, and notes to various books of the Bible; resided during his later years at Antwerp; was arrested 1535 on a charge of heresy through the agency of an emissary of Henry VIII. acting in concert with the clergy and magistrates of Brussels; imprisoned in a castle at Vilvoorden, Brabant; tried by virtue of a decree of Charles V., issued at Augsburg 1530, and the University of Louvain having urged his condemnation, with the eager approval of Henry VIII., he was convicted, and after eighteen months' imprisonment was strangled and burned at the stake at Vilvoorden Oct. 6, 1536. He met his fate with composure, his last words being a prayer, "Lord, open thou the king of England's eyes." The spot where he suffered is shown near the new penitentiary at Vilvoorden. A monument to his memory was erected at his birthplace, Nibley Knoll, Nov., 1866. His translation of the New Testament is the basis of the authorized version, and is executed with considerable accuracy and elegance. A beautiful edition, with a *Memoir of Tyndale's Life and Writings*, by George Offor, was published by S. Bagster (London, 1836), and reprinted at Andover, Mass., 1837. Another *Life*, by Rev. H. Walter, was prefixed to the Parker Society's reprint of his *Works* (3 vols., 1848–50). Other editions of the *Works* (in connection with those of Frith and of Robert Barnes) were published by John Fox, the martyrologist (London, folio, 1573), by the London Tract Society (*British Reformers*, vol. viii.), and by Rev. Thomas Russell (*English and Scotch Reformers*, vol. iii., 1828). The MSS. of Tyndale were utilized by John Rogers in the translation of the whole Bible, which he published in 1537 under the name of Thomas Matthew. PORTER C. BLISS.

Tyndall (JOHN), D. C. L., LL.D., F. R. S., b. at Leighlin Bridge, near Carlow, Ireland, Aug. 21, 1820; educated under the direction of his father, acquiring an intimate acquaintance with the Bible and with the standard English theologians, as well as a thorough knowledge of mathematics; became in 1839 "civil assistant" to a division of the Irish ordnance survey stationed at his native place; became in turn draftsman, computer, surveyor, and trigonometrical observer; devoted five hours a day for twelve years to systematic private studies, chiefly in the direction of natural science; was transferred to the English branch of the ordnance survey, with which he remained until 1844, when he determined to settle in the U. S., but was induced to remain in England by the offer of a position as railway engineer, which he filled for three years; was teacher of physics 1847–48 in Queenwood College, Hampshire, where Dr. Edward Frankland was resident chemist; went with Frankland to Germany, where they attended at Marburg the celebrated lectures on chemistry by Bunsen, on physics by Gerling and Knoblauch, and on mathematics by Stegmann; worked hard in the laboratory in conjunction with Knoblauch, making discoveries in magnetism and diamagnetism, which he embodied in a paper *On the Magneto-Optic Properties of Crystals, and the Relation of Magnetism and Diamagnetism to Molecular Arrangement*, published in the *Philosophical Magazine* for 1850; graduated in 1851, presenting for his degree an inaugural dissertation *On Screw Surfaces* (in German); continued his chemical studies in the laboratory of Prof. Magnus at Berlin; made the same year the acquaintance of Faraday, to whom he communicated a series of experiments of such ingenuity as to lead to his immediate election as a fellow of the Royal Society; became in 1852 a member of the British Association for the Advancement of Science, and was chosen one of the secretaries of its section of physics; was an unsuccessful applicant for a professorship in the University of Toronto, Canada, 1852; was invited in Feb., 1853, to give one of the Friday evening lectures at the Royal Institution; was elected June, 1853, professor of natural philosophy in that institution and in the government school of mines, which post he still fills (1876); visited Switzerland for the first time 1849; made a second visit, along with Huxley, in 1856, and has since made annual excursions to the Alps, where he distinguished himself by his investigations of the rate of motion of glaciers (1859) by planting thermometric stations on the sides and summit of Mont Blanc, and by scaling for the first time the Weisshorn (1861) and Matterhorn (1868); published the result of his observations in the *Philosophical Transactions* (1860), and in three volumes, *Glaciers of the Alps* (1860), *Mountaineering in 1861* (1862), and *Hours of Exercise in the Alps* (1871); had a prolonged scientific controversy with Prof. J. D. Forbes of Edinburgh upon the subject of the causes of glacial formation and motion, which he ascribed respectively to mechanical pressure and to regelation; communicated from time to time to the *Philosophical Transactions* and *Magazine* memoirs on the *Influence of Crystalline and Organic Structure upon Magnetism*, and on the *Polarity of the Diamagnetic Force*, as well as upon radiant heat—a subject which has engaged his attention since 1859, and has been the field of the brilliant discoveries described in his lectures at the Royal Institution in 1862, published under the title *Heat considered as a Mode of Motion* (1863), and in the "Rede Lecture," *On Radiation* (1865); became the successor of Faraday at the Trinity House 1866, and superintendent of the Royal Institution 1867; accompanied to Algeria the expedition sent to observe the solar eclipse of Dec., 1870; visited the U. S. in 1872 on a successful lecturing tour, the profits of which (more than $15,000) he placed in the hands of an American committee as a fund "in aid of students who devote themselves to original research;" has been honored with the Rumford medal of the Royal Society for his discoveries in thermodynamics, and with the doctorate of laws from the universities of Cambridge (1855), Edinburgh (1866), and Oxford (June 18, 1873), and was president of the British Association in its session at Belfast Aug., 1874, when his *Address* was the occasion of a sharp theological controversy from its enunciation of the last results of the evolution theory, of which he had long been a vigorous advocate. He had already attracted attention some years before by his proposition to submit the question of the efficacy of prayer to a scientific test. His later researches have been chiefly upon acoustics in connection with the Trinity House. Besides the works previously mentioned he has published—*Sound, a Course of Eight Lectures* (1867; 3d ed., enlarged, 1875), *Faraday as a Discoverer* (1868), *Natural Philosophy in Easy Lessons* (1869), *Nine Lectures on Light* (1870), *Researches on Diamagnetism and Magneto-crystallic Action* (1870), *Seven Lectures on Electrical Phenomena and Theories* (1870), *Essays on the Use and Limit of the Imagination in Science* (1871), *Fragments of Science for Unscientific People* (1871; new ed., enlarged, 1876), *The Forms of Water in Clouds and Rivers, Ice and Glaciers* (1872, being vol. i. of the "International Scientific Series"), and *Contributions to Molecular Physics in the Domain of Radiant Heat* (1872). PORTER C. BLISS.

Tyne, river of Northern England, is formed by the junction of the North and South Tyne, flows eastward, and enters the North Sea after a course of 85 miles through the richest mining districts of England.

Ty'ner (JAMES N.), b. at Brookville, Ind., Jan. 17, 1826; received an academic education; studied law, which he practised at Peru, Ind.; was secretary of the Indiana senate 1857–61; was chosen a Presidential elector in 1860; was a special agent of the post-office department 1861–66; was a Republican member of Congress 1869–75, serving on the committees on appropriations and post-offices; was appointed governor of Colorado at the expiration of his Congressional service in 1875, but before taking possession of that post was made second assistant postmaster-general, and on the resignation of Gov. Jewell in July, 1876, succeeded him as postmaster-general.

Tyng (STEPHEN HIGGINSON), D. D., b. at Newburyport, Mass., Mar. 1, 1800, son of Hon. Dudley Atkins (1760–1829), U. S. collector at that port and reporter of the Massachusetts supreme court, who assumed the name of Tyng on inheriting the estate of his relative, James Tyng of Tyngsborough; graduated at Harvard 1817; was for some time engaged in mercantile pursuits; afterward studied theology; was ordained in the Protestant Episcopal Church 1821; was minister of St. George's, Georgetown, D. C., 1821–23, of a church in St. Anne's parish, Md., 1823–29; rector of St. Paul's, Philadelphia, 1829–33, of the church of the Epiphany, Philadelphia, 1833–45, and from 1845 to May, 1878, of St. George's, New York City; has travelled in Europe; edited successively the *Episcopal Recorder*, the *Theological Repository*, and the *Protestant Churchman*; is author of *Lectures on the Law and Gospel* (1832), *Recollections of England* (1847), *Forty Years' Experience in Sunday-Schools* (1860), *The Prayer-Book Illustrated by Scripture* (3 series, 1863–67), *The Child of Prayer, a Father's Memorial to the Rev. Dudley A. Tyng, A. M.* (1858), and other works theological and biographical; published several volumes of sermons and many single addresses; edited with introductions or prefatory memoirs various works by other hands; has been a conspicuous advocate of temperance and other reforms, and enjoys high fame for eloquence in the pulpit and on the platform. —His son, DUDLEY ATKINS, b. in Prince George's co., Md., in 1825; graduated at the University of Pennsylvania 1843; studied theology at Alexandria Seminary; took orders in the Protestant Episcopal Church 1846; was assistant to his father at St. George's church, New York;

had charge of parishes at Columbus, O., Charlestown, Va., and Cincinnati, O., and was rector of the church of the Epiphany, Philadelphia, from 1854 until shortly before his death, at Brookfield, near Philadelphia, Apr. 19, 1858. He was a successful lecturer upon religious and social topics, and acquired a high reputation for ability and manliness, as well as philanthropy, by his course in preaching against slavery, which involved his dismissal from his pastorate. The touching ballad *Stand up for Jesus!* commemorates an incident of his deathbed. Author of *Vital Truth and Deadly Error* (1852), *Children of the Kingdom, or Lectures on Family Worship* (1854), republished in England as *God in the Dwelling* (4th ed. 1859), and *Our Country's Troubles* (1856). His *Life*, as above indicated, was written by his father. PORTER C. BLISS.

Tyng (STEPHEN HIGGINSON), JR., D. D., son of the above, b. at Philadelphia, Pa., June 29, 1839; graduated at Williams College 1858; studied theology at the Virginia Episcopal Seminary; was ordained deacon May 8, 1861; assisted his father in the ministry of St. George's church, New York, 1861–63; was ordained priest Sept. 11, 1863; became rector of the church of the Mediator, New York, 1863; went to the army as chaplain of the 12th New York Vols. 1864; organized the parish of the Holy Trinity, New York, 1865, building on 42d street a church which in 1873–74 was replaced by a large and commodious edifice; was tried in 1867 for a violation of the canon law of his Church; edited for some years a weekly religious journal, *The Working Church*; is noted for his cordial fellowship with evangelical churches of other denominations; took a prominent part in the revival movement of 1875 directed by Messrs. Moody and Sankey, and in the summer of 1876, in combination with other clergymen, commenced out-door Sunday services for the people in a "gospel tent" erected near his church.

Tyngs'borough, p.-v. and tp., Middlesex co., Mass., on Boston Lowell and Nashua R. R. P. 629.

Type, Type-casting Machines, Type-founding, Type-revolving Presses, Type-setting, and **Type-setting Machines.** See PRINTING, by W. S. PATERSON.

Type, in theology, denotes an image or representation prefiguring a person or thing, which then is called its antitype; thus, St. Peter describes baptism as the antitype of the ark of Noah (1 Pet. iii. 21). In this sense the word is used several times in the New Testament and by Jewish historians; and several of the Fathers, especially Augustine and Gregory the Great, are very ingenious in finding types by their interpretation of the Bible.

Type-Theories. In chemistry, the so-called "theory of chemical types" has played a great part in the literature of the science for a quarter of a century past. The idea arose first from the discoveries of Gay-Lussac and Dumas of the replacement of hydrogen by chlorine in organic bodies, which led the latter chemist to impugn the theoretical views of Berzelius, that had been based upon his discovery of the actual, natural, and indisputable arrangement of elements and radicals in the so-called electro-chemical series. Dumas believed his new facts, showing the actual equivalency of chlorine (and other halogens) with hydrogens, to be irreconcilable with the electro-chemical views, and, apparently rejecting the electro-chemical relations as nugatory, introduced the term *chemical type* to designate bodies derived from each other by substitution, without reference to acidic or basylic nature. Or, rather, he concluded that by virtue of such substitution the element or radical replacing the other assumed the chemical nature of the element or radical replaced, and the resulting body retained the same type as before. This was the initial point of what is now called the "new system of chemistry." Laurent and others extended Dumas's investigations largely, discovering great ranges of facts; and Laurent appears to have been the first (in 1846) to propose the hypothesis that certain series of organic bodies were molecularly derived by substitutions of this kind from those bodies in nature which are known to furnish the materials of which organic bodies are built up. His first suggestion appears to have been that the alcohols and ethers were thus derived from the type of *water*, the "residue," or hypothetical group C_2H_5, called now *ethyl*, being substituted, in H_2O, for one hydrogen equivalent to form alcohol, and for both hydrogen equivalents to form ether. The whole study was influenced by the universal hold that the so-called "dualistic" views had obtained upon the chemical world. The hypothetical *organic radicals*, some of which are even yet adhered to by many chemists, were rendered necessary in order to apply the type-theories to organic bodies, as in the initial case of ethyl, cited above. Our American chemist, Sterry Hunt, in 1848 (*Am. Journal of Science* for Sept., 1848, p. 173), first extended Laurent's suggestion to *acids*, both organic and inorganic; further proposing, in a paper read to the American Association for the Advancement of Science in the same month of that year, that *all oxygenated bodies* should be looked upon as derived from the *water-type*. Our distinguished compatriot may therefore be claimed as at least the most prominent of the founders of the famous "water-type theory," from which all the type-theories have grown, and into which, indeed, it is easy enough to merge them all. In the article on CHEMISTRY (which see for more on type-theories) it is explained how all the accepted types are really referable to one—namely, that of the H_2 in H_2O. In the American Association paper of 1848, above referred to, this idea was also fully set forth by Sterry Hunt.

The number of types or classes of typical compounds that has been admitted is *six*, which may be represented by the compounds HCl, H_2O, H_3N, H_4C, Cl_5P, Cl_6W. For the two highest no *hydrogen* compounds are known, but it is assumed that such compounds as H_5P and H_6W may exist, but have not yet been obtained. The elements here combined with the hydrogen are said to represent six different degrees of *equivalence*, or, as some express it, of *atomicity*—Cl being *monovalent, univalent, monadic* (or a *monad*), or *monatomic;* O being *bivalent, dyadic* (or a *dyad*), or *diatomic;* N being *trivalent, triatomic* (or a *triad*), or *triatomic;* C being *tetravalent, quadrivalent, tetradic* (or a *tetrad*), or *tetratomic;* P being *pentivalent quinquivalent, pentadic* (or a *pentad*), or *pentatomic;* and W, *hexavalent, sexivalent, hexadic* (or a *hexad*), or *hexatomic*.

The direct derivation of other bodies from these typical ones (or rather from *the type* generally) is supposed to consist in, or arise from, the substitution for any one or more of the equivalents of elements in the typical formula of any element, or elements, or radicals, the sum of whose equivalencies or atomicities is equal to that of the element displaced. Thus, it follows that they are all derivable from each other; as, for example, in three molecules of HCl or H_3Cl_3, by substituting for the three monads Cl_3 the triad N, we get H_3N, ammonia; or—to take a familiar case of *actual derivation*—when the dyadic metal zinc is dissolved in muriatic acid, H_2Cl_2 react with Zn, and we have formed free hydrogen and Cl_2Zn, a compound belonging to the water-type, or derivable directly from H_2O by substitution of two monads H_2 for two monads Cl_2, and of one dyad Zn for one dyad O. An indefinite number of other similar cases might be cited: and this mode of viewing these theories is now regarded by many advanced chemists as a sort of *reductio ad absurdum*, or at least as showing that these theories are inconclusive and indeterminate, reasoning in a circle, or having no solid basis except the fundamental facts of *equivalence*, based upon the different multiple combining proportions of other elements with oxygen. The term *theory of equivalence* is therefore being rapidly substituted for "theory of types," and the typical arrangement itself regarded only as a convenient and artificial mode of classification or notation in investigating chemical transformations. Sterry Hunt himself said long since: "The various hypotheses of copulates and radicals are based upon the notion of dualism, which has no other foundation than the observed order of generation, and can have no place in a theory of the science." . . . "The chemical history of bodies is a record of their changes"—meaning their modes of *derivation:* "it is, in fact, their genealogy; and in making use of typical formulas to indicate the derivation of chemical species, we should endeavor to show the ordinary modes of their generation." Kekulé has also said, much more recently—referring to the obvious derivation of all the types from each other and from H_2—that it "shows plainly that the entire system is nothing more than a comparison of compounds with regard to their composition, not a true theory which can teach us anything about their actual composition itself. The several types are therefore not classes of compounds distinctly separated from one another by differences of constitution, but rather movable groups, in which compounds may be placed together according to the particular analogies which it is desired to bring to light." HENRY WURTZ.

Type-Writers. See WRITING-MACHINES.

Typha. See CAT TAIL.

Typhlop'idæ [from *Typhlops*—τυφλώψ, "blind," the ancient name of a species—the principal genus], a family of reptiles of the order Ophidia (serpents) and sub-order Scolecophidia, characterized especially by the development of teeth in the upper jaw (and not in the lower), and therefore called epanodontians by Duméril and Bibron. They are worm-like animals, and about equally thick behind and before; the scales are smooth and imbricated, and nearly alike all round; the head is short, and not differentiated by constriction from the body; above, it is covered by large scale-like plates, and enlarged rostral and lateral

ones, as well as labials; the eyes are minute; the nostrils between the postrostral and labial plates; the mouth is small and crescentiform; the teeth, as already indicated, are confined to the upper jaw; the anus is a transverse fissure near the posterior extremity. The skull has no ectopterygoid bones and no prefrontals; the maxillaries are destitute of alveolar ridges or malar processes; the rudiments of a pelvis are existent, but no pubis. The family is represented by about half a dozen genera in various tropical countries. THEODORE GILL.

Typhoid Fever. See TYPHUS AND TYPHOID FEVERS.

Ty'phon, the Greek name of an Egyptian deity called Set, son of Seb or Cronos and Nut or Hannut or Rhea, b. on the third of the intercalary days of the year, brother of Osiris, Isis, Nephthys, Haroeris, and Anubis. According to the Greek legend, he was the rival and opponent of his brother Osiris, whom he destroyed. In this Typhon was aided by seventy-two conspirators and an Ethiopian queen named Aso. He enticed Osiris to lie down in a chest, which Typhon and his companions closed with a lid nailed down, and molten lead was poured over it. It was then thrown into the river, and reached the sea by the Tanitic mouth on the seventeenth of the month Athyr. Set was united to Nephthys, the mother of Anubis by Osiris. After the discovery of the remains of Osiris by Isis, Typhon again found the chest, and tore it into fourteen pieces, which he scattered over Egypt. Subsequently, Horus, the avenger of his father, gave battle to Typhon and his followers for three days and nights, commencing on the 26th of the month Thoth, having transformed themselves into beasts. Isis chained them both, but released Set at his intercession, and Horus, who had regained the human form, with a sword cut off her head, which Thoth replaced by that of a cow. This battle was supposed to have been at Antaeopolis, the modern *Qau* on the eastern bank of the Nile, the ancient *Kera*. Set afterward represented the principle of evil, as Osiris that of good, in the religion. His worship was of the most remote period, and he is mentioned as early as the sixth dynasty, and in chapters of the ritual possibly older. Set —or Sutech, another name of the god—was also the god of the Aramæan and other nations, such as the Khita, the neighbors and enemies of Egypt, as well as the Shasu or Shepherds, foreigners who invaded the Delta before the eighteenth dynasty. An attempt to enforce the building of a temple to him by the Hykshos or Shepherd kings led to their expulsion. In this quality he was considered a martial god, and called very valiant or glorious, king of heaven, and lord of victory. The kings of the nineteenth dynasty, probably on account of their Semitic origin, assumed his name, two being called Seti or Sethos, and a monarch of the twentieth dynasty Nechtset or Setnecht, "the power of" or "powerful Set." In the ritual, Set is said to be the god who swallows souls and devours hearts, or Baba, another of his names, who feasts off the wicked; and elsewhere he is said to change into a crocodile to devour Osiris, who changes into an ape, and throughout he is considered the evil and hostile principle of nature. Set was also identified with the Apap or Apophis, the great dragon or serpent, the type of darkness and opponent of Ra or light. The ass was sacred to Set, and his head is supposed to be in shape of that animal, but in reality he has the head of a gryphon, and is so represented as the god of Nubti or Ombos and protector of the gold country. Human sacrifices are said to have been offered to him at Heliopolis, and were abolished by Amasis I., but men were burnt in his honor at Eileithyia, for which a red cow is said to have been afterward substituted. Many esoterical explanations have been given of Set; his name was identified with the word *root*, and he was supposed to represent the desert, or drought, or the sea, or the orb of the sun; and the number of his conspirators and of the parts of Osiris show relations between the sun and moon in the myth. In Greek mythology, Typhon, called Typhœus, was one of the giants, son of Tartarus and Gaia, or a son of Hera, with a hundred serpents' heads vomiting fire, or had a gigantic human shape, with wings at the belly, and like the giants his legs terminated in snakes. He was the father of the dog Orthros, the companion of Geryon, of Cerberus, the Chimæra, and even Sphinx according to some legends. He attacked the gods, who flew to Egypt, and when Zeus endeavored to annihilate him with a thunderbolt and *harpe* or falchion, Typhon hacked him to pieces and hid the sinews of the god. These were restored to Zeus by Hermes or Mercury, and after a fierce contest and pursuit as far as Sicily, Zeus overcame Typhon and placed him under Mount Ætna, or, according to other versions, under the earth in Cilicia. Typhon appears to represent the volcanic powers of nature, and the contest between them and the aërial, and to be modelled on the Assyrian myths of the kosmos or genesis lately discovered in the cuneiform. S. BIRCH.

Typhoons. See STORMS, by PROF. A. GUYOT, PH. D., LL.D.

Ty'phus and Typhoid Fevers [*typhus*, from Gr. τῦφος, "stupor;" *typhoid*, from Gr. τῦφος, "stupor," and εἶδος, "form"], two idiopathic or essential continued fevers, by some authorities regarded as a greater and lesser degree of one common disease, but by a majority of physicians conceded to be distinct diseases with certain resemblances. Typhus is the more acute, virulent, and fatal, the more sudden and pronounced in its onset, rapid in its course, and in cases of recovery terminating promptly by a crisis. Typhoid is insidious in its development, less abrupt in its onset, slower in the development of its symptoms, which are less acute, and terminates by a prolonged and gradual convalescence. Typhus is known as ship-fever, jail-fever, camp-fever, etc., being the product of vast aggregations of humanity under unhygienic conditions, especially deficient ventilation; so that the rebreathing of air loaded with emanations from crowded living beings is its chief cause. With the sanitary reform of barracks, ships, prisons, etc., it has been reduced to a minimum. Typhoid fever is far more prevalent, occurring in all countries, among all classes of society, in isolated and healthy country villages as well as in the larger towns and cities. It has variable degrees of severity, and a variable predominance of different classes of symptoms in different persons and seasons. It may be induced by purely external causes, as by bad ventilation, sewer-gas, exhalations of decomposing matter in cellars or near houses, privies, and especially the contamination of drinking water, as when springs or wells receive by percolation the surface-water from outbuildings. In other cases typhoid fever would seem to have a purely intrinsic origin, the morbific matter being collected within the person's system by deficient elimination. Thus, it is induced in persons of nervous temperament by prolonged and excessive mental or bodily effort, care, exposure, fatigue, and privation of food. The nervous type is then developed, justifying the German designation of "nervous fever," since the depressed nervous system suspends the nutritive processes of the body, and effete matter becomes present in excess of the nutritive supply. Typhoid fever is also known as adynamic and asthenic fever, indicating the peculiar exhaustion characterizing it; pythogenic fever (Gr. πῦθος, "filth," and γενᾶν, to "generate"). In typhoid fever the PEYER'S GLANDS (which see) of the small intestine are invariably swollen, infiltrated with typhoid matter, and often ulcerated or sloughed out; hence from this specific lesion the disease is also called enteric fever, abdominal typhus, and ileo-typhus. Typhus fever has an average duration of two weeks, characterized by initial chill, active delirium, contracted pupil, dark-coated tongue, dusky suffusion of the face, a high temperature, a rapid and feeble pulse, and often weak heart-sounds. The body-heat rises steadily, remains constant at its height, when at the end of the second week speedy recovery ensues, with profuse perspiration, or the case becomes more serious or fatal. Exceptionally, the relapse is terminated by a crisis as late as the end of the third week. Typhoid is of longer duration—at least three full weeks of the active fever, and several weeks of gradual convalescence. During a week to ten days antecedent to the actual attack the specific poison or *materies morbi* is incubating, and the patient is languid, feeble, and depressed. It is ushered in by headache, chill, or chilliness, and elevated temperature; later, follow muttering delirium, semi-consciousness or "coma-vigil," wild excitement and tossing of the body, picking of the bedclothes; the face is suffused and blank, the tongue coated; the teeth may have "sordes," a deposit of blackened and dry saliva; the abdomen is tender on pressure, tumefied, and emits a drum-like sound when percussed; the bowels are often loose, the stools being "ochre-colored," and often found to contain the shreds or entire body of sloughing intestinal glands; in the second week in many cases minute spots appear on the lower part of the chest and upper part of the abdomen, coming in crops of twelve or more, each crop lasting about three days. The temperature, as shown by the medical thermometer, has a peculiar and almost diagnostic course in typhoid fever. There is after the initial rise an ascent for four or five days of about 2° F. each evening, and a descent in the morning of 1° F., making a daily gain of 1° F. Thus, the temperature reaches 103°, 104°, 105° F.; it then remains nearly constant for several days, when toward the end of the second week it has a gradual descent in the same manner of a degree daily; during convalescence there is a marked daily variation of temperature, resembling intermittent fever—an evidence of the debilitated and susceptible state of the convalescent, and of the periodic efforts of the recuperating system to cast off morbific matter. The modern treatment of typhus and typhoid may be summed up chiefly as good nursing, fresh air, food, and support by tonics and stimu-

lants. Cold water may be of the greatest value, either sponging, the cold pack, affusion, or immersion, to reduce the unusually high and dangerous temperature of the body. E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Typography. See PRINTING, by W. S. PATERSON.

Tyr, in Scandinavian mythology, the god of war, had only one natural hand; the other was made of iron. In order to persuade the wolf Feuris to suffer himself to be bound with Gleipnir, Tyr placed his right hand in the wolf's mouth as a pledge that he would be loosened again; and when the gods refused to remove Gleipnir, the wolf bit off Tyr's hand. The third day in the week is called after him: Icel. *Tyrsdagr;* Dan. *Tirsday;* Eng. *Tuesday,* after his Anglo-Saxon name, *Tir.*

Tyranga, tp., Crittenden co., Ark. P. 150.

Ty'rant [Gr. τύραννος], in ancient Greece, did not necessarily designate, as at present, a despotic and cruel ruler. The Greek tyrants were powerful citizens who by force or stratagem assumed the rulership of a state or city without lawful warrant. Sometimes, in seasons of political disturbance, the government of a *tyrannus* was highly beneficial to the state, commercially and socially. Some of the tyrants were men of wisdom and beneficence. But the natural tendency of such an unlawful exercise of power is toward oppression and injustice; hence at present the word "tyrant" designates a cruel and unjust ruler, whether a lawful king or a usurper.

Tyrant, in ornithology. See FLY-CATCHERS and KINGBIRD.

Tyrcon'nel (RICHARD **Talbot**), EARL OF, b. in Leinster, Ireland, about 1625, descended from an ancient Norman family; became notorious for daring and unscrupulous adventures in London, on which account he was recommended to the exiled princes Charles and James as a suitable person to entrust with a scheme for the assassination of Cromwell; enjoyed great favor at court at the Restoration (1660), when, in order to enable the duke of York to refuse to marry Anne Hyde, he made oath to personal knowledge of that lady's unfaithfulness to James; filled many posts of profit at court; was arrested and banished as a conspirator against Charles II. 1677; was created by James II., on his accession, earl of Tyrconnel 1685, and commander of the army in Ireland 1686; dismissed English Protestant officers from the service, replacing them with Irish Roman Catholics; was made lord deputy of Ireland Jan., 1687; proceeded to labor for the repeal of the act of settlement and for the independence of Ireland under the protection of France; formed a large army of native Irish; invited James II. to Ireland after the Revolution; received him at Cork and accompanied him to Dublin 1689; was present at the battle of the Boyne, but rendered little service; went to France Sept., 1690, and returned with French forces in the spring of 1691. D. at Limerick July 14, 1691. His second wife was the celebrated Frances Jennings, sister to the duchess of Marlborough.

Tyre, the *Tyrus* of the ancients, the *Tzor* of Scripture, was a daughter-colony of Sidon and the mother-city of Carthage. It was the wealthiest and most magnificent of all Phœnician cities, and flourished for 3000 years. In the time of Solomon it was the wonder of the world, and although it was taken and devastated successively by Shalmaneser, Nebuchadnezzar, Alexander the Great, Antigonus, Augustus, the Saracens, the Crusaders, and Selim I., it was always rebuilt; and it was the discovery of the route to India S. of the Cape of Good Hope, rather than its utter destruction in 1516 by Selim I., which prevented it from ever rising again. It stood 20 miles S. of Sidon, on the shore of the Mediterranean, and the locality it occupied was as strong in a military point of view as it was advantageous in commercial respects. One part of it was on the continent, and the other on an adjacent island; the narrow sound which separated these two parts formed its harbor. After conquering the continental part of the city, Alexander the Great built a mole to the island, by means of which he succeeded in conquering the insular part too. This mole has in the course of time been transformed by alluvial deposits into a peninsula. But otherwise the remains which are left of this magnificent city are few and utterly insignificant. Its renowned manufactures of purple are entirely dead, its commerce totally gone, and a miserable village straggles along the site where once stood the richest storehouses and the most splendid palaces.

Tyre, p.-v. and tp., Seneca co., N. Y. P. 1280.

Tyr'ian Purple, a celebrated dye used by the ancients, and prepared extensively at Tyre from the shell-fish MUREX (which see), from each of which only a minute quantity was obtained at an enormous cost; and hence this color became the symbol of imperial power. Tarentum, the modern *Taranto,* was one of the great murex fisheries of the Romans, and there they had a number of dyeing establishments. With the decline of the Roman empire the employment of this color ceased. Purple is now obtained from vegetable and mineral sources. (See ANILINE COLORS, ARCHIL, and DYESTUFFS.)

Tyringham, p.-v. and tp., Berkshire co., Mass. P. 557.

Tyr'nau, town of Hungary, on the Ternava, manufactures vinegar and sugar, and has 8 important annual fairs. P. 9566.

Tyro, tp., Davidson co., N. C. P. 985.

Tyr'ol, province of the Austrian empire, the ancient *Rhætia,* is bounded N. by Bavaria, W. by Switzerland, and S. by Italy, and comprises an area of 11,084 sq. m., with 885,789 inhabitants, of whom 538,000 are Germans and 348,000 Italians. The country is mountainous throughout, traversed from W. to E. by three lofty chains of the Alps—the Tyrolese Alps in the N., forming the boundary toward Bavaria; the Trent Alps in the S., on the Italian frontier; and in the middle the Rhætian Alps, the highest of the three ranges, Mount Ortler rising 12,852 feet and Gross-Glockner 12,560 feet. The valley between the Tyrolese and Rhætian Alps is drained by the Inn, which flows through Bavaria to the Danube; the valley between the Rhætian and Trent Alps is drained partly by the Adige, an affluent of the Po, partly by the Drave, which flows through Styria to the Danube. One-third of the surface is covered with perpetual snow, from which the glaciers descend to between 5000 and 6000 feet above the sea. Another third is covered with forests, and of the remaining third part most is pasture-ground. Only a small part of the country is suitable for tillage, but that part is very carefully cultivated. Wheat, rye, oats, and barley are grown, though not enough for home consumption; in the gardens, vineyards, and orchards, mostly situated in the southern valleys, excellent wine, numerous mulberry trees for the rearing of silkworms, and fine fruits, olives, and figs are raised. But the chief industry of the people is the rearing of cattle, especially sheep and goats, which in the summer-time are driven to the pastures just below the snow-line. Salt and iron are produced, and various branches of manufactures are pursued, though mostly on a small scale. Cap. Innsbruck.

Tyrone', an inland county of Ireland, province of Ulster, comprises an area of 1260 sq. m., with 215,765 inhabitants, of whom 55,348 are unable to read and write; in 1841 the county had 312,956 inhabitants. The surface is hilly, rising into mountains in the N. and S., and declining to a level toward Lough Neagh. In the hilly districts the soil is sandy or gravelly; in the valleys it is more productive, but agriculture is in a very backward state. Rye, oats, and potatoes are the common crops. Coal is raised for domestic purposes, and some manufactures are carried on, though on a small scale.

Tyrone, p.-v. and tp., Kent co., Mich. P. 730.

Tyrone, p.-v. and tp., Livingston co., Mich. P. 1222.

Tyrone, tp., Le Sueur co., Minn. P. 830.

Tyrone, p.-v. and tp., Schuyler co., N. Y. P. 1993.

Tyrone, tp., Adams co., Pa. P. 1009.

Tyrone, p.-b. and tp., Blair co., Pa., on Pennsylvania R. R., 131 miles E. of Pittsburg, has 7 churches, good schools, 2 newspapers, 3 banks, 6 hotels, 1 flouring and 2 planing-mills, railroad repair-shops, 1 furniture and several small factories, and a bloom forge. P. of b. 1840; of tp. 1006. C. S. W. JONES, "HERALD."

Tyrone, tp., Fayette co., Pa. P. 2276.

Tyrone, tp., Perry co., Pa. P. 1287.

Tyrone (HUGH **O'Neill**), EARL OF, b. in Ireland about 1550; commanded a troop of horse in the service of Queen Elizabeth in the war against the rebel earl of Desmond 1579–83; received from the Irish Parliament in 1587 the title of earl of Tyrone, which had been held by his father, Con O'Neill, in the time of Henry VIII.; obtained by a personal visit to the English court the restitution to himself, as their heir, of the confiscated estates of the rebel Shan O'Neill (d. 1567), who had virtually assumed the title of king of Ulster; married a sister of Sir Henry Bagnal, marshal of Ireland, 1588; maintained a correspondence with the English government while conspiring against it; formed an alliance with Red Hugh, the chief of the O'Donnells, 1590; assumed the title of "The O'Neill;" offered the sovereignty of Ireland to Philip II. of Spain; defeated Sir John Norris, and was proclaimed a traitor 1597; defeated and killed Marshal Bagnal at Blackwater Aug. 14, 1598; concluded a truce with the earl of Essex Sept. 8, 1599; retreated from Munster before Lord Deputy Mountjoy 1600; successfully invoked the aid of Spain, but was

defeated with his Spanish allies in an attack upon Kinsale Dec., 1601, and took refuge in a stronghold near Lough Erne; surrendered to Mountjoy; renounced the title of "The O'Neill;" received a pardon 1602; presented himself to King James, and was confirmed in his earldom and estates 1603; was suspected in 1607 of being engaged in a new conspiracy; proceeded to Brussels to invoke the protection of the Spanish government, and spent the remainder of his life in obscurity, poverty, and blindness, a pensioner of the king of Spain and of the pope. D. at Rome in 1616.

Tyrongin, tp., Cross co., Ark. P. 80.

Ty'rosine ($C_9H_{11}NO_3$), a nitrogenous substance formed by the decomposition of albumenoid bodies by acids, alkalies, and putrefaction, was first obtained by decomposing caseine with fusing potash. It can also be prepared by heating water with sulphuric acid. It occurs ready formed in the animal organism (in the spleen, the pancreas, and the urine; sometimes in the liver and bile of diseased persons). Tyrosine crystallizes from an aqueous solution in slender silky needles, arranged in a stellate form. It dissolves in boiling water and in alcohol, but is insoluble in ether. J. P. Battershall.

Tyr'rell, county of E. North Carolina, bordering upon Albemarle Sound; surface level, much of it being occupied by forests of pine, cypress, and red cedar, which furnish tar, turpentine, shingles, and staves, the production of which is the principal branch of industry. Staples, forest products, Indian corn, sweet potatoes, and cotton. Cap. Columbia. Area, about 350 sq. m. P. 4173.

Tyrrhenia. See Etruria.

Tyrrhe'nian Sea, The, the ancient *Mare Tyrrhenum*, is that part of the Mediterranean which lies between the Italian mainland and the islands of Sardinia, Corsica, and Sicily.

Tyrtæ'us, according to an old tradition, a lame schoolmaster of Attica and of mean extraction. When, on the outbreak of the Second Messenian war, the Lacedæmonians sent to Athens for a leader in obedience to an oracle, the Athenians, moved by fear and jealousy, sent them Tyrtæus as the most unfit person they could find for the position. Tyrtæus, however, was possessed of eminent lyrical power, and by his songs he so excited the Lacedæmonians that they finally came victorious out of the war (668 B. C.). The fragments still extant of these songs have been collected and edited in Schneidewin's *Delectus Poesin Gracæ Elegiacæ* (1838) and in Bergk's *Poetæ Lyrici Græci* (1866); also by A. Lami (Leghorn, 1874). There is a translation into English verse by Polwhele (1786–92).

Tyrwhitt (ter'it), (Thomas), F. R. S., b. in London, England, Mar. 29, 1730; educated at Eton; graduated at Queen's College, Oxford, 1750; became fellow of Merton and under-secretary of state in the war department 1756, and clerk to the House of Commons 1762; resigned the latter post 1768; devoted himself to literary criticism, and was appointed one of the curators of the British Museum 1784. D. in London Aug. 15, 1786. Among his works were—*Observations on Some Passages of Shakespeare* (1766), an edition of *Chaucer* (1773), critical dissertations on Babrius, Euripides, and Strabo, and editions of the writings of Orpheus and Isæus, and of Aristotle's *Poetics* (posthumous, 1794). He will be best remembered, however, as the original editor of Rowley's *Poems*, to which he furnished a preface and glossary, and subsequently added an appendix, showing them to have been written by Chatterton.

Ty'son, tp., Stanley co., N. C. P. 880.

Tyson (James), M. D., b. in Philadelphia Oct. 26, 1841; was educated at Haverford College, where he graduated as A. M. in 1860, and in the medical department of the University of Pennsylvania, where he graduated as M. D. in 1863; is hospital lecturer on pathological anatomy and histology in the University of Pennsylvania, professor of physiology and histology in the Pennsylvania College of Dental Surgery, and one of the visiting physicians and pathologists to the Philadelphia Hospital. He has published many papers in medical journals, and *The Cell-Doctrine, its History and Present State* (1870), *Introduction to Practical Histology* (1873), and *Practical Examination of Urine* (1875).

Tyson (Job Roberts), LL.D., b. at Philadelphia, Pa., Feb. 12, 1801; became a lawyer in his native city; served in the city councils and in the State legislature; was a member of Congress 1855–56; possessed literary and artistic accomplishments; was instrumental in procuring the publication of the archives of Pennsylvania, and projected a history of the American colonies, which he was prevented from prosecuting by his death at Woodlawn Hall, Pa., June 27, 1858. Besides miscellaneous addresses, reports, and contributions on commercial or literary topics to various periodicals, he was author of *An Essay on the Penal Laws of Pennsylvania* (1827), *A Discourse on the Integrity of the Legal Character* (1839), *On the Colonial History of the Eastern and some of the Southern States* (1842), *Social and Intellectual State of the Colony of Pennsylvania prior to 1743* (1843), and a *Discourse on the 200th Anniversary of the Birth of William Penn* (1844).

Tyt'ler (Alexander Fraser), Lord Woodhouselee, son of William, b. at Edinburgh, Scotland, Oct. 15, 1747; educated at Kensington and at the High School and University of Edinburgh; was called to the bar 1770; became in 1780 conjunct professor, and in 1786 sole professor, of civil history and Greek and Roman antiquities at the University of Edinburgh; became judge-advocate of Scotland 1790, lord of session, with the title of Woodhouselee, 1802, and a lord of justiciary 1811. D. at Edinburgh Jan. 5, 1813. Author, besides many other works, of *Essay on the Principles of Translation* (1791; 3d ed. 1813), *The Elements of General History, Ancient and Modern* (2 vols., 1801), and *Lives* of Lord Kames (2 vols., 1807) and of Petrarch (1810).

Tytler (Patrick Fraser), son of Alexander Fraser, b. in Edinburgh, Scotland, Aug. 30, 1791; educated at the High School and University of Edinburgh; studied law; was admitted into the faculty of advocates 1813; accompanied to the Continent Mr. (afterward Sir) Archibald Alison, for whom he wrote several chapters of his *Travels in France* (1816); held for some years the office of king's counsel in exchequer, but ultimately devoted himself to biographical and historical researches, chiefly among the MSS. of the state paper offices, and received from 1841 a pension of £200 from the Crown. D. at Great Malvern, England, Dec. 24, 1849. Author of a *Life of James Crichton of Cluny, commonly called the Admirable Crichton, with an Appendix of Original Papers* (1819), *An Account of the Life and Writings of Sir Thomas Craig of Riccarton* (1823), *Life of John Wicklyff, with an Appendix and List of his Works* (1826), *Lives of Scottish Worthies* (3 vols., 1832–33); in Murray's "Family Library," *Life of Sir Walter Raleigh* (1833), *Life of King Henry the Eighth* (1837), *An Historical View of the Progress of Discovery on the Northern Coasts of America, etc.* (1832), the two latter works forming part of Dr. Lardner's "Cabinet Library;" and a *History of Scotland from 1149 to the Union of the Crowns in 1603* (Edinburgh, 9 vols., 1828–43; 5th ed., 10 vols., 1866), a work undertaken at the request of Sir Walter Scott, and pronounced by Earl Stanhope and other critics "the standard history of Scotland." Like his grandfather, he was a staunch advocate of Mary Queen of Scots. He edited a series of original letters under the title of *England under the Reigns of Edward VI. and Mary, with the Contemporary History of Europe* (London, 2 vols., 1839); contributed the article "Scotland" to the *Encyclopædia Britannica* (7th ed.); wrote songs and essays for the magazines. A memoir, entitled *The Portrait of a Christian Gentleman*, by Rev. John W. Burgon, appeared in 1859.

Tytler (William), b. in Edinburgh, Scotland, Oct. 12, 1711; educated at the University of Edinburgh; became a writer to the signet 1744, and practised law with great success until his death, at Edinburgh Sept. 12, 1792. Author of *An Historical and Critical Enquiry into the Evidence produced by the Earls of Murray and Morton against Mary Queen of Scots* (1760), which ranks as one of the ablest of the numerous defences of Mary from the charge of being accessory to the murder of Darnley, a crime imputed in this work to Murray and Morton.

Tywap'pity, tp., Mississippi co., Mo. P. 1778.

Tzana, lake of Abyssinia. See Dembea.

Tzar. See Czar.

Tzarskoye-Selo. See Tsarskoe-Selo.

Tzetz'es (Johannes), a Byzantine author of the latter half of the twelfth century. His poems, *Hiaca* (edited by Jacobs, 1793, and Bekker, 1816) and *Chiliades* (edited by Kiessling, 1826), are not of any great interest, but his commentaries on Homer, Hesiod, Aristophanes, and other ancient poets are valuable on account of the extensive learning they evince.

Tzschir'ner (Heinrich Gottlieb), b. at Mittweida, Saxony, Nov. 14, 1778; studied theology at Leipsic; was appointed professor at Wittenberg in 1805 and at Leipsic in 1809, and was elected superintendent at Leipsic in 1815, and prebendary of Meissen in 1818. D. Feb. 17, 1828. He acquired great reputation as a preacher and by the firm and intelligent opposition he offered to the Roman Catholic reaction all around him. His most remarkable writings are *Der Uebertritt des Herrn von Haller zur katholischen Kirche* (1821), *Protestantismus und Katholicismus aus dem Standpunkte der Politik betrachtet* (1822), *Das Reactionssystem* (1824), *Briefe eines Deutschen an die Herrn Chateaubriand, de Lamennais, etc.* (published after his death, in 1828, by Krug).

U.

U, a letter long used interchangeably with V, but at present *u* always represents a vowel, and *v* a consonant. The vowel *u* has four principal sounds in English: (1) the sound of *u* in *tube*, which is nearly, but not quite, as if the word were spelled ty*oob*, the *y* being slightly sounded; (2) the sound as heard in *rule*, very nearly like that of oo, its historic sound in English, and almost universal power in other languages; (3) the sound heard in *bull*; (4) that heard in *burn* or in *tub*, but in the latter word it has a shorter sound than in the former. Anglo-Saxon *u* (oo) often became English *ou*, as in *grund*, "ground," *hund*, "hound;" but *wund* (woond) remains in "wound," and *wonder* (*w* as *w*) has become "wonder." U in chemistry is the symbol of uranium.

Ube'da, town of Spain, province of Jaen, contains many splendid edifices, remnants of its former splendor, but is now generally decaying. It has a brisk trade in grain, wine, oil, fruits, and horses from the very fertile adjacent districts. P. 16,040.

Ubicini' (Jean Henri Abdolonyme), b. at Issoudun, department of Indre, France, Oct. 20, 1818; was educated in the lyceum of Versailles; taught rhetoric for several years; went in 1846 to Italy and the Orient; visited Greece, Turkey, and the principalities of the Danube; participated in the revolution at Bucharest in 1848, and acted for some time as secretary to the provisory government; returned subsequently to France; settled in Paris, and engaged in literature. His principal works are *Lettres sur la Turquie* (2 vols., 1847–51), *La Question d'Orient devant l'Europe* (1854), *La Turquie actuelle* (1855), *La Question des Principautés danubiennes* (1858), *Études historiques sur les Populations chrétiennes de la Turquie d'Europe* (1867).

Ucaya'le, or **Ucayali,** river of South America, is formed in Peru by the junction of two smaller streams rising in the Andes and passing by Lima and Cuzco. It runs N., and after a course of about 1100 miles joins the Amazon in lat. 4° 40′ S., lon. 73° 40′ W. It is navigable for steamboats from its mouth to the neighborhood of Lima, and has attracted much attention of late as a means of connecting Peru with the Atlantic. (See Amazon.)

U'chee, p.-v. and tp., Russell co., Ala. P. 2238.

U'chee An'na (Euchee Anna P. O.), v., cap. of Walton co., Fla. P. 922.

U'chees, a tribe of American Indians of the Creek family; originally resided on both sides of Savannah River in South Carolina and Georgia; removed to the Chattahoochee at the time of the Yemassee war, and emigrated with the Creeks to the Indian Territory, since which time they have formed part of the Creek confederacy. They are industrious, peaceable, and well disposed; have made some progress in civilization, and retain their language, which is harsher and more guttural than the tongues of their neighbors. There are but a few hundred of them.

U'dall, or **Woodall** (Nicholas), b. in Hampshire, England, in 1504; graduated at Corpus Christi College, Oxford, 1524, where he became a fellow; wrote verses for the City of London pageant at the coronation of Queen Anne Boleyn, May, 1533; took orders in the Church of England; was a zealous advocate of the Reformation; was master of Eton School 1534–43, where he was noted as a severe disciplinarian; published *Floures for Latin Spekynge, Selected and Gathered out of Terence, and the same translated into Englysshe* (1533); wrote several Latin and English plays to be performed by his pupils, one of which, *Ralph Roister Doister*, probably produced as early as 1540, though not printed until 1565, is memorable as the earliest English comedy known to be extant. Udall was dismissed from the mastership of Eton in 1543 in consequence of having removed from the chapel some silver images—a proceeding for which he was charged with robbery by his Roman Catholic adversaries; was vicar of Braintree, Essex, 1537–44; entered the service of Queen Katharine Parr; obtained on the accession of Edward VI. the rectory of Calborne in the Isle of Wight; edited, with a dedication to the queen-dowager Katharine, *The First Tome or Volume of the Paraphrase of Erasmus upon the New Testament* (1549), translated partly by himself, partly by the Princess Mary, afterward queen, whose tutor he seems to have been; became canon of Windsor 1551–56, and head-master of Westminster School 1555, and wrote for the queen's entertainment various *Dialogues and Interludes*. D. at Windsor in Dec., 1556. He was author of several schoolbooks and of some poems, and translated Latin works of Peter Martyr and others. No copy of his *Ralph Roister Doister* was known to exist until 1818, when it was discovered and reprinted by Rev. Mr. Briggs; was again issued, with notes, by Mr. F. Marshall (1821), by Thomas White in his *Old English Drama* (1830), by William Durrant Cooper (1847), who edited it for the Shakspeare Society, prefixing an elaborate *Life* of Udall, and by Arber in his series of *English Reprints* (1869). It was identified as the earliest English comedy (a distinction previously accorded to *Gammer Gurton's Needle*) by J. Payne Collier in his *History of English Dramatic Poetry* (1831), by means of a quotation from it found in the *Arte of Logique* (1551) of Sir Thomas Wilson. The name of Udall also occurs under the forms *Owdall*, *Dowdall*, *Woddall*, *Uredale*, and *Vuedale*. Porter C. Bliss.

Udell, tp., Appanoose co., Ia. P. 907.

U'dine [*Utinum*], town of Northern Italy, province of same name, at the foot of the Alps, about 360 feet above the sea and 25 miles from the Adriatic. It is a walled town, nearly circular, handsomely built, with commodious streets and large squares flanked with fine porticoes, and many of its edifices, both public and private, recall Venice very strongly. The castle, near the centre of the city, on the elevation from which Attila is said to have witnessed the burning of the rich and proud Aquileia, is now used for military purposes. It was designed by G. Fontana, and occupies the site of a still earlier castle which was destroyed by an earthquake. The municipal palace was a very fine Gothic building, resembling the ducal palace of Venice and very rich in frescoes, but a recent fire has almost destroyed its contents and greatly damaged the edifice itself. The episcopal palace has frescoes by Giovanni da Udine. The Metropolitana (1236), injudiciously restored, except the W. front, in 1706, contains some admirable pictures, and there are many other churches interesting both for their architecture and their pictorial decorations. The Bartoliniana Library is well worthy the attention of the scholar, and that of the Casa dei Florio is also extremely rich. Udine first appears historically in the ninth century; was governed for a time by the patriarchs of Aquileia; was long the chief city of the duchy of Friuli, and formed an important portion of the Venetian republic when the latter fell. It is now an active centre of industry and traffic. P. 29,630.

Udol'pho, p.-v. and tp., Mower co., Minn. P. 380.

Ue'berweg (Friedrich), b. at Solingen, Rhenish Prussia, Jan. 22, 1826; studied at Göttingen and Berlin, and was appointed professor of philosophy in 1862 at Königsberg, where he d. June 7, 1871. His principal works are *System der Logik und Geschichte der logischen Lehren* (1857; translated into English by Thomas Lindsay, 1871); *Grundriss der Geschichte der Philosophie von Thales bis auf die Gegenwart* (3 vols., Berlin, 1862–66), translated into English by George S. Morris, with additions by Prof. Botta and Pres. Porter of Yale College; *History of Philosophy* (New York and London, 1874, 2 vols.), which is used as a textbook in Oxford and in several American colleges; and Berkeley's *Principles of Human Knowledge*, with notes (1869), translated by C. P. Krauth (1874).

U'fa, government of Eastern Russia, comprises an area of 50,742 sq. m., with 1,297,577 inhabitants. It extends along the rivers Ufa and Belaia, which flow to the Ural, and is mostly covered by branches of the Ural Mountains. The ground is to a large extent covered with forests, and only a comparatively small part of it is under tillage. The climate is cold but healthy. Mining is the main branch of industry; gold, lead, copper, and especially iron, are raised in large quantities and of superior quality. The transit-trade between Europe and Asia, or rather between Nizhnee-Novgorod and Bokhara, is important. Cap. Ufa.

Ufa, town of European Russia, capital of the government of the same name, on the Ufa at its influx in the Belaia, has several good educational institutions, some manufactures, and an active trade. P. 12,900.

Uglitch', town of Russia, government of Yaroslav, on the Vulga, contains many fine buildings, among which are

24 churches, and has extensive tanneries and some other manufactories. P. 13,126.

U'grians, The, a Finnish tribe, inhabiting parts of the government of Tobolsk, Siberia, speak a primitive Finnic dialect, much mixed, however, with Tartaric elements, and occupy a very low stage of civilization. They are nominally Christians, but their religion is really a mixture of Christianity, Mohammedanism, and Shamanism. They are nomads, and hunting and fishing are their chief occupations.

Uhar'rie, tp., Montgomery co., N. C. P. 480.

Uh'lan, or **Hulan** [Tartar for "brave" or "youthful"], a soldier of certain corps of light cavalry. Uhlans are employed in the Russian, Austro-Hungarian, and German armies. They were primarily recruited from the Turanian or Tartaric peoples; but at present the name is not indicative of any nationality or of any marked peculiarity of discipline, drill, or equipment.

Uh'land (JOHANN LUDWIG), b. at Tübingen Apr. 26, 1787; studied law at the university of his native city; practised in Stuttgart 1812–14; became a member of the Würtemberg assembly in 1819; was appointed professor of the German language and literature at Tübingen in 1830; sat in the national assembly of Frankfort in 1848. D. at Tübingen Nov. 13, 1862. His first poems were published in magazines in 1806; the first collection appeared in 1815, and this volume, subsequently enlarged, had in 1868 reached its 52d ed. His two dramas, *Herzog Ernst von Schwaben* (1817) and *Ludwig der Bayer* (1819), are interesting, but his ballads and lyrical poems, enriching the German literature with a new type, a new model, made the poet the head of a particular school, the so-called Suabian school. Of great value also are his scientific researches: *Ueber das altfranzösische Epos* (1812), *Ueber Walther von der Vogelweide* (1822), *Ueber den Mythus der nordischen Sagenlehre vom Thor* (1836), and his excellent collection of *Alte hoch- und niederdeutscher Volkslieder* (2 vols., 1844–45). It was, however, not so much his scientific labors which turned away his productivity from poetry as his very active participation in politics after 1819, in which field he played a conspicuous and noble part. Most of his poems have been translated into English, some by Longfellow, others by Alexander Platt (1848), by W. W. Skeat (1864), and by W. C. Sanders (1869). Biographies and reviews of him have been written by Pfizer (1837), Notter (1863), Jahn (1863), Pfeiffer (1863), Mayer (2 vols., 1867). See also *Ludwig Uhland, eine Gabe für Freunde, zum 26. April, 1865,* by Emilie Uhland.

Uh'ricksville, p.-v., Mill tp., Tuscarawas co., O. P. 1541.

Uigurs. See TURKS.

Uintah, county of W. Wyoming, occupying the whole of the W. side of the Territory, having Montana on the N., Utah on the S., and Idaho on the W.; is crossed by the Rocky Mountains and minor ranges, and contains the sources of rivers which finally find their way through the Columbia into the Pacific Ocean, through the Colorado into the Gulf of California, and through the Missouri into the Gulf of Mexico. In the extreme N. W. corner is Yellowstone Lake and the romantic region set apart for the Yellowstone National Park, comprising more than 3500 sq. m. Cap. Evanston. Area, about 13,500 sq. m. P. 856.

Uintah (or Uinta) Mountains. See ROCKY MOUNTAINS, by MAJOR J. W. POWELL.

Uist, North and South, two islands of the Outer Hebrides, belonging to Scotland. North Uist is 17 miles long and from 3 to 10 miles broad, with 3034 inhabitants. South Uist is 20 miles long and 7 miles broad, with 3406 inhabitants. Both islands are high and rocky, and ill suited for agriculture; fishing is the principal occupation of the inhabitants, who are generally poor.

U'jhely-Satoral'ja, town of Hungary, celebrated for the excellent wine which is cultivated and the fine marble which is quarried in its vicinity. P. 7200.

Uji'ji, a place in Africa, consisting of a number of mud huts, and situated on the shore of Lake Tanganyika, in a district of the same name, in lat. 4° 58′ 3″ S., lon. 30° 4′ 30″ E., became noted as the point where Stanley met Livingstone Nov. 10, 1871.

Ukase' [Russ. *ookáz*, from *kasatj*, to "speak"], an order, legislative or administrative, issued by the Russian autocrat or his senate. Both have the force of laws, and as such are duly collected and codified.

Ukiah, p.-v. and tp., cap. of Mendocino co., Cal., 100 miles N. W. of Sacramento, has 5 churches, 1 academy, 2 banks, 1 brewery, 2 hotels, 2 newspapers, and a mill. The surrounding country is picturesque, and the climate very healthy. P. 966. BELLE LYNCH, ED. "DISPATCH."

U'kraine (the "frontier-land"), the name commonly given to that easternmost portion of Poland which, extending on both sides of the Dnieper along its middle course, and conquered by the Poles in 1320, formed the frontier of the Polish empire against the Tartars; it hardly ever signified a political division with precisely defined boundaries, but it soon became an apple of contention between Russia and Poland. In 1654 ten Cossack tribes settled on the eastern bank of the Dnieper fell off from the Polish crown, and surrendered themselves to Russian authority; and by the Treaty of Andrussow (1667), and finally by the Peace of Grzymaltowsk (1686), this territory was ceded by the Poles and annexed to Russia under the name of Russian Ukraine, or Little Russia. The rest of the country, situated on the western bank of the Dnieper, remained with Poland, under the name of Polish Ukraine, until the second division of Poland, when Russia took the whole and divided it up into various governments.

Ulcer and Ulceration [Gr. ἕλκος; Lat. *ulcus*], the process of molecular death or disintegration occurring on the surfaces of the body at points where nutrition is low in consequence of local irritation or injury or defective circulation and bad states of the blood. Localized inflammation is often the determining cause of an ulcer, by locally occluding the capillaries and arresting or weakening local circulation and nutrition: thus, the canker is often an ulcer in the mouth due to stomatitis; the ulcerated tonsil has been previously inflamed, either acute or chronic. Sluggish venous circulation often causes ulcers, as ulcers upon the legs from varicose veins or weak circulation of the aged; ulcers upon haemorrhoids, or varicosity of the anus. When wounds have failed to heal promptly, their border and surface may take on the ulcerative process, and become bathed with a weak watery serum containing black granular detritus. The presence of foreign substances, as a splinter in the flesh or dead bone in a limb, creates secondary ulcers. Pressure and constant irritation are causes, as upon the feet from ill-fitting boots, and bed-sores from long lying. Lowered nerve-tone and depressed temperature favor ulceration, the paralyzed limb easily ulcerating. Ulcers are classed as—(1) Simple or healthy ulcers, if the term is not a misnomer—that is, ulcers having a healthful tendency to heal. (2) Weak ulcers, lacking the florid color and healing tendency of the first class; they often result from the debilitated health of the subject. (3) Indolent ulcers; often all recuperative power is lost; usually the border is thickened and elevated, and may be indurated. (4) Irritable ulcers are painful, and may bleed upon touch. (5) Inflamed ulcers. Ulcers are liable to become inflamed upon slight local irritation or derangement of the blood, use of alcohol, and exposure to cold. (6) Sloughing ulcers, conditions often following the inflamed ulcer or very low states of health. (7) Serpiginous ulcers, when some specific vice of the blood gives it a tendency to spread, and it pursues a tortuous, serpentine course. (8) Specific ulcers, with undermined edges, due to primary deposits beneath the skin, which soften and discharge upon the surface.

The simple ulcer needs simply to be kept clean and protected by any bland cooling lotion or ointment; the weak and indolent requires stimulating applications; the indurated often requires the incision of its thickened borders or removal by strapping with plaster; the inflamed ulcer calls for cold and evaporating lotions—the sloughing for antiseptics. In all forms the diet must be rich, the appetite maintained by tonics, and the blood enriched by iron and often alteratives.
E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

U'leaborg, town of Russia, province of Finland, at the entrance of the Uleå into the Gulf of Bothnia, was founded in 1610, and almost entirely destroyed by fire in 1822, but was rapidly rebuilt, and carries on an active trade in pitch, tar, timber, and salt fish. P. 7602.

Ule'ma [Arab., "wise"], in Mohammedan countries, a judge of the law and of religion. Strictly, the name is plural, including, as a class term, all muftis, mollahs, cadis, and indeed all who are learned in religion and the law. These are designated, in a body, the ulema.

Ulex. See FUNZE.

Ul'fila, or **Wulfila** [that is, "Little Wolf:" grecized, *Ulphilas*], b. in 313 among the pagan Visigoths, at that time settled on the northern bank of the Danube in the Dacian territories, and descended from a Christian family which half a century earlier, in the time of Valerianus and Gallienus, had been carried away by the Goths as captives from the village of Sadagolthina, near the city of Parnassus in Cappadocia. Thus he was educated in Christianity, and learned both the Gothic and the Greek language. In 343 he was consecrated bishop among the Goths, and so great was his success in converting them to Christianity that their chief, Athanaric, became alarmed and instituted persecutions. In consequence, Ulfila left

the Goths in 350, accompanied by a large congregation of converts, and received permission of the East Roman emperor, Constantius, to settle in the neighborhood of Nicopolis, at the foot of Mount Hæmus in Lower Mœsia. Here the Gothic colony flourished, and was much increased by immigration from the mother-tribe, for the work begun among the Goths by Ulfila was not stopped by Athanaric's persecution. New and still severer persecutions occurred, which show that the christianization of the people was still going on, and a century later the whole nation, not only the Visigoths, but also the Ostrogoths, appears to have adopted Christianity. This was chiefly the result of Ulfila's exertions. He was the apostle of the Goths. They adopted his creed, Arianism; they drew their spiritual nourishment from his translation of the Bible; and in all their numerous conflicts with the Roman emperors he acted as a mediator. It was with regard to the Goths settled within the boundaries of the East Roman empire that the emperor Theodosius convoked the Council of Constantinople (383) for the purpose of establishing a reconciliation between Arianism and the Nicene creed. The plan failed, however; the council decided in favor of the Nicene view, and Ulfila was declared a heretic. He was present at the council, and died in Constantinople in the same year. The few particulars of his life that have come down to us are due to one of his disciples, Auxentius, bishop of Dorostorus (Silistria); they are generally corroborated by the stray notices found in Philostorgius, Basilius, Socrates, and other writers. (See Waitz, *Ueber das Leben und die Lehre des Ulfilas* (1840), and Bessel, *Ueber das Leben des Ulfilas und die Bekehrung der Gothen zum Christenthum* (1860).) According to Auxentius, Ulfila was a prolific writer, but his principal work, and the only one which has come down to us, is his translation of the Bible into Gothic. For the Old Testament he used the Septuagint, for the New some Greek manuscript not known now; and for the transcribing of his work he had to invent a new alphabet, which he ingeniously composed of Gothic runes and Greek letters. This translation, which was well known in the Christian world between the fourth and the eighth century, and is frequently mentioned by Christian authors of that period, accompanied the Goths in all their wanderings through Italy, Gaul, and Spain, but in the ninth century it disappeared, together with the language and national existence of the people; and it remained unknown and forgotten till the latter part of the sixteenth century, when Arnold Mercator discovered, in the abbey of Werden, a fragment of it containing the four Gospels. It was the so-called *Codex Argenteus*, written with silver letters on purple parchment. (See PRINTING.) Somehow, it was transferred from Werden to Prague, and thence the Swedes carried it as spoil in 1648 to Upsal, where it is still preserved, and where it was published in an exact reprint by Andreas Uppström (1854–57). In 1818 another important fragment of the work, containing nearly the whole of the Epistles of St. Paul, was discovered on some palimpsests by Cardinal Mai and Count Castiglioni in the Lombardian monastery of Bobbio, and published at Milan (1819–39). Thus, the larger portion of the New Testament has been restored, but of the Old Testament only a few passages from Ezra and Nehemiah have come to light. The question of the worth of this work, considered as a translation of the Bible, has been thrown entirely in the background by the circumstance that the work is the only, or nearly the only, existing remnant of the Gothic language. On the Bobbio palimpsests some fragments were discovered of a paraphrase of the Gospels, probably from the sixth century: they were published by Massman, *Skeireins aivaggeljons thairh Johannen* (Munich, 1834). Some few other scraps have been found, and collected editions of all that remains of Gothic literature, accompanied by grammars and dictionaries, have been given by Von der Gabelentz and Löbe (2 vols., Leipsic, 1843–46) and by Stamm (Paderborn, 1858), the 5th ed. of which appeared in 1872, revised by Moritz Heine. But, besides being the only remnant of any importance of the Gothic language, Ulfila's translation of the Bible is the oldest monument of any of the Teutonic languages, and is consequently a document of paramount linguistic importance. It shows that the Gothic language, although closely related to the Icelandic, Anglo-Saxon, old High German, etc., occupied an entirely independent position among the other branches of the Teutonic family; and by this, its independent development, the Gothic language has been enabled to throw light on many peculiar features in the Teutonic languages. CLEMENS PETERSEN.

Uliasutai, or **Uljassutai,** an important commercial station of Mongolia, in lat. 48° 22′ N., lon. 97° E., on the line between the Russian frontier and Si-Ngan-Foo, capital of the Chinese province of Shen See, and principal dépôt for all goods destined for the markets of Central Asia. It consists of a civil and a military quarter, the latter occupied by the Chinese garrison, the former by inhabitants who are partly Chinese and partly Mongolian. The Mongolian nomads who visit the city during the time of the fair live in tents. Since 1868 it has repeatedly been visited by Russians, but it has not been possible to establish commercial connections, as the Dungan rebels from Urumtsi have occupied the city several times. EMIL SCHLAGINTWEIT.

Ul'lin, p.-v., Pulaski co., Ill.

Ull'mann (KARL), b. at Epfenbach, Baden, Mar. 15, 1796; studied theology at Heidelberg and Tübingen; lived in friendly intercourse with Hegel and Daub; afterward with Schleiermacher and Neander, was appointed professor at Heidelberg in 1821; founded in 1828, together with Umbreit, the *Theologische Studien und Kritiken,* which is still the principal representative of that school of German theology which believes in, and tries to work out, a complete reconciliation between Christianity and the modern culture; went to Halle in 1829, but returned to Heidelberg in 1836; was made president of the chief ecclesiastical council of Baden in 1856, but resigned this office in 1860 and retired into private life. D. at Karlsruhe Jan. 12, 1865. His principal writings are *Gregor von Nazianz* (1825), *Historisch oder mythisch?* directed against Strauss (1838), *The Worship of Genius* (1840; translated into English 1846), *Reformers before the Reformation* (2 vols., 1841; translated into English by Robert Menzies, 1855), *Apologetic View of the Sinless Character of Jesus* (1841; translated into English in the same year and afterward again from the sixth German edition), *Ueber das Wesen des Christenthums* (1845).

Ullo'a, de (ANTONIO), F. R. S., b. at Seville, Spain, Jan. 12, 1716; educated in the naval service; became lieutenant of the royal marine guards 1735, in which year he was sent to South America with Don Jorge Juan and a commission of the French Academy to measure a degree of the meridian in Peru; spent ten years in South America, making extended journeys, and being employed to fortify the Pacific coast against an anticipated attack by Lord Anson's expedition; embarked for Spain Oct., 1744; was captured by the British and carried a prisoner to London; obtained his liberty through the intervention of several scientific gentlemen; was elected a fellow of the Royal Society, and communicated to it several papers embodying results of his observations in South America; aided his companion Juan in the preparation of a narrative of their travels (Madrid, 4 vols., 1748), which appeared in French, German, and English translations, the latter under the title *A Voyage to South America* (2 vols., 1772; 4th ed. 1806); was instrumental in establishing the royal woollen manufactories and in the reform of the colleges of history and surgery, and superintended the completion of the basins of Ferrol and Cartagena; made a second visit to South America 1755; became the first Spanish governor of Louisiana 1766, but was unable to establish his government, and was soon driven away by the riots of the French population of New Orleans; published *Entretenimientos Físico-historicos sobre la America Meridional* (1772) and a volume of *Observations of a Solar Eclipse made at Sea* (1778); rose to be lieutenant-general in the naval service; was entrusted in 1779 with the command of a squadron destined to capture an English merchant fleet and to rendezvous at Havana for an attack upon the British settlements in Florida, but, being absorbed in astronomical investigations, forgot to open his sealed orders, and returned after two months without having effected anything; was court-martialled in 1780 and acquitted, but was never again employed in active naval service. D. in the isle of Leon, near Cadiz, July 3, 1795.

Ulloa, de (FRANCISCO), b. in Spain about the beginning of the sixteenth century; went to New Spain shortly after its conquest; was a lieutenant of Cortez in his explorations of the Pacific coast, and commanded the expedition which in 1539–40 explored the Gulf of California, to which he gave the name of "Sea of Cortez." On his return he was assassinated in Jalisco. A narrative of the expedition by Preciado, one of the officers, may be found in Ramusio and Birney.

Ulm, town of Germany, kingdom of Würtemberg, at the influx of the Blau into the Danube, which here becomes navigable, is old-fashioned and queer, but curious and interesting, like a ghost of the Middle Ages. Its cathedral, begun in 1377, but never completed, is a magnificent edifice in Gothic style, 485 feet long, 200 feet broad, and 141 feet high. Ulm is fortified, and contains a great variety of manufactures, of which no single branch, however, is extensively developed. On Oct. 17, 1805, Gen. Mack, at the head of an Austrian army of 30,000 men, here capitulated to Napoleon. P. 26,290.

Ulma'ceæ [Lat. *Ulmus,* one of the genera], a natural order of exogenous plants, either trees or shrubs, having

rough alternate leaves, each leaf with a pair of deciduous stipules. The flowers are small and in loose clusters. The perianth is small, membranous, bell-shaped, irregular; the stamens equal in number to the lobes of the perianth, and inserted into their base; the ovary superior. The fruit is 1-2-celled, nut-like, or compressed and winged. There are about 60 known species, natives of temperate parts of the northern hemisphere. (See ELM and NETTLE TREE.)

Ulmic Acid. See HUMUS, by PROF. H. WURTZ, A. M.

Ulmine. See HUMUS, by PROF. H. WURTZ, A. M.

Ulna. See ARM.

Ulphilas. See ULFILA.

Ulpin'nus (DOMITIUS), b. at Tyre about 170 A. D.; entered into public life in Rome under Septimus Severus; obtained the greatest reputation as a jurist, and held various judicial offices under Septimius Severus and Caracalla; lost his influence and his offices under Elagabalus, but came again into power after the accession of Alexander Severus, who made him *magister scriniorum*, *præfectus annonæ*, and *præfectus prætorio*, but he was murdered by the soldiers in 228 before the eyes of the emperor. Of his writings, *Ad Edictum*, *Ad Sabinum*, *Ad Leges Juliam et Papiam*, only fragments exist, but about one-third of the *Digest* of Julian consists of excerpts from his books. The *Tituli ex Corpore Ulpiani*, generally called *Fragmenta Ulpiani*, were edited by Hugo (1834) and by Böcking (1845).

Ul'ri'ci (HERMANN), b. at Pförten, Prussian province of Brandenburg, Mar. 23, 1806; studied law at Halle and Berlin, and entered on a juridical career, but devoted himself after 1829 exclusively to the study of philosophy, and was appointed professor of philosophy at the University of Halle in 1834. He wrote—*Ueber Princip und Methode der Hegelschen Philosophie* (1841), *Grundprincip der Philosophie* (2 vols., 1845-46), *System der Logik* (1852), *Glauben und Wissen* (1858), *Gott und die Natur* (1862), *Gott und der Mensch* (1866), *Der Philosoph Strauss* (1873), translated by C. P. Krauth (1874). Of his work, *Ueber Shakespeare's dramatische Kunst* (1839; twice reprinted in Germany, and translated into English by A. J. W. Morrison, London, 1846), the historical part contains much which is interesting and valuable.

Ul'ster, the northernmost of the four provinces into which Ireland is divided, borders N. and W. on the Atlantic and E. on the North Channel and the Irish Sea. Area, about 1150 sq. m. P. 2,389,263 in 1841, 2,013,879 in 1851, 1,914,236 in 1861, and 1,830,398 in 1871, of whom 894,525 are Roman Catholics, 522,774 Presbyterians, and 398,705 Episcopalians. The tables show that it is the Celtic and Roman Catholic element of the population which emigrates, while the English and Scotch colonists from the times of Elizabeth and James I. remain.

Ulster, county of S. E. New York, bounded E. by Hudson River, drained by Esopus, Rondout, and Wallkill creeks, traversed by Delaware and Hudson Canal, and intersected by the New York Kingston and Syracuse R. R. The surface is much broken by the Catskill and Shawangunk ridges. The soil is generally better adapted for grazing than tillage. Iron ore, limestone, and slate are found, and flagging-stone forms a considerable article of export. There are in all nearly 700 manufactories of different kinds, among which are carriages, cooperage, brick, cement, furniture, marble, paper, edge tools, machinery, paints, ironware, and glassware; many saw-mills, flour-mills, tanneries, and breweries. Cattle, horses, sheep, and swine are numerous. Staples, besides various articles of manufacture, dairy products, potatoes, oats, Indian corn, hay, wool, and lumber. Cap. Kingston. Area, 1201 sq. m. P. 84,075.

Ulster, tp., Floyd co., Ia. P. 500.

Ulster, tp., Bradford co., Pa. P. 1174.

Ulster King of Arms, the principal herald of Ireland and of the order of St. Patrick. The office was created in 1552 to supply the place of Ireland king of arms, whose office had long been in abeyance. Ulster has two heralds, Dublin and Cork, and four pursuivants, of which Athlone and St. Patrick are the principal.

Ultimate Analysis, in chemistry, a branch of the great art of CHEMICAL ANALYSIS (which see), which has for its object to determine the elementary constitution of bodies, as distinguished from *proximate analysis*, which merely seeks to separate the different distinct compounds which may occur, either mixed or combined, or both, in the body under consideration. Ultimate analysis is therefore more especially applicable to *homogeneous* or *definite* chemical compounds, such as *crystallized* salts and other compounds, minerals, and liquids of definite boiling-points, in order to determine their chemical constitution and place in chemical classification; while proximate analysis applies more to heterogeneous bodies. (See ORGANIC ANALYSIS, PROXIMATE, and ORGANIC ANALYSIS, ULTIMATE, where the distinctions are more narrowly applied.) HENRY WURTZ.

Ultimate Ratio. See RATIO.

Ultramarine' [Fr. *outre mer*, "beyond the sea"—*i. e.*, from Asia], a blue pigment formerly obtained from lapis lazuli, a mineral containing silica, alumina, soda, lime, sulphuric acid, a little sulphur and iron, with a very little chlorine and water. It is found in Siberia, Transylvania, Persia, China, Thibet, Tartary, and the East Indies, and furnishes a beautiful and very durable pigment. The analysis of lapis lazuli led to the production of artificial ultramarine, a prize of 6000 francs being offered in 1824 by the Société d'Encouragement of Paris for this purpose. It was awarded in 1828 to Guimet of Toulouse, who first produced it on a large scale, although Gmelin had shortly before made it by a process essentially the same as that now followed. Wagner (*Chemical Technology*) gives the following classification of the different methods followed: The *sulphate or glauber's salt ultramarine* is prepared by intimately mixing 100 parts of dried kaolin, 83 to 100 parts of calcined glauber's salt, and 17 of charcoal, or else 100 of kaolin, 41 of glauber's salt, 41 of calcined soda, 17 of charcoal, and 13 of sulphur, and heating the mixture very strongly for seven to ten hours in fire-clay crucibles. The contents are then repeatedly treated with water, pulverized, washed, dried, ground, and sifted, furnishing *green ultramarine*, ready for the market. This is a pigment of inferior value, because its color is not brilliant. To convert it into *blue ultramarine*, about 4 per cent. of sulphur is mixed with it, the whole roasted at a low temperature with access of air, and this treatment repeated until the desired blue color is produced. The blue product is pulverized, washed, dried, and separated into different qualities. *Soda ultramarine* is either made with a mixture of soda and sulphate, or with soda alone, as in the following mixture: kaolin 100, soda 100, charcoal 12, sulphur 60. The ignition is best performed in a reverberatory furnace, and the conversion into blue ultramarine in a large muffle, with addition of sulphur, the product being finer than the former. By increasing, within certain limits, the quantities of soda and sulphur, blue ultramarine may be at once obtained. *Silica ultramarine* is soda ultramarine prepared with kaolin which has received an addition of 5 to 10 per cent. of silica. It is at once obtained by calcination as blue ultramarine, withstands the action of alum, and has a violet tint. Wilkens considers the presence of iron in ultramarine unimportant, and Brunner states that the substitution of sulphide of potassium for sulphide of sodium yields a colorless compound.

Ultramarine is decomposed by the mineral acids, even dilute, with evolution of sulphuretted hydrogen. The natural ultramarine is far more durable, but the artificial is now very extensively employed as a pigment for calico-printing, coloring paper and cotton fabrics, and various other purposes for which smalt was formerly used. It should not be used for coloring candies. Sometimes it is mixed with chalk, kaolin, and barytes to make the tints lighter. *Cobalt ultramarine* is Thénard's blue. (See COBALT.) *Yellow ultramarine* is a name sometimes applied to chromate of baryta. *Ultramarine ashes* is a pale residue obtained in the preparation of native ultramarine. Ultramarine is largely manufactured in Germany, France, Belgium, and to some extent in England, about 9000 tons being annually made in Europe. H. B. CORNWALL.

Ultramon'tanism, a tendency within the Roman Catholic Church to place an absolute authority in matters of faith and discipline in the hands of the pope at Rome —*ultra montes*, "on the other side of the Alps"—in opposition to the tendency original in Christianity, and never altogether crushed under the papal arrogance, of placing the national churches in partial independence of the Roman curia, and making the pope subordinate to the statutes of an œcumenical council. (For the scope and history of this tendency see the articles ROMAN CATHOLIC CHURCH, COUNCIL OF TRENT, COUNCIL OF THE VATICAN, by PROF. PHILIP SCHAFF, and GALLICANISM.)

Ultramontanists. See ULTRAMONTANISM.

Ul'tra Vi'res [Lat., "beyond the powers"]. This term has been recently introduced into the law concerning corporations, and designates the contracts and other transactions entered into by those bodies without any express or implied authority contained in their charters, and the legal consequences which result therefrom. It is a familiar doctrine that corporations obtain all their powers from their charters, or from the statutes which take the place of charters, and they are only authorized to do such acts as are expressly permitted by, or as are fairly and reasonably included within, the terms of the enactment from which they derive their existence. A contract by a corporation which is prohibited by its charter, or for which there is no express

or implied authority, or which is outside of the fair and reasonable means for attaining the objects of its creation, is *ultra vires*. The questions concerning such contracts may arise in two very different conditions: (1) When the corporation itself seeks to enforce the agreement. Here there is no difficulty. The corporation cannot take advantage of its own violation or transgression of the law, and the contract is held void, whether it has been executed or is still executory. (2) When the other party seeks to enforce the agreement, and the corporation sets up its own want of authority as a defence. There are two cases under this head: (1) where the contract is executory on both sides; (2) where it has been executed by the party dealing with the corporation, and the latter has received and retains the benefits thereof. In the first of these two cases there is no equitable reason for not holding the contract void. The corporation could not be compelled to specifically perform what the law does not authorize it to do: and as the plaintiff has parted with no consideration beyond his own promise, and as he must be presumed to have known that the defendant's promise was without legal authority, it is not inequitable that he should be prevented from recovering damages for a mere breach of that promise. Under these circumstances the defence will prevail and the agreement be held void. The second case presents much greater difficulties, and has occasioned a conflict of judicial opinion. There are three classes of decisions. The first class hold that the *ultra vires* contract is not only void, but is absolutely illegal, and that no action upon it or growing out of it can be maintained, even though the corporation retains the money or other property derived through the transaction. Another class of decisions, regarding the defence of *ultra vires* under these circumstances as utterly inequitable and unjust, have declared that unless the contract was expressly prohibited or essentially illegal (*malum in se*), and the plaintiff was an actual *particeps criminis*, the corporation is estopped from setting up its own inability as a defence. The third class of decisions occupy a middle ground. They pronounce the *ultra vires* contract void, and therefore no action can be maintained *upon it*, but it is not necessarily illegal. The party dealing with the corporation, although he knew that it was exceeding its powers, may recover the consideration—the money or other property—which he has parted with, in an action brought upon the implied contract to repay, unless the charter should absolutely forbid a recovery in any form. This doctrine seems to be sustained by the weight of authority, although very able judges have favored the rule above stated, which would generally estop corporations from denying their liability upon the contracts which they had executed. The consequences resulting to corporations from the violation of their charters by entering into unauthorized contracts and other transactions may be very serious and penal. In the first place, the State, through its attorney-general, may institute a judicial proceeding called a *quo warranto* against the offending corporation, and compel it to answer and account for the usurpation and exercise of powers and franchises not conferred in its charter. If such usurpation and unlawful exercise be shown, a judgment may be rendered forfeiting the charter and terminating the corporate existence. In the second place, if the directors or other managing officers have engaged in, or are about to engage in, transactions which transcend the powers granted by the charter, and are therefore *ultra vires*, a stockholder may maintain a suit in equity against such officers and the corporation as defendants, and restrain the further prosecution of the unlawful or unauthorized acts. This jurisdiction, which is now well established, is founded upon the equitable doctrine of trusts, since the fiduciary relation of trustee and beneficiary exists between the directors and the stockholders. JOHN NORTON POMEROY.

Ulugh' Beg, b. in 1394, a grandson of Timur, succeeded his father on the imperial throne in 1447, but was put to death in 1449 by his own son. He founded the observatory at Samarcand, encouraged the study of astronomy, was a diligent and accurate observer himself, and wrote several astronomical works in Arabic, which have been translated into Persian; into Latin by Greaves (London, 1650–52) and by Thomas Hyde (Oxford, 1665); into French by L. A. Sédillot (1846–53). A new edition of his catalogue of stars appeared in the *Memoirs* of the Royal Astronomical Society, vol. xiii.

Ul'verstone, town of England, county of Lancaster, on Morecambe Bay, manufactures different kinds of coarse woollen and linen fabrics, and exports considerable quantities of pig iron, bar iron, iron ore, limestone, and slate. P. 6642.

Ulys'ses, or **Odysseus,** a son of Laërtes, the husband of Penelope, the father of Telemachus, king of Ithaca; participated in the expedition against Troy; wandered for many years after the capture of the city, and did not reach home until twenty years after his departure. He plays a very conspicuous part in the *Iliad*, and is the hero of the *Odyssey*.

Ulysses, tp., Butler co., Neb. P. 352.

Ulysses, tp., Tompkins co., N. Y. P. 3271.

Ulysses, p.-v. and tp., Potter co., Pa. P. 789.

U'ma, one of the names of the most important goddess of the modern Hindoo pantheon, the wife of Siva, otherwise called Durga, Devi, Bhavani, Kali, or PARVATI (which see; also HINDU RELIGION, by PROF. JOHN DOWSON).

Umatil'la, county of N. E. Oregon, bordering on Washington Territory, lying between Columbia River and the Blue Mountains, and watered by the Umatilla and other rivers. The surface is much diversified with wooded mountains, high table-lands, rolling prairies, and some fertile valleys. Gold is found in the mountains and on the bars of the Columbia; coal, iron, and copper also exist. Horses, cattle, and sheep are numerous. Staples, oats, Indian corn, wheat, wool, lumber, and dairy products. Cap. Pendleton. Area, about 5300 sq. m. P. 2916.

Umatilla, p.-v. and tp., Umatilla co., Or. P. 206.

Um'bagog Lake lies partly in Oxford co., Me., but principally in the town of Errol, Coos co., N. H. It is in a wild and beautiful region, and is famous for its fine trout. Length, 15 miles; breadth, 1 to 10 miles. It may be reached from Gorham, N. H., on Grand Trunk Railway. Its waters are discharged into a branch of the Androscoggin.

Umbellif'eræ [Lat. *umbellus*, "umbrella," alluding to the shape of the *umbels* or clusters of flowers and fruit], an important natural order of exogenous herbs, or rarely shrubs, abounding in both hemispheres, chiefly in cool regions. Among the useful plants of the order are the carrot, parsnep, skirret, chervil, fennel, caraway, dill, coriander, anise, parsley, celery, and others. Some are useful in medicine, many being active poisons—the medicines conium, cicuta, asafœtida, ammoniac, galbanum, etc. According to the latest revision of the order, by Bentham and Hooker, there are 152 genera and about 1300 or more known species. Most have hollow striated stems, and flowers in umbels, but these are not perfectly constant characters. Various as these plants are in aspect, it is difficult to accurately define their generic and specific distinctions.

Um'ber [Lat. *terra umbria, umbria*; Fr. *argile ochreuse brune, terre fine de Turquie umber*], a mineral pigment formerly obtained from Umbria in Italy, but at present chiefly imported from the island of Cyprus. Its composition is—silica, 13 per cent.; alumina, 5 per cent.; oxide of iron, 48 per cent.; oxide of manganese, 20 per cent.; water, 14 per cent.; being essentially a silicious brown hæmatite. It forms brown or yellowish-brown masses, possessing a hardness of 1.5 to 2.5 and a sp. gr. of 2.2; adheres to the tongue; shines when rubbed, and dissolves to some extent in hot hydrochloric acid, the solution giving the reaction of iron. When gently heated, water is expelled, and a dark-brown pigment termed *raw umber* is formed; at a higher temperature it is completely dehydrated, and converted into a soft red-brown modification known as *burnt umber*. The dark colors of these pigments depend upon the manganese. They are extensively used as oil and water-color pigments, and are often mixed with other colors. J. P. BATTERSHALL.

Umber (*Scopus umbretta*), a bird of the heron family, found in Africa. It has a sharp furrowed and keeled bill, the upper mandible hooked. The male has a large crest on the head. The bird is of the size of a crow, but has much longer legs.

Umbertide [formerly *Fratta*], town of Italy, province of Perugia, on the left bank of the Tiber, and about 20 miles N. of the city of Perugia. It is a walled town, with some respectable buildings, but a large portion of the population live in suburbs outside the old walls. The ancient and celebrated Benedictine convent of Monte Corona (1050) occupies a neighboring height and is a very conspicuous object. P. 11,039.

Umbilical Cord. See FŒTUS, by G. H. WYNKOOP, M. D.

Umbilical Hernia. See HERNIA, by E. J. BERMINGHAM, M. D.

Um'breit (FRIEDRICH WILHELM KARL), b. at Sonneborn, Saxe-Gotha, Apr. 11, 1795; studied theology at Göttingen, and was appointed professor of theology and philosophy in 1820 at Heidelberg, where he d. Apr. 26, 1860. In connection with Ullmann he founded *Studien und Kritiken* (1828); of his other works the most remarkable are *Commentar über die Sprüche Salomos* (1826), and *Com-*

mentar über die Propheten des alten Testaments (4 vols., 1841–46).

Umbrel'la-Bird, one of the most singular birds known, is the *Cephalopterus ornatus* of South America, one of the Corvidæ of the group called fruit crows. On its head is a curious crest of blue hair like feathers, and beneath its throat hangs a large wattle covered also with blue feathers. It is of a deep-black color, and of the size of the common crow.

Umbrellas and Parasols. The word *umbrella* is a diminutive from the Latin *umbra*, and signifies "a little shade." It is said to have been brought into English from the Italian *ombrella*, which has the same meaning. *Parasol* is from the Greek *para*, "against," or possibly the Latin *parare*, to "protect," and *sol*, the "sun." The two words have, then, substantially the same meaning, a shade or protection from the sun. The Germans and French are more definite in their names for these articles, the German *Regenschirm* and the French *parapluie* signifying a protection from the rain, while *Sonnenschirm* and *parasol* denote protection from the sun's rays. The umbrella, both as a protection against the rays of the sun and as an emblem of high rank, is of very ancient origin. The Egyptian and Ninevite sculptures, even those of the earliest dates, have frequent representations of it, but only in connection with royalty. The umbrella was spread over the head of the monarch, whether in his chariot, on horseback, or in his great open-air feasts; it appeared like a halo over his head. The Chinese had adopted it at a very early period of their history, and, so far as we can ascertain, were the only people, for many centuries, who did not confine its use to the king and the princes of the blood. With them, however, the man who was privileged to bear an umbrella must be a man of wealth and high position. The common people made their hats so broad and of a shape so similar to that of the umbrella that with those and their cloaks of rushes they were alike protected from sun and rain. The Japanese have used the umbrella ever since they established themselves in their island empire. The use of the umbrella or parasol is universal throughout India, but in Burmah and Siam it is a mark of rank. The king of Burmah has for one of his titles "lord of the twenty-four umbrellas." The umbrellas of the king are of white silk, and no other person is allowed to carry a white one. The princes of the blood have two gilt umbrellas, with handles ten or fifteen feet in length, borne above their heads; the other officers of the state but one. In some of the Hindoo sculptures Vishnu is represented as visiting the infernal regions with his umbrella spread above his head. In Greece the umbrella or parasol was much used by women of rank, and there are frequent allusions to it in the Greek poets. In Rome its use was confined to women and effeminate men. It was used only as a protection from the sun, and was made substantially like those we have now. It seems to have come to the Romans from the Etruscans, rather than the Greeks. Its use extended to all the countries of Southern Europe and Northern Africa. In the Middle Ages its use among women was less common, but it was an emblem of rank in the Church. The cardinals and bishops were allowed to have them borne over their heads in solemn processions. All the large churches, especially the cathedral churches, owned an umbrella to be used for these processions. The umbrella was probably introduced into England as early as the fourteenth century, for one of the Harleian MSS. (No. 603) has a drawing of an Anglo-Saxon gentleman walking out with a servant behind him carrying an umbrella over his head, with a handle that slopes backward. The parasol was introduced into general use in France and England, probably from China, about the middle of the seventeenth century. The forms in use and the material indicate their Chinese origin, though they were in use in Italy nearly seventy-five years earlier. Beaumont and Fletcher and Ben Jonson refer to their use. In England they were carried by women as a protection from the rain as well as the sun as early as about 1700. Gay, Dean Swift, and Addison all refer to this. De Foe in his *Robinson Crusoe* describes an umbrella made by Robinson and covered with skins. The allusions to them in the poems and essays of the first half of the eighteenth century are so frequent as to show that they were coming into general use for women. But Jonas Hanway, an eccentric traveller and philanthropist, is believed to have been the first man of note who carried one in the streets, and he encountered a great deal of ridicule for doing so. The umbrella generally in use at this time was made of oiled muslin or silk, sometimes of a tough oiled paper, and rarely, as in Hanway's case, of silk. They were generally very heavy. Improvements made in their construction have made them light and graceful, and they are now universally used. Aside from their hand-service in protecting the person from sun and rain, they are also largely used for carriages, where they take the place of the leather carriage top; for express-wagons, omnibuses, trucks, etc., and a modification of them as parachutes for descending from balloons. Another modification is the umbrella tent.

The umbrella, in the general construction of its frame, has undergone very little change in thousands of years, though the materials used have been constantly changing. The Chinese frames, which have been to some extent the models of all others, were made mostly of bamboo and light but strong woods. In Europe the ribs were at first made of rattan or split bamboo, then of wood (white oak being chosen usually), afterward for many years of whalebone. The parts of an umbrella are the top notch and runner; a notched wheel or disk into which the ends of the ribs fit, and are secured by a steel wire or sliding ring; the ribs or supports of the umbrella, now made of the best steel (and often grooved) in the finer classes of goods, and of rattan in the cheaper; at the outer end of the ribs they are tapered to a point and finished with a minute head or tip, which may be either plain, plated, or tipped with some other substance. In the cheap rattan ribs these are tipped with metallic caps. The stretchers are short iron rods, flat and light, but strong, extending from the notched wheel or disk to the ribs, each of which has a little perforated projection on its inner side, to which the stretcher is attached by a rivet through its fork-like end. The notched wheel from which the stretchers start has a metallic cylinder called the runner, which slides up and down on the stick of the umbrella; a bent wire, which by its construction forms a simple spring, over which the runner passes in the act of opening the frame, slides into a slot in the runner, and serves to keep the umbrella open: and when it is closed by pressing this simple spring inward, the runner, in the act of closing, passes over a similar spring near the handle, and, being released by the slot, keeps the umbrella closed. The other parts of the umbrella are—the stick, which may be of bamboo, metal, pimento, or any one of fifty other kinds of wood, for the cheaper grades usually of maple, and which is divided into the handle, which is often fanciful and sometimes mounted with ivory, silver or other metals gilt or silvered; the stick or staff which forms the support of the umbrella, and over which the two notched wheels and the runner play; the ferule or end, usually tipped with bone or metal; and the covering, which in the finer qualities is of silk of various grades, and next to this of mohair or alpaca; to some extent other wool or wool and cotton fabrics are used, corresponding to the merinos, cashmeres, or delaines of dress goods; these are known under various names, as regina, victoria, etc. Some waterproof goods are also used. But the larger number of umbrellas are made of ginghams and cotton stuffs of various qualities. The sections of the covering are cut out in triangular pieces and sewed together on sewing-machines, and then hemmed or corded around the outer edge in the same way. They are next drawn upon the open frame (the notched wheel at the top being forced against a little wire stop), and are sewed to the ribs, a metal cap slipped over the ferule, brought down to the covering, and secured by a rivet or pin; the closed umbrella is secured by an elastic band, and the umbrella is complete. Some manufacturers have a metallic cup in which the tips are confined, but this is not generally regarded as an improvement. The paragon frame, in which the ribs and stretchers are grooved—an English invention—has recently been improved by a slight bending inward of the ribs, so that when closed they fit compactly round the stick. Parasols are made in a similar way, though occasionally lined, trimmed, or covered with lace, etc. The English market has long been the best for umbrellas, single manufacturers there making millions of them in a year. Umbrellas have been made here since 1802, and in considerable numbers since 1812, but except for the cheapest goods, the sticks, the ribs, the stretchers, and the coverings were imported. Even now, the greater part of the silk and alpaca, the steel ribs, and a large proportion of the sticks are imported, though the duty on silk and alpaca is 60 per cent., on the ribs 45 per cent., and on the sticks 35 per cent. Our American silk manufacturers are now beginning to produce silks nearly or quite equal to the imported umbrella silk; some of the steel manufacturers are endeavoring to produce frames of quality equal to the English; and Messrs. William A. Drown & Co. of Philadelphia, who have been exporting sticks of their own manufacture for some years, have recently turned their attention to American woods, and hope to succeed in making the umbrella an entirely American production. The census of 1870 reported that there were in the U. S. that year 83 establishments for the manufacture of umbrellas and canes, employing 2618 hands and producing $4,098,032 of goods, and 10 establishments for the production of umbrella furniture, employing 578 hands, and producing goods to the

amount of $724,034. There is good reason for believing that the present production is nearly $10,000,000, as the production of four leading houses exceeds $6,000,000. Philadelphia is the principal city in the manufacture.

L. P. Brockett.

Umbrella-Shell (*Umbrella*), a genus of gasteropod mollusks of the family Pleurobranchidæ, containing only three known living and two extinct species. The small, flattened, umbrella-shaped shell only covers the more important organs, and the shell itself is often concealed by the mantle.

Umbrel'la-Tree, a small tree of the genus *Magnolia*, found in the U. S. along the Alleghany Mountains from Pennsylvania to Kentucky; has obovate-lanceolate leaves, pointed at both ends, and a rose-colored fruit. It takes its name from the fact of the leaves being crowded on the summit of the flowering branches in an umbrella-like circle.

Um'bria, an ancient division of Italy, between Etruria and the Ager Gallicus, which stretched along the Adriatic from Æsis to Rubicon, and was inhabited by a Gallic tribe called the Senones. The Umbrians, occupying the heights of the Apennines, were in ancient times considered the oldest inhabitants of Italy, and are often spoken of as aborigines. This view is corroborated by the fragments of their language which have been preserved on the Eugubian Tables (which see), and which prove it to be one of the oldest Latin dialects. At the end of the second century B. C. the Umbrians were thoroughly Romanized.

Umbridæ, a family of fishes. See Appendix.

Um'pire. When a controversy is referred to two or any other even number of arbitrators, it is usual to provide for the appointment of a person who shall be called in to make a final and peremptory decision in case the arbitrators themselves are equally divided, and are therefore unable to agree. This referee is called the *umpire*. He is sometimes named in the agreement or submission executed by the contestants, but the arbitrators themselves are more frequently empowered to select an umpire when one is needed. He is not regarded as a presiding officer giving a casting vote, by means of which the decision is that of a majority of the arbitrators; the decision when made is his *instead of* the arbitrators', but is none the less conclusive and binding. When two nations undertake to adjust their respective claims by treaty, and to that end a commission is created consisting of two members, one of them appointed by each of the high contracting powers, an umpire is either named in the convention or is left to be chosen by the commissioners. John Norton Pomeroy.

Ump'qua River rises in Douglas co., Or., in the Cascade Mountains, by two forks, the N. and the S., of which the latter is the largest. The forks unite 8 miles below Roseburg. The river's course thence is N. W. to the Pacific Ocean. Its valley is hilly and fertile, and is famous for its wool-product. Placer gold-mining has been carried on here to some extent.

Umritsir. See Amritsin.

Unadil'la, tp., Livingston co., Mich. P. 1041.

Unadilla, p.-v. and tp., Otsego co., N. Y., on Albany and Susquehanna R. R., 42 miles E. of Binghamton, contains an academy, the usual county-seat buildings, 2 banks, a foundry and machine-shop, 1 newspaper, and Young Men's Christian Association. P. of v. 875; of tp. 2555. G. A. Dodge, Pub. "Home and Abroad."

Un'cas, an Indian sachem, b. about 1600; originally a war-chief of the Pequods, he revolted against Sassacus, the sachem, in 1634; made friends with the whites, and became chief of the Mohegans. In 1637 he joined Mason's expedition against the Pequods, and was rewarded with some of their lands; made several treaties with the settlers in Massachusetts and Connecticut, and in 1643 joined them in a war against Miantonomoh, the Narragansett sachem. In 1657 he was besieged in his stronghold on Connecticut River by the Narragansetts, but when on the point of starvation was relieved by Ensign Leffingwell, to whom it is said that he granted the land upon which Norwich now stands, although he subsequently sold it to others. Many complaints were made against him by other Indians, and in 1654 he was warned by the commissioners of the united colonies that the English would not protect him in any unlawful, treacherous, or outrageous course. He was always on good terms with the whites. D. in 1683.

Un'cial Let'ters [Lat. *unciales literæ*, from *uncia*, "inch"], a term used in Diplomatics and Paleography (which see) to indicate characters of a large and round form used in some ancient manuscripts. The earliest Greek and Latin manuscripts are written in *majusculæ* or capital letters, which were used until about the middle of the fifth century, when the necessity for more rapid writing brought into general use characters of a smaller form composed of rounded and not straight lines, termed uncial, many of the letters resembling the majuscule, or capital, and others the minuscule, or small, letters. This style, being more easily learned than the cursive, was employed in books and manuscripts of importance from the third to the eighth, and even the tenth, century, while legal instruments, requiring despatch, were executed in a corrupted form of the Roman cursive or running hand. In Italy and to some extent elsewhere during the sixth and seventh centuries, a transitional form of writing prevailed, which approximated to the Roman cursive hand; and this gradually passed into the minuscule style, which became the usual form in manuscripts from the tenth century. (See specimens of uncial writing under Codex.)

Unconformable Strata. See Conformable.

Unction, Extreme. See Extreme Unction.

Un'derhill, p.-v. and tp., Chittenden co., Vt. P. 1655.

Underhill (John), b. in Warwickshire, England; came to America in 1630; was a representative in the Assembly from Boston, and in 1637 commanded the colony troops, who with those of Mason destroyed the Indian forts at Mystic, and broke the power of the Pequods. Banished from Boston on account of his religious opinions, he went to England, where in 1638 he published an account of the Pequod war. Returning to America, he was in 1641 governor of Exeter and Dover; removed to Stamford, and in 1646 to Flushing, L. I., and held a command in the war between the Dutch and the Indians. In 1665 he was a delegate from Oyster Bay to the assembly at Hempstead, and in 1667 the Mantinenoe Indians gave him a tract of 150 acres of land on Long Island, which is still held by his descendants. D. at Oyster Bay, L. I., about 1672.

Under-Lease. When a tenant lets the premises or a portion of them for a period less than the unexpired part of his own time, the contract is an under-lease. If the entire interest of a lessee is transferred, the transaction is an assignment (see Tenant for Years); but if the transfer is of a portion only, if the possession will return to the lessee before his own leasehold estate runs out, and even if he reserves the right of entry for the non-payment of the rent so that he *may* regain the possession, the transaction constitutes an under-letting. Between the original lessee and his under- or sub-lessee the relations are those of landlord and tenant. The latter is liable to the former for the stipulated rent, and both are bound by whatever covenants they choose to insert in their contract. Between the original lessor and the under-tenant there are no legal relations whatever; there is neither privity of contract nor of estate. The under-lessee is not bound to pay rent to the one who first let the premises, nor is the latter bound to accept such rent if offered. The sub-tenant acquires no rights to the possession of the premises greater than those held by his immediate landlord, the original lessee, while as against the prior lessor he is subject to all the conditions assumed by that lessee. If, therefore, the lessor is entitled to re-enter for a breach of any condition in his own lease, he may dispossess the under-tenant, although the latter may have complied with all the stipulations of his contract.

John Norton Pomeroy.

Understanding. See Mind, by W. T. Harris, LL.D.

Un'derwood (Abin Ballou), b. at Milford, Mass., May 19, 1828; graduated at Brown University in 1849; studied law, and was admitted to the bar at Worcester in 1853; removed to Boston in 1855. At the opening of the civil war he was chosen captain of volunteers; colonel in 1862; took part in the battles of Fredericksburg, Chancellorsville, and Gettysburg; severely wounded at Chattanooga, and disabled from active service; brigadier-general in 1863, brevet major-general in 1865, and subsequently appointed surveyor of customs at Boston.

Underwood (Joseph Rogers), b. in Goochland co., Va., Oct. 24, 1791; went with an uncle to Kentucky; was educated at various schools in that State; graduated at the University of Lexington 1811; studied law, and was admitted to the bar. At Dudley's defeat in 1813 he was severely wounded, but was taken care of in a cabin near Cleveland. In 1813 he entered upon the practice of law at Glasgow, Ky.; was a member of the legislature in 1816–19; in 1823 removed to Bowling Green; was member of the assembly 1825–26; judge of the court of appeals 1828–35; Representative in Congress 1835–43; member and Speaker of the House in the Kentucky legislature 1846; U. S. Senator 1847–53, Presidential elector in 1824 and 1844, and delegate to the national Democratic convention at Chicago in 1864. D. at Bowling Green, Ky., Aug. 23, 1876.

Underwood (William Henderson), b. in Culpeper co., Va., Sept. 13, 1779; when a boy moved to Elbert co., Ga., with his father; his education was obtained almost entirely by his own exertions; after his majority taught a

country school for several years; studied law, and was admitted to the bar in 1810; was a captain of volunteers in the war of 1812; after the war rose to distinction in his profession, and was elected judge of the western circuit in 1825, which position he held for several years. In the controversy of the Cherokees with the State of Georgia he became the leading counsel of this aboriginal tribe, and became famous in the Supreme Court of the U. S. for the ability with which he advocated their cause. D. suddenly at Marietta, Ga., Aug. 4, 1859. A. H. STEPHENS.

Un'derwriter and **Un'derwriting.** Insurance companies up to 1824 were prohibited from effecting marine insurances, with the exception of the London and the Royal Exchange of England, whose high rates and restrictions eventually threw the system into the hands of a few individuals, who shared the risks. These persons could not legally enter into any joint-stock action, as it could be prohibited by the above chartered companies, but held their sittings at Lloyd's coffee-house in London, and became gradually known as Lloyd's. When a merchant or a shipowner wished to insure vessel or freight, these individuals, acting in common, subscribed or *wrote under* the policy of insurance the sums for which they severally bound themselves in case the ship or cargo was damaged or lost. Most of the principal ports also had agencies of this association. The traditional system of underwriting still prevails, though co-ordinately with chartered marine insurance companies. (For marine insurance see INSURANCE.)

Undine' [Lat. *unda*, "wave"], in mediæval superstition, a water-spirit, corresponding nearly to the nymphs of classical mythology. Paracelsus has given several minute rules of what to do and how to act when one has happened to marry an undine, and Friedrich de la Motte Fouqué has treated the subject in a German tale entitled *Undine*.

Undulation. See ACOUSTICS, by O. N. ROOD; also VIBRATION and UNDULATORY THEORY OF LIGHT, by PRES. F. A. P. BARNARD.

Un'dulatory Theory of Light, the theory which regards light as a mode of motion generated by molecular vibrations in the luminous source, and propagated by undulations in a subtile medium, sensibly imponderable, presumed to pervade all space, including the intervals which separate the molecules or atoms of ponderable bodies. Only one other theory can be opposed to this, the theory which supposes light to consist of material particles emitted from the source, and projected in straight lines in all directions with a velocity which continues uniform at all distances, and is the same for all intensities. The relative claims of these two theories to acceptance have been considered under the title LIGHT. The phenomena of light have also been descriptively treated under their appropriate heads, as REFLECTION, REFRACTION, INTERFERENCE, DIFFRACTION, POLARIZATION, etc. The object of the present article is to show in what manner the undulatory theory satisfactorily accounts for all these phenomena.

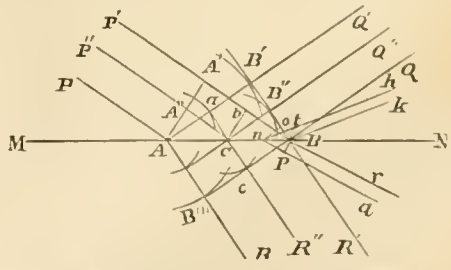
The laws of vibration, and of the composition of vibrations, must first be presumed to be understood. These are demonstrated under the title VIBRATION (which see). The manner also in which a vibrating solid generates undulations in a surrounding elastic medium is explained in the article ACOUSTICS, to which the reader is referred. In that explanation, however, mention is only made of undulatory movements excited in a single determinate direction. It is impossible, nevertheless, to disturb the equilibrium of an elastic fluid at any point, in any direction whatever, without disturbing that of the adjacent molecules, and so giving rise to tremors in all directions. Accordingly, if the original disturbance is confined to a mere point, the generated wave will be spherical; and such also will be sensibly its form, whatever be the dimensions of the vibrating body, when the distance from the body is considerable compared with those dimensions. The curvature of a spherical surface is less in proportion as the radius is greater. Hence, at a very great distance from the centre of disturbance the wave-front is sensibly plane. It should further be kept in mind that, inasmuch as the movements of the molecules in undulations may be derived from any of the possible modes of vibration, those movements may be circular or elliptical as well as linear, and, instead of being confined to the direction of the radius of the wave, may be transverse to it, or may take place in the tangent plane to the wave-surface. In the case of circular movements performed around the radius as an axis, an undulation will therefore consist of a chain of molecules occupying positions less and less advanced, in the direction of progress, in their respective circles, until the last differs from the first by 360°. Accordingly, at any instant, the molecules in such undulations, or series of undulations, will present the exact counterpart, direct or reversed, of the thread of a screw.

Now, suppose that, in the way of an advancing plane wave-surface, and parallel to it, there be interposed a plane obstructing solid, having in it a small aperture through which a minute elementary portion of the movement may be propagated, while all the remaining part is arrested, then this aperture will become the centre of a new spherical wave on the other side of the obstruction. If the solid be perforated by a great number of apertures, each of these will generate its own independent wave; and all these waves, as in their progress they encounter each other and become blended, will ultimately reproduce anew the plane wave from which they originated. By supposing the number of these apertures infinitely great, and the spaces between them infinitely small, we shall arrive at the conclusion that *a plane wave is equivalent to an infinite number of spherical waves, whose centres are infinitely near to each other in that plane*, and of which the plane wave is the resultant; so that if, at any time, we intercept any number of these component waves, either such as are contiguous to each other or such as are separated by determinate intervals, the consequences of the proceeding may be calculated *a priori* by finding the resultant of those which remain unobstructed. This principle, which is of the highest importance to the physical theory of undulation as applied to optics, was first laid down by Huyghens.

We proceed now to consider in what manner it may be applied to explain the phenomena of the reflection and refraction of light.

Reflection and Refraction.—In order to deduce from the theory of undulation an explanation of the phenomena of reflection and refraction, we must assume that the condition of the ethereal medium through which the undulations are propagated is different in the intervals between the molecules of material bodies from what it is in free space. We may suppose a difference either of density or of elasticity. We adopt the first of these suppositions. In considering, therefore, the manner in which tremors are propagated, we may regard the strata of the ether which are successively disturbed as being so many independent elastic bodies, and apply to them the known laws relating to the impact and reactions of such bodies. If these successive strata are equal in mass, an impulse applied to the first of the series will be wholly transmitted to the second, then to the third, and so on, leaving all behind at rest. But if, at any point, a stratum of greater mass (that is, an ether of superior density) be encountered, there will be a movement of recoil on the part of the impinging mass, as well as one of advance on that of the denser mass which receives the impact. That is, there will be a reflected as well as a transmitted undulation; and this, in the case supposed, will be an undulation by condensation. But if the stratum impinged upon is of less density than the other, it will not fully absorb the living force of the impinging stratum; and this will still advance beyond the point of equilibrium, and generate an undulation by rarefaction. We here suppose the impinging wave to encounter the stratum of different density in that stage of the undulation in which the molecules are advancing. The result would be the same, however, were we to assume it to be in the opposite phase; only in such case the phases of the reflected waves would also be the reverse of what is stated above.

FIG. 1.



Now let MN be the upper surface of a transparent medium more dense than air, and let AA' be the front of a plane wave advancing in the direction PA, P'A', and passing from the air into the medium between the points A and B. A will be the centre of an elementary spherical wave reflected from that point; and when the point A' has reached B, this reflected wave will have travelled from A a distance equal to A'B. From A as a centre, therefore, with a radius equal to A'B, describe a circular arc, as at B', and draw BB' from B tangent to it. BB' is the front of the entire reflected plane wave. For, if AB be divided into any number of equal parts—say two—as at C, and CA''P'' be drawn parallel to PA, and also C*b* parallel to AA', then, as before, when *b* reaches B, the elementary

spherical wave from C will have travelled a distance equal to Bb. Then if from C, with radius = Bb, a circular arc as at B″ be described, the tangent from B to that arc will coincide with the tangent BB′, because

$$CB'' : AB' :: Bb : BA' :: BC : BA;$$

or the triangles BCB″, BAB′ are similar.

It is also evident that the triangles BAA′ and BAB′ are similar and equal, and consequently the inclinations of the wave-fronts AA′ and BB′ to the reflecting surface are equal. But these inclinations are also those of the rays themselves to the normal; and hence it follows that the angle of reflection is equal to the angle of incidence.

If we now turn our attention to the portion of the incident wave which enters the medium through the surface AB, we find experimentally that the beam changes its direction, so that its limiting lines PA, P′B assume directions, AR, BR′, more largely inclined to the surface, MN, than before. From B draw BB‴ perpendicular to AR. This line must represent the front of the transmitted plane wave. For B‴ must be in the surface of the elementary spherical wave generated from the centre A during the time that A′ has been advancing to B. It follows that the velocities of light in the air and in the medium respectively, which we may denote by V and v, will be in the ratio of A′B to AB‴; and as A′B = AB . sinA′AB, and AB‴ = AB . sinB‴BA, we have the proportion

$$\sin A'AB : \sin B'''BA :: V : v :: n : 1;$$

n being assumed to denote the constant ratio of the velocities, and being the number commonly called the index of refraction. These angles are, once more, the inclinations of the wave-fronts to the surface of the medium, or of the rays themselves to the normal to that surface; and hence the Snellian law is verified, that the sine of the angle of incidence is to the sine of the angle of refraction in an invariable ratio.

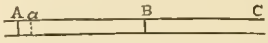
This very satisfactory theory of ordinary refraction had been proposed by Huyghens before the more difficult problem of double refraction had presented itself. On becoming acquainted with the remarkable optical properties of calcite, the crystal then known as Iceland spar, he found it necessary to suppose that the incident wave, in entering this body, is divided at the surface into two waves advancing with different velocities and generally in different directions. Both could not be spherical and still fulfil these conditions; yet the inference was irresistible that both must be of some regularly geometrical figure. That one of them is spherical was obvious from the conformity of the phenomena presented by it to the Snellian law. It seemed probable that the other must be spheroidal, and this hypothesis was, upon investigation, found to furnish a perfect explanation of all the apparent anomalies of double refraction then known. But while Huyghens was thus successful in determining the forms of the two waves generated by refraction in Iceland spar, he was unable to account for the fact of double refraction itself. He supposed the molecular movements in luminous, as in acoustic, undulations to be confined to the direction of the radius of the wave. This hypothesis suggested no physical cause for the division of a wave, or for the generation of waves of different forms. When, early in this century, however, it was suggested by Young, and independently by Fresnel, that the ethereal vibrations are transverse to the radius, or to the direction of progress, the difficulty disappeared; for in a body like a crystal, in which the molecular structure presents different aspects as considered from different directions, it is easy to suppose that such differences may affect the elasticity in different directions of the ether within the body; so that the transverse vibrations of the incident light which are distributed indiscriminately in all azimuths, may be determined to the two rectangular directions of maximum and minimum elasticity, thus giving rise to waves of unequal velocities.

The subject of double refraction will be resumed later in this article. In the mean time it may be observed that the direction from the point of incidence which will be taken by the extraordinary ray, or the ray belonging to the spheroidal wave, as well as that of the ordinary, may be determined by a generalization of the geometrical construction used above for common refraction. Thus, if a plane wave of light fall obliquely upon the surface of a crystal of Iceland spar, intersecting it in a straight line, any point of this line of intersection may be assumed as the common centre of a spherical and a spheroidal wave, having one diameter in common, parallel to the optic axis of the crystal, which common diameter is the axis of revolution of the spheroid. Moreover, as this supposition may be made of every other imaginable point of the line of intersection, it follows that there will be an infinite number of elementary waves, spherical and spheroidal, simultaneously generated. As the incident wave advances, the line of intersection will advance along the surface of the crystal, always during this advance remaining parallel to itself; and in every position of this line a new set of elementary waves will in like manner originate. By reasoning similar to that which was employed in the illustration of ordinary refraction, it may be shown that, in any position of the incident wave, all the elementary spherical waves will be touched by one and the same tangent plane, and all the elementary spheroidal waves will be touched by one plane likewise. These two tangent planes must intersect each other in the line in which the incident wave intersects, at the moment, the surface of the crystal, or the plane of that surface; but they will not coincide except in the single case in which the velocities of wave-progress are equal; that is to say, when the movement of progress within the crystal is in the direction of the optic axis.

The geometrical problem of determining the extraordinary ray in a negative crystal of one axis, like Iceland spar, reduces itself, therefore, to this: With the point of incidence as a centre describe a sphere. Upon that diameter of the sphere which coincides with the optic axis describe a spheroid of revolution, whose revolving axis is to its fixed axis as the greatest index of refraction is to the least. In the plane of incidence lay down the path of the ordinary ray according to the law of Snellius. Through the intersection of this path with the surface of the sphere pass a plane tangent to the sphere; and through the intersection of this tangent plane with the plane of the refracting surface pass another plane tangent to the spheroid. The radius of the spheroid drawn to the point of contact will be the path of the extraordinary ray.

As the theory of refraction necessitates the assumption of a change of velocity in the progress of luminous undulations passing from one medium into another, and as the component rays of different colors which make up common light are found to be differently refracted, the conclusion is unavoidable that these components after refraction proceed with unequal velocities. There is nevertheless no physical difference between the component rays except a difference of undulation-length; and the ordinary modes of investigating the velocity of wave-propagation in elastic media lead to the conclusion that this velocity is independent of wave-length. Thus, if the elasticity of a medium, or the resistance which it offers to the displacement of its molecules (measured in the atmosphere by the force with which air tends to expand into a vacuum), be represented by e, and if, in a column of the medium occupying the space AC, a displacement of the first stratum through the minute space from A to a occur in the indefinitely small time t, during which same time the tremor produced by the displacement advances from A to B, the portion of the medium between a and B will be reduced in volume in the proportion of aB to AB; and as, in elastic media, pressure is inversely as volume, its elasticity will be increased in the same proportion. The increment of elasticity will be the force which tends to propagate the tremor beyond B, and putting AB = x and Aa = x', will be represented by the expression

FIG. 2.



$$f = e\frac{Aa}{AB} = e\frac{x'}{x - x'} = e\frac{x'}{x};$$

the second form being sensibly equivalent to the first on account of the minuteness of x' as compared with x in the denominator.

This force for the minute time t may be regarded as constant. It is capable of moving the mass AB in that time through a space $\frac{1}{2}x'$, which is the distance the mean stratum of AB will have moved, and hence of generating in the whole mass a velocity which would carry it, if continued uniform, over the entire space x' in the same time. But this velocity is directly as the product of force and time, and inversely as mass. The mass is proportional to the length of the column and density of the medium; or m is as xd, m representing mass, and d density. Putting, then, v for this velocity, and V for that of the tremor, which is to v as x is to x', we shall have

$$v = \frac{ft}{m} = e\frac{x't}{x^2 d}.$$

But as $\frac{v}{V} = \frac{x'}{x}$, and $x = Vt$; by substitution and reduction,

$$V^2 = \frac{e}{d}, \text{ or } V = \sqrt{\frac{e}{d}}.$$

As e and d are constants, the velocity of wave-propagation is uniform.

In the air, the assumption that the elasticity is inversely as volume requires to be corrected for the effect of the heat

generated by compression in increasing elasticity. This increase is in the ratio of the capacities of air for heat at constant pressure and at constant volume, represented by the symbols c' and c. The elasticity of the air is also measured by the weight it will sustain on a unit of surface multiplied by the velocity which gravity is capable of imparting to that weight in a second. Putting, therefore, g for the velocity due to gravity, h for the height of the barometric column, and D for the density of the mercury in it, we have, for the velocity of sound in the air, $V = \sqrt{\frac{ghDc'}{dc}}$; a result which observation confirms.

The marked inequality in the velocity of light-waves after refraction contradicts this deduction of theory; and for a long time this fact was regarded as an almost insuperable objection to the undulatory theory of light. There is, however, an assumption in the foregoing demonstration which is not strictly true—viz. that Aa is too insignificant a quantity to be regarded when subtracted from AB. In the case of acoustic waves this assumption introduces no sensible error; but if the wave theory of light be true, the undulations must themselves be excessively minute, so that it is possible, and even probable, that the amplitude of the molecular excursions may have a sensible ratio to the undulation-length. This subject has been investigated by Mr. Cauchy, who has arrived at the conclusion that the velocity of wave-propagation is a function of the wave-length, such that, *in vacuo*, the velocity is constant, while in every material medium it is greater as the waves are longer. The theoretic conclusions of Mr. Cauchy have been subjected by Prof. Baden Powell to the test of observation in a large number of cases, with results which serve to confirm their accuracy. The objection to the undulatory theory derived from the unequal velocity of the light-waves in different parts of the spectrum has, therefore, been successfully removed.

Interference.—In the article on VIBRATION it is shown that if a vibrating solid derives its motion from two impulses which are not synchronous, its resultant phases of vibration will be somewhere between those which the impulses would have produced separately. In its actual vibration it will therefore produce a series of undulations occupying the same situation in space relatively to those which the component vibrations would have produced, as the generating vibration occupies to those components in time. Accordingly, any two series of undulations, following the same path and interfering with each other, will, by composition, produce a resultant series, of which the phases and amplitudes of molecular excursion may be determined by the same equations which express the results of the composition of simple vibrations. Those equations are, for the effect of impulses acting in the same plane, and with a difference of time proportional to the circular arc θ (when the entire circumference, 2π, is taken to represent the time of a complete double vibration),

$$A^2 = a^2 + a'^2 + 2aa'\cos\theta. \qquad (1)$$

$$A\sin\psi = a'\sin\theta. \qquad (2)$$

And, for impulses acting normally to each other,

$$a^2y^2 + a'^2x^2 - 2aa'xy\cos\theta = a^2a'^2\sin^2\theta; \qquad (3)$$

$$\left.\begin{aligned} A &= \tfrac{1}{2}\left(\sqrt{a^2+a'^2+2aa'\sin\theta} + \sqrt{a^2+a'^2-2aa'\sin\theta}\right) \\ B &= \tfrac{1}{2}\left(\sqrt{a^2+a'^2+2aa'\sin\theta} - \sqrt{a^2+a'^2-2aa'\sin\theta}\right) \end{aligned}\right\}; \qquad (4)$$

$$(A^2 - B^2)\cos^2\psi = a^2 - B^2. \qquad (5)$$

From the discussion of these expressions, the effect of difference of phase upon the intensity of the light and the nature of the molecular movements in the interfering undulations is made evident. In the first, by putting $\theta = 0$, $\cos\theta$ becomes unity, and $A = a + a'$, or if $a = a'$, $A = 2a$.

If $\theta = 60$, $\cos\theta = \frac{1}{2}$, $A = \sqrt{a^2 + a'^2 + aa'}$; or if $a = a'$, $A = a\sqrt{3}$.

If $\theta = 90°$, $\cos\theta = 0$, $A = \sqrt{a^2 + a'^2}$; or if $a = a'$, $A = a\sqrt{2}$.

If $\theta = 120$, $\cos\theta = -\frac{1}{2}$, $A = \sqrt{a^2 + a'^2 - aa'}$; or if $a = a'$, $A = a$.

If $\theta = 180°$, $\cos\theta = -1$, $A = a - a'$; or if $a = a'$, $A = 0$, and the undulations extinguish each other.

Again, from equation (2) it appears that if $\theta = 0$, $\sin\psi = 0$, or the resultant and both component undulations begin together.

If $\theta = 60°$, $\sin\psi = \frac{\frac{1}{2}a'\sqrt{3}}{\sqrt{a^2 + a'^2 + aa'}}$; or if $a = a'$, $\sin\psi = \frac{1}{2}$ and $\psi = 30°$.

If $\theta = 90°$, $\sin\psi' = \frac{a'}{a\sqrt{2}}$, or if $a = a'$, $\sin\psi = \sqrt{\frac{1}{2}} = \sin 45°$.

For normal impulses, putting $\theta = 0$ in equation (3),

$$a^2y^2 + a'^2x^2 - 2aa'xy = 0, \text{ or } ay - a'x = 0;$$

which is the equation of a straight line; and if $a = a'$, $x = y$, or the plane of the undulation is inclined 45° to the original direction of a or a'.

If $\theta = 90°$, $a^2y^2 + a'^2x^2 = a^2a'^2$, which is the common equation of the ellipse, a and a' being the semi-axes.

If $\theta = 180°$, the resultant is again a straight line, but when $a = a'$, $x = -y$, and the inclination is once more 45°, but normal to the former direction.

To find the values of the semi-axes A and B, equations (4) give, when $\theta = 0°$,

$$A = \tfrac{1}{2}\left[\left(\sqrt{a^2 + a'^2} + \sqrt{a^2 + a'^2}\right)\right] = \sqrt{a^2 + a'^2};$$

$$\text{or if } a = a',\ A = a\sqrt{2},$$

$$B = \tfrac{1}{2}\left[\left(\sqrt{a^2 + a'^2} - \sqrt{a^2 + a'^2}\right)\right] = 0,$$

showing, as before, that the resultant is a straight line.

$$\text{If } \theta = 90°, \quad A = \tfrac{1}{2}\left[(a + a') + (a - a')\right] = a,$$
$$B = \tfrac{1}{2}\left[(a + a') - (a - a')\right] = a',$$

showing that the resultant is an ellipse having a and a' for semi-axes, which becomes a circle when $a = a'$.

For ψ, the inclination of the major axis of the ellipse to a, we have when $\theta = 90°$,

$$\cos^2\psi = \frac{a^2 - a'^2}{a^2 - a'^2} = 1; \text{ and } \cos\psi = \pm 1;$$

which, being the cosine of 0° or 180°, signifies that the major axis is coincident with a. It is here assumed that a exceeds a'. If $a = a'$, $\cos^2\psi = \frac{0}{0}$, or is indeterminate. As in this case the ellipse becomes a circle, and any diameter may be regarded as the major axis, the expression for $\cos\psi$ indicates that the vibration may be understood to begin at any point of the circumference indifferently.

When θ is put $= 0°$, $\cos^2\psi = \frac{a^2}{a^2 + a'^2}$ = when $a = a'$, $\frac{a^2}{2a^2} = \frac{1}{2}$. And $\cos\psi = \pm\sqrt{\frac{1}{2}}$, which shows that the ellipse is a straight line inclined 45° to a.

When other values are substituted for θ, the numerical expressions are less simple.

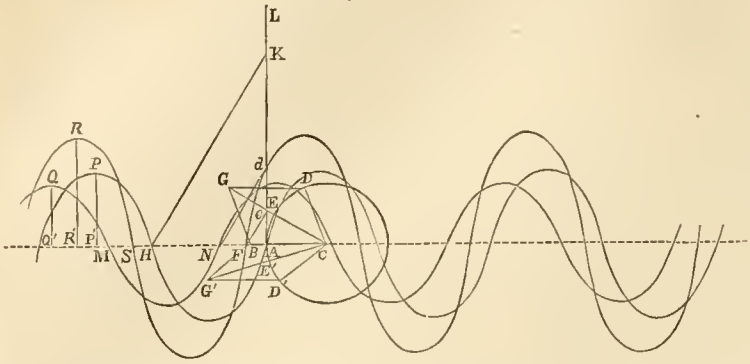
The formulæ (1) and (2) are applicable to the interferences equally of acoustic and of luminous waves; but (3), (4), and (5), which involve impulses normal to each other, apply only to waves of light. In order that they may apply, moreover, it is evident that the transverse vibrations in each of the interfering waves must be confined to a single plane—that is, that the rays must be plane polarized—or else, as in interfering rays of common light, that they must be affected with identically the same changes of plane at identically the same instants, which only occurs when they are derived from the same source. The following figure illustrates the interference of two plane polarized waves in their common plane of polarization, together with their resultant. The component undulations are represented by the two curves, PHA, QMN, whose molecular velocities are represented by ordinates drawn to the common axis, Q'MNA, and whose maximum velocities are PP', QQ'. The undulation PHA is the more advanced in position; but, referred to any common intersecting line, as LA, the undulation QMN is the more advanced in phase.

We have seen that the resultant maximum molecular velocity, when these undulations are combined, will be the diagonal of a parallelogram, of which PP' and QQ' are the sides, and of which the angle of inclination of the adjacent sides shall be equal to the difference of phase between the components. Accordingly, from the point A, where the curve representing the undulation least advanced in phase crosses the axis, measure off AC, in the direction of progress, equal to QQ', the maximum velocity of the wave most advanced in phase. From C, measure backward, CB, equal to PP', the other component maximum velocity. From the centre C, with the radius CA, describe the circle AED, etc. At the point C lay off the angle DCA, equal to the difference of phase of the two components, thus:

Draw AL perpendicular to the axis at A. Upon this take AK, the development of the semicircle AED, etc. Join KH, and draw Nd parallel to it. Ad is the development of the arc AED, which measures the angle DCA, the difference of phase. For HA is to NA as a half undulation is to the difference of phase—that is, as a semi-circumference is to the arc which measures the difference of phase. Join therefore CD, and complete the parallelogram CDGB, drawing the diagonal CG. The angle ACE, or the arc AE, is the measure of the interval in phase between the resultant and the component CB = PP'. The curve of that component crosses the axis in A. Let, then, Ae be the development of AE, and draw eF parallel to KH. F is the point at which the curve of the resultant undulation will cross the axis in ascending. Making

FS = AH, S is the point where the same curve crosses in descending. And making SR′ = HP′, R′ is the point of maximum resultant velocity. Draw R′R perpendicular to the axis, and make it equal to GC, the diagonal of the parallelogram; R is the vertex of the resultant curve. Any other points of this curve may be found by taking the sums of the ordinates of the two components corresponding to the same abscissa or point of the axis, with like signs when both components are above or both below the axis, and with unlike signs when one is above and the other below, for the ordinates of the resultant curve. The curve itself may then be drawn through the points so determined.

FIG. 3.



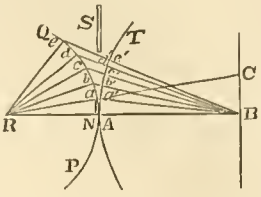
This construction enables us visibly to verify the analytical results which were just now presented. Let the radius CD revolve round the point C, the parallelogram changing its figure as the revolution advances, and the variations in the value of CG may easily be conceived.

Thus, when $\theta = DA = 0°$, the point D will fall upon CA, and the point G upon BH. CB and BG will then be in a straight line, and CG will equal $CB + BG = a + a'$. When $\theta = 90°$, DCA and GBC are right angles, and $CG = \sqrt{BC^2 + BG^2}$, or $A = \sqrt{a^2 + a'^2}$. When $\theta = 180°$, CD falls on the axis to the right of C, and BG falls on BA. Hence, $CG = a - a'$. In this case, if $a = a'$, $A = 0$; or if equal waves differ in phase by half an undulation, they destroy each other. The two curves intersect the axis in the same points, but the convexity of one of them corresponds in position to the concavity of the other. Also, if equal waves differ in phase in any manner, the crest of the resultant will fall half way between the crests of the two components.

When θ exceeds 180°, or the waves are more than half an undulation apart, the angle of the parallelogram must still be measured from A through D round to D′, and the inclination of the diagonal must be taken in the same way, from A through ED and D′ round to E′. These arcs being developed on AL produced, will give the position of the movable component and of the resultant by drawing parallels to cut KH, as before.

Diffraction.—The colored fringes formed by diffraction may be produced in a variety of ways. The simplest, and that first employed by Grimaldi, is to place any convenient opaque object in a divergent pencil of light in a dark room, and to observe the borders of its shadow as thrown upon any suitable surface. The best radiant for the purpose is obtained by concentrating a small solar beam by means of a convex lens of short focus. Let R (Fig. 4) be such a radiant, PQ the front of a spherical wave proceeding from it, and BC the receiving surface. S is an opaque screen which is supposed to be first advanced to A in the perpendicular from R upon BC, so as to intercept the half wave AQ and to be subsequently gradually withdrawn. The light which reaches B will be at first the resultant effect of the unobstructed half wave AP. Divide AQ at a, b, c, etc., into parts such that the lines Ba, Bb, Bc, etc., may successively exceed each other by the length of one-half an undulation; or such that, drawing the arc AT with B as a centre, the intercepts aa', bb', cc', etc., may have the successive values $\frac{1}{2}\lambda$, λ, $\frac{3}{2}\lambda$, etc. Now, if the screen S be drawn upward from A to a, the light which reaches B will be the resultant effect of the half wave PA, combined with the resultant effect of the small additional wave-surface Aa. This latter resultant will be compounded of the molecular movements produced at B by the infinite number of minute elementary waves, which may be supposed to originate from all the points of the given wave-front between A and a. Since all these elementary waves originate simultaneously, their relative phases, when they reach B, will depend on the differences in the lengths of their paths; and as these differences are the intercepts between the arcs AQ and AT, there will be none, until we reach a, which will differ from the wave proceeding from A by so much as half an undulation. Assuming, then, that their several intensities are equal, there will be no complete conflict between any of the elementary waves within these limits; and accordingly their resultant effect must be positive, or must add to the intensity of the light at B.

FIG. 4.



If, however, we raise the screen S higher, the intercepts will begin to exceed half the length of an undulation, and some of the elementary waves originating just beyond a will neutralize the effect of some of those near A. Raising it to b, there will be a complete series of waves originating between a and b, which will be in absolute conflict with the series which originate between A and a; so that, if Aa and ab were exactly equal, and their separate intensities, as above supposed, equal also, their resultant effect at B would be zero. Aa is, however, a little larger than ab, both because of the inclination of Ba to BA, and because of the curvature of AQ. The intensities of the elementary derivative waves are also presumed to be greater in the direction of the radius of the original wave than in directions inclined to it, though the law of such variation of intensity is not known. These causes of difference will, nevertheless, exist to no very marked degree in the immediate vicinity of the line RB, and consequently the total effect at B of the portion of wave-front Ab will be sensibly null. If, now, the screen S be further raised to c, the elementary waves originating between b and c will be in complete conflict with those between a and b. Thus the power of ab to interfere with Aa will be nearly neutralized, and the point B will receive, once more, nearly all the illumination which Aa is capable of sending to it. And in like manner, if the screen be successively raised to the points d, e, etc., similar alternations of diminished and increased brightness may be inferred. After passing the fifth or seventh division, however, these successive maxima and minima cease to be perceptible in white light; a consequence partly due to the unequal lengths of the undulations of the different colors, causing the maxima of some to fall more and more on the minima of others, and partly to the diminishing length and increasing obliquity of the successive divisions of the wave-front.

Dr. Lloyd has illustrated this case in the following felicitous manner. Let the light received at B from the half wave PA be represented by 1, and that from the total unobstructed wave by 2. Represent the effect of Aa by $+m$, that of ab by $-m'$, that of bc by $+m''$, and so on. Then we have,

$$2 = 1 + m - m' + m'' - m''', \text{ etc.}$$

Now as each of the successive literal terms is greater than that which follows it, if we cut the series at any point the value of all the terms which succeed on the right will have the same sign as the first of them; and the sum of the remaining terms on the left will be less than 2 if the value cut off is positive, and greater than 2 if the value cut off is negative.

To determine the distance of these fringes from the boundary of the shadow, suppose S to be at a, RaC being the boundary of the geometrical shadow. Draw aN perpendicular to RA. Call aN, y, and AN, x. By construction, Ba − BA = $\frac{1}{2}\lambda$ (the undulation-length). Put RA = r, BA = s, Ba = q. Then

$$q - s = \sqrt{(s+x)^2 + y^2} - s = s + x + \frac{y^2}{2(s+x)} - s = x + \frac{y^2}{2s} = \tfrac{1}{2}\lambda,$$

disregarding inappreciable terms of the root, and omitting the minute term x in the denominator. In the circle whose radius is r, $AN = x = \frac{y^2}{2r}$; whence

$$\tfrac{1}{2}\lambda = \frac{y^2}{2r} + \frac{y^2}{2s}; \text{ or } y^2 = \frac{rs\lambda}{r+s}.$$

Put δ to represent BC, and we have, from similarity of the triangles RAa, RBC, and assume RN = RA,

$$y^2 = \frac{r^2\delta^2}{(r+s)^2} = \frac{rs\lambda}{r+s}\text{; and finally } \delta^2 = \frac{\lambda}{r}(rs+s^2).$$

This is the equation of an hyperbola. Hence, if the surface BC be advanced toward A, the locus of all the points in space at which occurs the first stripe of maximum illumination outside the shadow will be a hyperbolic curve of which the vertices are a and R. Strictly speaking, R and a are the foci and not the vertices; since the points on the moving surface corresponding to B are determined by the geometrical condition Ba − BA = ½λ; whence RA + BA − Ba, or RB − Ba = r − ½λ, which is the property of an hyperbola whose major axis is r − ½λ, and whose foci are a and R. The discordance of the two results arises from the neglect of minute terms in the analysis above.

The minor axis will be $\sqrt{r^2 - (r - \frac{1}{2}\lambda)^2} = \sqrt{r\lambda - \frac{1}{4}\lambda^2} = \sqrt{r\lambda}$, nearly; and the equation of the curve, employing the exact values of the axes, is

$$\delta^2 = \frac{r\lambda - \frac{1}{4}\lambda^2}{(r - \frac{1}{2}\lambda)^2}\left((r - \tfrac{1}{2}\lambda)s + s^2\right),$$

which, when the minute terms are dismissed, simplifies itself to the expression found before.

The semi-axis major of this curve being ½r − ¼λ, it appears that the curve itself passes behind the obstructing edge at the distance of ¼λ, at which distance a wave reflected from the obstacle would meet a wave advancing with a difference of ½λ. Whether this theoretic indication is actually realized, it would perhaps be difficult experimentally to determine. Such a reflected wave, considering only the difference of path, would be out of harmony with the advancing wave; but, considering that its molecular movements would be reversed by reflection from the dense ether of the obstacle, the harmony would be restored.

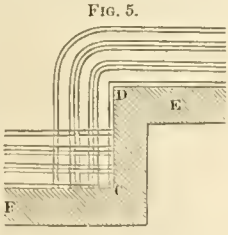
For the distance of the second fringe from the shadow, the expression already found for the first answers perfectly, if we prefix to the quantity under the radical the coefficient 3; since the difference of paths Bc − BA, by which it is produced, is equal to ¾λ, instead of ½λ. For the third we prefix 5. Thus the successive distances are—

$$\delta = \sqrt{\frac{(rs+s^2)\lambda}{r}};\ \delta' = \sqrt{\frac{3(rs+s^2)\lambda}{r}};\ \delta'' = \sqrt{\frac{5(rs+s^2)\lambda}{r}}.$$

The second hyperbola passes at the distance of ¾λ behind the obstructing edge, and the third at the distance of ⅝λ. Owing to the great disproportion between the axes, r − ½λ, and $\sqrt{r\lambda - \frac{1}{4}\lambda^2}$, which are very nearly in the ratio of $\sqrt{r} : \sqrt{\lambda}$, the curvature is very slight except for a short distance from the vertex; so that the branches in fact sensibly coincide with their asymptotes. But near the vertex the curvature is very decided.

From what has been said, it will be evident that when the obstruction presents a salient angle instead of a straight edge, the fringes will pass round the angle in circular arcs, instead of making an angle also. Indeed, the systems of fringes around such an angle are surfaces of hyperboloids of revolution. In the case of re-entering angles of 90° or less, the fringes cross each other without interference, and are continued up to the edge of the shadow on each side of the angle. These are easily seen to be necessary consequences of the theory of their formation. The annexed figure exhibits the phenomena.

Fig. 5.

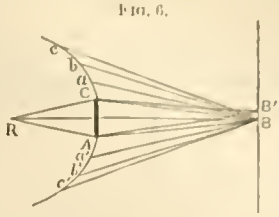


When the obstructing body is large, no fringes are seen within the shadow. Some light strays beyond the geometrical boundary of the shadow, but it rapidly fades away, and produces no very sensible effects. If, however, a very narrow object be employed, the waves from opposite sides may mingle and interfere. In this case fringes or stripes will be seen within the shadow. The light concerned in producing these fringes comes from the portion of the main wave which is close to the obstruction, as the more distant parts of each half wave will hold each other in check in the manner heretofore explained. Points being taken at a, b, c, a', b', c', etc., such that the successive differences of distance of these points from B may be ½λ, we shall have, on each side, a series of resultant actions alternately positive and negative, as illustrated in the foregoing case, such as—

$$+m - m' + m'' - m''' + m'''', \text{ etc.}$$

And as the effect of any portion of this series, left by cutting off terms from the beginning, depends on the sign of the first of the remaining terms—that is to say, as the effect due to the first of these terms exceeds the joint effect of all that follow—it is evident that no part of the main wave can have anything to do with producing fringes in the shadow except Ca and Aa'. And since there can be no fringes produced at all unless the light from both sides reaches the same point, the centre of the shadow, which is equidistant from the edges of the obstacle—that is, from the front of the main wave—must exhibit a light stripe. On each side of this will be found positions, as, for instance, B′, where the distances from A and C differ by half an undulation, and here the darkness will be complete. A little farther on, the distances from A and C amount to an entire undulation, and here will be found once more bright stripes. If the object be very narrow, these interferences may occur not only throughout all the shadow, but to some distance into the light on either side. The fact that the light from both sides conspires to produce them is made strikingly apparent by interposing a card to intercept the light from one side. The stripes within the shadow will instantaneously disappear.

Fig. 6.



The loci of these fringes in space, since they are determined by the intersection of lines from A and C having a constant difference, must necessarily be hyperbolas with A and C for their foci. As the relation B′A − B′C = ½λ would give the first dark stripe, the principal axis of this curve would be no greater than ½λ. Putting CA = c, the conjugate axis will be $\sqrt{c^2 - \frac{1}{4}\lambda^2}$. And putting n for any integral number, even or odd, the axes of the successive trajectories will be determined by the expressions ½$n\lambda$ and $\sqrt{c^2 - \frac{1}{4}n^2\lambda^2}$, in which the odd values of n correspond to the dark stripes, and the even values to the light stripes. As the conjugate axis in each of these cases greatly exceeds the principal axis, the curves open out very widely, and have little curvature even at the vertices. The general equation of these curves will be

$$y^2 = \frac{c^2 - \frac{1}{4}n^2\lambda^2}{\frac{1}{4}n^2\lambda^2}\left(\tfrac{1}{2}n\lambda x + x^2\right).$$

Suppressing the minute term ¼$n^2\lambda^2$ from the numerator, and reducing,

$$x + \tfrac{1}{2}\lambda = \delta = \sqrt{\frac{(4y^2 + c^2)n^2\lambda^2}{16c^2}}.$$

But y is sensibly equal to BC = s; and c^2 in the numerator is inappreciable except for very small distances from C. The expression may therefore be simplified to the form $\delta = \frac{sn\lambda}{2c}$, which is the equation of a straight line.

Except very near to the obstructing body, therefore, the hyperbolic trajectory sensibly coincides with the asymptote.

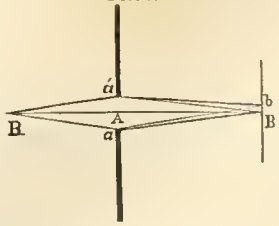
The expression for the value of δ shows that the breadth of the fringes is inversely as the diameter of the intercepting object. Thus, to double the value of δ we have only to reduce c by one half. Accordingly, if a tapering object, as a sewing-needle, be employed, the fringes will spread out toward the top with a beautiful plumose appearance. This becomes still more striking when the taper is more rapid, as when we use an acute-angled or even a right-angled plate of thin metal. The fringes, which in this case are very remarkable, have been called *Grimaldi's crests*.

Fig. 7.

A case which is the converse of the last is that of a narrow elongated opening with parallel sides, through which the beam of light is allowed to pass. Here, as before, if RAB pass centrally through the aperture, and if Ba − BA = Ba' − BA = ½λ or less, there will be no complete conflict between different parts of the wave-front aa', and B will be fully illuminated. But if B be brought nearer A, Ba − BA will exceed ½λ, and certain marginal portions of the wave will extinguish equal portions of the centre. A position of B may be found in which Aa and Aa' shall be each equally divided into two conflicting parts, and then the central point B will be dark. At a nearer point, Ba − BA may be

equal to $\frac{3}{2}\lambda$, and then B will be once more illuminated; but in this case the outer two-thirds of each half of aa' will extinguish each other, and the central one-third of each will only be efficient. Generally, at any distance at which $Ba - BA$ is an odd number of half undulations, the central line at B will be bright, but when the same difference is an even number of half undulations—that is to say, any number of entire undulations—it will be dark. When the distance has been reached at which $Ba - BA$ is just one-half undulation, the dark stripe will not be reproduced by increasing the distance.

Fig. 8.



When the central line is dark, it is evident that each half of the wave-front aa'—viz. Aa or Aa'—is suppressed at B, independently of the other. If, for instance, $Ba - BA = n\lambda$, there will be n completely conflicting pairs on each side of A. If, therefore, the sides of the aperture at a and a' be so far advanced toward A as to shorten Ba or Ba' by $\frac{1}{2}\lambda$, the brightness will reappear at B; or if, instead of this, an opaque obstacle, with sides parallel to those of the aperture, be placed at A, having a breadth equal to the nth part of $\frac{1}{2}aa'$—that is, of Aa—and its middle point exactly at A—the light at B will reappear. Also, supposing n greater than 1, if this obstacle be moved parallel to itself toward a or a', the brightness at B will be extinguished n times during the movement, with intervening intervals of reappearance. Also, if the breadth of the obstacle placed centrally be increased, and made successively two, three, four, etc., nth parts of $\frac{1}{2}aa'$ up to $n - 1$, for every odd value the light will reappear, and for every even value it will remain extinguished at B.

On either side of the central point, B, will be found other points, b, where the same alternations of light and darkness will occur; *i. e.* when B is light, b will be light also, with a dark stripe between; and when B is dark, b will also be dark, with a bright stripe between. Only, if $Ba - BA = \frac{1}{2}\lambda$, $ba - bA$ will be equal to $\frac{3}{2}\lambda$, and so on.

Fringes are also produced outside of the bright image of the opening, and are broader and more beautiful than those within, being, especially when the aperture is narrow, richly colored. With an apparatus in which the opposed edges are movable, the expansion of the fringes as these edges are made gradually to approach is very striking. When the aperture is a very slender isosceles triangle, they spread out widely toward the vertex. The distances δ from the central line are all determined by the same equation which was found for the fringes formed in the converse case of a narrow opaque object. The geometrical conditions are the same in both; but, the optical conditions being reversed, the even values of n (the number of half undulations in the difference of path) give the dark stripes, and the odd values the light stripes. As, in the equation just referred to, it appears that δ varies directly as λ, it follows that, with homogeneous light, red will give the broadest fringes, and violet the narrowest. Hence, with white light, the different colors more or less overlap; and as δ is greater in proportion as the breadth of the aperture is less, the separation, and therefore the richness of the coloring, increases as this diameter is diminished.

If the aperture is circular, the fringes take the circular form also, and in place of the central stripe of the last experiment there appears a central spot which is alternately dark and light at different distances. If, instead of an aperture, an opaque circular disk attached to a transparent plate be employed, the central point will also be alternately dark and light; and when the brightness is at maximum, it is mathematically true that its intensity is exactly equal to that which would be produced at the same point by light passing directly through a central aperture of such diameter as would give $Ba - BA$ (Fig. 8) $= \frac{1}{2}\lambda$. A disk, therefore, of such dimensions as would give $Ba - BA = \lambda$, 2λ, $n\lambda$, suitably perforated in the middle, would produce a brightness at B twice as great as would exist there in the absence of the disk altogether.

What has been said of the appearance of dark spots at the centre of the image of an open aperture is strictly true only when the light employed is homogeneous. For the geometrical condition required to produce the extinction of light at B is that $Ba - BA$ shall be equal to $n\lambda$, and λ varies with the different colors. Hence at the distance BA at which red disappears, the blue or the violet is not wholly suppressed, and so of the others. And consequently when common light is used, the central spot, instead of becoming absolutely dark, changes its color as the screen is advanced toward the aperture or withdrawn. And as the fringes surrounding the centre are themselves colored, and as their diameters are determined severally by the condition $ba - bA = \frac{1}{2}\lambda$, $\frac{3}{2}\lambda$, $\frac{5}{2}\lambda$, etc., it follows that these diameters will diminish as the screen approaches A, till each ring successively occupies the central spot and gives it its color. If the light be directly received upon the eye, with or without the aid of a magnifier, but better with one, the rings, in approaching, will seem to be successively absorbed into the aperture, and in receding to be evolved out of it.

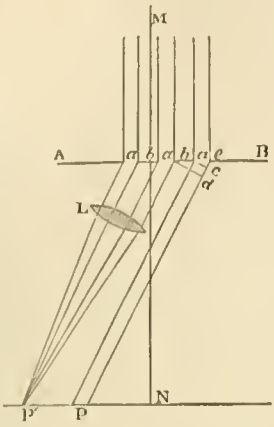
Sharp Definition of Shadows.—We are able now to explain what, if the undulatory theory of light is true, seems at first thought a paradoxical fact—viz. that the edges of the shadows of large bodies in ordinary light are sharply defined. This is owing to the smallness of the values of λ for all the rays. For if we take any point within the line of the geometrical shadow, and suppose the wave-front, beginning at the edge of the opaque body, to be divided into portions whose extremes are remote from that point by distances differing $\frac{1}{2}\lambda$, these portions will neutralize each other's effects except for positions of the assumed point very near to the line of the geometrical shadow, and will be there so slight as in contrast with the neighboring illumination to be insensible. To the same cause it is owing that, in reflection and refraction, the reflected or refracted beam is as sharply defined as the incident. For, in Fig. 1, suppose that an undulation originating at B should take the direction Bk, different from that of the main reflected wave BQ. There will always be found at the left of B a point, as n, from which an undulation following the same direction, and nearly coincident with it, will differ from the first by half an undulation. Draw no perpendicular to BB′, and Bt perpendicular to nk. The angle onB = angle of incidence $= \iota$. Put $\rho = nBt$. Then $Bo = Bn.\sin\iota$, and $nt = Bn.\sin\rho$. When the movement whose front is Bt starts from n, the movement which is to produce the wave from B is at o. There will therefore be interference, if $nt - Bo = \frac{1}{2}\lambda$; that is, if $Bn(\sin\rho - \sin\iota) = \frac{1}{2}\lambda$. As $\sin\rho$ approaches equality with $\sin\iota$, the distance Bn of the origin of the interfering wave will be greater; but there will always be an interfering wave, if the surface AB is unlimited, except in the case where $\sin\rho = \sin\iota$, or in which the sine of the angle of reflection equals the sine of the angle of incidence. By similar reasoning, in the case of refraction, if we suppose a wave to take the direction Br, deviating from that of the regularly-refracted wave BR′, we shall find that there will be interference when $Bn(n\sin\rho - \sin\iota) = \frac{1}{2}\lambda$. And when AB is unlimited, such a wave will be found, unless $n\sin\rho = \sin\iota$. In either case, if AB is not unlimited, but is large in comparison with λ, the directions for which there will not be an interfering wave will be so close to those of the regular reflection or refraction that the deviation will be insensible. These reasonings assume that the forces of the elementary derivative waves are the same in all directions. But it is probable that these forces are less in lines *oblique* to the direction of progress of the primitive wave than *in* that direction. How far this is true could be easily investigated experimentally, by employing apertures less than the length of a half undulation in diameter, were it not that the extreme minuteness of such apertures (the mean length of a half undulation not exceeding $\frac{1}{100000}$th of an inch) would render the light too feeble for the purpose.

Some material for the formation of an opinion on this subject may, however, be gathered from certain phenomena of diffraction first observed by Fraunhofer, more remarkable and more brilliant than any which have been thus far mentioned. If a single very minute aperture will not furnish light enough for experiment, an assemblage of very many very minute apertures, closely grouped, may do so; and if these be so arranged that, for any determinate point in the shadow, they shall allow only such portions of the wave-front to pass as *conspire* in their effects at that point, while the intervals between them obstruct those portions which conflict, we shall possibly find that the tendency of a wave originating in a single molecular impulse to expand equally in all directions is much more decided than had been supposed. Fraunhofer's original experiments were made with *gratings* formed by stretching an exceedingly fine wire across two parallel screws of a great number of threads to the inch—the threads serving to keep the wires equidistant. He subsequently employed gratings formed by cementing leaves of gold to glass and cutting them through in very fine parallel lines ruled with a sharp instrument. Instead of these, also, he employed similar lines ruled with a diamond on glass itself. A beam of strictly parallel rays is in these experiments preferable to a divergent beam.

The results of such an arrangement may easily be predicted. The image of an aperture closed by such a grating will appear bright, as though the obstruction were not in-

terposed. But toward either side, in the direction perpendicular to the lines of the grating, will be found several points for which the part of the wave which the grating obstructs would if allowed to pass be more or less in conflict with those which it transmits; and which, therefore, are bright when the grating is present, and dark when it is absent. Suppose, for simplicity, that the open spaces and the opaque bars are equal in breadth. Let a, a, a, represent several of these open spaces, and b, b, b, etc., the intermediate bars. A point, P, may be found from which lines being drawn as in the figure, and perpendiculars let fall upon them from the edges of the apertures, as at c and d, will give $ce = \frac{1}{2}\lambda$, $cd = \frac{1}{2}\lambda$, and therefore $cd = \lambda$. The distances from P to the corresponding parts of the several openings will thus differ by an entire undulation, and hence the waves which reach P through them will be in harmony. The distances from P to any points of the obstructing bars, and to corresponding points of the adjacent openings, will differ by half an undulation: hence, if the bars were removed, the wave from those points would neutralize the effects of the former, but being obstructed, the point P remains illuminated. A lens interposed as at L will give sharpness to the points, or rather lines, of illumination.

Fig. 9.



Furthermore, since the position of P is determined by the condition that cd shall be the length of an undulation, it will be necessary to take P farther from B for the longer undulations and nearer for the shorter. The different colors will thus be separated, and a perfect spectrum will be formed on the screen.

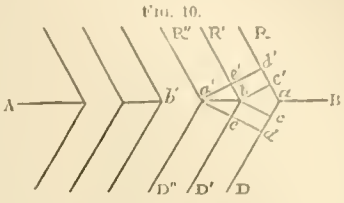
Should the point P be taken so that cd is equal to two undulations, there will be no spectrum; for in this case ce will be equal to one undulation, and, as in the cases we have considered of a single aperture, one-half of each opening, a, will hold in check the other half. If we find still another point where cd is equal to three undulations, then ce will equal one undulation and a half; two-thirds of each opening will then be neutralized, but the remaining third will be effective; and there will be another spectrum, but less brilliant than the first. If $cd = 4\lambda$, the spectrum again will fail; if $cd = 5\lambda$, it will return, and so on. If the bars are broader than the open spaces, there will be a spectrum for $cd = n\lambda$, n being any integral number, until the light is too feeble, or until $ce = n'\lambda$, n' being also any integral number. If the spaces are broader than the bars, there will be a spectrum for every integral value of n in $cd = n\lambda$ until $n = \frac{a+b}{b}$ (a and b standing for the breadths of the spaces and bars respectively). If, however, $\frac{a+b}{b}$ is not integral, and q is the greatest common measure of a and b, $n = \frac{a+b}{q}$ will give the number of the first spectrum that will fail. Put this value of n equal to m, and we may say generally that the mth spectrum will fail, and also the $n'm$th, n' being also any integral number. If a and b are incommensurable, there can theoretically be no perfect spectra; nor will any spectrum absolutely fail, but a near approach to failure will occur for approximate values of q.

The construction indicates a simple expression for the deviation of each spectrum from the direction, RB, of movement of the original wave. Calling the deviation δ, we have

$$\sin\delta = \frac{n\lambda}{a+b}.$$

Putting $n = 1$, $\lambda = \frac{1}{50000}$ inch, and supposing 1000 opaque lines to the inch in the grating, we have $\sin\delta = 0.02 = \sin 1°9'$. As the sines of small angles are nearly proportional to the angles themselves, the deviations of the succeeding spectra will be multiples of this. It is evident, also, that the deviations will increase with the increase of the number of lines of the grating to the unit of length, the sines being inversely as this number. With 10,000 lines to the inch, $\sin\delta = 0.2 = \sin 11° 32'$, or the first spectrum will deviate by this amount. The deviation of the second will be 36° 52', and of the third 90°—too great to be observed. With 25,000, $\sin\delta = 0.5$, or the first spectrum will deviate 30°. No other spectrum can be obtained from a grating so closely ruled as this when the light is incident perpendicularly. For if we make $n = 3$, $\sin\delta$ becomes $= 1.5$, which is impossible. Moreover, even the first spectrum will fail if the sum of a and b be not greater than λ. Thus, if $\lambda = \frac{1}{50000}$th of an inch, and there be 50,000 opaque lines to the inch, $\sin\delta = 1 = \sin 90°$, when $n = 1$, and the spectrum is not observable. But in this case, if the incident light be oblique to the grating, and the plane of incidence perpendicular to the bars, a spectrum will be possible until the value of $a + b$ is reduced down to $\frac{1}{2}\lambda$. For in Fig. 10, let AB be the plane of the grating, and R, R', R'' be parallel rays falling on AB at the incidence δ:

Fig. 10.



then if the parallel lines aD, bD', etc., be drawn at the incidence δ', there will be a spectrum in this direction, provided δ and δ' be so taken that $(a + b)(\sin\delta + \sin\delta') = \lambda$. For, drawing the perpendiculars bc, be', $a'd$, $a'd'$, it is evident that if $ad + ad' = \lambda$, $ac + ac' = \frac{1}{2}\lambda$, and the part of the wave ab which is in opposite phase to ba' is obstructed, so that ab' remains efficient; and the same is true of the other openings. Hence, so long as it is possible to find two sines whose sum is not less than $\frac{\lambda}{a+b}$, a spectrum can be produced. The maximum possible value of $\sin\delta + \sin\delta'$ is 2. Hence, there can be a spectrum so long as $2(a + b)$ is not less than λ, or $a + b$ not less than $\frac{1}{2}\lambda$. And if $\lambda = \frac{1}{50000}$th of an inch, which is near its mean value, a spectrum can be formed by employing an oblique incidence, if the number of opaque lines in the grating is less than 100,000. At 75,000, for instance, $\sin\delta + \sin\delta' = 1.5$. If the incidence be put $= 40°$, the deviation of the spectrum will be 58°. If the incidence be 46°, the deviation will be about $51\frac{1}{2}°$.

The effects produced by diffraction may be endlessly varied by employing, instead of gratings, reticulations and groups of apertures of various figures symmetrically disposed. Many of the phenomena are exceedingly rich and beautiful.

Diffraction spectra furnish the best of all possible means of measuring the lengths of the undulations corresponding to the different colors. They exhibit very distinctly the very numerous transverse spectral lines, the study of which has become, in modern physics, a matter of so much importance. These lines in every diffraction spectrum preserve necessarily the same relative distances from each other; whereas in the spectra formed by refraction these distances are modified by the media in which the refraction occurs. From the expression for deviation above given, we obtain

$$\lambda = \frac{(a+b)\sin\delta}{n}.$$

In order to calculate the wave-length corresponding to any given point or line in the spectrum, we have to measure carefully the angle of deviation, and to substitute its sine in this formula. The value of $a + b$ is presumed to be known from the construction of the grating.

The wave-lengths corresponding to the principal lines of the spectrum have been in this manner determined by Fraunhofer, Kirchhoff, Ångström, Ditscheiner, Thalen, and others. To extend the determination to the great multitude of lines which fill up the intervening intervals, a method has been devised by Prof. Wolcott Gibbs of Harvard University, of determination by comparison and computation, which has been applied by him to the preparation of the extended and valuable tables of WAVE-LENGTHS which will be found under their proper title in this work. The method consists in measuring upon an arbitrary scale the distance between the line under investigation and another for which the wave-length has been already determined. Then, when the relation between the scale divisions and the corresponding wave-lengths is known, the wave-length sought is obtained by computation.

In the following brief table are given the wave-lengths corresponding to a few remarkable lines in the spectrum, with a view chiefly to illustrate the immensity of the numbers which it is necessary to employ in order to express the frequency of the recurrence of distinctly different physical conditions in the medium which we call light. The fact of these alternations and of the rapidity with which they succeed each other is established independently of theory; and whatever we call them, whether "undulations," with Huy-

ghens and Young, or "fits," with Newton, their existence is beyond question.

In the preparation of this table, the velocity of light has been assumed to be 187,000 miles per second—a velocity corresponding to the generally-received horizontal parallax of the sun at the present time—viz. 8.87″. The wave-lengths in millionths of millimètres are taken from the tables of Dr. Gibbs, above referred to. The lengths in ten-millionths of an inch have been computed from these. No line yet determined in the spectrum of any element has a wave-length greater than that of the line B, nor less than that of the calcium line, with which this table ends. The numbers of undulations per second are given to the nearest trillion.

Undulation Lengths and Numbers per Second.

Line in spectrum.	Color.	λ in millionths mm.	No. of λ in 1 mm.	λ in ten-millionths of inch.	No. of λ in 1 inch.	Number of undulations per second.
Line A	Red	760.04	1315	299.22	33,422	396,000,000,000,000
Line B	"	686.71	1456	270.48	36,970	438,000,000,000,000
Lithium	"	670.52	1491	264.18	37,850	448,000,000,000,000
Hydrogen—C	"	656.21	1524	258.27	38,714	459,000,000,000,000
Strontium	"	640.70	1561	252.37	39,624	470,000,000,000,000
Lithium	Orange	629.65	1588	248.04	40,316	478,000,000,000,000
Sodium—D	Yellow	589.51	1696	232.09	43,085	510,000,000,000,000
Tellurium	"	564.70	1770	222.44	44,955	533,000,000,000,000
Calcium	"	558.76	1789	220.08	45,649	538,000,000,000,000
Uranium	"	547.95	1825	215.75	46,349	549,000,000,000,000
Thallium	Green	534.95	1869	210.63	47,475	562,000,000,000,000
Line E	"	526.96	1897	207.48	48,197	572,000,000,000,000
Cæsium	"	497.15	2011	195.67	51,106	605,000,000,000,000
Barium	"	493.34	2027	194.10	51,520	610,000,000,000,000
Strontium	Blue	460.75	2170	181.50	55,096	653,000,000,000,000
Cerium	"	457.25	2187	179.92	55,580	658,000,000,000,000
Iridium	Indigo	450.95	2217	177.56	56,319	667,000,000,000,000
Titanium	"	439.30	2276	172.83	57,860	685,000,000,000,000
Line F	"	436.07	2293	171.66	58,255	690,000,000,000,000
Line G	"	430.73	2322	169.58	58,969	699,000,000,000,000
Rubidium	Violet	420.20	2380	165.44	60,444	716,000,000,000,000
Indium	"	410.10	2438	161.46	61,934	732,000,000,000,000
Strontium	"	407.85	2452	160.57	62,278	737,000,000,000,000
Calcium—H	"	396.81	2520	156.23	64,008	758,000,000,000,000
Magnesium	Ultra violet	394.30	2536	155.24	64,416	763,000,000,000,000
Calcium	" "	393.28	2543	154.84	64,582	765,000,000,000,000

Colors of Thin Plates.—On the theory of undulation. Newton's rings are produced by the interference of the wave reflected from the upper surface with that reflected from the lower surface of the thin plate in which they appear. To fully understand the circumstances of this interference, it will be convenient first to consider an unusual case—viz. one in which the thin plate has a refracting power intermediate between those of the bounding media, both of these being transparent. Represent the thickness of the plate by θ. The ray perpendicularly reflected from the lower surface has a longer path than that reflected from the upper by 2θ. There should, therefore, be an extinction of light when 2θ is equal to $\frac{1}{2}\lambda$ or to some odd multiple of $\frac{1}{2}\lambda$. That is, the dark rings in Newton's apparatus (see THIN PLATES, COLORS OF) should occur at the thicknesses indicated by the equation

$$2\theta = \tfrac{1}{2}\lambda(2n+1); \text{ or when } n = 0,\ 2\theta = \tfrac{1}{2}\lambda \text{ and } \theta = \tfrac{1}{4}\lambda.$$

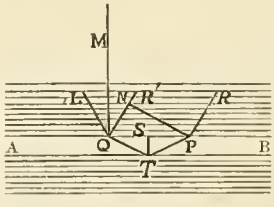
For the purposes of accuracy in this experiment it is best to use homogeneous light. We will suppose the rings to be formed between a spherical surface of low curvature and known radius and a plane surface on which a micrometric scale has been ruled. The scale enables us to measure the diameters of the rings by inspection, and with the diameters and the known radius of curvature we can calculate the thicknesses at the middle points of the several rings, dark and light. The dark rings will be found to correspond to the thicknesses $\theta = \frac{1}{4}\lambda$, $\theta = \frac{3}{4}\lambda$, $\theta = \frac{5}{4}\lambda$, and so on; while the bright rings will be produced by the thicknesses $\theta = \frac{1}{2}\lambda$, $\theta = \lambda$, $\theta = \frac{3}{2}\lambda$, and so on.

If, however, the refracting power of the thin plate is less or greater than those of the bounding media on both sides—a state of things which most usually exists—the bright rings will appear where, on the former supposition, dark ones are formed, and *vice versâ*. The reason of this difference will be found in the fact heretofore mentioned, that when a wave encounters an ether of greater density, the direction of molecular movement is reversed in the part of the wave reflected; but when it encounters an ether of less density, the direction of molecular movement in the reflected wave is maintained unchanged. When the refracting power of the thin plate is intermediate between those of the bounding media, the reflections from both surfaces take place under similar circumstances; *i. e.* both are from a more refracting, or both from a less refracting, medium; and the molecular movements in the reflected waves are either both reversed or both maintained. But when the thin plate is of either less or greater refracting power than the media which bound it, the molecular movements in one will be maintained and in the other reversed; a condition which alters their relations as to phase by half an undulation, and causes the dark rings to take the place of the light ones in the former arrangement, and the light of the dark.

This transformation may be experimentally observed by first forming the rings in a thin plate of air, as in Newton's arrangement, between a crown glass, having the index 1.5, and a flint glass, index 1.575. Introducing, then, a drop of the oil of sassafras, index 1.53, the bright rings will immediately become dark, and the dark, bright. There will also be a slight contraction of all the rings, since the value of λ is less in the oil than in the air.

When the rings are viewed obliquely their apparent diameters are enlarged. If AB, Fig. 11, be the thin plate and RP the ray incident at P, which after reflection at T emerges at Q, this ray will then fall in with another, R′Q, reflected toward L. Let PN be perpendicular to R′Q, then NQ will be the distance traversed by R′Q while RP passes over the distance PT + TQ = 2TQ. Put the angle of incidence R′QM = ι, and the angle of the refraction PTS = ρ, and let θ = thickness, TS, as before. Then NQ = PQ sin ι, and PQ = 2TS tan ρ.

FIG. 11.



Hence, NQ = 2θ tan ρ sin ι.

Also $2TQ = \frac{2\theta}{\cos\rho}$. 2TQ − NQ is the difference of length of path. This, to produce extinction (the bounding media being both more or both less dense than the lamina), should be an even number of half undulations. But, as the undulation-lengths are inversely as the refracting powers of media, if n is the index of refraction of the lamina relatively to the medium, we must divide NQ by n in order to obtain in the expression 2TQ − NQ the effective difference of path. We shall have then

$$2TQ - NQ = \frac{2\theta}{\cos\rho} - \frac{2\theta\tan\rho\sin\iota}{n} = \frac{2\theta(n - \sin\rho\sin\iota)}{n\cos\rho}.$$

$$\text{But } \sin\iota = n\sin\rho \therefore 2TQ - NQ = 2\theta\left(\frac{1-\sin^2\rho}{\cos\rho}\right) = 2\theta\cos\rho.$$

And finally, $\theta\cos\rho = \frac{1}{2}\lambda(2m+1)$ for bright rings.
$\theta\cos\rho = \frac{1}{2}\lambda(2m)$ for dark rings.

If, as in Newton's experiments, the lamina AB is air, and the observation is made from above the upper dense medium in the air also, ρ is the angle of incidence at the upper surface, and the thicknesses at which the several rings appear are inversely as the cosine of that angle—a result in which theory confirms his observation.

One point further requires attention, in order to complete the theory of this phenomenon. The intensity of the light reflected at the first surface is greater than that interfering with it after a single reflection from the second, both because the incident light in the latter case is less intense, and because the reflected portion on emergence is again diminished by a second reflection from the first. Yet the dark rings shown by reflection are absolutely dark, showing

that the interference is total, or that the interfering waves are equal. To understand this, we must consider that the wave emergent at the first surface after one reflection at the second is reinforced by a series of feebler emergent waves which have undergone two, three, four, etc., reflections at the same surface after being partially turned back at the first. These several components will conspire with each other in phase, and conflict with the wave reflected from the first surface, wherever the thickness of the lamina is adapted to produce a dark ring, as we shall presently see. In what follows we continue to have in mind Newton's experiment of a lamina of less density than the bounding media.

That the extinction of light may be total, the intensities of the interfering waves must be equal. Intensities are measured by the living forces which animate the masses of ether in which the molecular movements take place. Take m for the mass in the denser medium, and m' for that in the rarer. It will be proved further on that the velocity of molecular movement in a wave reflected at a given incidence from the separating surface of two given media, is in a constant ratio to the velocity in the incident wave. Put this ratio $= v : 1$, the incident velocity being unity. The living force of the reflected wave is, therefore, mv^2, and that of the wave transmitted $m(1 - v^2)$. This divided by m' will give the square of the molecular velocity in the rarer medium, which is the thin plate. Represent it by u^2. By reflection at the second surface u becomes vu, and this by a second reflection at the first surface becomes v^2u. From the living force of the wave returning from the second surface, subtract the living force which it loses by re-reflection from the first, and the remainder, which is the living force transmitted through the first surface, will be $m'v^2u^2(1 - v^2)$, which divided by m will give the square of the first component of molecular velocity of the wave from the second surface emergent at the first. In like manner v^2u becomes v^3u by second reflection at the second surface; and this becomes v^4u by the next reflection from the first; so that the square of the second component of molecular velocity in the reflected wave from the second surface emergent from the first will be $m'v^6u^2(1 - v^2)$ divided by m. The next term will be $m'v^{10}u^2(1 - v^2)$ divided by m; whence the law is evident.

Now, as to the phases of these successive components. Remembering that the direction of molecular movement is reversed in reflection from a denser medium, and maintained in reflection from a rarer, it will be perceived that reversal occurs at every reflection within the thin plate, but it does not occur in the wave reflected from the first surface without entering the plate. Let it also be borne in mind that emergent waves maintain the direction of movement of the incident waves from which they are derived. Call, then, the movement in the originally incident wave positive. Suppose the thickness of the plate to be zero (the successive reflections still going on), then the sign of movement in the waves successively emergent will be always negative for the first surface (the number of reversals being odd), and always positive for the second (the number of reversals being even).

But if the plate have a sensible thickness, θ, the difference of length of path (2θ) has to be considered. If $\theta = \frac{1}{4}\lambda$, $2\theta = \lambda$, and the signs will remain the same as when $\theta = 0$; *i. e.* always negative at the first surface, and positive at the second. The same will be true for $\theta = n \times \frac{1}{4}\lambda$, n being any integral number. If $\theta = \frac{1}{4}\lambda$, or $(2n + 1) \times \frac{1}{4}\lambda$, $2\theta = \frac{1}{2}\lambda$, or $(2n + 1) \times \frac{1}{2}\lambda$. Accordingly, the sign is reversed for the first, third, fifth, and all the odd-numbered waves, but remains unchanged for the even. The direction of movement is therefore alternately positive and negative for the upper surface, and negative and positive for the lower.

Next, as to the resultant value of these components. Calling, as above, u the value of the molecular movement in the ray transmitted through the first surface, and v the ratio of reflected to incident light, the advancing and returning waves within the lamina will have the successive molecular velocities—

1. Advancing wave, u, v^2u, v^4u, v^6u, v^8u, etc.
2. Returning wave, vu, v^3u, v^5u, v^7u, etc.

And the squares of the velocities of the emergent components will be—

$$\text{1st surface, } \frac{m'}{m}(v^2u^2 - v^4u^2),\ \frac{m'}{m}(v^6u^2 - v^8u^2),$$

$$\frac{m'}{m}(v^{10}u^2 - v^{12}u^2),\ \frac{m'}{m}(v^{14}u^2 - v^{16}u^2), \text{ etc.}$$

$$\text{2d surface, } \frac{m'}{m}(u^2 - v^2u^2),\ \frac{m'}{m}(v^4u^2 - v^6u^2),$$

$$\frac{m'}{m}(v^8u^2 - v^{10}u^2),\ \frac{m'}{m}(v^{12}u^2 - v^{14}u^2), \text{ etc.}$$

The sum of the square roots of these squares is the resultant molecular velocity of the emergent wave in each case. Substitute for u^2 its value, reduce, and put v' and u' for the resultant velocities at the first and second surfaces respectively; then, for the case in which $\theta = n \times \frac{1}{4}\lambda$, $v' = (v^2 - 1)(v + v^3 + v^5 \ldots ad\ inf.)$. Whence $v' = v$. The interference is therefore absolute, and the rings at these thicknesses will be perfectly dark. Also,

$$u' = (1 - v^2)(1 + v^2 + v^4 + v^6 \ldots ad\ inf.) = (1 - v^2)\frac{1}{v^2 - 1} = 1.$$

That is to say, the brightness of the rings seen by transmission is equal to that of the light originally incident upon the first surface.

For the case in which $\theta = (2n + 1) \times \frac{1}{4}\lambda$, the alternate terms are of opposite signs—viz.

$$v' = (1 - v^2)(v - v^3 + v^5 - v^7 \ldots ad\ inf.);$$

$$u' = (1 - v^2)(1 + v^2 - v^4 + v^6 \ldots ad\ inf.).$$

Here we may put v'' for the sum of the positive terms, and v''' for that of the negative; thus,

$$v'' = (1 - v^2)(v + v^5 + v^9 + v^{13} \ldots ad\ inf.) = \frac{v}{v^2 + 1}.$$

$$v''' = (v^2 - 1)(v^3 + v^7 + v^{11} + v^{15} \ldots ad\ inf.) = \frac{v^3}{v^2 + 1}.$$

And $$v'' + v''' = v' = v.\frac{1 - v^2}{1 + v^2}.$$

The value, being positive, shows that the rings seen at these thicknesses by reflection are bright.

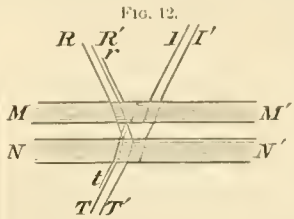
By pursuing a similar course for u', we obtain

$$u'' + u''' = u' = \frac{1 - v^2}{1 + v^2}.$$

This is positive, but is always less than unity, showing that the rings seen at these thicknesses by transmitted light are obscure, but not dark.

Colors are also produced by repeated reflections in parallel thick plates, when the thicknesses slightly differ. This is illustrated in Fig. 12, where the rays II′ undergo repeated reflections in the plates MM′, NN′, the reflected rays finally emergent from the first surface being RR′, and those transmitted through the second, TT′. Call L the length of path for T, and L′ the same for T′. Also put θ for the thickness of MM′, θ' for that of NN′, and δ for the distance between the plates. Then by inspection it is seen that

Fig. 12.



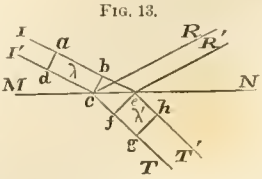
$$L = 3\theta + \theta' + \delta;\ L' = \theta + 3\theta' + \delta,\ \therefore L' - L = 2(\theta' - \theta).$$

Or, when the difference of thickness is equal to the thickness of a plate producing Newton's rings, similar colors may be seen in these.

Polarization.—A plane polarized ray is one in which the molecular movements are all performed in a single azimuth relatively to a given plane of reference. In a succession of waves proceeding directly from any natural source, such constant direction of vibratory movement is found experimentally not to exist; but after refraction or reflection, there will always be perceived a tendency toward it; and in reflection at certain angles from certain surfaces, as also in double refraction, it is completely produced. When produced by reflection, the polarized ray undergoes subsequent reflection in the azimuth of the original reflection more easily than in any other; and the plane of this polarizing reflection is called the plane of polarization. The transverse molecular movements in the polarized wave are normal to this plane, and this relation serves to fix the position of the plane of polarization for any ray. In order to investigate the theory of polarization by reflection, we must examine for two distinct cases the manner in which the living force of a wave impinging upon a reflecting surface is decomposed—first, when the molecular movements are normal to the plane of incidence, and therefore parallel to the reflecting surface; and secondly, when the same movements are in the plane of incidence, and consequently inclined to the reflecting surface. In the first case, since the movements of the incident, reflected, and transmitted waves are parallel, we may assume that the sum of the molecular velocities in the last two is equal to the molecular velocity in the first. Putting unity for this incident velocity, r for that in the reflected wave, and u for that in the transmitted, we have $1 = u + r$, or $1 - r = u$. In Fig. 13 let I, I′ be the bounding limits of a mass of the ether, along which an undulation moves, meeting the reflecting surface MN in *ce*.

Let cR, cR' be the limits of the reflected undulation, and cT, cT' those of the transmitted undulation. Draw cb, ef perpendicular to Ic, cT. Let cd be the length of the incident, and eh that of the transmitted undulation. Draw ad, gh parallel to cb, ef, respectively. We may regard the incident undulation as a mass whose bulk is the prism $abcd$, and density δ, impinging upon a mass whose bulk is $efgh$, and density δ'. Since the molecular movements in this case are *in* the common surface of the media, the *breadths* of the prisms, according to the second assumption foregoing, are equal to each other. Their *lengths* will be λ and λ', and their depths bc and ef. Or, putting m and m' for their masses, $m : m' :: bc \times \lambda \times \delta : ef \times \lambda' \times \delta'$. Now, the wave-lengths are proportional to the velocities of progress of the wave in the two media (which we may denote by V and V′). Hence, if we put ι for the angle of incidence, and ρ for the angle of refraction, we shall have, $\lambda : \lambda' :: V : V' :: \sin\iota : \sin\rho$. Also, $ecb = \iota$, and $cef = \rho$; from which we derive $bc = ce.\cos\iota$, and $ef = ce.\cos\rho$. And substituting—

FIG. 13.



$$m : m' :: \sin\iota\cos\iota\,\delta : \sin\rho\cos\rho\,\delta'.$$

But, in the propagation of tremors through elastic media, the velocity of progress is directly as the square root of the elasticity, and inversely as the square root of the density.

Or, putting ϵ for the elasticity, $V^2 = \frac{\epsilon}{\delta}$, and $V'^2 = \frac{\epsilon}{\delta'}$, ϵ being constant. Accordingly—

$$\delta : \delta' :: \frac{1}{V^2} : \frac{1}{V'^2}; \text{ and, by substitution,}$$

$$m : m' :: \frac{\sin\iota\cos\iota}{V^2} : \frac{\sin\rho\cos\rho}{V'^2} :: \frac{\sin\iota\cos\iota}{\sin^2\iota} : \frac{\sin\rho\cos\rho}{\sin^2\rho} : \frac{\cos\iota}{\sin\iota} : \frac{\cos\rho}{\sin\rho}.$$

Now the living force in the reflected and transmitted waves must be equal to the living force in the incident; or—

$$m \times 1^2 = m \times v^2 + m' \times u^2; \text{ that is,}$$

$$\frac{\cos\iota}{\sin\iota} = \frac{\cos\iota}{\cos\iota}v^2 + \frac{\cos\rho}{\sin\rho}u^2; \text{ or, } (1 - v^2).\frac{\cos\iota}{\sin\iota} = \frac{\cos\rho}{\sin\rho}u^2.$$

Combining this with the equation $1 - v = u$, we obtain

$$v = \frac{\sin(\rho - \iota)}{\sin(\rho + \iota)}, \text{ and } u = \frac{2\cos\iota\sin\rho}{\sin(\rho + \iota)}.$$

The essential sign of v depends upon the relative value of $\sin\iota$ and $\sin\rho$. If the refracting power of the medium impinged upon is less than that of the medium in which the impinging wave was moving, v will be positive; if greater, negative; which is in accordance with the law that when the wave passes from a more refracting to a less refracting medium the direction of molecular motion is maintained, while in the contrary case it is reversed. Understanding, therefore, by a sum of velocities, a geometrical instead of an arithmetical sum, we may make, in the expression for v, the angle of incidence the leading term, by putting in the original statement, $1 + v = u$, when

$$v = \frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}, \text{ which is Fresnel's formula.}$$

In either case, the expression for u remains unchanged and positive, as it should, since in the transmitted wave the direction of molecular motion of the incident wave is preserved.

Eliminating ρ by means of the equation, $\sin\iota = n\sin\rho$,

$$v = \frac{\sqrt{n^2 - \sin^2\iota} - \cos\iota}{\sqrt{n^2 - \sin^2\iota} + \cos\iota} \qquad u = \frac{2\cos\iota}{\sqrt{n^2 - \sin^2\iota} + \cos\iota}.$$

When the incidence is perpendicular, $\iota = 0$, $\sin\iota = 0$, $\cos\iota = 1$, and $v = \frac{n-1}{n+1}$; $u = \frac{2}{n+1}$; at incidence 90°, $v = \frac{\sqrt{n^2 - 1}}{\sqrt{n^2 - 1}} = 1$; $u = 0$.

The intensity of light is measured by the living force of the molecular movements, or by the mass into the square of the velocity. The mass being the same for the incident and reflected waves, their intensities are as 1^2 and v^2. But in comparing with the transmitted light, we must multiply by the expressions for measure of mass found above. Substituting for m and m' in the equation,

$$1^2 \times m = v^2 m + u^2 m',$$

both sides of the equation will be found $= \frac{\cos\iota}{\sin\iota}$, as they should be.

At perpendicular incidence $\sin\iota = \sin\rho = 0$, and m and m' become infinite; but this is of no consequence, since these terms express not the absolute masses, but only the ratio of the masses, which is all that the investigation requires. Replacing $\sin\iota$ by its equivalent $n\sin\rho$,

$$m : m' :: \frac{\cos\iota}{n\sin\rho} : \frac{\cos\rho}{\sin\rho} : \cos\iota : n\cos\rho,$$

which, when $\iota - \rho = 0°$, gives $\cos\iota = \cos\rho = 1$; and $m : m' :: 1 : n$. And at perpendicular incidence the sum of the intensities is

$$1 \times v^2 + n \times u^2 = \frac{(n-1)^2}{(n+1)^2} + \frac{4n}{(n+1)^2} = \frac{(n+1)^2}{(n+1)^2} = 1 \times I^2,$$

the intensity of the incident wave.

Considering the general value of v, we find that it increases with the angle of incidence, and becomes unity when $\iota = 90°$, since here $\cos\iota = \cos 90° = 0$. For the same reason u at this incidence $= 0$.

We take next the case of a wave in which the molecular movements, perpendicular to the direction of progress, are in the plane of incidence, and therefore in general inclined to the reflecting surface. The measures of mass will be the same as before, but instead of the actual velocities of the molecules we take the components of those velocities parallel to the reflecting surface. These are, for the incident wave, $1 \times \cos\iota$, for the reflected wave $v'.\cos\iota$, and for the transmitted $u'.\cos\rho$. Hence, adopting Fresnel's assumption,

$$(1 + v')\cos\iota = u'.\cos\rho.$$

Combining this with the equation of living forces, and reducing,

$$v' = \frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}; \quad u' = \frac{2\cos\iota\sin\rho}{\sin(\iota + \rho)\cos(\iota - \rho)}.$$

Eliminating ρ as before, we obtain

$$v' = \frac{\sqrt{n^2 - \sin^2\iota} - n^2\cos\iota}{\sqrt{n^2 - \sin^2\iota} + n^2\cos\iota}; \quad u' = \frac{2n\cos\iota}{\sqrt{n^2 - \sin^2\iota} + n^2\cos\iota}.$$

And at perpendicular incidence,

$$v' = \frac{1 - n}{n + 1}; \quad u' = \frac{2}{n + 1}, \text{ and at incidence } 90°,$$

$$v' = \frac{\sqrt{n^2 - 1}}{\sqrt{n^2 - 1}} = 1; \quad u' = 0, \text{ which agree, as they}$$

should, with the results at the same incidences in the other case.

If we examine the first value of v' given above, we shall perceive that it does not constantly increase with the increase of the incidence; for the denominator, $\tan(\iota + \rho)$, becomes infinite when $\iota + \rho = 90°$; so that at this incidence $v' = 0$, and there is no reflection. If, then, in the incident beam there had been a succession of waves, some polarized in the plane of incidence, and others in the plane at right angles to that, all this latter class of waves would at this particular incidence be transmitted, while a portion of the others would be reflected. The incident light, from the mixture of these two classes of waves, would be imperfectly polarized, or not polarized at all; but the reflected light would be wholly polarized in the plane of reflection. In this result we see a reproduction of the empirical law of Brewster, that at the polarizing angle the reflected and transmitted rays are perpendicular to each other; which is equivalent to saying that $\iota + \rho = 90°$.

If we take next the case of a ray which is polarized in any azimuth to the plane of reflection, we may, by decomposing its molecular movements into components, one coincident with the plane of reflection and the other coincident with the reflecting surface, proceed with these components severally according to the methods employed above. Let the given azimuth be α, that of the molecular movements will be $90° - \alpha$. In the plane of reflection, therefore, the molecular movement will be $\cos(90° - \alpha) = \sin\alpha$; that in the reflecting surface will be $= \cos\alpha$. The living force in the reflected beam (which measures intensity, and which we may represent by R) will consequently be—the mass being assumed for convenience = unity—

$$R = \left(\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}\right)^2.\cos^2\alpha + \left(\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}\right)^2.\sin^2\alpha.$$

The agreement of this result with previous conclusions may be verified by making α successively $= 0°$ and $= 90°$. In the first case—

$$R = \left(\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}\right)^2; \text{ and in the second, } R = \left(\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}\right)^2.$$

If $\alpha = 45°$, $\sin^2\alpha = \frac{1}{2}$, and $\cos^2\alpha = \frac{1}{2}$. Consequently,

$$R = \frac{1}{2}\left[\left(\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}\right)^2 + \left(\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}\right)^2\right].$$

This might easily be anticipated by considering that, in the supposed case, the incident beam is equivalent to two beams, each having an intensity of $\frac{1}{2}$, and polarized—one

in the plane of reflection, and the other in the plane perpendicular to it. The reflected beam should contain one-half the force in each plane which it would have done had each intensity been = 1.

Let there now be two beams, each = $\frac{1}{2}$, incident together, and polarized in the azimuths α and α'. From what has just been said, it is evident that the value of R will be—

$$R = \tfrac{1}{2}\left(\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}\right)^2 . (\cos^2\alpha + \cos^2\alpha'),$$
$$+ \tfrac{1}{2}\left(\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}\right)^2 . \sin^2\alpha + \sin^2\alpha').$$

In this expression, if $\alpha' = 90° - \alpha$, $\cos^2\alpha + \cos^2\alpha' = 1$. Also $\sin^2\alpha + \sin^2\alpha' = 1$. R becomes, therefore, equal to the sum of the intensities of two rays each = $\frac{1}{2}$, polarized, one in the plane of incidence, and the other at right angles to it, no matter what may be the value of α. If, then, any number of waves, in different azimuths, follow each other in so close succession as to blend their impressions upon the eye, and if their azimuths are so impartially distributed that for every value of α there is another = $90° - \alpha$, the forces in all these azimuths being equal, then the resultant effect of the whole must necessarily be—

$$R = \tfrac{1}{2}\left(\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)}\right)^2 + \tfrac{1}{2}\left(\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)}\right)^2.$$

But this is the condition of common light. The formula just stated, therefore, represents the living forces in the two principal planes, in a beam of common light after reflection, the original force being taken = 1. When $\iota + \rho = 90°$, the second term disappears. The reflected beam is then entirely polarized.

If we decompose the second term in the value of R, above, into its factors, we shall have (disregarding the numerical coefficient, and omitting the exponent)—

$$\frac{\tan(\iota - \rho)}{\tan(\iota + \rho)} = \frac{\sin(\iota - \rho)}{\sin(\iota + \rho)} \cdot \frac{\cos(\iota + \rho)}{\cos(\iota - \rho)}.$$

The molecular velocity of the wave polarized at right angles to the plane of reflection appears thus to be equal to that of the wave polarized in the plane of reflection, multiplied by the factor $\frac{\cos(\iota + \rho)}{\cos(\iota - \rho)}$. When $\iota = 90°$ (which is the greatest value it can have), the numerator and denominator of this fraction are equal, with opposite signs. The sign does not concern us at present, as it has no effect upon the value of the living force in the wave. For all values of ι less than 90° (ρ being necessarily less than ι when n exceeds 1) the denominator is greater than the numerator. It follows that in the reflection of common light, a larger amount of living force will, in the reflected beam, be preserved in the movements perpendicular to the plane of reflection than in those coincident with that plane; in other words, that the reflected beam will be more or less polarized in the plane of reflection. As also it follows that a larger amount of living force in the beam transmitted will be preserved in the plane of reflection than in the plane at right angles to that, we conclude that the transmitted beam will be more or less polarized, and that its plane of polarization will be normal to that of the reflected beam.

Reverting to the case of a wave polarized in azimuth α previous to reflection, we shall find that after reflection it is still polarized, though the azimuthal angle will be diminished. For putting r_1 to stand for velocity normal to the plane, and r_2 for velocity in the plane after reflection, we have

$$r_1 = \frac{\sin(\iota - \rho)}{\sin(\iota + \rho)} \cos\alpha;\ r_2 = \frac{\tan(\iota - \rho)}{\tan(\iota + \rho)} . \sin\alpha =$$
$$\frac{\sin(\iota - \rho)}{\sin(\iota + \rho)} . \frac{\cos(\iota + \rho)}{\cos(\iota - \rho)} . \sin\alpha.$$

And the second of these expressions divided by the first will give the tangent of inclination of the resultant plane of polarization to the plane of reflection. Calling this angle α',

$$\tan\alpha' = \frac{\sin\alpha}{\cos\alpha} . \frac{\cos(\iota + \rho)}{\cos(\iota - \rho)} = \tan\alpha . \frac{\cos(\iota + \rho)}{\cos(\iota - \rho)}.$$

If the reflected ray undergo reflection from a second mirror parallel to the first, its incident azimuth will be α', and after reflection it will have another azimuth α'', of which the tangent will be

$$\tan\alpha'' = \tan\alpha' . \frac{\cos(\iota + \rho)}{\cos(\iota - \rho)} = \tan\alpha . \frac{\cos^2(\iota + \rho)}{\cos^2(\iota - \rho)}.$$

And as the law is manifest, we may say that after any number, n, of reflections, the tangent of the azimuth will be

$$\tan\alpha^{(n)} = \tan\alpha . \frac{\cos^n(\iota + \rho)}{\cos^n(\iota - \rho)}.$$

While $\cos(\iota + \rho)$ has any value (that is, so long as $\iota + \rho$ is greater or less than 90°), $\tan^{(n)}\alpha$ will also have a value, or the plane of polarization will not be brought by any number of reflections absolutely into coincidence with the plane of reflection, though when $\iota + \rho = 90°$, it will be so by the first reflection. When $\cos(\iota + \rho)$ is small, or $\iota + \rho$ is near 90°, the plane of polarization will after a few reflections coincide sensibly with the plane of reflection. Thus, if $\iota = 45°$ and $\alpha = 45°$, the reflecting medium being crown glass with an index of 1.5, $(\iota + \rho)$ will be about 73°, and $\frac{\cos(\iota + \rho)}{\cos(\iota - \rho)}$ = about $\frac{3}{10}$. In this case after one reflection the azimuth will be only 16° 12′; after two, 5° 9′; after three, 1° 32′; after four, 0° 28′; and after five, 0° 8½′.

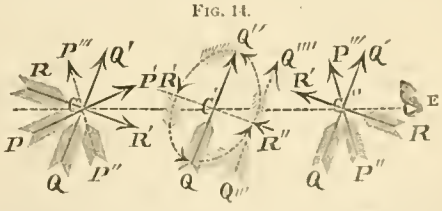
Circular and Elliptic Polarization by Reflection.—The expressions for molecular velocity in the reflected wave—viz.

$$v = \frac{\pm\sqrt{n^2 - \sin^2\iota} - \cos\iota}{\pm\sqrt{n^2 - \sin^2\iota} + \cos\iota}, \text{ and } v' = \frac{\pm\sqrt{n^2 - \sin^2\iota} - n^2\cos\iota}{\pm\sqrt{n^2 - \sin^2\iota} + n^2\cos\iota},$$

are real for all incidences so long as n is greater than unity. If n = unity exactly, they are both zero for all incidences, as they should be, since in this case there is no reflection. If n is less than unity, they are real for all incidences at which $\sin\iota$ does not exceed n, but become imaginary when $\sin\iota$ is greater than n. Experimentally, we know that in this case the reflection is total, and the expressions admit of the interpretation $v = -1$, $v' = 1$, verifying the equations $(1 + v) = n$, $(1 + v')\cos\iota = n'\cos\rho$, since n and n' are equally zero, there being no transmitted wave.

From the form of these expressions, Mr. Fresnel was led to infer that reflection in some manner modifies the phase of the undulation. The logic of the argument is not very clear, but the fact appears to be so. In the article Optics the conversion of plane into circular polarization by total reflection in Fresnel's rhombs has been described. It has been already shown that when two plane undulations normal to each other and of equal intensity, with a difference of phase of one-quarter of an undulation, interfere, the paths of the molecular movements become circular. In the rhomb of Fresnel it is found that two total reflections in an azimuth of 45° produce circular polarization; and hence it is inferred that of the two component waves to which the incident wave is equivalent, one in the plane of reflection and the other normal to it, one has been advanced or retarded upon the other by a quarter of an undulation. If the ray has undergone but one reflection in these conditions, the resulting molecular movements will be elliptical, and will be such as would be produced by an advancement or retardation of one of the waves upon the other by an eighth of an undulation. Fig. 14 may serve to illustrate these

Fig. 14.



effects. Let CE be the direction of progress of a plane polarized wave, PP′ being the original direction of molecular motion. This is decomposed into two movements, one of them QQ′ being coincident with the plane of reflection, and the other RR′ with the reflecting surface. If CC′ be the length of a quarter undulation, a movement commencing at C and decomposed in the directions CQ′, CR′ will have reached Q″ and R″ when the wave is at C′, if neither component is disturbed in phase. But if the movement in CQ′ stands still till that in CR′ has reached R″, and then becomes once more active, we may regard it as commencing at R″ just as the movement in CR′ is about returning toward the centre. The consequence of this combination, as shown in the article Vibration, will be revolution in a circle. The component RR′ therefore is in effect advanced, or the component QQ′ is retarded, a quarter of an undulation by two reflections in the rhomb. Four reflections double the effect; and the consequence may be inferred by supposing the movement in QQ′ to stand still while that in CR′ advances to R″ and subsequently returns to C″, when, combining with C″Q′, it produces a resultant in the direction P‴P‴′; that is to say, plane polarization in a plane normal to the first.

Suppose the eye of the observer to be at E, the revolution of the molecule is dextrogyre, or, as it is also called, *dextrorsum*. Conceived as viewed in the opposite direction, it would be lævogyre, or *sinistrorsum*. In the earlier history of this subject some confusion arose from the fact

that different observers applied these terms in different ways. Since observation, however, is only made upon rays approaching the observer, this is the point of view now universally adopted in naming the direction of gyration. It appears, then, that the advance of the left-hand component by a quarter undulation produces a dextrogyration, and *vice versâ*. If the plane of original polarization were P″P‴, then, in the resolution, RR′ would be reversed, and the advance of RR′ would be the advance of the right-hand component, producing lævogyration.

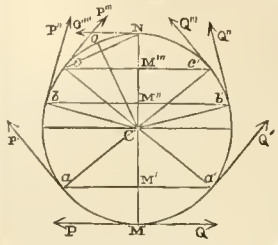
If we distinguish as *positive* the azimuths to the right of the plane of reflection, and as *negative* those to the left, we may say that a plane polarized ray in original azimuth $-45°$, is circularly polarized dextrorsum by passing through one of Fresnel's rhombs; and becomes plane polarized again in azimuth $+45°$, after passing through two. If the original azimuth be $+45$, the circular polarization is sinistrorsum, and the final azimuth of plane polarization, negative. One of these rhombs may therefore be used as a polariscope, to detect the direction of rotation of a circularly polarized ray.

If the azimuth of the original plane of polarization be greater or less than 45°, the intensities of the two components will be unequal, and the resulting polarization will be elliptical. If two equal waves in equal azimuths, positive and negative, be simultaneously reflected in one of Fresnel's rhombs, their opposite gyrations will produce a linear resultant. As in common light the molecular movements follow each other in all possible azimuths, it results that common light cannot be polarized by total reflection. If, however, we suppose a surface which is not a surface of total reflection to possess the power of accelerating or retarding one of the rectangular components of the incident velocity over the other, the reflected light will in general be elliptically polarized. For the two components are never equally reflected except in total reflection, and hence partial reflection can never produce circular polarization. There are very few substances which do not possess such a power, and accordingly elliptical polarization is the effect most usually attending reflection. Polarization which is sensibly plane is produced by reflection only from the surfaces of media whose indexes of refraction are near 1.414.

This subject has been thoroughly investigated, theoretically by Mr. Cauchy, and experimentally by Mr. Jamin, with mutually confirmatory results. The experimental methods are very ingenious and interesting, but space will not allow a description of them here. The most important of Mr. Jamin's conclusions are the following: Nearly all transparent bodies produce, by reflection from their surfaces, a difference of phase between the component waves polarized in the two principal planes. All whose indexes of refraction exceed 1.414 advance the phase of the component polarized in the plane of incidence. All those whose indexes are below that value retard the phase of the same component. The difference of phase augments with the incidence from $\frac{1}{4}\lambda$ at 0° to λ at 90°, and becomes $\frac{3}{4}\lambda$ at the polarizing angle. The variations are slow and almost insensible for some distance from either 0° or 90°. They usually become sensible near the polarizing angle. The limits are nearer together as the polarization under that angle is greater. Beyond these limits the polarization is plane but imperfect. Within them it is elliptic. The two limits are nearer to each other as the index of refraction approaches 1.414. They *unite* for substances whose index has that exact value. Mr. Jamin found but two substances in which this condition is fulfilled. They were a specimen of menilite, and a crystal of alum cut perpendicularly to the axis of the octahedron. Water and glass, which under ordinary light appear to polarize perfectly, are easily seen not to do so under the strong light of the sun. In the cases in which the index has the particular value just mentioned, the advance of phase at the polarizing angle is "brusque" from $\frac{1}{2}\lambda$ to λ. This is very nearly the case with water and glass. Reflection from the surface of metals always produces elliptical polarization. The advance of phase is progressive from incidence 0° to incidence 90°. There are, however, very large differences between metals in this respect.

Rotatory Polarization.—The property possessed by certain crystals and many solutions of producing in the plane of polarization of a plane polarized ray a change of azimuth in a constant direction, uniformly increasing with the distance passed over in the medium, has been mentioned in the article POLARIZATION. It is also there stated that Fresnel, by an ingenious combination of prisms, succeeded in demonstrating the existence in quartz of two circularly polarized rays gyrating in opposite directions. The wave-progress of these two rays is unequal. And as in circular undulations the molecules in a given undulation-length form at any given moment a spiral beginning and ending in the same azimuth, if there are two such spirals, beginning together and turning in opposite directions, they will also end together if the undulation-lengths are equal. Suppose these spirals to be traced on the surface of an imaginary cylinder, and that a plane perpendicular to the axis of the cylinder, or to the direction of progress, intersect this surface and move parallel to itself along the axis. The intersections with the spiral may be supposed in Fig. 15 to be at M, a, a', b, b', c, c', and so on, and the molecules at these several points will be acted upon by tangential forces represented by P, Q; P′, Q′, etc., and also by forces directed toward the centre C. The forces PQ being equal and opposite, the central force MC will prevail, and no actual circular movement will occur at all. The molecule will advance to M′, M″, etc., and the tangential forces P′, Q′, P″, Q″, etc., must be understood to be applied successively at those points in MN, and parallel to the directions shown. The practical result will be plane polarization.

FIG. 15.



But if one of these component spirals is shorter than the other, then, though the two begin together, they do not end together. When one has completed a revolution and reached the same azimuth again, the other will be short of a revolution. In like manner the first will complete any fraction of a revolution—say a half—before the other; so that the intersecting plane may, for example, cut one spiral at N and the other at c. At this moment the soliciting tangential forces will be P‴ and Q‴, and the direction of motion will be from the centre in the line bisecting the arc cN. The movement will still be linear, but the direction will be changed in azimuth; and as it is obvious that this change must be regularly progressive, the *locus* of all these movements will be a warped surface, resembling a lamina of some material substance twisted. The tangents show the assumed direction of gyration, and, the ray being supposed to approach the observer, the rotation of the plane of polarization is in the direction of the winding of the longest spiral, but in that of the gyration in the shortest undulation.

This illustration shows us that the angular movement in azimuth during each undulation is one-half the difference of phase between the two component waves. By observing, therefore, the amount of rotation produced by a known thickness of crystal, we may determine the relative velocities of the two waves. Represent this thickness by t, and the observed rotation by θ. Then, if λ denote the larger wave-length and λ' the shorter, we shall have

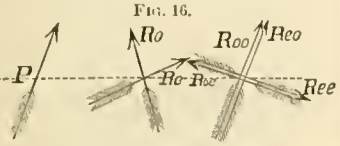
$$t = m\lambda = \left(m + \frac{2\theta}{2\pi}\right)\lambda'; \text{ or } \frac{\lambda}{\lambda'} = \frac{m\pi + \theta}{m\pi}.$$

As λ can be found by experiment, and t is known, m is ascertainable. Mr. Babinet found the value of $\frac{\lambda}{\lambda'}$ in quartz to be only 1.00003—a value which, small as it is, is the largest known for rotatory polarization.

As the two components in quartz have unequal velocities and pursue the same path, they must, for certain thicknesses of the crystal, differ in phase by a half undulation; and since their gyrations are in opposite directions, it might be supposed that they would exhibit some sensible phenomena of interference. This is not the case, and a little consideration will show the reason. Each of the two circular waves is the resultant of two elementary plane waves normal to each other and differing in phase by a quarter undulation. Let their elementary movements at any instant be represented by q and r', q' and r. In the beginning q and q' are in the same phase; so also are r and r', but in a phase 90° more advanced. We may suppose q and q' to be situated in a plane cross-section of the wave, distant a quarter of an undulation from a similar plane occupied by r and r'. Now, if the gaining circular undulation is that represented by q and r', these two components will advance out of their planes, q approaching r, and r' receding from q'. When q has gained a quarter undulation, it conspires with r, and the joint intensity is maximum; but at the same time r' will be distant from q' half an undulation, and their joint intensity will be minimum. In like manner, at intermediate points, the values of the two resultants are compensatory, and no effects of interference are perceived. But when two circularly and oppositely polarized rays of equal undulation-length are thrown together in nearly a common direction, they exhibit the effects of interference like common light.

Chromatics of Polarized Light.—In the article POLARIZATION the effect of double refraction has been stated to be to generate two waves of unequal velocity and dissimilar form, polarized at right angles to each other in the doubly refracting body. In consequence of the inequality of velocity, these two waves may emerge from a surface opposite and parallel to the surface of incidence, in different phases. If not entirely separated by the deviation of their paths, they may thus, so far as phase is concerned, be in condition to interfere. But as interference is impossible between waves whose molecular movements are perpendicular to each other, if, by any contrivance, we can turn the planes of polarization of the two rays, when, by double refraction, their paths have been made to differ by half an undulation, or by any odd number of half undulations, so that these planes shall coincide, interference will be produced. It is this which is done in the arrangements described in the article referred to, by which the gorgeous colors first observed by Arago in plates of doubly refracting crystals, are made to appear. In the first place, the lamina must be doubly refracting, in order that there may be two rays. In the second place, it must be thin, that the difference of length of path may be small. In the third place, the original light must be polarized, otherwise there will be two systems of interferences compensating each other, and obliterating each other's effects. In the fourth place, the principal plane of the lamina should, in order to produce the most complete interference, be at an azimuth of 45° to the plane of original polarization—the two rays being, in this position of the crystal, exactly equal to each other. In the fifth place, we must observe the phenomena by means of an analyzer, which allows only the light polarized in a single plane to come to the eye, or which, like a doubly refracting prism, separates the emergent light which is polarized in one plane from that which is polarized in the transverse plane; otherwise in this case again we shall have the blended effects of two compensatory interferences. Finally, the principal plane of the analyzer should, in order to produce the best effect, be at an azimuth of 45° from the principal plane of the lamina. The necessity of this condition may be readily deduced from the law of Malus. The annexed Fig. 16 may illustrate the changes which take place in the passage of the ray through the system. If the arrow, P, represent the direction of an elementary molecular movement of the original polarized ray, this movement will be resolved in the lamina into two movements at right angles to each other, and each inclined 45° to P, as shown by the arrows R_o (the ordinary ray) and R_e (the extraordinary). Suppose these rays to emerge, without difference of path, from the lamina, and to be received upon a crystal of Iceland spar whose principal plane coincides with the direction of P. Then R_o will be resolved into R_{oo} and R_{oe}; and R_e will be resolved into R_{eo} and R_{ee}. R_{oo} and R_{eo} will conspire, and R_{oo} and R_{eo} will conflict. The first pair, on the supposition we have made, will only be effective. The second will destroy each other.

Fig. 16.

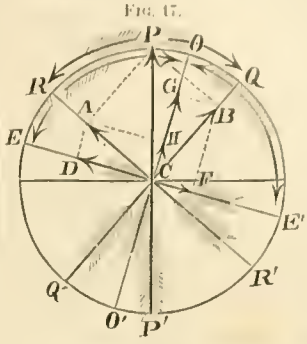


But if, as actually happens, one of these rays, as R_{oo}, is retarded, when this retardation amounts to $\frac{1}{2}\lambda$, R_{oo} and R_{eo} will conflict, and R_{oe} and R_{ee} will conspire. In white light, the different component undulations are unequal; and in such light a retardation which produces conflict between the shorter undulation, as in violet or indigo, will not equally do so in the red or orange. Hence light will still appear in both the planes R_{oo}, R_{eo}, and R_{oe}, R_{ee}; but it will be colored in both, and the tints extinguished in one will be present in the other.

It is common to speak of polarized light which has passed in this manner through a thin crystalline lamina, as having undergone *depolarization* in the lamina—an expression which seems to imply that it is restored to the condition of common light. This, however, is not true. There is one analogy between the cases, which consists in the fact that the vibrations of common light, when resolved into components parallel to two planes passing through the direction of the ray and normal to each other, are equivalent to those of the two rays into which the one original polarized ray is divided by the lamina. But the great dissimilarity of physical condition between the two is evidenced by the fact that in the one case the analyzer produces colors, while in the other it does not. There is a particular thickness of the lamina which produces something more resembling depolarization. It is that at which one ray is retarded behind the other a single quarter of an undulation. In this case the analyzer finds an equal amount of light in both planes, and in fact in all planes; so that, so far as this test is concerned, the light is truly depolarized. But it has been shown that this amount of dislocation of the rectangular components of molecular movement in plane polarized rays—the components being equal—produces circular polarization. In fact, the most convenient mode of producing circularly polarized light is to employ for the purpose what is called a "quarter wave lamina." Such a lamina will convert a plane polarized ray, incident upon it in azimuth 45° to its principal section, into a circularly polarized ray.

When the lamina which is the subject of experiment is so thick that the difference of path between the two rays amounts to many half undulations, then no color can be totally extinguished in either plane. For it must be remembered that each color occupies a considerable space in the spectrum, and therefore has undulations belonging to it of many different lengths. The differences may be slight, but slight values many times repeated become large values at last; so that two red rays whose phases are for several undulations sufficiently alike to conspire, may after a larger number be sufficiently unlike to conflict. Thus, when a certain amount of retardation has been reached, there will be found undulations of all colors impartially distributed through all varieties of phase, and chromatic phenomena will cease to appear.

Fig. 17.



A general expression for all these phenomena may be found as follows: Let PP′ be the plane of polarization of the original ray; QQ′ the principal plane of the lamina; RR′ the conjugate plane; OO′ the principal plane of the analyzer, which we will suppose to be a doubly-refracting prism or rhomb of Iceland spar; and EE′ its conjugate plane. Draw PA, PB, perpendicular to QQ′ and RR′; BF, BG perpendicular to EE′, OO′; and AD, AH perpendicular to EE′, OO′. Then if CP represent the velocity of molecular movement in the original ray, CA and CB will represent its equivalent components in the directions R′R and Q′Q. If these components be further decomposed in the directions OO′ and EE′, we shall have the original velocity CP represented by the four elements CG, CH in the principal plane, and CD, CF in the conjugate plane of the analyzer.

Represent the original velocity CP by V. Put the angle $PCQ = \alpha$, and the angle $PCO = \beta$. Then the angle OCQ will be $\alpha - \beta$. The triangles PCA, PCB give $CA = V \sin \alpha$; $CB = V \cos \alpha$. And the triangles ACD = ACH, and BCF = BCG, give $CD = V \sin \alpha \cos(\alpha - \beta)$; $CF = V \cos \alpha \sin(\alpha - \beta)$; $CG = V \cos \alpha \cos(\alpha - \beta)$; $CH = V \sin \alpha \sin(\alpha - \beta)$. Then, to find the resultant of CG, CH, the molecular velocities of the two rays emergent in the plane OO′—that is, of the emergent ordinary ray—we recur to the general equation—

$$A^2 = a^2 + a'^2 + 2aa' \cos \theta,$$

in which we must substitute for a and a' the values of CG and CH given above; and for θ the amount of retardation in phase of one of the rays behind the other in passing the lamina, which, if h represent the actual difference in length of path, may be represented by $2\pi \frac{h}{\lambda}$. The equation just stated may be conveniently transformed by adding $2aa' - 2aa'$ to the second member, when it will become—

$$A^2 = a^2 + a'^2 + 2aa' - 2aa' + 2aa' \cos \theta.$$

Or $A^2 = (a + a')^2 - 2aa'(1 - \cos \theta) = (a + a')^2 - 4aa' \sin^2 \frac{1}{2}\theta$.

Substituting now the values of a, a', and θ, we obtain—

$$A^2 = V^2 \left[[\cos \alpha \cos(\alpha - \beta) + \sin \alpha \sin(\alpha - \beta)]^2 - 4 \sin \alpha \cos \alpha \sin(\alpha - \beta) \cos(\alpha - \beta) \sin^2 \pi \frac{h}{\lambda} \right].$$

Which may be reduced to the following:

$$A^2 = V^2 \left[\cos^2 \beta + [\cos^2(2\alpha - \beta) - \cos^2 \beta] \sin^2 \pi \frac{h}{\lambda} \right].$$

And by pursuing a similar course with the values of the components CD, CF, of the extraordinary ray, we shall obtain for its resultant—

$$A'^2 = V^2 \left[\sin^2 \beta + [\sin^2(2\alpha - \beta) - \sin^2 \beta] \sin^2 \pi \frac{h}{\lambda} \right].$$

The intensity of the light in either plane is thus expressed in a formula of two terms, one of which is affected

by interference, while the other is not. It is from the second that the colorific effects proceed—directly when this term is positive relatively to the first, and indirectly when it is relatively negative. This term may therefore be called the chromatic term, and the other the achromatic. By the discussion of these equations we shall find that they embrace a complete explanation of all the varying phenomena presented by doubly-refracting substances observed in polarized light.

First, if we add the values of A^2 and A'^2, the chromatic term disappears. The colors are therefore complementary, and their resultant when blended is white. It follows that in order to observe these phenomena an analyzer must be used which allows only rays to pass polarized in a single plane, and not in the transverse, such as a plate of tourmaline cut parallel to the axis, or a Nicol's prism.

Second, $A^2 + A'^2 = V^2$, or the sum of the two intensities is equal to the intensity of the original ray, as it should be on the principle of the preservation of living forces.

Third, the chromatic effects, which depend on the factor $\sin^2\pi\frac{h}{\lambda}$ for their character, depend for quantity not only on this, but on the coefficients $\cos^2(2\alpha-\beta)-\cos^2\beta$ and $\sin^2(2\alpha-\beta)-\sin^2\beta$ also. Their greatest values will therefore occur when this coefficient is maximum. The maxima, so far as they depend on β, are found by making α constant, and will then occur when $\alpha=\beta$, or $\beta-\alpha=45°$. If α is variable, they will occur when $\alpha=\pm 45°$. Hence, the absolute maxima will be obtained when the principal plane of the lamina is inclined 45° to the plane of polarization of the incident light, and that of the analyzer is in azimuth 0° or 90°—theoretic conclusions already anticipated by experiment.

Fourth, the chromatic terms in the values of A^2 and A'^2 are both affected by the positive sign. If the term itself is essentially positive, the color is that of the two interfering rays added to and diluted by the amount of white light expressed in the achromatic term. If it is essentially negative, the color will be that which is left after the subtraction of its own color from the white of the achromatic term. That the subtraction will always be possible will be apparent from an analysis of the expression; since it is apparent that the achromatic term is never less than the coefficient of the achromatic, and this coefficient is multiplied by a factor which never exceeds unity. The achromatic term, however, becomes zero in the value of A^2 when $\beta=90°$, and in that of A'^2 when $\beta=0°$; but in these cases the chromatic term is essentially positive.

Fifth, if the position of the analyzer remain unchanged, and the lamina is rotated in azimuth, β being constant and α variable, the chromatic term is zero when $\alpha=\beta$, or $\beta\pm 90°$, or $\beta\pm 180°$, etc., and increases to a maximum when $\alpha=\beta\pm 45$, or $\beta\pm 135$, etc. White light therefore only is seen in the first series of positions here defined, and in the second, colored light—the same colors alternately fading and reappearing, since the chromatic term does not change its sign. But when the lamina remains at rest and the analyzer is rotated, although white light once more appears when $\beta=\alpha$, $\beta=\alpha\pm 90°$, $\beta=\alpha\pm 180°$, etc., and colored light at the intermediate positions, the colors will change in passing each neutral point, and will be complementary to each other in the successive quadrants; since it is evident from inspection that the essential value of the coefficient of the chromatic term changes from positive to negative, and the contrary, in making those passages.

Sixth, when $\alpha=0°, 90°, 180°$, etc., the chromatic term disappears for every value of β. In this case the light remains white throughout the entire revolution of the analyzer, and one or the other of the achromatic terms disappears whenever $\beta=0°, 90°, 180°$, etc.

Seventh, if the lamina and the analyzer both remain stationary, and the polarizer revolves, the chromatic term changes its sign in every quarter revolution, and complementary colors successively appear. It is hence manifest that unless the light is originally polarized no chromatic effects will be observable, since the colors produced by undulations in one azimuth will be neutralized by the complementary colors proceeding from other undulations in an azimuth at right angles to this.

Eighth, the factor $\sin^2\pi\frac{h}{\lambda}$, on which color depends, is maximum when $h=\frac{1}{2}\lambda, \frac{3}{2}\lambda, \frac{5}{2}\lambda$, etc. Hence the chromatic effect is greatest when the difference of phase of the two undulations is an odd number of half undulations.

Ninth, if $h=\lambda, 2\lambda, 3\lambda$, etc. the chromatic effects disappear and the equations become simplified to the forms $A^2=V^2\cos^2\beta$; $A'^2=V^2\sin^2\beta$; which are a reproduction of the law of Malus. (See POLARIZATION.)

Tenth, if $h=\frac{1}{4}\lambda, \frac{3}{4}\lambda, \frac{5}{4}\lambda$, etc.—that is to say, an odd number of quarter undulations—and $\alpha=45°$, the equations become

$$A^2=V^2(\cos^2\beta+\tfrac{1}{2}(\sin^2\beta-\cos^2\beta))=\tfrac{1}{2}V^2(\cos^2\beta+\sin^2\beta)=\tfrac{1}{2}V^2.$$
$$A'^2=V^2(\sin^2\beta+\tfrac{1}{2}(\cos^2\beta-\sin^2\beta))=\tfrac{1}{2}V^2(\sin^2\beta+\cos^2\beta)=\tfrac{1}{2}V^2.$$

This result, being independent of the value of β—that is, of the position of the analyzer—would seem to indicate depolarization of the light. It is, however, the case of circular polarization already considered. It will be seen that α must be 45° in order that the two component normally-polarized rays may be equal, else in any other azimuth of the lamina the polarization will be elliptical.

Colored Rings of Crystalline Plates.—If a lamina cut from a crystal of Iceland spar at right angles to the axis be subjected to examination in polarized light, then, as in the axial direction the ordinary and extraordinary rays are confounded, no chromatic effects will be perceived in the centre. But the rays which come to the eye converging from points not central will differ in velocity, the difference increasing with the obliquity. As every plane which passes through the axis is a principal plane, there will be an infinite number of principal planes intersecting each other in the line which forms the path of the central ray, the projections of which upon the surface of the lamina will form so many radii diverging from a centre. And as all planes which are parallel to the axis, however placed, are principal planes also, it is obvious that the planes normal to these radiating principal planes will form cylindrical principal sections having a common axis. The plane of polarization of the incident light can only coincide with one of the radiating principal planes. For that plane, the value of α in our formulæ will be 0°. For the principal plane at right angles to that, the value of α will be 90°. But when $\alpha=0°$ or 90°, the value of the chromatic term is 0. Hence there will be two planes in which no color will appear for any position of the analyzer—that is, for any value of β. But the brightness of the light seen in those planes will undergo variations of intensity, as β varies, according to the law of Malus.

For every plane except the two which have just been mentioned, the chromatic term will have a value—very slight in the neighborhood of those planes, and maximum at 45°. Very near to the centre, converging rays will have but a slight obliquity to the axis; and as a difference in length of path of one-quarter of an undulation or less fails to produce color in white light, there will be a central area which will be alternately white and black as the analyzer turns. From this area will proceed at right angles the arms of a cross, alternately dark and bright, which from the faintness of the color in the neighborhood of azimuths 0° and 90°, will have a very sensible breadth.

At that degree of convergency which makes the amount of retardation for the most refrangible rays $=\frac{1}{2}\lambda$, will appear the first decided chromatic effect. And as, in a plate of uniform thickness, this convergency must be the same on every side, the color will take the form of a ring. This ring will be bright if the analyzer is crossed upon the polarizer; in the opposite position, dark. In order to observe the phenomena to the greatest advantage, it is best to employ homogeneous light. Then at greater convergencies, corresponding to retardations, or values of h, equal to $\frac{3}{2}\lambda, \frac{5}{2}\lambda$, etc., will be seen, with the crossed analyzer, other bright rings; while at the intermediate convergencies, corresponding to values of $h=\lambda, 2\lambda, 3\lambda$, etc., will be seen dividing rings, intensely dark. When white light is used, the dark rings will be mainly occupied by the smaller rings of the colors whose undulations are shorter than the mean, or the larger rings of those which are longer. Since the retardation depends directly upon the convergency, and the place of a ring of any color depends on the equality of the retardation with the length of a half undulation of that color, it will be evident without further demonstration, that the longer the undulation the larger the ring, and *vice versâ*.

Rotating the crystalline plate in azimuth will produce no change in the phenomena. For in all positions of the plate there will always be one principal place in azimuth 0°, and another in azimuth 90°.

Rotating the analyzer will cause the rings to pass by progressive changes into the complementary tints. In this rotation β becomes $=\alpha$ and $>\alpha$ successively for every one of the radiating principal planes which it passes, up to $\beta=90°$. The sign of the chromatic term changes, therefore, in every such case. And, as the sign changes also for $\beta=\alpha\pm 90°$, $\beta=\alpha\pm 180°$, or $\beta=\alpha\pm 270°$, the color in all the quadrants will undergo similar changes simultaneously. Thus, in an entire revolution of the analyzer, the colors will be four times successively reversed; and for every position in which $\beta=45°$ or any of its odd multiples they will disappear.

The remarkable dislocations of the rings seen in crystals

cut across the axis, when examined in circularly polarized light, has been mentioned in the article POLARIZATION. This appearance is shown in Fig. 18. In the alternate quadrants, the dark rings and bright rings assume each other's positions, and no ring is continuous throughout the circle. This curious appearance is, however, easily explained, if we suppose the circularly polarized ray to be replaced by its component plane rays polarized normally to each other and differing in phase a quarter of an undulation. Call these components p and q, and suppose p to be in advance of q by a quarter undulation. There will be two quadrants (which we may call one and three), in which the plane of polarization of p will be radial, while in the alternate quadrants (two and four) it will be tangential. The other component, q, will be tangential in one and three, and radial in two and four. In the first and third quadrants, therefore, p will be the ordinary ray, and in the second and fourth the extraordinary. The extraordinary ray will be accelerated in velocity, or the ordinary retarded, relatively to the other; and at such an inclination with the axis as shall produce a retardation of a quarter of an undulation, p and q will be coincident in phase in quadrants one and three, while their difference will have been increased to half an undulation in quadrants two and four. As the planes of polarization of p and q are normal to each other, no effects of interference are observable without the analyzer; but when the principal plane of the analyzer is in azimuth 45° to both components, a positive chromatic effect is produced at a certain distance from the centre in the first and third quadrants, and a negative in the second and fourth at the same distance—that is, the same ring is bright in two quadrants and dark in the two alternate quadrants.

FIG. 18.

Crystals of Two Axes.—In crystals of two axes neither ray obeys in general the law of Snellius. But there are three planes in which one of them does so. These are, first, that which passes through both axes, and secondly, both the planes normal to the first which bisect the angles between the axes. The terms "ordinary ray" and "extraordinary ray" in the sense in which those words have been used in speaking of crystals of one axis, are inapplicable in the present case. The following equation, deduced from the general theory of double refraction, expresses the relation between the velocities of two rays traversing the crystal in the same direction, but possessing the different polarizations produced by its double refraction:

$$\frac{1}{v'^2}-\frac{1}{v^2}=\left(\frac{1}{c^2}-\frac{1}{a^2}\right)\sin\phi\sin\phi'.$$

In this formula v and v' are the two variable velocities; a and c are the Snellian velocities (constant) in the two principal planes co-ordinate to the plane of the axes; and ϕ and ϕ' are the angles made by the common direction of the two rays with the axes themselves. Putting $vv'=ac$, and $v+v'=2\sqrt{ac}$, suppositions sensibly true near the axes, we find

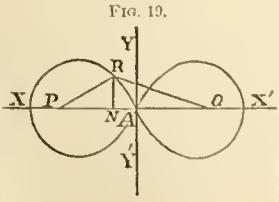
$$v-v'=\frac{v^2v'^2}{v+v'}\left(\frac{a^2-c^2}{a^2c^2}\right)\sin\phi\sin\phi' \text{ (very nearly).}$$

In the immediate vicinity of the axes, where ϕ and ϕ' are small, we may take the angles themselves, or their chords, instead of their sines. Let these chords be r and r'. Then the equation becomes,

$$rr'=\frac{2\sqrt{ac}}{a^2-c^2}(v-v'),$$

which, if $v-v'$ be made constant, is the equation of a *lemniscate*. Fig. 19 represents a *lemniscate*, or curve whose distinguishing property is that the products of every pair of *radii vectores*, drawn from two polar points, and intersecting in the curve, are equal to each other and to a constant quantity. If PQ, the distance between the poles, be bisected at A, and PA made $=q$, then the constant value of PR × QR, divided by q, is called the *parameter*, and may be represented by p. Put PR $=r$, QR $=r'$, AN $=x$, and RN $=y$. The construction gives, immediately

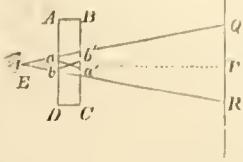
FIG. 19.



$$r'^2=(q-x)^2+y^2;\ r^2=(q+x)^2+y^2;\ \text{whence}$$
$$r^2r'^2=((q-x)^2+y^2)((q+x)^2+y^2)=p^2q^2.$$
$$\text{Or } r^2r'^2=(q^2+x^2+y^2)^2-4q^2x^2=p^2q^2.$$

In the case in hand the parameter is found by substituting the values of v and v' in the foregoing equation and dividing by q. The value of q itself is the tangent of half the angle between the axes, when the thickness of the lamina is made radius. This supposes the lemniscate to be referred to the surface of the lamina. When projected on a screen, or referred to a more distant surface, as QR, Fig. 20, q must be increased in the ratio of EP, the distance of that surface from the eye, to AB, the thickness of the lamina; and the constant value of rr' in the equation above must be increased in the square of that ratio.

FIG. 20.



When $v-v'=$ half an undulation, there will be seen—the analyzer being crossed upon the polarizer—the first bright ring. When $v-v'=\lambda$, the first dark ring will be formed. The parameter changes with $v-v'$, and the parameters of the bright rings evidently form an arithmetical series, corresponding to the odd numbers, 1, 3, 5, etc.; while those of the dark rings form a similar series with the even numbers.

The lemniscates are not perfect (though some of them are nearly so), because small errors have been admitted into our assumption. The inner curves, moreover, will in many cases form ellipses around a single pole. It is obvious that this must be the case when the constant is less than q^2. For q^2 is the smallest value that the product of the radii vectores can have; and when the parameter is not equal to q, there can be no lemniscate.

When the analyzer is crossed upon the polarizer, in observing these curves, if the plane of the axes is in the plane of polarization of the incident light, there will be seen a black cross intersecting the system symmetrically; the principal bar of which will coincide with the plane of the axes. The transverse bar will pass at right angles to this, halfway between the poles. In these two planes there is (in the position of the crystal supposed) no double refraction of the incident polarized ray. The light is therefore transmitted without interruption, and being cut off by the analyzer, shows the dark cross. By rotating the analyzer 90°, the cross becomes bright, as with crystals of one axis. But when the crystal itself is turned in azimuth, while the analyzer remains in one of the principal azimuths, the arms of the cross break at the centre, two of them on each side forming together a curve. At 45°, the two curves present the appearance of opposite hyperbolas. The analytic expression for these changes is by no means so simple as in the case of crystals of one axis. Wherever colorless or dark curves appear, the light passes the crystal without double refraction.

General Theory of Double Refraction.—The theory which embraces all the cases of double refraction in the most general manner is founded on the assumption of a difference of elasticity in the ether in the directions of three rectangular axes; and among the conclusions mathematically deducible from this assumption is the proposition that, in a medium so constituted, the molecular movements of an incident ray will be unstable except in two determinate azimuths at right angles to each other. If they are not in those azimuths, or in one of them, on entering the medium, they will be instantly turned into them; and thus the ray will be polarized in planes having transverse directions in the crystal.

If we take a crystal of two axes, and form from it prisms, of one of which the edges shall be perpendicular to the plane containing the axes, while the others have their edges respectively parallel to the lines which bisect the angles between the axes, we shall find that, in the planes of refraction of these prisms, one of the rays follows the law of Snellius; but that the indexes of refraction for these are different. These rays thus obeying the ordinary law are moreover polarized in their several planes of refraction. Their molecular movements are therefore perpendicular to those planes, or parallel to the edges of the prisms, that is to say, parallel (by construction) to three determinate fixed lines in the crystal, each at right angles to the other two. Their velocities, then, determine the elasticities in the direction of three rectangular axes. From these, as constants, is derived an equation expressing the elastic force in all intermediate directions. The three velocities are distin-

guished by the letters a, b, and c, in the order of their magnitude—that denoted by a being greatest. And elasticities being as the squares of the velocities which they generate, the three elasticities are a^2, b^2, and c^2. Now if any line be taken which makes with the directions of the elasticities a^2, b^2, c^2, angles represented by A, B, and C, and if R denote the velocity which the elasticity in the direction of that line is capable of generating, then we shall have the equation—

$$R^2 = a^2\cos^2 A + b^2\cos^2 B + c^2\cos^2 C.$$

Giving A, B, and C all possible values, R will have all possible directions; and, considered as a radius vector, its extremity will describe a surface the squares of whose radii will be equal to the elasticities in their directions. This surface, therefore, Fresnel denominated the surface of elasticity. The surface, as might be inferred from the principle of its construction, is an ellipsoid, of three unequal axes.

The polar equation above given may be referred to rectangular co-ordinates by putting x, y, and z for the co-ordinates parallel to a, b, and c, respectively, and assuming

$$R^2 = x^2 + y^2 + z^2;\ \cos A = \frac{x}{R};\ \cos B = \frac{y}{R};\ \cos C = \frac{z}{R}.$$

Whence

$$R^4 = a^2x^2 + b^2y^2 + c^2z^2;\ \text{or}\ (x^2 + y^2 + z^2)^2 = a^2x^2 + b^2y^2 + c^2z^2.$$

It would occupy a larger space than is allowed us here to examine analytically all the questions which can arise in the general theory of double refraction. We limit ourselves to a statement of the more important conclusions.

Every section of the surface of elasticity made by a plane is an ellipse. Every such section may represent the front of a plane wave. As the elasticities of the medium in different directions in this ellipse are as the squares of its radii, the greatest and least elasticities will be in the directions of its axes. And as the effect of the elastic resistances to a disturbing force is to turn the molecular movements into the directions of the greatest and least elasticities, the wave will be polarized in entering the medium in the planes of these two axes. Also, as the velocities of wave-progress are as the square roots of the elasticities producing them, the velocities of the two polarized waves will be as the axes in the directions of which their molecular vibrations are performed, and therefore the axes which are normal to their respective planes of polarization.

Since the two velocities are both uniform, though unequal, a plane wave is transformed into two plane waves by double refraction. Supposing the refracting surface to be also plane and of indefinite extent, and that a plane wave enters it obliquely, the intersection of the wave-front with the surface will be a straight line, and will advance along the surface parallel with itself, as the wave advances. The refracted waves necessarily both intersect the refracting surface in the same straight line. And if we suppose these refracted waves to be compounded of the infinitely numerous elementary waves which may be imagined to originate in the line of intersection, each resultant refracted wave-front will be a common tangent plane to all the elementary waves of its own kind thus generated. Though the planes of vibration of the two refracted rays are originally perpendicular to each other, yet the taking of different velocities slightly modifies this relation, but the change is hardly sufficient to be sensible.

There are two sections of the surface of elasticity which are circles. They are normal to the plane of the greatest and least axes, and their inclination (α) to the first is such that

$$\tan\alpha = \pm\sqrt{\frac{a^2 - b^2}{b^2 - c^2}}.$$

The inclination to the same axis of the normals to these planes—that is, of the directions of progress of the waves of which they are the planes—expressed by α' will have for tangent the reciprocal of the last expression—viz.

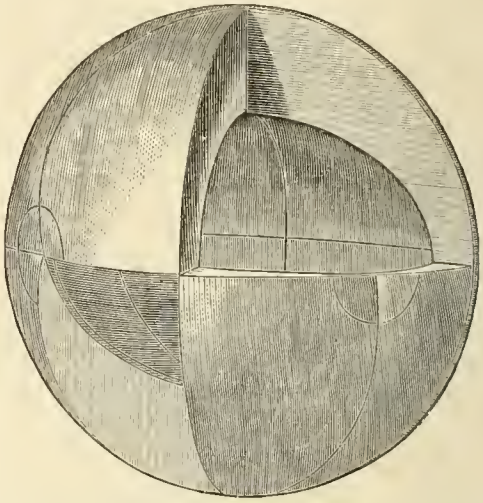
$$\tan\alpha' = \pm\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}.$$

If the wave-front of the incident light coincide with one of these circular sections of the surface of elasticity, the wave can have no determinate plane of polarization. For all the radii of the section being equal, the elastic forces are in equilibrio in every azimuth. Some curious peculiarities, however, belong to this wave, which are mentioned farther on. If, in the first expression foregoing, we make $b = c$, the denominator becomes zero, and the tangent is infinite, or tan 90°. The two circular sections then coincide in the plane of bc at right angles to a, and the crystal is a negative crystal of one axis. If $a = b$, tan $\alpha = 0$, and the two circular sections meet in the plane of ab at right angles to c, and the crystal is positive. If $a = c$, then, since b is the mean axis, all the axes are equal, and $\tan\alpha = \frac{0}{0}$; an indefinite value, signifying that the circular sections have no fixed positions; or that all the sections are circular. In such a medium there can be no double refraction.

The direction of ray-propagation is that of the radius of the wave. When the wave is spherical, the ray is normal to the surface, but not otherwise. The velocity of wave-progress is measured by the normal let fall from the centre upon the plane which is tangent to the wave at the extremity of the ray. The direction of molecular movement in the ray is in the intersection of the tangent plane with the plane of the ray and the normal. In spherical waves, ray-progress and wave-progress are equal; in waves not spherical, the velocity of ray-progress may be greater than that of wave-progress.

Wave-Surface.—Could a molecular movement be produced, starting from a single point and propagated in all directions in a medium of variable elasticity of three axes, the surface defining the limits of the tremor at any moment would be the wave-surface. The same form of surface (sensibly) would be defined by an infinite number of planes tangent to a luminous sphere like the sun, moving outwardly from the body in all directions with velocities such

Fig. 21.



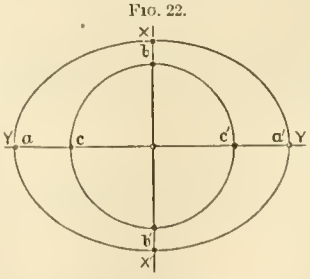
as the law of variable elasticity requires, when their distance from the body becomes very great compared with the diameter of the sphere itself. Proceeding upon this supposition, Mr. Fresnel obtained an equation for the wave-surface, which is the following:

$$a^2x^2[x^2 + y^2 + z^2 - (b^2 + c^2)] + b^2y^2[x^2 + y^2 + z^2 - (a^2 + c^2)] + c^2z^2[x^2 + y^2 + z^2 - (a^2 + b^2)] + a^2b^2c^2 = 0.$$

Or, $(a^2x^2 + b^2y^2 + c^2z^2)\,[x^2 + y^2 + z^2 - (a^2 + b^2 + c^2)] + a^4x^2 + b^4y^2 + c^4z^2 + a^2b^2c^2 = 0.$

This is an equation of the fourth degree, and represents a surface of two nappes, or sheets, inosculating at four points. Fig. 21 is a representation of this surface. In order to exhibit the interior nappe, two angulæ are represented as cut away; one of the section planes passing through the two points of inosculation in the visible surface, and another through one of them.

Fig. 22.



The three principal sections of this surface present each two curves returning into themselves, as shown in these figures.

The equation through $a\,b$, Fig. 22, is deduced from the general equation of the curve by putting $z = 0$, when it becomes

$$(a^2x^2 + b^2y^2)\,[x^2 + y^2 - (a^2 + b^2)] + a^4x^2 + b^4y^2 + a^2b2c2 = 0;$$

which may be resolved into the two factors,

$$(a^2x^2 + b^2y^2 - a^2b^2)(x^2 + y^2 - c^2) = 0,$$

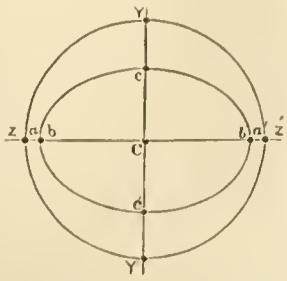
being the equation of an ellipse and a circle combined. In like manner, making $x = 0$, we obtain the equation of the section through $b\,c$, Fig. 23—viz.

$$(b^2y^2 + c^2z^2 - b^2c^2)(y^2 + z^2 - a^2) = 0;$$

and making $y = 0$, we obtain that through $a\,c$, Fig. 24—viz. $(a^2x^2 + c^2z^2 - a^2c^2)(x^2 + z^2 - b^2) = 0$.

The last section is remarkable, as showing an intersection of the circle and the ellipse. The intersection is necessary, because the diameter of the circle is the mean axis of elasticity b, while the major and minor axes of the ellipse are the extreme axes of elasticity, a and c. The points of intersection shown at N, N′ are the inosculating points of the two nappes of the wave-surface.

Fig. 23.



Since the velocity of ray-propagation is measured by the radius of the wave-surface, it is evident that, along the radii drawn to N, N′, etc., there may be two refracted rays having the same velocity. These lines have a peculiar optical interest. Their inclination to x, or a, the axis of greatest elasticity (or the angle MCN), may be found from the equation (putting $\beta = \mathrm{MCN}$),

$$\tan\beta = \frac{\mathrm{MN}}{\mathrm{CM}} = \frac{\mathrm{MN}}{\mathrm{NO}}.$$

MN and NO are obtained by making both factors of the equation of the section, just given, simultaneously $= 0$. The values of x and z which render this possible are the values of NO and NM. We have then,

$$x^2 + z^2 - b^2 = 0, \quad \text{and} \quad a^2x^2 + c^2z^2 - a^2c^2 = 0,$$

from which we obtain, by elimination,

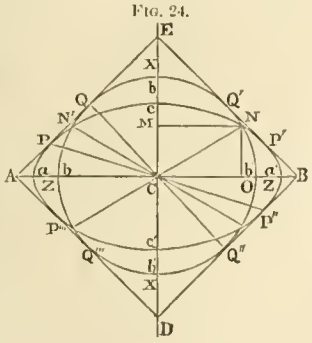
$$x^2 = \frac{c^2(a^2 - b^2)}{a^2 - c^2}, \quad \text{and} \quad z^2 = \frac{a^2(b^2 - c^2)}{a^2 - c^2}.$$

Whence,

$$\frac{\mathrm{MN}}{\mathrm{NO}} = \frac{z}{x} = \pm\frac{a\sqrt{b^2 - c^2}}{c\sqrt{a^2 - b^2}} = \tan\beta,$$

which differs a little from the value found for the tangent of inclination of the normals to the circular sections. But these normals are the directions of *equal wave-velocity*; and CN is the direction of *equal ray-velocity*. These two directions are therefore not coincident, though nearly so.

Fig. 24.

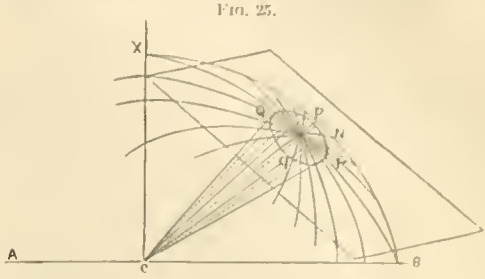


The lines drawn through N and N′ are, however, the optic axes, for it is equality of ray-velocity which makes an optic axis. But it is not true that the two rays whose velocities in CN are equal can spring from the same incident ray. Herein is an important difference between crystals of one axis and those of two. It is further true that in this latter class of crystals no single incident ray of common light can give a single refracted one; for there are no points of common tangency in which both nappes can be met by the same plane.

If a tangent plane be drawn to the wave-surface parallel to one of the circular sections of the surface of elasticity, it will take the position AE or EB in the figure, and may easily be shown to be tangent at once to the ellipse and to the circle in the principal section through the optic axes. Hence, if AB represent a refracting surface, and N′C a ray of common light incident at C, so as to take the direction CQ″ for the nappe whose section is circular, it will yield another ray CP‴ for the nappe whose section is elliptical. These will be polarized in planes transverse to each other. The molecular movements of the ray CQ″ are necessarily perpendicular to the circular section, and that section is therefore its plane of polarization. Those in CP‴ are of course transverse to these, but may also be inferred to be so from the fact that Q″ is the foot of the normal from the centre to the tangent plane, and P″ is the point of contact. The molecular movements in CP‴ must necessarily take the direction P″Q″.

In the discussion of the tangent plane AE or EB, drawn parallel to one of the circular sections of the surface of elasticity, Sir William Hamilton made the remarkable discovery that the tangency is not confined to the points P′ and Q in the principal section; but that it extends throughout the circumference of a minute closed curve, sensibly circular, of which P′ and Q are only two points of the circumference. The point N* is, therefore, the vertex of a conoidal or umbilical depression; and all the points of the circumference of the circle of contact are equally points in the wave-front to which CQ is normal, and which is parallel to the same circular section of the surface of elasticity to which the tangent plane is parallel. The annexed figure represents this little circle. As, in this, CQ is the normal to the circular section of the surface of elasticity, and CN is the optic axis, we have—

Fig. 25.



$$\tan \mathrm{QCX} = \tan a' = \pm\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}, \text{ and } \tan \mathrm{NCX} = \tan\beta = \pm\frac{a}{c}\sqrt{\frac{b^2 - c^2}{a^2 - b^2}}. \quad \text{Whence } \tan a' = \pm\frac{c}{a}\tan\beta.$$

In anhydrous sulphate of lime (anhydrite) in which the doubly-refracting power is uncommonly great, the ratio of c to a is .9725 to 1. The value of β is 14° 3½′, from which we deduce $a' = 13°\ 41'\ 11''$, and $\beta - a' = 0°\ 22'\ 19''$.

A general expression for $\beta - a'$, easily found, is the following—

$$\sin(\beta - a') = \frac{a - c}{c}\sin a'\cos\beta.$$

In so far as the variation dependent on the trigonometrical function $\sin a'\cos\beta$ is concerned, we may easily determine the outside limit. For, since a' is less than β, $\sin a' < \sin\beta$; and $\sin a'\cos\beta < \sin\beta\cos\beta$. But when $\sin\beta\cos\beta$ is at its maximum, $\cos^2\beta = \sin^2\beta = \sin^2 45° = \frac{1}{2}$. Therefore, $\sin\beta\cos\beta = \frac{1}{2}$ also. And $\sin a'\cos\beta$ is always less than $\frac{1}{2}$. Hence, the sine of the angle between the optic axes and the normals to the corresponding circular sections is always less than half the difference between the greatest and least axes of elasticity, divided by the least axis.

Inasmuch as all the points of the little circle $QqPp$ are in the tangent plane, it follows that, if a ray should be incident upon a crystal in such a manner as that CQ should be its direction for one nappe and CP for the other, neither the ray CQ nor the ray CP would be confined to the point Q or P, but both would spread themselves along the circumference $QqPp$, until, by blending together, they should form a hollow cone. At their emergence they would resume their parallelism to the incident ray, and thus in their further progress would constitute a hollow cylinder. On the other hand, in every plane of intersection of the wave which can pass through CN, there may be two rays in different incidences which will equally be refracted in the direction CN; and all these together will form an incident hollow cone refracted in the crystal into the single direction of the optic axis. These, on their emergence, resuming parallelism severally to their incident directions, will form an emergent hollow cone similar to that which was incident. Should the incident cone be even a solid cone of light instead of a hollow cone, the emergent cone would still be hollow, because the interior rays of the incident cone would be diverted by double refraction to more distant parts of the wave-surface.

These deductions of theory were announced before any phenomena of the kind had been observed or suspected. At the request of the discoverer, Dr. Lloyd of Cambridge made a careful study of a crystal of aragonite properly prepared, and the result of his examination was to confirm the theory in every particular. The success of the observation requires very delicate adjustments. An apparatus for facilitating it is constructed by Mr. Soleil of Paris.

When the emergent cylinder or cone of rays is observed with an analyzer like Nicol's prism, one radius of the circle disappears. As the analyzer is turned in azimuth, this dark radius changes its position, advancing in azimuth twice as fast as the analyzer. When the analyzer is in azi-

* The letter N should stand at the centre of the depression.

muth 90° from its original position, the dark radius is in azimuth 180°; when the analyzer has completed half a revolution, the dark radius has made a whole one. This singular fact is, however, easily explained. The analyzer suppresses that ray on whose plane of polarization it is *crossed*; and the planes of polarization of the rays in this small circle are, at opposite ends of every diameter, at right angles to each other.

In the equation of the wave-surface, if b be the mean axis, and we make $c = b$, we shall have, after reduction—

$$(a^2x^2 + b^2y^2 + b^2z^2 - a^2b^2)(x^2 + y^2 + z^2 - b^2) = 0.$$

If b and c remain unequal, and we put $b = a$, the equation is

$$(a^2x + a^2y^2 + c^2z^2 - a^2c^2)(x^2 + y^2 + z^2 - a^2) = 0.$$

These are both equations of a spheroid and a sphere, touching each other at the poles. The first is that of an oblate spheroid circumscribing the sphere, and answers to the case of a negative crystal of one axis. The second is that of a prolate spheroid circumscribed by the sphere, and answers to the case of a positive crystal. The case of quartz, so remarkable on other accounts, is peculiar also in the fact that the two nappes of its wave-surface are not in contact anywhere. The ellipsoid is entirely within the sphere, and there is no direction either of equal wave or of equal ray velocity.

These equations suggest the geometrical relations between the surface of elasticity and the wave-surface. The larger diameters of the one are at right angles to the larger diameters of the other, and the smaller have the same relation. For crystals of one axis, the surface of elasticity is an ellipsoid of revolution. If its form is prolate, it generates an oblate wave; if oblate, the wave is prolate.

The causes of varying elasticity of the luminiferous ether within crystals are not well understood. They are dependent, in some manner, upon molecular arrangement. This is evident from the fact that variations resembling those which naturally exist in crystals may be produced (see POLARIZATION) in homogeneous bodies, by heat or by the force of pressure, flexure, or torsion. So delicate a test does the polariscope furnish of inequality of temperature, stress, or mechanical force of any kind that chromatic thermometers and dynamometers founded on these principles have been proposed for determining differences of temperature, stress, or pressure too slight to be easily measured by ordinary instruments.

The literature of this subject is extensive. The theory was first proposed by Huyghens in his *Traité de la Lumière* (1690), but met with little favor; was revived by Young in the *Phil. Trans.* of London (1800–03), and systematically presented in his *Lectures on Natural Philosophy* (2 vols. 4to, 1807); was largely developed by Fresnel in very numerous papers published in the *Annales de Chimie* and the *Bulletin de la Société philomathique*, and especially in the *Memoirs* of the French Academy of Sciences for 1846 and the *Memoirs* of the Institute, vols. v. and vii. An important memoir on the subject by Fraunhofer appeared in the Munich *Transactions* in 1814. The subject is very fully treated in the elaborate article on "Light" by Sir John Herschel, *Encycl. Metropol.* (1827), by Brewster, *Encycl. Britan.*, art. "Optics," and by Arago, art. "Polarization" in the same work. Also by Peclet, *Traité de Physique* (1847), Müller, *Handbuch der Physik* (1864), and Jamin, *Traité de Physique* (1872). Special essays on the general theory or particular topics under it are—Airy, *Undulatory Theory of Light* (1831); Lloyd, *Wave Theory of Light* (1832); Baden Powell, *On the Undulatory Theory applied to the Dispersion of Light* (1841); Cauchy, *Comptes Rendus* of the French Academy of Sciences; Sir William Rowan Hamilton, *Systems of Rays* (*Memoirs Royal Irish Academy*, vols. xv.–xvii.); Lloyd, on *Conical Refraction* (*Mem. Royal Irish Acad.*, vol. xvii.); McCullagh, on *Polarization* (*Mem. Royal Irish Academy*, 1830, 1835, 1838); Stokes, on *Dispersion* (*Cambridge Transactions*, vol. ix.); Green, on *Dispersion* (*Cambridge Transactions*, vol. ix.); Schwerd, *Die Beugungserscheinungen aus den Fundamentalgesetzen der Undulationstheorie analytisch entwickelt* (1835); and a treatise by the present writer in *Report of the Smithsonian Institution* for 1862.

F. A. P. BARNARD.

Unfermented Bread. See BREAD, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Ung'er (FRANZ), b. in Styria in 1800; studied medicine at Prague and Vienna; practised for several years as a physician; was in 1836 appointed professor of botany and director of the botanical garden at Gratz; removed in 1850 to Vienna; undertook extensive scientific journeys in Denmark, Sweden, and Norway, subsequently in Egypt and Syria. D. at Gratz Feb. 13, 1870. His principal works are—*Anatomie und Physiologie der Pflanzen* (1855), *Versuch einer Geschichte der Pflanzenwelt* (1852), and *Botanische Streifzüge auf dem Gebiete der Culturgeschichte* (1857), *Genera et Species Plantarum Fossilium* (1850), *Iconographia Plantarum Fossilium* (1852), *Sylloge Plantarum Fossilium* (1860), *Die Fossile Flora von Sotzka* (1850), *Die Fossile Flora von Kumi in Eubœa* (1867).

Unghvar', town of Hungary, on the Ungh, is well built, has many good educational institutions, and 8 well-attended annual fairs. P. 8537.

Unguents. See OINTMENTS.

Un'gula [Lat.], a segment of a volume. An ungula of a cone or cylinder is a portion of the cone or cylinder included between the base and an oblique plane intersecting the base. A spherical ungula is a portion of a sphere bounded by two semicircles meeting in a common diameter.

Ungulata. See APPENDIX.

Unicoi, county of E. Tennessee, separated from North Carolina by the Unaka Mountains, and drained by Nolichucky River and its tributaries, formed in 1875 from portions of Carter and Washington cos., is situated in a well-wooded, cold, and rugged mountain-region, several peaks being 5500 feet in height; has but little arable land, but abundance of iron ore, and is well fitted for pasturage. Area, 300 sq. m. P. about 2000. Cap. Vanderbilt.

U'nicorn [Lat. *unum*, "one," and *cornu*, a "horn"], described by various writers, from Ctesias, Aristotle, and Pliny down, as a horse-like creature with a straight horn in the middle of the forehead. Its figure occurs as a heraldic charge. The word *reem* in the Hebrew Bible, translated "unicorn" in the English version, denotes some horned creature, perhaps the buffalo.

Unigen'itus, The Bull [from its first word, *unigenitus*, "the Only-Begotten"], a famous bull issued in 1713 by Pope Innocent XI. against 101 propositions contained in the *Réflexions morales* of Pasquier Quesnel (1634–1719). The bull excited the strongest controversies in the Gallican Church, the opposition to the pope and the king being led by Cardinal de Noailles and the other Jansenist bishops. In 1730 the bull was accepted by the Parliament of Paris.

Un'ion, county of S. Arkansas, bordering on Louisiana, and drained by the Washita and its tributaries; surface hilly, soil fertile. Cattle and swine are numerous. Staples, cotton and Indian corn. Cap. El Dorado. Area, 1230 sq. m. P. 10,571.

Union, county of S. E. Dakota, bordering on Iowa and Nebraska, and traversed in its S. part by Dakota Southern R. R.; surface rolling, soil fertile in the river-bottoms. Staples, Indian corn, wheat, oats, and dairy products. Cap. Elk Point. Area, 380 sq. m. P. 3507.

Union, county of N. Georgia, bordering on North Carolina, drained by the head-waters of Hiawassee and Tocoa rivers, and traversed by the Blue Mountain ridge. Iron, marble, and granite occur, and gold was formerly found in considerable quantities. The soil is generally well adapted to pasturage. Staples, Indian corn, tobacco, sweet potatoes, and wool. Cap. Blairsville. Area, about 400 sq. m. P. 5267.

Union, county of S. Illinois, bordering on Mississippi, and traversed by Illinois Southern R. R.; surface undulating, soil fertile. Iron ore, bituminous coal, porcelain clay, chalk, alum, and copperas occur. There are flour-mills and manufactories of agricultural implements, carriages, stone and earthen ware, and lime. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, Irish and sweet potatoes, wool, tobacco, and dairy products. Cap. Jonesborough. Area, 320 sq. m. P. 16,518.

Union, county of S. E. Indiana, bordering on Ohio, drained by the E. fork of Whitewater River, and traversed by Cincinnati and Indianapolis Junction R. R.; surface generally undulating, soil productive. There are flour-mills, saw-mills, planing-mills, and manufactories of agricultural implements, carriages, and woollen goods. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, wool, and dairy products. Cap. Liberty. Area, 168 sq. m. P. 6341.

Union, county of S. W. Iowa, drained by the head-waters of Platte and Grand rivers, and traversed by Burlington and Missouri River R. R.; surface undulating, soil fertile. Staples, Indian corn, oats, and wool. Cap. Afton. Area, 482 sq. m. P. 5986.

Union, county of N. W. Kentucky, separated from Indiana and Illinois by Ohio River, and drained by Tradewater and Ohio creeks; surface generally hilly, soil fertile, with much bituminous coal and several chalybeate and sulphur springs. Staples, tobacco, Indian corn, and wool. Cap. Morganfield. Area, 350 sq. m. P. 13,640.

Union, parish of N. Louisiana, bordering on Arkansas, bounded E. by Washita River, and intersected by Bayou

d'Arbonne, both of which are navigable by steamboats. Principal exports, live stock, swine, and cattle. Staples, cotton, Indian corn, and sweet potatoes. Cap. Farmersville. Area, about 1000 sq. m. P. 11,685.

Union, county of N. Mississippi, drained by the head-waters of Tallahatchie River. Cap. New Albany. Area, about 400 sq. m. P. not given in the census of 1870.

Union, county of N. E. New Jersey, bounded by Passaic River, Staten Island Sound, Newark Bay, and Rahway River, drained by Elizabeth River and other streams, and traversed by New Jersey Central and other railroads; surface flat, soil generally productive. There are about 350 manufacturing establishments, among which are carriages, wagon materials, sashes, doors, and blinds, iron, machinery, cutlery, and edge tools, railway cars, cordage and twine, oilcloth, and paving materials, flour-mills, and bleaching and dyeing establishments. The number of live-stock is small. Staples, principally the foregoing manufactures. Cap. Elizabeth. Area, 101 sq. m. P. 41,859.

Union, county of S. North Carolina, bordering on South Carolina, and drained by Lyncho's Creek and affluents of Catawba and Yadkin rivers; surface hilly, soil fertile only in portions. There are some gold-mines, which were formerly productively worked. Granite and slate abound, and there is stone excellently adapted for hones and whetstones. There are considerable numbers of swine, cattle, and sheep. Staples, cotton, Indian corn, wool, and a little tobacco. Cap. Monroe. Area, 350 sq. m. P. 12,217.

Union, county of Central Ohio, drained by affluents of Ohio River and intersected by Cleveland Columbus Cincinnati and Indianapolis and Atlantic and Great Western R. Rs.; surface level, soil productive. There are manufactories of carriages and woollen goods, saw-mills, flour-mills, planing-mills, and distilleries. Sheep, cattle, horses, and swine are very numerous. Staples, Indian corn, wheat, oats, wool, lumber, and dairy products. Cap. Marysville. Area, 145 sq. m. P. 18,730.

Union, county of N. E. Oregon, bounded N. by Washington Territory and E. by Idaho, from which it is separated by Snake River, and watered by Grande Ronde and Powder rivers. The surface is generally elevated, a large portion being covered with forests of pine, larch, and fir, most of the remainder being chiefly adapted for pasturage, but the valley of the Grande Ronde contains much arable soil. Gold and silver are found, and there are some mines worked. There are considerable numbers of cattle, swine, sheep, and horses. Staples, lumber, wheat, oats, barley, potatoes, and dairy products. Cap. La Grande. Area, about 4550 sq. m. P. 2552.

Union, county of Central Pennsylvania, bounded E. by the W. branch of Susquehanna River, and drained by Penn's, Buffalo, and White Deer rivers. The surface is generally hilly, being traversed in various directions by spurs of the Alleghany Mountains, but the soil along the streams is productive, and bituminous coal and limestone are abundant. There are manufactories of carriages, agricultural implements, boots and shoes, woollen goods, pig iron, and iron castings; tanneries, saw-mills, and planing-mills. There are considerable numbers of cattle, swine, and horses. Staples, oats, Indian corn, wheat, and dairy products. Cap. Lewisburg. Area, 250 sq. m. P. 15,565.

Union, county of N. South Carolina, bounded N. by Broad River and E. by the Ennoree, intersected by Pacolet and Tyger rivers, and by Spartanburg and Union R. R.; surface hilly, soil generally productive. Gold was formerly mined, and iron ore and granite abound. Has flour-mills and ironworks. Swine, cattle, and sheep are numerous. Staples, cotton, Indian corn, wool, and a little tobacco. Cap. Union. Area, about 500 sq. m. P. 19,248.

Union, county of N. E. Tennessee, bounded N. by Powell's River and intersected by Clinch River; surface generally hilly, soil better adapted for grazing than for tillage. Iron and lead are found. The principal live-stock are swine and sheep. Staples, Indian corn, oats, wool, and some tobacco. Cap. Maynardville. Area, about 400 sq. m. P. 7605.

Union, tp., Dallas co., Ala. P. 2949.
Union, tp., Greene co., Ala. P. 1115.
Union, tp., Ashley co., Ark. P. 480.
Union, tp., Conway co., Ark. P. 1085.
Union, tp., Fulton co., Ark. P. 775.
Union, tp., Greene co., Ark. P. 543.
Union, tp., Hot Springs co., Ark. P. 423.
Union, tp., Independence co., Ark. P. 531.
Union, tp., Izard co., Ark. P. 1153.
Union, tp., Jackson co., Ark. P. 1061.
Union, tp., Marion co., Ark. P. 998.
Union, tp., Newton co., Ark. P. 203.
Union, tp., Ouachita co., Ark. P. 382.
Union, tp., Pulaski co., Ark. P. 360.
Union, tp., Saline co., Ark. P. 279.
Union, tp., Sharpe co., Ark. P. 177.
Union, tp., St. Francis co., Ark. P. 1325.
Union, tp., Van Buren co., Ark. P. 216.
Union, tp., White co., Ark. P. 1013.
Union, tp., San Joaquin co., Cal. P. 333.
Union, tp., Tolland co., Conn. P. 627.
Union, tp., Cumberland co., Ill. P. 1836.
Union, tp., Effingham co., Ill. P. 637.
Union, tp., Fulton co., Ill. P. 1914.
Union, tp., Livingston co., Ill. P. 711.
Union, tp., Union co., Ill. P. 781.
Union, tp., Adams co., Ind. P. 865.
Union, tp., Bartholomew co., Ind. P. 1008.
Union, tp., Benton co., Ind. P. 310.
Union, tp., Boone co., Ind. P. 1057.
Union, tp., Clarke co., Ind. P. 1022.
Union, tp., Crawford co., Ind. P. 1082.
Union, tp., De Kalb co., Ind. P. 3059.
Union, tp., Delaware co., Ind. P. 1211.
Union, tp., Elkhart co., Ind. P. 1221.
Union, tp., Fulton co., Ind. P. 1200.
Union, tp., Hendricks co., Ind. P. 1326.
Union, tp., Howard co., Ind. P. 1745.
Union, tp., Huntington co., Ind. P. 1016.
Union, tp., Jasper co., Ind. P. 196.
Union, tp., Johnson co., Ind. P. 1466.
Union, tp., La Porte co., Ind. P. 585.
Union, tp., Madison co., Ind. P. 851.
Union, tp., Marshall co., Ind. P. 1335.
Union, tp., Miami co., Ind. P. 982.
Union, tp., Montgomery co., Ind. P. 4746.
Union, tp., Ohio co., Ind. P. 669.
Union, tp., Parke co., Ind. P. 1256.
Union, tp., Perry co., Ind. P. 1365.
Union, tp., Porter co., Ind. P. 1057.
Union, tp., Rush co., Ind. P. 1206.
Union, tp., Shelby co., Ind. P. 1200.
Union, tp., St. Joseph co., Ind. P. 1801.
Union, tp., Union co., Ind. P. 1289.
Union, tp., Vanderburg co., Ind. P. 1010.
Union, tp., Wells co., Ind. P. 1263.
Union, tp., White co., Ind. P. 1832.
Union, tp., Whitley co., Ind. P. 1291.
Union, tp., Adair co., Ia. P. 169.
Union, tp., Adams co., Ia. P. 393.
Union, tp., Appanoose co., Ia. P. 668.
Union, tp., Benton co., Ia. P. 725.
Union, tp., Black Hawk co., Ia. P. 419.
Union, tp., Boone co., Ia. P. 398.
Union, tp., Cass co., Ia. P. 111.
Union, tp., Crawford co., Ia. P. 555.
Union, tp., Dallas co., Ia. P. 1663.
Union, tp., Davis co., Ia. P. 1225.
Union, tp., Delaware co., Ia. P. 689.
Union, tp., Des Moines co., Ia. P. 1362.
Union, tp., Floyd co., Ia. P. 978.
Union, tp., Guthrie co., Ia. P. 168.
Union, p.-v. and tp., Hardin co., Ia., has a private bank. P. 1276.
Union, tp., Harrison co., Ia. P. 238.
Union, tp., Jackson co., Ia. P. 1214.
Union, tp., Johnson co., Ia. P. 790.
Union, tp., Louisa co., Ia. P. 616.
Union, tp., Lucas co., Ia. P. 658.
Union, tp., Madison co., Ia. P. 1041.
Union, tp., Mahaska co., Ia. P. 1190.
Union, tp., Marion co., Ia. P. 765.
Union, tp., Mitchell co., Ia. P. 355.
Union, tp., Monroe co., Ia. P. 1161.

Union, tp., Poweshick co., Ia. P. 824.
Union, tp., Ringgold co., Ia. P. 325.
Union, tp., Story co., Ia. P. 1089.
Union, tp., Union co., Ia. P. 1531.
Union, tp., Van Buren co., Ia. P. 1672.
Union, tp., Warren co., Ia. P. 1112.
Union, tp., Wayne co., Ia. P. 1005.
Union, tp., Jefferson co., Kan. P. 618.
Union, p.-v. and tp., Smith co., Kan.
Union, p.-v. and tp., Knox co., Me. P. 1701.
Union, tp., Branch co., Mich. P. 2121.
Union, tp., Isabella co., Mich. P. 657.
Union, tp., Houston co., Minn. P. 456.
Union, tp., Barton co., Mo. P. 152.
Union, tp., Benton co., Mo. P. 1185.
Union, tp., Bollinger co., Mo. P. 1436.
Union, tp., Clarke co., Mo. P. 1155.
Union, tp., Crawford co., Mo. P. 1015.
Union, tp., Daviess co., Mo. P. 1515.
Union, tp., Dunklin co., Mo. P. 797.
Union, p.-v. and tp., cap. of Franklin co., Mo., 55 miles W. of St. Louis, has 2 churches, schools, 1 newspaper, county-seat buildings, 1 brewery, and a steam-mill. P. 2855.
Wilson Leisen, Ed. "Franklin County Record."
Union, tp., Harrison co., Mo. P. 1193.
Union, tp., Holt co., Mo. P. 1118.
Union, tp., Iron co., Mo. P. 743.
Union, tp., Laclede co., Mo. P. 1850.
Union, tp., Lincoln co., Mo. P. 1361.
Union, tp., Marion co., Mo. P. 1471.
Union, tp., Monroe co., Mo. P. 1566.
Union, tp., Nodaway co., Mo. P. 1308.
Union, tp., Pulaski co., Mo. P. 958.
Union, tp., Putnam co., Mo. P. 2053.
Union, tp., Randolph co., Mo. P. 1136.
Union, tp., Ripley co., Mo. P. 855.
Union, tp., Scotland co., Mo. P. 1104.
Union, tp., Sullivan co., Mo. P. 1222.
Union, tp., Washington co., Mo. P. 1187.
Union, tp., Webster co., Mo. P. 1593.
Union, tp., Worth co., Mo. P. 1199.
Union, tp., Douglas co., Neb. P. 217.
Union, p.-v., Carroll co., N. H., on the Conway division of Eastern and Maine Central R. Rs.
Union, tp., Bergen co., N. J. P. 2057.
Union, p.-v. and tp., Hudson co., N. J. P. of v. 4640; of tp. 6737.
Union, tp., Hunterdon co., N. J. P. 1051.
Union, tp., Ocean co., N. J. P. 1923.
Union, p.-v. and tp., Union co., N. J. P. 2314.
Union, p.-v. and tp., Broome co., N. Y., on Erie R. R., 9 miles W. of Binghamton, has 3 churches, excellent public and private schools, a banking-house, flouring and saw mills, 3 hotels, 1 newspaper, 1 foundry, and a carriage-factory. Principal business, dairying and lumbering. P. 2538. Moses B. Robbins, Ed. "News."
Union, tp., Lincoln co., N. C. P. 1331.
Union, tp., Nash co., N. C. P. 1639.
Union, tp., New Hanover co., N. C. P. 1381.
Union, tp., Randolph co., N. C. P. 597.
Union, tp., Rutherford co., N. C. P. 492.
Union, tp., Wilkes co., N. C. P. 894.
Union, tp., Auglaize co., O. P. 1462.
Union, tp., Belmont co., O. P. 1684.
Union, tp., Brown co., O. P. 5399.
Union, tp., Butler co., O. P. 2013.
Union, tp., Carroll co., O. P. 609.
Union, tp., Champaign co., O. P. 1600.
Union, tp., Clermont co., O. P. 1920.
Union, tp., Clinton co., O. P. 4227.
Union, tp., Fayette co., O. P. 4471.
Union, tp., Hancock co., O. P. 1546.
Union, tp., Highland co., O. P. 1455.
Union, tp., Knox co., O. P. 1017.
Union, tp., Lawrence co., O. P. 1940.
Union, tp., Licking co., O. P. 1855.
Union, tp., Logan co., O. P. 753.
Union, tp., Madison co., O. P. 3109.
Union, tp., Mercer co., O. P. 1475.
Union, tp., Miami co., O. P. 3291.
Union, tp., Montgomery co., O. P. 212.
Union, tp., Morgan co., O. P. 1583.
Union, tp., Muskingum co., O. P. 1643.
Union, tp., Pike co., O. P. 651.
Union, tp., Putnam co., O. P. 1031.
Union, tp., Ross co., O. P. 2790.
Union, tp., Scioto co., O. P. 552.
Union, tp., Tuscarawas co., O. P. 742.
Union, tp., Union co., O. P. 1336.
Union, tp., Van Wert co., O. P. 524.
Union, tp., Warren co., O. P. 1089.
Union, tp., Washington co., O. P. 862.
Union, tp., Adams co., Pa. P. 1105.
Union, tp., Alleghany co., Pa. P. 1986.
Union, b., Allegbany co., Pa. P. 1335.
Union, tp., Bedford co., Pa. P. 1791.
Union, tp., Berks co., Pa. P. 2165.
Union, tp., Centre co., Pa. P. 847.
Union, tp., Clearfield co., Pa. P. 400.
Union, tp., Erie co., Pa. P. 1334.
Union, b., Erie co., Pa. P. 1500.
Union, tp., Fulton co., Pa. P. 424.
Union, tp., Huntingdon co., Pa. P. 789.
Union, tp., Jefferson co., Pa. P. 595.
Union, tp., Lawrence co., Pa. P. 1434.
Union, tp., Lebanon co., Pa. P. 1614.
Union, tp., Luzerne co., Pa. P. 1637.
Union, tp., Mifflin co., Pa. P. 1469.
Union, tp., Schuylkill co., Pa. P. 1110.
Union, tp., Snyder co., Pa. P. 1091.
Union, tp., Tioga co., Pa. P. 1098.
Union, tp., Union co., Pa. P. 840.
Union, tp., Washington co., Pa. P. 1418.
Union, p.-v. and tp., cap. of Union co., S. C., at the terminus of the Spartanburg and Union R. R., has a national bank and a newspaper. P. 2845.
Union, tp., Barbour co., West Va. P. 1382.
Union, tp., Cabell co., West Va. P. 977.
Union, tp., Clay co., West Va. P. 434.
Union, tp., Grant co., West Va. P. 1033.
Union, tp., Harrison co., West Va. P. 1720.
Union, tp., Jackson co., West Va. P. 1830.
Union, tp., Kanawha co., West Va. P. 2449.
Union, tp., Lincoln co., West Va. P. 468.
Union, tp., Marion co., West Va. P. 1739.
Union, tp., Marshall co., West Va. P. 2742.
Union, tp., Mason co., West Va. P. 1084.
Union, tp., Monongalia co., West Va. P. 1618.
Union, p.-v. and tp., cap. of Monroe co., West Va., 10 miles S. of Chesapeake and Ohio R. R. Fort Spring is the nearest station, and is connected by a daily stage, mail, and express line. Union has 4 churches, a female academy and graded school, 2 newspapers, a court-house, 2 hotels, and 1 tannery. Large numbers of cattle are raised. P. of v. 419; of tp. 1676.
R. Burke, Ed. "Monroe County Register."
Union, tp., Pendleton co., West Va. P. 1286.
Union, tp., Pleasants co., West Va. P. 338.
Union, tp., Pocahontas co., West Va. P. 1330.
Union, tp., Preston co., West Va. P. 1395.
Union, tp., Putnam co., West Va. P. 676.
Union, tp., Randolph co., West Va. P. 340.
Union, tp., Ritchie co., West Va. P. 2152.
Union, tp., Taylor co., West Va. P. 966.
Union, tp., Tyler co., West Va. P. 1085.
Union, tp., Upshur co., West Va. P. 1176.
Union, tp., Wayne co., West Va. P. 1690.
Union, tp., Wood co., West Va. P. 1362.
Union, tp., Crawford co., Wis. P. 348.
Union, tp., Door co., Wis. P. 294.

Union, tp., Pierce co., Wis. P. 266.

Union, tp., Rock co., Wis. P. 2145.

Union, tp., Vernon co., Wis. P. 506.

Union, tp., Waupaca co., Wis. P. 211.

Union, American. See SOVEREIGNTY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Union, American. The "United States of America" constitute a federal or "confederated republic" of a novel, peculiar, and extraordinary character. There has never been anything like it in the annals of history. It is true there have been many federal or confederated unions. But, in speaking of the American Union, and its rare and peculiar features, Lord Brougham, in his *Political Philosophy*, vol. iii. p. 336, says: "It is not at all a refinement that a federal union should be formed; this is the natural result of men's joint operations in a very rude state of society. But the regulation of such a union upon pre-established principles, the formation of a system of government and legislation in which the different *subjects* shall be *not individuals* but *States*, the application of legislative principles to such a *body of States*, and the devising means for keeping its *integrity* as a *federacy* while the rights and powers of the individual States are *maintained entire*, is the very greatest refinement in social policy to which any state of circumstances has ever given rise, or to which any age has ever given birth." Independent and separate States may become united by convention or compact in two ways—one, by forming what is called an "incorporate union," in which the sovereignty of each is merged in the new conventional state or nation thus formed; the other is a "federative union," in which each state retains its sovereignty, but delegates to the new or conventional state the exercise of certain specific, sovereign powers for the common benefit of all. A union of the first class is what the Germans style a *Bundesstaat*, and is what is known with us as an "incorporate union," or consolidated state or nation. A union of the second class is what the Germans style a "*Staaten-Bund*," or states-union. The American system under the present Constitution is neither a *Bundesstaat* nor a *Staaten-Bund*. While it differs specifically, in several particulars, from the *Staaten-Bund* (in which the acts of the conventional state are without validity until sanctioned by the several states), yet it agrees with it entirely in its essential, generic difference from the *Bundesstaat* in this, that in the American system, while the States, collectively, constitute an international unit as regards third parties, yet they do not cease to be international units as regards each other. (See decision United States Supreme Court, 13 *Peters's Reports*, p. 559, and Stephens's *Constitutional View of the Late War*, etc., vol. i. p. 393.)

The American system differs further from the *Bundesstaat* class of unions in this, that no sovereign power whatever under the American system is surrendered or alienated by the several States. The exercise of certain expressly-enumerated powers is only delegated to the conventional state. All others are expressly reserved in the Constitution to the States respectively or the people. The difference, however, between the American system and the *Staaten-Bund* class of unions, as clearly appears, is specific only; it is not generic. Ours is a newly-developed species of unions of states of the *Staaten-Bund* class or genus. This specific difference is what struck De Tocqueville as "a wholly novel theory, which may be considered as a great discovery in modern political science." Further on he says, speaking of the American system: "The new word which ought to express this novel thing does not yet exist. The human understanding more easily invents new things than new words, and we are hence constrained to employ many improper and inadequate expressions."

These new features in the constitution of a federal republic, by which the American Union presents the States thus united as "one nation as to foreign concerns, and keeps [them] distinct as to domestic ones," with a division of the delegated powers into legislative, judiciary, and executive departments, and with an organization and machinery in the conventional government thus formed for the full exercise of its delegated and limited powers, similar to those of the separate States creating it, are what chiefly distinguish that grand step in the progress of the science of government under our system which so profoundly impressed Brougham and De Tocqueville.

From this exposition clearly appears the proper solution of the vexed question whether the United States constitute a nation or not. It is clearly seen not only that they do constitute a nation, but also what sort of a nation it is. It is not a nation of individuals blended in a common mass, with a consolidated sovereignty over the whole; but a nation, the constituent elements or members of which are separate and distinct States. The American Union is, as Washington styled it, a "confederated republic." The United States of America, therefore, with their most appropriate motto, "*E Pluribus Unum*"—that is, one republic composed of many—do constitute the highest type of a nation in the annals of history, and form the first great model of what may be justly styled a nation of nations ever presented to the wonder and admiration of mankind. (See CONSTITUTION OF THE UNITED STATES and GOVERNMENT; also Stephens's *Constitutional View of the Late War*, vol. ii. p. 17 *seq.*) ALEXANDER H. STEPHENS.

For a different view of this important subject see SOVEREIGNTY, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Union Bridge, v., Carroll co., Md. P. 323.

Union (British). The present British empire is composed of the three kingdoms of England, Scotland, and Ireland, which long preserved their independence under the same crown, Ireland having been an appendage of the English royal domain since the Middle Ages, and Scotland having been governed by the kings of England since the accession of James I. to that throne (1603). The legislative union with Scotland was consummated by a treaty signed by twenty commissioners, ratified by the English and Scotch Parliaments, and finally proclaimed May 1, 1707. The legislative union with Ireland was not consummated until 1801. (For the terms of union see articles SCOTLAND and IRELAND.)

Union, Christian. See EVANGELICAL ALLIANCE, by PROF. P. SCHAFF, PH. D., S. T. D.

Union Christian College, at Merom, Sullivan co., Ind., on Wabash River, and under the direction of the Christian Connection, was incorporated in 1859, has an endowment of $100,000, and occupies several buildings, the college edifice being of brick, four stories, 109 feet long, 65 feet broad, and 83 feet high. There are academic, business, classical, musical, and scientific departments, to which both sexes are admitted and taught by seven instructors. It also gives disabled soldiers free instruction. The president is Rev. T. Corwin Smith, A. M.

Union Church, tp., Bullock co., Ala. P. 1307.

Union Church, v., Jefferson co., Miss. P. 120.

Union City, p.-v., Randolph co., Ind., at the crossing of Cleveland Columbus Cincinnati and Indianapolis and Pittsburg Cincinnati and St. Louis R. Rs., 84 miles N. E. of Indianapolis, contains 7 churches, excellent schools, 2 newspapers, 2 banks, 2 steam flouring-mills, an efficient fire department, the Dean waterworks, a public well, and 6 manufactories. Forests of walnut, oak, ash, hickory, and other valuable woods abound in the vicinity. P. 1439.
BENTLEY MASSLICH, ED. "EAGLE."

Union City, tp., Allamakee co., Ia. P. 578.

Union City, p.-v., Branch co., Mich., on St. Joseph River, at the head of navigation and on the Michigan Central R. R., has a national bank and a newspaper.

Union City, tp., Darke co., O. A part of the v. lies in Randolph co., Ind. P. 792.

Union City, post v. of Erie co., Pa., on Philadelphia and Erie, Atlantic and Great Western, and Union and Titusville R. Rs., 23 miles S. E. of Erie, has 4 churches, good graded schools, 3 newspapers, 3 banks, 3 hotels, 2 large flouring-mills, 3 barrel, 2 stave, 2 handle, 1 chair, 1 furniture and cabinet ware, and 2 pump factories, 1 oil-refinery, an extensive tannery, and 2 carriage-factories. P. about 3400. H. D. PERSONS, ED. "TIMES."

Union City, p.-v. and tp., Obion co., Tenn. P. 2479.

Union College, or **Union University.** Schenectady, N. Y., incorporated in 1795 under the name of Union College, indicative of the union of the various evangelical sects engaged in its foundation. John Blair Smith was president for four years, succeeded by Jonathan Edwards the younger, who died in 1801, and was followed by Rev. John Maxey, D. D. In 1804, Eliphalet Nott was chosen president, and remained with the college till his death in 1866. Dr. Laurens P. Hickok was then chosen president after a service of fourteen years in the vice-presidency, and in two years resigned, and was followed by C. A. Aiken, D. D., now of Princeton; and on his retirement, in 1871, Rev. Eliphalet Nott Potter, D. D., S. T. D., became president. About 4000 alumni have left its halls. The faculty consists of 12 members, in addition to 2 tutors, and there are two courses of study in the college proper—the classical and the scientific. There is a flourishing engineering school, and the chemical and natural history departments are provided with ample means for practical study in the laboratory and the field. An academical department for preparatory collegiate instruction has been recently established under the control of the college. Ordinary and prize scholarships have been established, and there is a brilliant series of prizes for oratory, demeanor, and scholarship. Soon after the accession of Dr. Potter to the

presidency, measures were instituted to bring the college into connection with the Albany Medical and Law Schools of the Albany University and the Dudley Observatory, and an act was passed to that effect which embodies all these schools into one university bond under the title of the "Union University," in which, however, each body was to maintain its corporate rights and privileges and pursue its respective aims. A beautiful alumni hall of stone is now rising on the campus, and will soon be completed at an expense not much below $100,000. A gymnasium building of brick is nearly finished, and a new library edifice is contemplated, toward which some funds have already been contributed.

Union Creek, tp., Madison co., Nev. P. 256.

Union, Evangelical, or **Evangelische Kirche, Lutheran and Reformed.** See EVANGELICAL CHURCHES.

Union Grove, p.-v. and tp., Whitesides co., Ill. P. 1070.

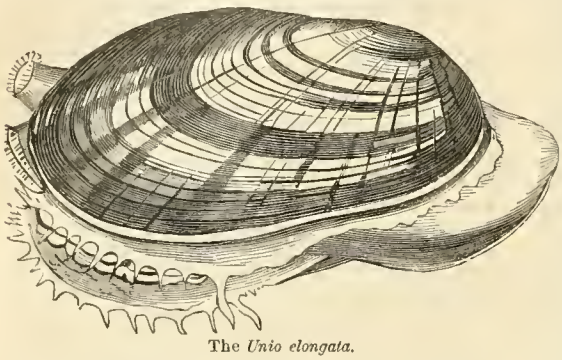
Union Grove, tp., Meeker co., Minn. P. 314.

Union Grove, tp., Iredell co., N. C. P. 1029.

Union Grove, p.-v., Racine co., Wis.

Union Hall, p.-v. and tp., Franklin co., Va. P. 1906.

Union'idæ [from *Unio*—an ancient name—the typical genus of the group], a family of conchiferous (bivalve) mollusks of the order Dimyaria, comprising the so-called



The *Unio elongata.*

fresh-water "mussels" and "clams." These animals are, however, not at all closely related to the true mussels (Mytilidæ) or clams (Veneridæ) of the salt water, but constitute a group peculiar to the fresh water, and very extensively developed in the streams of the U. S. Under the term Unionidæ are, however, generally confounded three distinct families—viz. (1) Unionidæ, (2) Mycetopodidæ, and (3) Iridinidæ. Of these several forms descriptions follow:

(1) *Unionidæ.*—In this family the animal and shell vary greatly in form, sometimes being extremely elongated, and at others higher than long; the mantle lobes are entirely disconnected, and not produced into siphonal tubes; the gills are double, and the outer behind united to the mantle, generally at least; the labial palps are wide and moderate, and partially attached to each other; the foot is tongue-shaped, large, thick, and compressed, and produced forward; the sexes are differentiated among two distinct individuals—*i. e.* diœcious. The shell is diversiform, but always equivalve, and with the valves tightly closing together all round; the pallial impression is entire, and not emarginated behind; the adductor scars two (anterior and posterior) and deeply marked; the pedal scars three, two behind the anterior adductor, and one in front of the posterior adductor; the ligament is external and well developed; the hinge diversiform, generally provided with cardinal and lateral teeth, but often edentulous. Such are the most prominent characteristics of the family as now understood by many naturalists. The specimens are very numerous, and exist in the fresh waters of every continent and most of the contiguous islands where there are suitable habitats. The number of species admitted by Mr. Isaac Lea, the chief authority as to the species of the group, is about 1300. Between 700 and 800 are inhabitants of North America, about 150 of South America, 13 of Europe, nearly 200 of Asia, and nearly 40 of Africa. It is probable, however, that on a rigorous comparison of the species the numbers will be very considerably reduced, in accordance with the present tendency of investigation. By Mr. Lea all these species have been combined under seven sub-genera. By most authors, however, many independent genera are recognized: Prof. Agassiz, *e. g.*, admitted 22 for the North American species alone. These have been differentiated on conchological grounds as well as on differences in the extent of the fringing of the mantle and of the siphonal openings, as well as the freedom or attachment of the gills with reference to the abdominal sac. All such characters, though, require confirmation as to their value. The females are often distinguishable from the males by having more ventricose shells, either in whole or part, the eggs sometimes filling the entire outer gill, and sometimes being confined to the hinder part of the gill. The embryonic young are very unlike the mature form: they spin a delicate byssus, and the posterior shell-muscle is very largely developed, while the anterior is rudimentary. The family has survived at least from the Jurassic epoch, when typical forms existed. Presumably, they must have lived in more or less modified forms long before.

(2) *Mycetopodidæ.*—This type is characterized by its elongated, solen-like form; the mantle lobes disconnected backward to the anal aperture, which is closed; the gills double and equal; the labial palps comparatively narrowed; the chief character is the form of the foot, which is much produced, elongated, and subcylindrical, and expanded into a disciform knob, whence the name of the family (μύκης, "mushroom," and πούς, "foot"). The shell is elongated and soleniform, the valves closed, the pallial impression entire; the adductor and pedal scars are developed essentially as in Unionidæ, but differing in details; the hinge is edentulous. The family has but one genus and few (about 8) species, confined to the streams of South America. They bury themselves in the mud, using for this purpose their peculiar foot.

(3) *Iridinidæ.*—The animals and shells are almost as diversiform as in the Unionidæ; the mantle lobes are more or less united backward, and two distinct siphons (branchial and anal) are developed; the gills are double, and the outer is "united to the mantle all the way to its extremity;" the labial palps are diversiform, but not united; the foot is tongue-shaped, thick, and compressed, as in Unionidæ; the sexes are diœcious. The shell is equivalve, the valves tightly fitting, the pallial impression generally emarginated behind, sometimes entire; the adductor and pedal scars substantially similar to those of the Unionidæ; the ligament external, the hinge varying. The family is composed of types mostly peculiar to Africa, but one is attributed to Asia and South America. The several generic types admitted by Mr. Isaac Lea (as sub-genera) are *Iridina* (including *Pleiodon*) and *Spatha* of Africa, and *Columba* (properly *Leila*), *Triquetra* (= *Hyria*), and *Prisodon* (= *Castalia*) of South America; to which should be added at least *Arconaia* of Eastern Asia, confounded by Mr. Lea with *Triquetra*, if it really belongs to this family. Mr. Lea recognized 25 species only in 1870. Little is known of the ancient history of the family. THEODORE GILL.

Union Point, p.-v., Greene co., Ga.

Union Prairie, tp., Allamakee co., Ia. P. 912.

Union River, Me., rises in Hancock co., and flows S. into Union River Bay. It is navigable to Ellsworth, and affords excellent water-power.

Union Springs, p.-v. and tp., cap. of Bullock co., Ala., at the junction of Mobile and Girard and Montgomery and Eufaula R. Rs., 55 miles from Columbus, has excellent schools, 1 cotton-gin, 3 corn-mills, a planing and saw mill, 1 sash, door, and blind factory, a cotton-gin manufactory, the county-seat buildings, an efficient fire department, and 1 newspaper. P. of v. 1455; of tp. 4664.

J. R. ROGERS, ED. "HERALD AND TIMES."

Union Springs, p.-v., Cayuga co., N. Y., on Cayuga R. R. and the E. shore of Cayuga Lake, 10 miles from Auburn, the county-seat, has 7 churches, 2 boarding-schools, a bank, 1 newspaper, a fire insurance company, gypsum and limestone quarries, and flouring-mills. P. 1150.

JAMES B. HOFF, ED. "ADVERTISER."

Union Star, v. Breckenridge co., Ky. P. 104.

Union Stock-Yards, the largest live-stock market in the world, within the city limits of Chicago, Ill., were built in 1865; cost, up to Jan. 1, 1875, with enlargement, $2,600,000. The receipts for the year 1874 were, 843,966 cattle, 4,258,379 hogs, 338,645 sheep, and 17,588 horses. The aggregate value of all stock received was $95,727,000. The pens and necessary buildings with solid improvements cover 110 acres of ground. NATHANIEL HART.

Unions, Trades. See TRADES-UNIONS, by PROF. T. E. CLIFFE LESLIE, LL.B.

Un'iontown, p.-v. and tp., Perry co., Ala. P. 1444.

Uniontown, p.-v., Union co., Ky. P. 896.

Uniontown, p.-v. and tp., Carroll co., Md. P. of v. 319; of tp. 3058.

Uniontown, p.-v., Wheeling tp., Belmont co., O. P. 156.

Uniontown, v., Muskingum co., O. P. 207.

Uniontown, b., Dauphin co., Pa. P. 299.

Uniontown, p.-b., cap. of Fayette co., Pa. (originally Beesontown), on Fayette County branch of Pittsburg Washington and Baltimore, South west Pennsylvania branch of Pennsylvania Central, and the E. terminus of Uniontown and West Virginia R. Rs., 10 miles S. E. of Pittsburg, laid out by Jacob Beeson 1783, has 10 churches, schools, 4 banks, 1 woollen factory, 5 hotels, 2 newspapers, a cement manufactory. Incorporated 1796. P. 2503.

W. A. McDowell, Ed. "Genius of Liberty."

Union Vale, tp., Dutchess co., N. Y. P. 1434.

Union Village, v., Warren co., O. P. 232.

Un'ionville, p.-v., Hartford co., Conn.

Unionville, p.-v., Udell tp., Appanoose co., Ia. P. 183.

Unionville, p.-v., cap. of Putnam co., Mo., on Burlington and South-western R. R., 110 miles N. of Jefferson City, has good schools, 2 newspapers, 1 bank, 2 hotels, 1 grist mill, and the usual county-seat buildings. It is the principal business centre of the county. P. 162.

Alex. R. Wear, Ed. "Republican."

Unionville, p.-v., Buena Vista tp., Humboldt co., Nev. P. 470.

Unionville, p.-v., Orange co., N. Y.

Unionville, v., Meigsville tp., Morgan co., O. P. 92.

Unionville, b., Centre co., Pa. P. 320.

U'nison [It. *unisono*], in music, two sounds of the same pitch or degree of the scale; thus, certain passages in a composition are said to be "in unison" when two or more parts sing or play the same notes.

U'nit [Lat. *unus*], a single thing of a kind. Thus, in the expression 20 *feet*, the unit is one foot; in the expression $\frac{3}{4}$ the unit is $\frac{1}{4}$.

Unita'rianism [Lat. *unitas*]. Ever since thinking man has been in the world there have been speculations about the Cause of all things—about its nature, or its action, or the mode of its existence. These speculations have always held to one Being supreme, while they have been put into various forms—polytheism, trinity, or simple and indivisible unity. The tendency, however, in successive ages has always been to the latter. In the Jewish and Christian systems this has come to be distinctly maintained; for the Trinity, at least while it is conceived of merely and abstractly as a mode of existence, has not been construed to be a denial of the Unity. It is impossible, perhaps, in strict thesis, to decide which of these views is true; for of the mode of the Divine Existence, if we presume to think upon it, we cannot undertake to form any judgment; and it is not the business of this statement to argue for one or the other, but only to give an historical account of the latter—*i. e.* of Christian Unitarianism.

Judaism was undoubtedly unitarian, and it is held that Christianity was at the start. That the first disciples, who had passed one or two years in daily intercourse with their Master, should have thought of him as God, or, if they did, should have failed plainly and pre-eminently to teach this doctrine, is doubtless hard to believe. It is certain that the earliest churches of which we have any definite knowledge upon this point consisted in the mass, or at least in great numbers, of Unitarians. Believers in Christ at the beginning were simply denominated, as at Antioch, Christians, and doubtless continued to bear that common name; but the oldest body of Christians holding a distinctive faith upon the point in question—*i. e.* the Ebionites—were undoubtedly Unitarians; and the earliest Fathers, Justin Martyr, Tertullian, and Origen, while advocating their "Economy," the initial form of Trinity, evidently wrote in an apologetic strain, as if they felt that there was a great body of opinion against them: and Tertullian at the end of the second century complains of the mass of people—"*idiotæ*" he calls them—as obstinately opposed to the Economy. And later, Chrysostom and Athanasius undertake with considerable explanation to show why the apostles did not plainly teach the sublimer doctrine of the Economy or Trinity, the reason being that the people were not prepared to receive it. Gradually, however, the early Fathers, falling in with Platonic speculations, were tending to ideas of a Trinity, but it was not till the fourth or fifth century, as J. H. Newman has shown, in his *Development of the Christian Doctrine*, that the doctrine of the Trinity was completely formulated and established. And this continued for several centuries—except with the great Arian division, which was essentially unitarian—to be the settled orthodoxy of the Church, till in the sixteenth century Unitarianism was revived by the Socini, and made a lodgment in Poland and in Transylvania, where it still exists in permanent churches.

Lælius and Faustus Socinus, uncle and nephew, were Italians of a noble family. It is the more remarkable that they should have been learned men and studious in the Scriptures, and that both should have broken off from the religion of their education and social position to embrace new and unpopular opinions—so unpopular and, indeed, dangerous to them, that they both found it expedient to leave, for their evidently honest convictions, their home and country. Lælius went to Switzerland, where he died in Zurich in 1562, after having gone to Germany and Poland and made visits of some length in those countries. After the death of his uncle, Faustus resided in Bâle, and spent some time in collecting and arranging the papers which Lælius had left to him, and then went to Transylvania, where, with the aid of the celebrated physician Blandrata, a number of Unitarian churches were formed and established. Thence he removed to Poland, and, marrying into a noble family and becoming settled in life, had leisure for study and wrote theological works, which are to be found in the *Fratres Poloni*. His opinions met with favor among the higher classes, with whom he was associated, and it appeared for a time as if he were likely to escape the usual fate of reformers. But his speculations gave offence to the lower classes; they rose against him, and that which happened to Priestley in Birmingham befell him: a mob broke into his house, tore him from a sick bed, exposed him in the market-place, ransacked his dwelling, and destroyed his manuscripts; and he died near Cracow in 1604, a martyr to his faith. There is still left, however, in Hungary and Transylvania, a considerable body of Unitarians who inherit his faith, and by their character are doing signal honor to their progenitor. They have 106 churches, with parishes, numbering 60,000 persons. They have parish schools, and schools of theology in which are professors who are discharging their duties with salaries scarcely able to support them. These churches, with their pastors and professors, are attracting the earnest sympathy of their brethren in England and America; and it is to be hoped that they will be assisted in holding their stand, thus far manfully sustained, against Austrian bigotry.

In Germany, England, and America, Unitarianism has found a more favorable soil, and many churches in the two latter countries, about 300 in each, bear the name; besides 1000 or 2000 congregations of Universalists, and more than as many of a body which refuses every name but that of *Christians;* both of whom, without the name, hold substantially the same faith. In Germany the speculations of many of her eminent theologians and critics have taken the same direction, without any formal separation from the Lutheran Church; while in France only the honored names of the Coquerels, father and son, have been distinctly known in connection with it. In England its earliest confessors were men unknown to fame, but remarkable for their virtues—Thomas Firmin, a merchant of London, and well known as a friend of Archbishop Tillotson, and John Biddle, who set up in London the first Unitarian public worship known in England. He was a scholar bred at Oxford, who was able to expound and defend his opinions; who drew upon himself the attention of Parliament and of Cromwell, and of Archbishop Usher to convert him from his heresy; whom courts and judges pursued and hounded through five imprisonments, till on the sixth he died in a dungeon on Sept. 22, 1662, at the age of forty-seven. He was a man whose memory, for his unblemished probity, for his calmness and firmness, and for his cruel fate so bravely met, deserves to be remembered, and would do honor to the lineage of any body of men holding dear their opinions and their history.

Indeed, it is by a lineage of remarkable men that English Unitarianism has been most distinguished—in which are the names of Milton, Locke, and Sir Isaac Newton, William Penn and Sir Wm. Jones; and of authors such as William Roscoe, Samuel Rogers, Charles Lamb, Priestley, and Lardner, besides those of the present day, as Joseph Blanco White and his biographer, J. H. Thom, and James Martineau. The works which have been written expressly in its defence are Emlyn's *Humble Inquiry* and Yates's *Vindication*, and many others. Some of the later writings even of the divine Watts show that although he did not come to any decided result, he distrusted his theology and leaned to the Unitarian view. Penn wrote ably against the Trinity and its kindred doctrines in the *Sandy Foundation Shaken*, for which he was put in prison, and when he came out, sturdily said, "I have not budged a jot." There too, in prison, he wrote *No Cross, no Crown*, a work as remarkable as that other book written in prison, Boethius on *Consolation*. Also to be mentioned among English Unitarians are Dr. Samuel Clarke of a former day, Ricardo, the political economist, Sir John Bowring: and not the least to be honored John Pounds of Portsmouth, the founder of the ragged schools, and of celebrated women, Joanna Baillie and Florence Nightingale.

Boston, with its vicinity, may be called the birthplace of Unitarianism in America. The controversy which brought matters to that result in a good many churches there and in New England, carried on by Dr. Worcester of Salem and Prof. Stuart of Andover on one side, and Channing and Prof. Henry Ware, Sr., and Norton on the other, broke out in 1812. Just before, in 1810, Noah Worcester had published his *Bible News*. Nearly thirty years before, Dr. James Freeman of King's chapel in Boston had taken the same ground, and his congregation altered the Liturgy in accordance with his views. It was the first church in America that decidedly espoused the Unitarian faith, though many years before Jonathan Mayhew, pastor of the West church in Boston, was known as an Arian. In Boston and its vicinity also there were several distinguished laymen who took the same side, as the Presidents Adams, father and son, the celebrated jurist Theophilus Parsons, George Cabot, Nathaniel Bowditch the astronomer, Harrison Gray Otis, Daniel Webster, and others. As early as 1718, Dr. Gay of Hingham was settled, and became generally known as a Unitarian. In 1794, Dr. Priestley came to America, and, though he was received with attention in Philadelphia, he chose to retire to Northumberland, Pa., to pursue his philosophical studies, where he also collected a small congregation for worship. Two years after, a church was formed in Philadelphia, of which for many years Dr. Furness has been the honored pastor.

The American Unitarian Association was formed in Boston in 1825, chiefly for the publication and distribution of tracts and books. It has used its funds also to build churches and assist feeble ones, and to send out preachers in this country: and it has for a number of years supported a missionary in India, the devoted Mr. Dall, who has done an excellent work there by his schools, by circulating books, and by publications of his own, and also through communication with the Brama Somaj, with its thousand congregations—a very remarkable body of native dissenters from the idolatry and religion of their country, from which more is to be hoped for the religious condition of India than from any other cause—in which congregations, though they are not Christian, there is worship and preaching as in our own. Chunder Sen, one of their preachers, if not their chief, has visited England, and made a most favorable impression in London (as Ram Mohun Roy did before him) by his liberal and earnest inculcation of universal religious truth and virtue.

But the first general convocation of the Unitarian clergy of America was held in New York in 1865, consisting of ministers and delegates from the churches; and on this occasion arose and was keenly debated the question about a *creed*. But the word met with no favor in the conference. With regard to the distinctive tenets of Unitarians, indeed, except that which the name indicates, it is less easy precisely to define them, because Unitarianism is an embodiment of principles—principles of reasoning and criticism—rather than a collection of institutes like the *Institutes* of Calvin or the *Confessions* of Augsburg and Dort, or the *Thirty-nine Articles* of the Church of England. Its history is a history of individual opinions, rather than of organizations, measures, or methods of action. It is biographical, not national. Heresies, as they are called, rather than creeds, are the forms it has taken. Protests rather than professions have marked it. It has been called by its opposers a system of negations, though it is to be considered that every negation implies an affirmation. The affirmations of the conference were—that every man has a perfect right to judge for himself, unbound by any set of articles; that while professing itself to be a Christian body, it left every one to decide for himself what Christianity itself is—*i. e.* without forfeiting his place in the body, to choose among the conflicting views of Christian doctrine and statement that which seemed to him to be true and right.

In fact, Unitarianism is characterized not so much as being a system of thought as a way of thinking; and *that* may be called, whether for praise or blame, the rational way. Religion it regards as addressing itself to reason and conscience alike, requiring of men to believe nothing which contradicts reason, and to do nothing which they have not ability to do. Human nature, in its view, is not a mass of helpless depravity, but is endowed with moral qualities which are capable of good, and which are to be educated to virtue and religion, just as truly as the mental powers are to be educated to knowledge and the highest intelligence. Human life is appointed to be the sphere of this culture, with all its toils, cares, trials, and sufferings—its natural affections and enjoyments also not to be crushed down, but intended to minister to the same end.

In short, the stand taken by Unitarianism is for nature, for human nature, for everything that God has made, as the manifestation of his will as truly as anything written in the Bible. This world, the world of nature and of life, does not lie under the curse of Adam's sin nor any other curse, but is ordained by infinite wisdom and goodness to be the field of human training for a life to come, whose allotments are to be in accordance with the law that "whatsoever a man soweth, that shall he also reap." Righteousness, and not dogma, is the everlasting condition of all welfare in this world and the next, and what needs to be done for religion is to free it from all falsehoods, from all substitutions of ceremony, profession, and sensational experience for truth and virtue, and thus to purify and rationalize it—to lift it up, not as a terror to men, but as friendship and help, as strength and comfort, as a joy and delight, and so to relieve it of the mystery or misery that it is to many. In fine, the ground taken by this Christian body is that to which many churches are approaching, and is this—that Christianity is not a philosophy, but a divine power: that the acceptance of it is not the believing in a creed, but believing with the heart; that Jesus Christ himself in his life and death, all dogmatizing apart, is the embodiment of his religion; that he holds that supremacy in the beauty and power of his life which makes it, of all that has appeared upon earth, the fittest to be imitated and followed; and that the man who comes nearest to that is the best Christian. ORVILLE DEWEY.

Unitarians. See UNITARIANISM.

Unit'ed Arme'nians, a name applied to those Armenian Christians who acknowledge the pope, the orthodox Armenians being called Gregorians. The Armenian Rite in the Roman Catholic Church has 1 patriarch and primate (in Cilicia), 4 archbishops (at Constantinople, Aleppo, Seleucia (or Diarbekir), and Lemberg), besides 2 *in partibus*, and 16 bishops. Their union took place 1314–44. They number some 100,000, of whom 78,000 are in Turkey and Persia (20,000 under the archbishop of Constantinople, 56,000 under the patriarch of Cilicia, and 1000 in Mount Lebanon). Austro-Hungary in 1870 had 8279 United Armenians: Russian Caucasia and Siberia in 1869 had 13,722. In 1872 a very considerable part of the Turkish United Armenians left the Roman Catholic communion and joined the Old Catholic movement.

United Brethren, or **Unitas Fratrum.** See MORAVIAN CHURCH, by BISHOP E. DE SCHWEINITZ.

United Brethren in Christ (often confounded with the United Brethren, see MORAVIAN CHURCH), a denomination of Protestant Christians which arose in the U. S., about 1755, under the leadership of the Rev. Philip William Otterbein (1726–1813), a German missionary of the Reformed Church, and Martin Böhm. Their polity is a mixture of Methodism, Congregationalism, and Presbyterianism. They oppose Freemasonry and the manufacture, sale, and use of alcohol. Since 1820 they have held services in both German and English, and have prospered greatly, especially in the North-west and in Pennsylvania. In 1867 they had 3444 churches and 97,982 members. In 1870 they claimed 3753 churches, 1429 church edifices, 116,525 communicants, and church property worth $2,454,302. They have an episcopal organization and sustain a publishing-house at Dayton, O. They support several colleges and seminaries. (See notice in this work of OTTERBEIN UNIVERSITY, Westerville, Franklin co., O.)

United Christians of St. Thomas, a body of East Indian Roman Catholics, chiefly found in Travancore, at the southern extremity of India. In 1599 the synod of Diamper (Udiamperoor) compelled the ancient Church of St. Thomas Christians (see CHRISTIANS OF ST. THOMAS) to conform to the Church of Rome, conceding to them a modified Syrian rite. In 1653 nearly all fell away, but were soon after induced in great numbers to return, chiefly by the labors of the Barefooted Carmelites. At present more than one-half are of the Latin rite, but a portion retain the Oriental rite. They are chiefly in the vicariate apostolic of Verapoly (Latin rite), reported in 1868 as having 295 priests and 233,000 members.

United Copts, since 1732 the designation of a body of Roman Catholic Copts of the Eastern rite. They number (in Egypt) 12,000, and are under a vicar apostolic and bishop *in partibus*, who is of their own rite. The United Copts are of two rites, the Egyptian and the Ethiopic or Abyssinian. According to the reports of Roman Catholic missionaries, the latter would appear to be the more numerous.

United Evangelical Church. See EVANGELICAL CHURCHES.

United Greek Church, a body of Roman Catholics of the Eastern rite, who acknowledge the pope and accept the doctrines of the Latin Church, but use the Greek liturgies and follow the Greek rule as to the marriage of secular priests and the use of both kinds in the Eucharist. They

are (*La Gerarchia Cattolica*, 1872) of four rites—the Romanian, Ruthenian, Bulgarian, and Melchite. There are also some United Russian Greeks and a few United Melchitic Copts of the Greek rite. The Melchites proper are estimated at 50,000, the Rumanians of Turkey at 35,000. The United Greeks of Bosnia are given as numbering 454,787, those of Austria-Hungary 3,941,796 (1869). The number of United Russians is given by Wetzer as 6,000,000, and by others as 250,000; both of which are apparently large over-statements. In 1861 there were 75,721 United Greeks in Italy.

United Kingdom of Great Britain and Ireland. See ENGLAND, GREAT BRITAIN, IRELAND, SCOTLAND, WALES, and UNION (BRITISH).

United Methodist Free Churches, a denomination of Great Britain and Ireland, dating from 1857. In 1867 they reported in England 1119 chapels, 271 itinerant and 3216 local preachers, and 68,494 members; and in Ireland 1 minister, 8 local preachers, and 90 members.

United Nestorians, a body of Roman Catholics of the Syrian rite, more often called CHALDÆAN CHRISTIANS (which see).

United Original Seceders, a Presbyterian sect of Scotland, dating from 1820, when a number of ministers of the General Associate Synod refused to reunite with the Associate Synod. In 1867 they reported 4 presbyteries, 23 ministers, and 27 churches.

United Presbyterian Church in England, Scotland, and Ireland dates in its present form from 1847, when the UNITED SECESSION CHURCH (which see) was made one with the Relief Church. The United Presbyterians differ from the Established and the Free Church in taking the ground that the civil government should have nothing whatever to do with the Church, either by contributing to its support or meddling with its affairs. In 1867 they reported 26 presbyteries, 537 ministers, 504 congregations, 161,467 communicants, and 132 students in their theological college at Edinburgh; in England, 4 presbyteries, 77 ministers, 82 churches, and 212,610 members; in Ireland, 1 presbytery, 10 congregations, 9 ministers, and 853 communicants.

United Presbyterian Church of North America dates from 1858, when the Associate Presbyterian Church (originated in 1751) joined in one organization with the greater part of the Associate Reformed Church (dating from 1782). Its greatest strength is in the Western and Central States. It has theological seminaries in Newburg, N. Y., Allegheny, Pa., Xenia, O., Monmouth, Ill., and at Osioot and Ramleh in Egypt, where there is a successful mission among the Copts. In 1872 there were 55 presbyteries, 584 ministers, 755 congregations, 72,896 members, 96 home missionaries (besides 17 missionaries and teachers among the freedmen), 35 foreign missionaries, and a total of church property valued at $4,096,000.

United Provinces. See NETHERLANDS, by C. PETERSEN, A. M.

United Secession Church was formed in Scotland in 1820 by a reunion of the Associate and General Associate Synods. In 1847 it was united to the present United Presbyterian Church.

United Society of Believers in Christ's Second Appearing. See SHAKERS.

United States, The, a federal republic occupying the central portion of the North American continent. On the N. the territory of the United States is separated from the British dependencies and possessions by the following described boundary: From the mouth of the St. Croix River to its head, and thence due N. to the highlands which divide those rivers that empty themselves into the St. Lawrence from those which fall into the Atlantic Ocean; thence along the crest of those highlands to the north-westernmost head of the Connecticut River; down that river to and westward along the 45th parallel to and along the middle of the Ontario, Erie, Huron, Superior, and

Obverse.

Reverse.

Great Seal of the United States.

Long lakes, and their water-connections, to the most northwestern point of the Lake of the Woods; and thence along the 49th parallel to the Pacific Ocean, the line at the extreme N. W. being so drawn as to exclude Vancouver's Island, but to include the islands of the San Juan group. The southern boundaries of the United States consist of the Gulf of Mexico, the Rio Grande del Norte to the plateau of the Sierra Madre, thence to the Pacific by a broken line drawn between the 31st and 33d parallels. The eastern and the western boundaries of the United States are the Atlantic and the Pacific Oceans respectively. The total area embraced within these boundaries is computed at 3,026,494 sq. m., made up as follows: The territory of the original thirteen States after the cession of their Western lands, 420,892; the lands thus ceded, being the original territory of the United States, 406,952; the province of Louisiana, acquired from France in 1803, 1,171,931; Florida, acquired from Spain in 1819, 59,268; the Texan annexation in 1845, 376,133; the first Mexican cession in 1848, 545,783; the second Mexican cession in 1853, 45,535. The single dependency of the United States is the district of Alaska, obtained by purchase from Russia in 1867. (See ALASKA.)

Physical Features.—The skeleton of the United States is represented by two great systems of mountain-ranges. The eastern system consists of the Appalachian ranges, the western of the complex masses to which Prof. J. D. Whitney has applied the appropriate name "the Cordilleras." The Appalachian chain extends from the promontory of Gaspé south-westerly 1300 miles into Alabama. The base from which it rises on the eastern side is the Atlantic seaboard. The elevation of the plain above the sea in New England hardly exceeds 300 to 400 feet, but farther to the S. it rises to a height of 1000 feet, and widens to a distance of 200 miles. The Appalachian chain presents the feature, especially in its middle portion, of numerous nearly parallel lines of elevation, which preserve their direction over great distances, forming long valleys of remarkable regularity. In particular, one great central valley extends from Northern New York to East Tennessee. The Appalachian chain presents three obvious subdivisions in latitude, the middle one extending from New York to the Kanawha River in Virginia. Each subdivision has a peculiar curvature and course. The northern presents its concavity to the S. E.; of the middle, the concavity faces the Atlantic shore, while the southern forms a curve concave toward the N. W. So complete is the physical break between the northern and middle divisions of the Appalachian chain that Prof. Whitney states that a rise of the ocean of 400 feet only would cut off all the region included between the St. Lawrence, the Atlantic, and the Hudson and Mohawk valleys; while a rise of 140 feet only would detach all the country E. of the Hudson and Lake Champlain. Of the northern subdivision of this chain, the most continuous, though not the highest range, is that of the Green Mountains, with the White Mountains on the E. and the Adirondacks on the W. The central division of the chain extends from the Hudson to the Kanawha, about

450 miles; is narrow toward the northern extremity, widens out in Pennsylvania, and decreases again in Virginia. It is composed of a considerable number of subordinate chains, much curved toward the W., and remarkable for their regularity, their parallelism, their abrupt declivities, and their moderate elevation, rarely rising to 2500 feet. In Pennsylvania the mountainous zone is, according to Prof. Rogers, divided into five well-marked parallel belts, which are, in order from the E. toward the W., as follows: 1st, the South Mountains, being the continuation of the New York Highlands and the equivalent of the Blue Ridge in Virginia; 2d, the Great Appalachian Valley; 3d, the Central Appalachian ridges; 4th, the sub-Alleghany Valley; 5th, the Alleghany Mountains. The southern division of the Appalachians exhibits marked peculiarities of structure. The main chain, known as the Blue Ridge, which borders the great valley on the E., bears off to the S. W., leaving a wider seaboard and rising to a great height. In the regions comprised between the Blue Ridge and the chain of the Iron, Smoky, and Unaka mountains is the culminating portion of the Appalachians. For 150 miles the mean elevation of the valley is more than 2000 feet, while the mountains rise in scores of summits to 6000 feet or more. To the W. is the Valley of the Tennessee, a portion of the great central valley already mentioned. Still farther to the W. is the plateau of Tennessee, known as the Cumberland Mountains. Such is the system of mountains which form the eastern side of the framework by which the central portion of the United States is embraced. Between these and the Rocky Mountains are no connected masses of mountain-ranges. A few short ranges skirt the S. shore of Lake Superior, and here and there appear isolated hill-ranges, notably in Missouri and Arkansas.

The Cordilleras belong to the great chain of mountains which borders the Pacific coast of North and South America. Entering the United States from Mexico, the system widens rapidly until along the line from San Francisco, by way of Salt Lake, to Fort Laramie, the mass of mountains has a width of 1000 miles. "The whole area," says Prof. Whitney, "embraced within the mountainous belt which is called the Cordilleras is but very little, if any, short of 1,000,000 sq. m.; hence it may with propriety be called the greatest physical feature of our territory." This enormous mass of a lozenge shape, the length of each side being approximately 600 miles, is formed by the Cascade Range and the Sierra Nevada on the two westerly faces, and by the Rocky Mountains, with the Big Horn, Wind River, and Bitter Root ranges, on the two easterly faces. The plateau thus enclosed has through its centre, E. and W., an elevation of 4000 to 5000 feet, falling off alike to the N. and to the S. This plateau is traversed by various ranges, of which the Wahsatch, extending N. and S. through nearly six degrees, is the most notable. Between the Wahsatch and the Rocky mountains runs the Uintah range, the only high and well-defined chain in the Cordilleras having an E. and W. trend. W. of the Wahsatch are numerous parallel ranges, generally long, narrow, and precipitous, running obliquely from the Sierra Nevada E. of N. to the Humboldt River, beyond which lies the volcanic plateau which covers a large portion of Eastern Oregon and Washington, of Northern Nevada, North-eastern California, and South-western Idaho. From the plateau W. of the Snake River rise the Blue Mountains. The highest part of the Sierra Nevada is near the parallel of 36° 30′, where the peaks rise above 14,000 feet, the passes having an elevation of nearly 12,000. Farther to the N., where the Pacific R. R. crosses, the pass is only 7000 feet above the sea-level. W. of the Sierra Nevada and the Cascade Mountains, and not always to be distinguished from them, lie the Coast Ranges of California and Oregon.

River Systems.—The river systems of the United States may be grouped sectionally into four grand divisions—the northern lake, the Atlantic, the Gulf, and the Pacific divisions. The first consists of innumerable streams, many of them very short, emptying into the great lakes from Superior to Ontario, with which may here, for convenience, be associated the streams emptying into the river St. Lawrence and those running N. into British America. Of the last by far the most important is the Red River of the North, which empties into Lake Winnipeg in Canada. The whole river system thus composed embraces 184,339 sq. m. of the territory of the United States, lying between the 71st and 104th degrees of lon. W. from Greenwich. The second division comprises all those streams which flow eastward or southward to the Atlantic. This division covers the total eastern side of the United States, extending from 47° 15′ to 25° 15′ in latitude, and covers an estimated area of 304,538 sq. m. The most important rivers of this division, which embraces more than one-third the population of the United States, are the Penobscot, Kennebec, Androscoggin, Merrimack, Connecticut, Hudson, Delaware, Susquehanna, Potomac, Rappahannock, James, Roanoke, Neuse, Cape Fear, Pedee, Santee, Edisto, Savannah, Ogeechee, Altamaha, Saltilla, and St. Johns. The third grand division embraces the Mississippi system, and also the rivers of Western Georgia, Western Florida, Alabama, Mississippi, Louisiana, and Texas, which empty into the Gulf of Mexico. The total area of this division is computed at 1,683,303 sq. m., of which 1,257,545 are drained by the Mississippi and its tributaries, the principal of which, with their several areas of drainage, are the Missouri (527,690), the Ohio (207,111), the Arkansas (184,742), and the Red (92,721). Other prominent tributaries are the Minnesota, Des Moines, Illinois, and Yazoo. Of the rivers in this division emptying directly into the Gulf, the most important are the Suwanee, Apalachicola, Mobile, Pearl, Sabine, Trinity, Brazos, Colorado (of Texas), Guadalupe, and Nueces, the Rio Grande del Norte forming for a considerable part of its course the south-western boundary of the United States. The fourth grand division embraces the Great Interior Basin, without outlet to the sea, between the Rocky Mountains and the Sierra Nevada (210,274 sq. m.), and the basins of the Columbia, the Klamath, the Sacramento and San Joaquin, and the Colorado, as well as the tracts drained by smaller streams flowing into the Pacific. The total area is 854,314 sq. m.

A notable peculiarity of all the streams draining the Cordilleras to the W. is want of navigability. The mighty Colorado is almost without importance for purposes of navigation; the Columbia has two portages by railroad before the Cascade Range is passed; the Sacramento is navigable for moderate-sized boats for only 60 miles. In striking contrast are the rivers of the Mississippi Valley, which offer vast reaches to steam navigation. Cairo is 1100 miles from the mouth of the Mississippi, yet only 322 feet above the level of the Gulf; Pittsburg, at the head of the Ohio, 975 miles farther from the sea, has an elevation of only 699 feet.

The following table exhibits the relation to population of each of the four grand divisions enumerated, and also of each of certain principal river-basins embraced:

Divisions.	Population.	Area in square miles.	Inhabitants to a square mile.
Northern Lake	4,399,604	184,339	23.7
Atlantic	14,207,453	304,538	46.6
Gulf	19,111,804	1,683,303	11.3
Pacific	839,510	854,314	.98
Total U. S.	38,558,371	3,026,494	12.7
Basin of the Ohio	7,806,453	207,111	37.7
" Missouri	1,524,171	527,690	2.9
" Red	468,298	92,721	5.1
" Arkansas	517,923	184,742	2.8
" Columbia	106,718	219,706	.5
" Colorado	16,144	264,386	.06
" Sacramento and San Joaquin	455,972	66,927	6.8

The Great Lakes.—The upper waters of the St. Lawrence River expand between the 76th and 92d degrees of lon. W. from Greenwich into a series of lakes, which form, for the greater part of that distance, the northern boundary of the United States. These lakes are five in number—Ontario, Erie, Huron, Michigan, and Superior. They are remarkable not alone for their immense area, but for their uniformity of elevation, affording extraordinary facilities for commercial intercourse. Lake Michigan is but 19 feet higher than Erie, while Superior is but 22 feet higher still. Between Erie and Ontario, however, there is a descent of not less than 331 feet, about one-half being made at a single plunge in the Falls of Niagara. These lakes have considerable depth, their basins being below the surface of the sea. Their combined area exceeds 90,000 sq. m., one-third being covered by the waters of Superior, while Michigan and Huron have each a surface of over 20,000.

Climate.—To speak of the climate of the United States would be misleading. Nothing can be said of the United States as a whole in respect to temperature, humidity, or the force of winds. The United States, owing to its vast extent in latitude and to the influence of the great longitudinal chains of mountains, has many climates. The annual rainfall ranges from 72, 80, and even 100 inches upon the Upper Pacific slopes, to 12, 8, and even 4 inches only on the great interior basin between the Rocky Mountains and the Sierra Nevada. The mean annual temperature ranges from 72° or 76° F. in Southern Florida and portions of Arizona to 36° on the plains of Northern Minnesota and Dakota. Nor are such differences of heat due mainly to the great extent of the United States in latitude. The line of 41° mean annual temperature, in its course from the Atlantic to the Pacific, crosses every parallel of latitude from

34° to 45°. Nor do sections differ less in respect to the variability of temperature. The line of 20° below zero for the coldest week of the year in Minnesota crosses the line of 85° for the hottest week; while in Florida, the line of 40° above zero for the coldest nearly coincides with that of 90° for the hottest week. The annual precipitation of rain and melted snow is greatest on the Pacific slope of the Sierra Nevada and on the Coast Range above the 42d degree. In Southern California the annual precipitation is reduced to a low average, while occasional droughts seriously affect the economical conditions of stock raising in that section. Speaking generally, the entire Atlantic slope is well watered, the average annual fall ranging from 32 to 56 and more inches. The precipitation is greatest toward the S., furnishing the most favorable conditions for the culture of cotton. Of the Mississippi Valley, the eastern side receives an abundance of rain, though the southern portion, especially in Mississippi, is the most liberally watered. From the Mississippi River westward the rainfall runs down from an average of 44, 40, or 36 inches to an average of 20, 16, or 12 inches along the 100th degree of longitude.

In respect to the temperature of the United States E. of the 100th degree of longitude, the largest generalization which can be offered is that the line of the 39th degree of latitude, which has been the line on which the centre of population for the United States has moved from 1790 to 1870, makes a marked division between the mean annual temperature of the sections N. and S. of it. The belt of 60°, or more, mean annual temperature covers pretty much the whole cotton region, whether on the coast or in the Gulf States. W. of the 100th meridian the lines of 41° and 48° run far to the N., embracing the region of the upper Missouri as far W. as the 112th degree of longitude, allowing the cultivation of crops not elsewhere found on the continent in so high a latitude.

The region of storms in the United States is found principally N. of the 37th degree of latitude, the most numerous and severe visitations occurring throughout the Northern lake district. The plains of Illinois, Wisconsin, Iowa, Nebraska, and Minnesota are also swept by frequent local storms of great violence.

Flora.—The flora of the United States, as might be inferred from the wide range of soil, topography, geology, and climate, is both rich and varied. No full enumeration of plants has ever been published, but the whole number, exclusive of the lower cryptogams, probably amounts to 5000 indigenous species, many of which have a great range. There is perhaps not a single State which does not possess 1000 species; many States have 1500, while California has 2500 or 3000. The number of woody species is not less than 800, and over 400 are large enough to be called trees, 250 of which are not rare. If we consider only the larger and more important, excluding all the smaller and rarer ones, and also those tropical forms found only along the extreme southern border, there still remain about 120 species of trees within the United States in sufficient abundance to be somewhere of economic importance, which attain a maximum height of 100 or more feet. Twelve of these occur 200 feet high, and five or six are sometimes 300 or more feet. About 50 of the 120 species belong to the Coniferæ.

E. of the Rocky Mountains, a broad and treeless belt, known as "the Plains," separates two very different forest floras, only two species being common to both, neither of them of much importance. E. of the Plains the larger number of species are deciduous, or at least broad-leaved; and the entire region, excepting the prairies of the West, was originally forest-clad. But while deciduous species predominate, there are extensive pine forests from Louisiana to Maine, and some of the coniferous lumber produced has an almost world-wide fame. Along the Appalachians, from New Hampshire to Alabama, a larger number of valuable hard woods occur than is known to any other temperate climate. The Ohio Valley is known commercially for the size and excellence of some of its deciduous trees, notably black walnut, tulip, bass, and ash, while Florida is equally noted for its live-oak. In Southern Florida are many truly tropical forms, interesting to the botanist, but not sufficiently abundant to be of special economic importance. Over the regions W. of the Plains extensive forests occur only on the mountains or near the sea, and when found are essentially of Coniferæ. Broad leaved trees occur in this region, sometimes in considerable abundance, particularly in the western and southern portions, but they are usually scattered, and never form an important forest element. Conspicuous among these are the cottonwood along streams, the mesquite of the southern parts, and several species of California and Oregon trees. Among the latter, several oaks, the madroña, laurel, Oregon ash, and the great-leaved maple are of most value, some growing to a great size and being of wondrous beauty. Along the western flanks of the Cascades and Sierra Nevada, and also near the coast from Cape Mendocino northward, are perhaps the heaviest forests on the globe. They are entirely of Coniferæ. Trees of 200 feet high are in vast abundance; trees 300 feet high and 10 to 15 feet in diameter not being rare. All these figures are often exceeded. W. of the Rocky Mountains many plains and slopes, and even mountains, which are destitute of timber, are nevertheless abundantly and often densely clothed with shrubs. Among the more noteworthy kinds of these are several species of *Artemisia* (popularly called "sage") and other shrubby Compositæ; *Cercocarpus* (called mountain mahogany), *Nuttallia*, in Oregon the vine maple, in California various species of *Ceanothus* (called wild lilac) and *Adenostoma* (chamisse), and on the southern deserts *Larrea* (creosote bush) and various *Cacti*.

Compared with Europe, the local floras are poorer in the actual number of species, but vastly richer in trees, many of which belong to older types. The hickories, magnolias, sequoias, liquidamber, sassafras, and other genera, so abundant or noteworthy in the New World, are only found fossil in the Old.

The United States has contributed a few species to the useful plants of cultivation. Many valuable varieties of grasses have originated from native species, and several fruits and nuts now but rarely cultivated will probably pass into wider cultivation and greater economic importance. Near the Atlantic coast and along our southern borders European explorers found maize, potatoes, squashes, tobacco, and other useful plants in cultivation among the Indians. Whether they were originally native, or had been introduced earlier from Mexico, cannot now be known. On the N. W. coast a poor kind of native tobacco was the only plant originally cultivated by the natives, and in the interior there were large regions where absolutely no plant was cultivated. The East has actually furnished a few useful plants to cultivation, and the West many ornamental species. In the gardens and parks of Europe it has been remarked that Asia has furnished the larger number of useful trees and shrubs (other than timber), and North America, particularly the United States, the most beautiful of the ornamental species.

Fauna.—No account exists of the species of the animal kingdom within the limits of the United States. In general, the fauna is the same as that of North America, which is especially rich in fresh-water forms, for the reason, doubtless, that North America has been a continent ever since the Carboniferous period. The species of Vertebrata described number 2249, distributed as follows: Mammalia, 310; Aves, 756; Reptilia, 257; Batrachia, 101; Pisces, 816; Dermopteri, 8; Leptocardii, 1. The Mollusca found in rivers and lakes number 1034 species; about 400 more are terrestrial and air-breathers; the marine species are very numerous, but nothing approaching a complete enumeration is possible. Of the number of species in the inferior divisions of the animal kingdom only the rudest estimates can be made. Of insects, Prof. Cope considers 50,000 species as probably "below the mark."

Geology.—In describing the geology of the United States it will be convenient to divide the territory into two great geographical areas—the eastern from the Atlantic to the base of the Rocky Mountains, and the western extending thence to the Pacific. The eastern is occupied in large part by an immense basin of Palæozoic rocks, bounded on the W. by the crystalline Eozoic formations of the Rocky Mountains; which formations, with some intervals of concealment, stretch around to Lake Superior, and thence through Canada to the mountainous regions of Northern New York and New England. They are thence prolonged south-westward in the Highlands of Southern New York, New Jersey, and Pennsylvania, and continued in the Blue Ridge as far as Alabama. Within the great basin thus enclosed on the N. and E. and W. lie the unerystalline rocks of Palæozoic age, including representatives of all of the great divisions of Palæozoic time—Cambrian, Silurian, Devonian, and Carboniferous. These have been by American geologists subdivided into minor and often local formations, characterized by distinctive organic remains. One of the most striking facts in regard to the Palæozoic formations in this area is that they have to the N. and E. a great thickness, estimated at about 40,000 feet for the whole Palæozoic column, which in the valley of the Mississippi is represented by not more than 4000 feet—a diminution due to the thinning out, and in some cases to the entire disappearance, of important formations of mechanical origin, which had their source to the eastward of the basin. Another fact of great significance is that the strata of this wide basin, while almost horizontal over the greater part of the area, are affected in the eastern portion by numerous folds and dislocations, which are nearly parallel to the belt of crystalline rocks forming the eastern bor-

der of the basin. These folded Palæozoic rocks, more or less eroded, constitute the floor of the great Appalachian Valley, and to the W. of it the mountains commonly known as the Alleghanies and the elevated plateau which slopes off toward the valleys of the Ohio and the Mississippi to the W. While to the eastward these N. E. and S. W. folds are very sharp, and often marked by great dislocations of the strata (in which case the upthrows are on the S. E. side of the breaks), they become more and more gentle to the W. The last one of mark is the broad anticlinal which brings up at Nashville, Tenn., and at Cincinnati, O., the Silurian strata separating the great Appalachian coal-field on the E. from the coal-fields of Michigan and Illinois on the W. The eastern coal-field itself has been greatly affected by these undulations, and the detached semi-bituminous and anthracitic coal-areas of Pennsylvania, Maryland, and Virginia, lying among the Appalachian hills, are portions of what was once a great continuous coal-basin cut off by folding and subsequent erosion from the main body of the bituminous coal of Western Pennsylvania and West Virginia, and modified in character by processes apparently connected with this great geological disturbance. Beneath the coal-measures, to the eastward, is a great series of strata consisting entirely of sandstones, conglomerates, and shales, and included in the Carboniferous and Devonian divisions; but to the westward there appears at the base of the coal a limestone known as the Carboniferous limestone, which becomes a conspicuous formation in the valley of the Mississippi, and is the chief representative of the Carboniferous series in the Rocky Mountain area, presently to be described. These sandstones and conglomerates beneath the coal are important as being the horizon from which the petroleum of Western Pennsylvania is produced, though there is good reason for supposing that its original source is, like that of the petroleum of Canada, to be sought in an older limestone formation, or rather series of formations, included in the Lower Devonian and the Silurian divisions. This series, which embraces the Corniferous in New York and the underlying magnesian limestones of the Salina and Niagara formations, and to the eastward the group of the Lower Helderberg limestones at the base of the Corniferous, constitutes a second great horizon of calcareous rocks. Beneath these come the sandstones of the Medina and Oneida formations, another horizon of mechanically-formed rocks which constitute the base of the Silurian proper, and rest, sometimes, unconformably on the great Trenton limestone group of New York, with the overlying Utica and Loraine shales, and the underlying Chazy limestone and the Calciferous sandrock, a magnesian limestone which in its turn rests upon the Potsdam sandstone, regarded in Northern New York as the base of the Palæozoic series. These limestones and their associated rocks below the Medina represent the Upper Cambrian or Siluro-Cambrian, with a portion of the lower or proper Cambrian rocks.

In Eastern New York and southward, along the eastern base of the Alleghanies, stretches a great series of quartzites, limestones, and argillites, which have been regarded by some geologists as belonging to the same age as the series last mentioned, while by others they are considered as an older group, overlaid by small portions of the Siluro-Cambrian of New York. They constitute the Taconic system of Emmons, and are the floor of the great Appalachian Valley from Massachusetts to Alabama. They most probably correspond to the lower portions of the Cambrian as known in Europe, and have certain resemblances with the crystalline rocks along their eastern border. These latter have been divided into three great divisions, which in descending order are supposed to be as follows: (1) The Montalban or newer gneiss and mica-schist series, which is largely developed in the White Mountains of New Hampshire, and can be traced along the Appalachians to Alabama. This series underlies the cities of New York, Philadelphia, and Washington. (2) The Huronian, which is the great iron-bearing series of Northern Michigan, and is also largely developed in Vermont and southward throughout the Appalachians. It includes the talcose and chloritic slates and serpentines of the region, and is important for its deposits of gold and copper ores. (3) The Laurentian or oldest gneiss series, which forms the Laurentides in Canada, the Adirondacks of New York, the Highlands of the Hudson, and the South Mountain in New Jersey and Pennsylvania, and appears again elsewhere in the Appalachian chain. This series is noted for its great beds of magnetic iron ores and its deposits of graphite. To these three great divisions of the Eozoic rocks must be added a fourth, the Norian, made up chiefly of norite or labradorite rocks, which occupies a large area in Essex co., N. Y., and appears elsewhere in New England and in Canada. It has been called Upper Laurentian, since it rests unconformably on the Laurentian, but its place in the series is yet undetermined. Resting upon the Huronian, and overlaid by the lower Palæozoic beds around the basin of Lake Superior, is the Keweenaw series, a great thickness of sandstone and conglomerates, with rocks of igneous origin, remarkable for containing the greatest known mines of native copper. This group of rocks is apparently local; nothing like it has been met with elsewhere. Resting unconformably upon the Atlantic side of the Appalachian belt of crystalline rocks are several long and narrow portions of lower Mesozoic rocks, chiefly red sandstones, which probably include both the Triassic and Jurassic formations; the principal of these are the red sandstones of the Connecticut Valley and those of the belt extending from the Palisades of the Hudson to Virginia. In other and smaller areas of similar strata are the coal-beds of North Carolina and of Eastern Virginia. Rocks of Cretaceous age, overlaid in large part by Tertiary strata, extend from near the mouth of the Hudson to that of the Mississippi, forming the lowlands of the Atlantic and the Gulf States, and stretching up along the Mississippi Valley as far as the mouth of the Ohio. To the westward, between the Mississippi River and the Rocky Mountains, are found great areas of strata of Mesozoic and Tertiary ages which stretch northward into Canada.

Small portions of strata, apparently belonging to another Palæozoic basin, are found along the eastern coast of New England. To it belong little areas of fossiliferous Cambrian, Silurian, and Devonian rocks, and also the anthracites of Rhode Island and Massachusetts.

The geological structure of the great western area, including the region from the eastern base of the Rocky Mountains to the Pacific, differs widely from that of the eastern. The crystalline rocks of the Eozoic are in parts overlaid by Palæozoic strata, which, though holding the organic forms of those of the eastern basin, are unlike them lithologically, being in great measure limestones, of which a large portion are of Carboniferous age. Vast areas of more recent rocks, in great part of the newer Secondary and Tertiary periods, occur in these regions, including large deposits of coal and the remains of a great variety of vertebrate animals. These strata, which are undisturbed in the Atlantic and Gulf regions, have in the West been greatly broken and faulted and eroded, and penetrated by eruptive rocks, overflows of which cover wide territories in the north-western part of the area.

Over the north-eastern portions of the United States the strata already described are irregularly overlaid in parts by the so-called Drift formation, supposed to be the result of ice-action. The higher portions of the hard and often crystalline rocks are rounded and scratched or grooved, while in the lower levels is found the unstratified or glacial drift with boulders, overlaid by stratified clays and sands. These deposits are more recent than the Pliocene Tertiary. The southern limit of the Drift is about 40° N. lat.; beyond this the limestones and the crystalline Eozoic rocks are in great part covered with a soil resulting from their decay in place. This decayed covering is seen at intervals, where the strata have been protected from glacial action, as far N. as Massachusetts, but is remarkable in the Blue Ridge, where the hard crystalline rocks are often concealed beneath a layer of 100 feet or more of softened material, resulting from the decomposition of these *in situ*. Similar phenomena are seen in the upper valley of the Mississippi, which, like the S., has escaped the agencies of the Glacial period.

Iron.—The iron resources of the United States are stupendous in extent. All varieties of ore are found, most of them in great abundance, and in such juxtaposition with coal and limestone, often close upon navigable waters, as to afford the highest facility for production. Magnetic ores are found in the Adirondacks and throughout the entire length of the Alleghanies. They have been developed especially in the Champlain district about Port Henry, in Orange co., N. Y., in Northern New Jersey, and in Lebanon and York cos., Pa. These ores are largely used in the manufacture of Bessemer steel. Magnetic ores, as yet undeveloped, are also found in the Black Hills and various parts of the Rocky Mountains and the Sierra Nevada. In the Lake Superior region, and in the region of Central Missouri, where are literally mountains of iron, occur vast deposits of hæmatite ores, the production of the Lake Superior region reaching nearly 1,000,000 tons a year, the product being widely distributed, like the magnetic ores of the East, both by boat and by rail, to hundreds of furnaces, some at a great distance. Red hæmatite ores are found over broad areas from Maine to Georgia and East Tennessee, the variety known as the Clinton or fossil ore being of unsurpassed industrial importance, though not used in the manufacture of steel. Brown hæmatite or limonite ore occurs on both sides of the Alleghanies, and also in Missouri. This ore is adapted for use as an adjunct to the

magnetic ores, and at the East the two are generally worked together. Spathic iron (the sparry carbonate of iron) is found only in two deposits of economic value in the United States, in Roxbury, Conn., and near Burlington, Vt. The earthy carbonate (clay ironstone) is found plentifully throughout the Alleghany coal-field, and occurs also in Illinois and Missouri. This variety is less used than formerly, when it supplied large numbers of furnaces in Pennsylvania and Ohio, especially in Western Pennsylvania and Southern Ohio. Another carbonate of iron, blackband ore, the chief material of the Scotch iron manufacture, has been found in considerable amount in Ohio, and in small quantities in the anthracite region of Pennsylvania. The production of pig iron in the United States is stated by the Iron and Steel Association as follows:

Year.	By use of anthracite coal.	By use of charcoal.	By use of bituminous coal and coke.	Total.
	Tons.	Tons.	Tons.	Tons.
1854	339,435	342,298	54,485	736,218
1855	381,866	339,922	62,390	784,178
1856	443,113	370,470	69,554	883,137
1857	390,385	330,321	77,451	798,157
1858	361,130	285,313	58,351	705,094
1859	471,745	284,044	84,844	840,627
1860	519,211	278,331	122,228	919,770
1861	409,229	195,278	127,037	731,544
1862	470,315	186,650	130,687	787,652
1863	577,638	212,095	157,951	947,601
1864	684,018	241,853	210,125	1,135,996
1865	479,558	262,342	189,682	931,582
1866	749,367	332,580	268,396	1,350,343
1867	798,638	344,341	318,647	1,461,626
1868	893,099	370,300	340,300	1,603,300
1869	971,150	392,150	553,341	1,916,641
1870	939,000	365,390	570,000	1,875,390
1871	956,608	385,300	570,009	1,911,698
1872	1,369,812	500,587	984,159	2,854,558
1873	1,312,751	577,620	977,904	2,868,278
1874	1,292,144	576,557	910,712	2,689,413
1875	998,046	410,990	917,545	2,266,581

The product of 1875 was distributed as follows:

State.	Whole No. of stacks completed Dec. 31, 1875.	No. tons of pig iron made.
Maine	1	2,046
Vermont	2	2,400
Massachusetts	6	21,255
Connecticut	10	10,880
New York	57	266,431
New Jersey	18	64,069
Pennsylvania	278	960,884
Maryland	24	38,741
Virginia	34	29,985
North Carolina	8	800
Georgia	12	16,508
Alabama	14	25,108
Texas	1	
West Virginia	12	25,277
Kentucky	23	48,339
Tennessee	22	28,311
Ohio	100	415,893
Indiana	9	22,081
Illinois	12	49,762
Michigan	34	114,805
Wisconsin	14	62,139
Missouri	19	59,717
Oregon	1	1,000
Utah	1	150
Minnesota	1	

The production of the principal districts of Pennsylvania in 1875 was as follows:

Lehigh Valley	280,360
Schuylkill Valley	123,184
Upper Susquehanna	71,731
Lower Susquehanna	79,717
Shenango Valley	137,025
Pittsburg and Alleghany co.	131,856
Miscellaneous coke	102,520

Coal.—The extensive coal-measures of the United States may be grouped into seven grand divisions: the New England basin, the anthracite regions of Pennsylvania, the Appalachian coal-field, the Michigan, the Illinois, and the Missouri basins, and the Texas coal-field. The New England basin in Massachusetts and Rhode Island occupies about 750 sq. m.; the coal is a plumbaginous anthracite. Small quantities are raised for use in smelting. The anthracite basins of Pennsylvania are estimated to embrace 472 sq. m. They are usually divided into three groups—the first, the southern, or Schuylkill basin and Mine Hill; the second, the middle, or Shamokin, the Mahanoy, and the Lehigh basins; the third, the northern, or Wyoming and Lackawanna basin. Prof. Rogers reports that the first coal-field has an average thickness of 100 feet, the second and third of about 60 feet. The Appalachian coal-fields comprise over 59,000 sq. m., distributed as follows: Pennsylvania, 12,302; Maryland, 558; Ohio, 10,000; Virginia and West Virginia, 16,000; Kentucky, 8983; Tennessee, 5100; Georgia, 170; Alabama, 6000. The Michigan basin has an area of 6700 sq. m., with 123 feet of measures and 11 feet of coal as a maximum in the centre of the basin. The coal measures of the Illinois basin occupy about 47,188 sq. m. in the States of Illinois, Indiana, and Kentucky. In this field the beds of coal are not so thick as in the Appalachian, though their number is about the same. The coals themselves are more apt to be impure, though there is abundance of good workable beds. In Illinois the measures occupy 36,000 sq. m. In Indiana the measures occupy 6500 sq. m. In Western Kentucky this field occupies 3888 sq. m. The Missouri basin covers the largest expanse of territory, though it is thinner and with fewer beds of coal than the Appalachian. In this basin are embraced 18,000 sq. m. in Iowa; 23,100 in Missouri; 36,000 in Nebraska; 17,000 in Kansas; 13,600 in the Indian Territory; and 9000 in Arkansas; a total of 84,500 sq. m. The Texas basin embraces about 6000 sq. m.

In addition to all the above, there are considerable areas in the Rocky Mountains, underlaid with beds of lignite.

The Precious Metals.—The Appalachians in their southern parts present a somewhat remarkable variety of mineral deposits. Gold in greater or less quantity is found in nearly all the Southern States which share in the elevation of this chain. In North Carolina and Georgia mines have been worked from an early period, but with varying success. In 1849 the discovery of gold in California led to the development not only of a new industry, but of a new empire. In two years the population of the Pacific slope rose from 15,000 to 100,000, and now exceeds 750,000. The first form of gold-mining on the Pacific was that of diggings, the soil being shovelled into a pan, and the gold washed free of the clay, sand, and pebbles. Later came the rocker, afterward the "tom" and the sluice. The first ditch of importance was made in 1850, while in the eight years following 6000 miles of mining canals had been constructed in California at a cost of $15,000,000. The present chief sources of gold production are (1) old placer-mining regions, where the ground is worked with sluices by miners in partnerships and gangs; (2) deep placers and cement deposits, worked by drifting and blasting and by the hydraulic process, usually by joint-stock companies; (3) quartz-mines, operated by individuals or companies. Prof. Raymond offers the following estimate of the gold product of the United States since 1847. The figures represent millions of dollars:

Years.	California.	Other States and Territories.
1848	10	
1849	40	
1850	50	
1851	55	
1852	60	
1853	65	
1854	60	
1855	55	
1856	55	
1857	55	
1858	50	
1859	50	
1860	45	1
1861	40	3
1862	34.7	4.5
1863	30	10
1864	26.6	19.5
1865	28.5	24.725
1866	25.5	28
1867	25	26.725
1868	22	26
1869	22.5	27
1870	25	25
1871	20	23.5
1872	19	17
1873	18	17
	986.8	252.95
	252.95	
	1239.75	

During the same period the production of silver is stated at $186,600,000. Mr. Clarence King has called attention to the existence of seven longitudinal zones or chains of deposits upon the Pacific slope.

"The Pacific Coast Ranges upon the W. carry quicksilver, tin, and chromic iron. The next belt is that of the Sierra Nevada and Oregon Cascades, which upon their western slope bear two zones, a foot-hill chain of copper-mines and a middle line of gold deposits. These gold-veins and the resultant placer-mines extend far into Alaska, characterized by a small amount of that metal, which is entangled in iron sulphurets, and by occupying splits in the upturned metamorphic strata of the Jurassic age. Lying to the E. of this zone, along the E. base of the Sierras, and stretching southward into Mexico, is a chain of silver-mines, contain-

ing comparatively little base metal, and frequently included in volcanic rocks. Through Middle Mexico, Arizona, Middle Nevada, and Central Idaho is another line of silver-mines, mineralized with complicated association of the base metals, and more often occurring in older rocks. Through New Mexico, Utah, and Western Montana lies another zone of argentiferous galena lodes. To the E., again, the New Mexico, Colorado, Wyoming, and Montana gold-belt is an extremely well-defined and continuous chain of deposits."

POLITICAL DIVISIONS.—*States and Territories.*—Thirty-eight States compose the Union. The relation of the States to the general government will be spoken of later. The following table exhibits the date of admission of each State not of the original thirteen by which the Constitution was adopted, as well as the area and population of each State in 1870. The date 1789 designates the original thirteen States. In the absence of official surveys, the statements of areas are necessarily approximate only:

STATES.	Date of admission as a State.	Area and population in 1870.		
		Area in sq. miles.	Population.	Inhabitants to a sq. mile.
Alabama	1819	50,722	996,992	19.66
Arkansas	1836	52,198	484,471	9.30
California	1850	188,981	560,247	2.29
Colorado	1876	104,500	39,864	0.38
Connecticut	1789	4,750	537,454	113.15
Delaware	1789	2,120	125,015	58.97
Florida	1845	59,268	187,748	3.17
Georgia	1789	58,000	1,184,109	20.42
Illinois	1818	55,410	2,539,891	45.84
Indiana	1816	33,809	1,680,637	49.71
Iowa	1846	55,045	1,194,020	21.69
Kansas	1861	81,318	364,399	4.48
Kentucky	1792	37,680	1,321,011	35.33
Louisiana	1812	41,346	726,915	17.58
Maine	1820	35,000	626,915	17.91
Maryland	1789	11,124	780,894	70.20
Massachusetts	1789	7,800	1,457,351	186.84
Michigan	1837	56,451	1,184,059	20.97
Minnesota	1858	83,531	439,706	5.26
Mississippi	1817	47,156	827,922	17.56
Missouri	1821	65,350	1,721,295	26.34
Nebraska	1864	75,995	122,993	1.62
Nevada	1864	104,125	42,491	.41
New Hampshire	1789	9,280	318,300	34.30
New Jersey	1789	8,320	906,096	108.91
New York	1789	47,000	4,382,759	93.25
North Carolina	1789	50,704	1,071,361	21.13
Ohio	1802	39,964	2,665,260	66.69
Oregon	1859	95,274	90,923	.95
Pennsylvania	1789	46,000	3,521,951	76.56
Rhode Island	1789	1,306	217,353	166.43
South Carolina	1789	34,000	705,606	20.75
Tennessee	1796	45,600	1,258,520	27.60
Texas	1845	274,356	818,579	2.98
Vermont	1791	10,212	330,551	32.37
Virginia	1789	38,348	1,225,163	31.95
West Virginia	1863	23,000	442,014	19.22
Wisconsin	1848	53,924	1,054,670	19.56

In addition to the 38 States enumerated, "the United States" embraces the District of Columbia, 63 sq. m., the seat of government, obtained by cession from the State of Maryland, eight Territories, duly organized, and the District of Alaska. Over the District of Columbia Congress exercises exclusive jurisdiction, under the Constitution. The Territories have provisional governments more or less completely organized, but are subject to legislation by Congress, even to the extent of the addition or subtraction of territory without their own consent, or to the extinguishment of their existing governments. Once admitted as States, however, they come to possess all the rights and immunities of original members of the Union, and their territory cannot thereafter be increased or diminished without their consent. In general, the government of the Territories consists of (1) a governor, who is appointed by the President of the United States, holding office for four years, unless sooner removed; is commander-in-chief of the militia of the Territory; may grant pardons and reprieves for offences against the laws of the Territory, and for offences against the laws of the United States may grant reprieves till the decision of the President be made known; commissions all persons appointed to office under the laws of the Territory, and exercises generally the executive functions, with a secretary who in the absence of the governor performs the duties of that office; (2) a Territorial legislature, comprising a council and house of representatives (the members, terms of service, and qualifications of members varying in different Territories), having powers of legislation extending to "all rightful subjects of legislation consistent with the Constitution of the United States and the Territorial organic act;" the governor of the Territory, however, possessing the veto power under provisions similar to those under which the President of the United States exercises that power; (3) a judiciary composed of a supreme court, district courts, probate courts, and justices of the peace. The following table exhibits the area and population of each of the Territories in 1870:

Name.	Area in sq. m.	Population.	Inhabitants to a sq. m.
Arizona	113,916	9,658	0.08
Dakota	150,932	14,181	0.09
Idaho	86,294	14,999	0.17
Montana	143,776	20,595	0.14
New Mexico	121,201	91,874	0.76
Utah	84,476	86,786	1.03
Washington	69,994	23,955	0.34
Wyoming	97,883	9,118	0.09

No government for Alaska has yet been organized. The secretaries of war and of the treasury, in pursuance of certain acts of Congress, exercise certain functions along the coast of this district.

The Arithmetical Progress of Population.—Mr. Bancroft presents the following estimates of the population of the thirteen colonies which became States of the Union:

Year.	Whites.	Blacks.	Total.
1750	1,040,000	220,000	1,260,000
1754	1,165,000	260,000	1,425,000
1760	1,385,000	310,000	2,195,000
1770	1,850,000	462,000	2,312,000
1780	2,383,000	562,000	2,945,000

The progress of the country in population is shown in the following table:

Year.	Whites.	Blacks.	Total.
1790	3,172,006	757,208	3,929,214
1800	4,306,446	1,002,087	5,308,483
1810	5,862,073	1,377,808	7,239,881
1820	7,862,166	1,771,656	9,633,822
1830	10,537,378	2,328,642	12,866,020
1840	14,195,805	2,873,648	17,069,453
1850	19,553,068	3,638,808	23,191,876
1860	26,922,537	4,441,830	31,443,321
1870	33,589,377	4,880,009	38,558,371

In addition to the elements enumerated, the totals above included in 1860, 34,933 Chinese and 44,021 Indians found living among the whites; in 1870, 63,254 Chinese and Japanese and 25,731 Indians. The Indians preserving their tribal relations have never been counted in any census of the United States, nor have their numbers ever been ascertained precisely in any way.

The following table shows the ratio of the increase in population for each ten, twenty, and thirty year period since 1790:

Increase per cent.

YEAR.	In 10 years.	In 20 years.	In 30 years.
At 1800	35.1		
1810	36.3	84.2	
1820	33.1	81.5	145.1
1830	33.5	77.7	142.3
1840	32.6	77.2	135.8
1850	35.8	80.2	140.7
1860	35.6	84.2	144.4
1870	22.6	66.2	125.9

Immigration and the Foreign Elements of Population.—Dr. Seybert estimates the aggregate immigration from foreign countries between 1790 and 1820 at 250,000. The following table shows the immigration from 1820 to 1870:

YEARS.	From all countries.	From Great Britain and Ireland.	From Germany.
1820–30	151,824	81,827	7,729
1830–40	599,125	283,191	152,454
1840–50	1,713,251	1,047,763	434,626
1850–60	2,598,214	1,338,093	951,667
1860–70	2,491,209	1,106,976	822,007

For the first time, the census in 1850 recorded the "place of birth" of the population. The number of persons of foreign birth was then determined to be 2,244,602. This number in 1860 had increased to 4,138,697, and in 1870 to 5,567,229. At the several dates named the several specific nationalities contributed to the total foreign population as follows:

NATIONALITY.	1850, per cent.	1860, per cent.	1870, per cent.
Irish	43.5	38.9	33.3
Germans	26.4	30.8	30.4
English and Welsh	13.9	11.5	11.2
British Americans	6.7	6.0	8.9
Swedes, Norwegians, and Danes	0.81	1.7	4.4

The foreign immigrants to the United States have placed themselves mainly between the 38th and 46th degrees of latitude. Indeed, the geographical relation of the foreign and colored elements of the population is in a high degree complemental. Taking the States of Delaware, Maryland,

West Virginia, Kentucky, and Tennessee as a central belt common to both, we have the following numerical proportions in each 1000 inhabitants (Pacific States excluded):

Divisions.	Total.	Colored.	Foreign.	Native white.
Northern and North-western States	1,000	14	197	789
Central States	1,000	132	91	777
Southern and South-western	1,000	415	22	563

In like manner, the location of certain foreign elements will be found in turn largely complemental. Two-thirds of the Germans are located W. of Buffalo; two-thirds of the Irish E. of it. The Scandinavians are mainly W. of Lake Michigan, the British Americans E. of it.

Colored Population.—The following table exhibits, at ten-year intervals, (1) the total number of colored persons in the United States; (2) the percentage of the total population which this element constituted; (3) the percentage of increase within that element itself:

Years.	No. of colored persons.	Percentage of total population.	Percentage of increase during preceding decade.
1790	757,208	19.3	
1800	1,002,037	18.9	32.32
1810	1,377,808	19.	37.05
1820	1,771,656	18.4	28.58
1830	2,328,642	18.2	31.44
1840	2,873,648	16.8	23.40
1850	3,638,808	13.3	26.60
1860	4,441,830	14.1	22.07
1870	4,880,009	12.7	9.21

The number of free colored persons in the United States was, in 1790, 59,527; 1800, 108,435; 1810, 186,446; 1820, 233,634; 1830, 319,599; 1840, 386,293; 1850, 434,495; 1860, 488,495. By 1870 the entire colored population had become free.

The population of 1870 was divided in respect of sex as follows:

Native males	16,486,622	
Foreign "	3,006,913	
		19,493,565
Native females	16,504,520	
Foreign "	2,560,986	
		19,064,806

The colored population consisted of 2,393,263 males and 2,486,746 females.

The following table shows the respective numbers of males and of females in each State or Territory:

With excess of females.			With excess of males.		
States.	Males.	Females.	States.	Males.	Females.
Alabama	488,738	508,254	Arizona	6,887	2,771
Connecticut	265,270	272,181	Arkansas	248,261	236,210
Dist. of Columbia	62,192	69,508	California	319,479	210,768
Georgia	578,955	605,154	Colorado	24,820	15,044
Louisiana	362,165	364,750	Dakota	8,878	5,303
Maine	313,103	313,812	Delaware	62,628	62,387
Maryland	384,984	395,910	Florida	91,548	93,200
Massachusetts	703,379	733,572	Idaho	12,184	7,815
Mississippi	413,421	414,501	Illinois	1,316,537	1,223,354
New Hampshire	155,640	162,660	Indiana	857,994	822,613
New Jersey	449,672	450,424	Iowa	625,917	568,103
New York	2,163,224	2,219,530	Kansas	202,224	162,175
North Carolina	518,701	552,657	Kentucky	665,675	635,336
Pennsylvania	1,758,490	1,763,452	Michigan	617,745	566,314
Rhode Island	104,756	112,587	Minnesota	235,299	204,407
South Carolina	343,902	361,704	Missouri	896,347	824,918
Tennessee	623,347	635,174	Montana	16,771	3,824
Virginia	597,058	628,105	Nebraska	70,425	52,568
			Nevada	32,379	10,112
			New Mexico	47,135	44,739
			Ohio	1,337,550	1,327,710
			Oregon	53,131	37,792
			Texas	423,557	395,022
			Utah	44,121	42,665
			Vermont	165,721	164,830
			Washington	14,990	8,965
			West Virginia	222,843	219,171
			Wisconsin	541,886	509,784
			Wyoming	7,219	1,899

The total number of families in the United States in 1870 was 7,579,363, which, with a population of 38,558,371, gives as the average number of persons to a family, 5.09. The lowest averages among the States were—California, 4.35; Connecticut, 4.67; Louisiana, 4.60; Nevada, 4.30; New Hampshire, 4.11; South Carolina, 4.67; Vermont, 4.69. The highest averages were—Delaware, 5.46; Kentucky, 5.67; Maryland, 5.57; Missouri, 5.43; Tennessee, 5.44; West Virginia, 5.63. The total number of dwellings in the United States in 1870 was 7,042,833, the average number of persons to a dwelling being thus 5.47. The lowest State averages were—California, 4.44; Florida, 4.57; Louisiana, 4.83; Nebraska, 4.89; Nevada, 3.27; New Hampshire, 4.75; Oregon, 4.69; South Carolina, 4.92. The highest averages were—Maryland, 6.02; Massachusetts, 6.16; New York, 6.37; Rhode Island, 6.24. In the eight principal cities the number of persons to a family was—New York, 5.07; Philadelphia, 5.28; Brooklyn, 4.95; St. Louis, 5.23; Chicago, 5.03; Baltimore, 5.35; Boston, 5.20; Cincinnati, 5.01. In these cities the number of persons to a dwelling was—New York, 11.72; Philadelphia, 6.01; Brooklyn, 8.61; St. Louis, 7.81; Chicago, 6.70; Baltimore, 6.63; Boston, 8.46; Cincinnati, 8.81.

The Geographical Progress of Population.—The first census, in 1790, found the population of the United States substantially all between the 31st and 45th degrees of latitude and the 67th and 83d degrees of longitude W. from Greenwich, the area actually covered by population of 2 or more persons to a square mile within these limits being 226,085 sq. m. At 1870, if we exclude the Pacific settlements and the region W. of the Rocky Mountains, the population was found between the degrees of latitude 27° 15′ and 47° 30′, and the degrees of longitude 67° and 99° 45′, the area covered by population within those limits being 1,140,329 sq. m. The following table exhibits the westward movement of population along the several degrees of latitude, the Pacific settlements being excluded, and all the areas of settlement on each degree being consolidated. The figures in the table represent the number of miles settled along each degree at each alternate census, measuring from the Atlantic westward:

Degree of N. lat.	1790.	1810.	1830.	1850.	1870.
47	0	0	0	79	209
46	0	0	15	50	239
45	30	392	392	437	858
44	226	279	299	494	777
43	339	425	485	816	1137
42	234	568	691	984	1218
41	238	471	663	1107	1325
40	358	584	912	1140	1252
39	270	565	1038	1013	1224
38	425	707	871	1032	1193
37	344	706	797	1018	1134
36	462	682	878	1057	1057
35	384	391	961	1030	1030
34	302	362	707	938	938
33	175	230	554	989	1055
32	30	227	742	929	1008
31	10	240	634	860	991
30	0	150	323	725	785
29	0	0	0	255	372
28	0	0	0	80	140
27	0	0	0	0	25
26	0	0	0	0	65

This westward movement of population may be further shown by positing the "centre of population" at each successive census. If we assume the area of the country to be a plane surface, without weight, but capable of sustaining weight, and load it with the inhabitants both in number and in position as they were found by the several censuses, each individual being assumed to be of the same gravity as every other, and to exert pressure on the pivot directly proportioned to his distance therefrom, the points at which the population E. and W., N. and S., would have balanced were as follows:

Years.	Position of centre of population.			Westward movement during decade.
	N. lat.	W. lon.	Approximate location by important towns.	
	° ′	° ′		miles.
1790	39 16.5	76 11.2	23 miles E. of Baltimore.	
1800	39 16.1	76 56.5	18 " W. " "	41
1810	39 11.5	77 37.2	40 " W. by N. W. of Washington	36
1820	39 05.7	78 33	16 " N. of Woodstock	50
1830	38 57.9	79 16.9	19 " W. S. W. of Moorefield	39
1840	39 02	80 18	16 " S. of Clarksburg	55
1850	38 59	81 19	23 " S. E. of Parkersburg	56
1860	39 00.4	82 48.8	20 " S. of Chillicothe	81
1870	39 12	83 35.7	48 " E. by N. of Cincinnati	42
				399

The following table exhibits the area in square miles actually covered by a population, two or more to a square mile at each census:

Years.	Settled tracts within the continuous frontier-line.	Settled tracts outside the frontier-line, including the Pacific coast settlements after 1850.	Total area of settlement.	Average density of settlement, persons to a sq. m.
1790	226,085	13,850	239,935	16.4
1800	271,908	33,800	305,708	17.3
1810	382,845	25,100	407,945	17.7
1820	504,517	4,200	508,717	18.9
1830	628,017	4,700	632,717	20.3
1840	805,142	2,150	807,292	21.1
1850	940,874	38,375	979,249	23.7
1860	1,087,379	107,375	1,194,754	25.5
1870	1,140,329	131,910	1,272,239	30.2

Thus it appears that while population has been advancing

westward, it has also been deepening upon the older regions of settlement. This will be best shown by dividing the total area of settlement in the above table into groups representing different densities of population. This is done in the following table, which shows the proportionate areas at each census embraced within each of five groups: I. tracts having a population of 2 to 6 to a square mile; II. 6–18; III. 18–45; IV. 45–90; V. 90 and more:

Date.	Increase per cent. in ten years in total area of settlement.	Proportion of each group of population to total settled area.					
		Total.	I.	II.	III.	IV.	V.
1790	.....	1000	348	348	247	54	3
1800	27.4	1000	265	403	270	58	4
1810	33.4	1000	286	379	265	67	3
1820	24.7	1000	277	348	296	76	3
1830	24.4	1000	239	357	295	103	6
1840	27.6	1000	228	361	299	105	7
1850	21.3	1000	239	301	346	103	11
1860	22.	1000	216	296	361	113	12
1870	6.5	1000	193	286	369	137	13

The inter-State migration is a most remarkable social feature of the United States. The following table exhibits the effect of this cause on the status of the population in 1870:

States.	No. residing in the State who were born therein.	No. residing in the State who were born in other States or Territories.	No. born in the State who were residing in other States or Territories.
Alabama	744,000	243,000	230,000
Arkansas	233,000	247,000	55,000
California	170,000	181,000	12,000
Connecticut	350,000	73,000	137,000
Delaware	95,000	21,000	39,000
Florida	110,000	73,000	15,000
Georgia	1,034,000	139,000	274,000
Illinois	1,190,000	835,000	290,000
Indiana	1,049,000	491,000	321,000
Iowa	429,000	561,000	89,000
Kansas	63,000	253,000	11,000
Kentucky	1,081,000	177,000	403,000
Louisiana	502,000	163,000	63,000
Maine	551,000	27,000	149,000
Maryland	630,000	68,000	176,000
Massachusetts	903,000	201,000	244,000
Michigan	507,000	409,000	66,000
Minnesota	126,000	153,000	13,000
Mississippi	564,000	253,000	139,000
Missouri	874,000	625,000	171,000
Nebraska	19,000	74,000	5,000
Nevada	3,000	20,000	2,000
New Hampshire	242,000	46,000	125,000
New Jersey	575,000	142,000	149,000
New York	2,988,000	257,000	1,074,000
North Carolina	1,029,000	40,000	307,000
Ohio	1,842,000	450,000	807,000
Oregon	37,000	42,000	6,000
Pennsylvania	2,727,000	250,000	675,000
Rhode Island	125,000	37,000	45,000
South Carolina	679,000	19,000	246,000
Tennessee	1,028,000	212,000	404,000
Texas	389,000	368,000	26,000
Vermont	244,000	40,000	177,000
Virginia } West Virginia }	1,545,000	91,000	584,000
Wisconsin	450,000	240,000	97,000

Cities.—In 1790 there were 6 cities in the United States having a population of 8000 or more inhabitants. Their aggregate population was 131,472, being 3.4 per cent. of the population. The following table shows the growth of the urban population, including only cities of 8000 or more inhabitants:

Years.	Number of cities.	Aggregate city population.	Residents of cities in each 100 inhabitants.
1790	6	131,472	3.4
1800	6	210,873	3.9
1810	11	356,920	4.9
1820	13	475,135	4.9
1830	26	864,509	6.7
1840	44	1,453,994	8.5
1850	85	2,897,586	12.5
1860	141	5,072,256	16.1
1870	226	8,071,875	20.9

Speaking roundly, then, it may be said that at 1790 one-thirtieth of the population lived in cities; at 1800, one-twenty-fifth; at 1810 and 1820, one-twentieth; at 1830, one-sixteenth; at 1840, one-twelfth; at 1850, one-eighth; at 1860, one-sixth; at 1870, one-fifth.

The following table shows the growth of the city system, with distinction as to size of the cities embraced within the total—population in thousands:

Years.	Cities by classes according to size.								
	8 to 12.	12 to 20.	20 to 40.	40 to 75.	75 to 125.	125 to 250.	250 to 500.	500 and over.	Total.
1790	1	3	1	1	...	...	...	...	6
1800	1	...	3	2	...	..	...	...	6
1810	4	2	3	...	2	...	...	...	11
1820	3	4	2	2	2	...	...	...	13
1830	12	7	3	1	1	2	...	...	26
1840	17	11	10	1	3	1	1	...	44
1850	36	20	14	7	3	3	1	1	85
1860	62	34	23	12	2	5	1	2	141
1870	92	63	39	14	8	3	5	2	226

Government.—The government of the United States is one of limited powers, all authority not delegated to it by the Constitution being reserved to the States severally or to the people. The legislative power has the following extent: to lay and collect taxes, duties, imposts, and excises; to pay the debts and provide for the common defence and general welfare of the United States, but all duties, imposts, and excises must be uniform throughout the United States; to borrow money on the credit of the United States; to regulate commerce with foreign nations and among the several States, and with the Indian tribes; to establish a uniform rule of naturalization and uniform laws on the subject of bankruptcy; to coin money, regulate the value thereof and of foreign coin, and fix the standard of weights and measures; to provide for the punishment of counterfeiting the securities and coin of the United States; to establish post-offices and post-roads; to secure for limited times to authors and inventors the exclusive right to their writings and discoveries; to constitute tribunals inferior to the Supreme Court; to define and punish piracies and felonies committed on the high seas, and offences against the laws of nations; to declare war, grant letters of marque and reprisal, and make rules concerning captures on land and water: to raise and support armies, but no appropriation for that purpose can be for a longer term than two years; to provide and maintain a navy; to make rules for the government of the land and naval forces, and to provide for calling forth the militia to execute the laws of the Union, suppress insurrections, and repel invasions; to provide for organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the United States, there being reserved to the States the appointment of officers and the authority of training the militia according to the discipline prescribed; to exercise exclusive jurisdiction over such district, not exceeding ten miles square, as by the cession of particular States and the acceptance of Congress may become the seat of government of the United States, and to exercise like authority over all places purchased, by consent of the legislature of the State in which the same shall be, for the erection of forts, magazines, arsenals, dockyards, and other needful buildings; to make all laws which shall be necessary and proper for carrying into effect the foregoing powers, and all other powers vested by the Constitution in the government of the United States or in any department or officer thereof. By the thirteenth, fourteenth, and fifteenth Amendments to the Constitution the legislative power has been extended to the enforcement of (1) the prohibition of slavery and involuntary servitude, except as a punishment for crime whereof the party shall have been duly convicted; (2) the prohibition to the States of the power to make or enforce any law which shall abridge the privileges or immunities of citizens of the United States (which description is declared to embrace all persons born or naturalized in the United States, and subject to the jurisdiction thereof), or deprive any person of life, liberty, or property, without due process of law, or to deny to any person within their respective jurisdictions the equal protection of their laws; (3) the prohibition of civil or military office under the United States, or under any State, or of a seat in either house of Congress, or in the electoral college, to any person who, having previously taken an oath as a member of Congress, or as an officer of the United States, or as a member of a State legislature, or as an executive or judicial officer thereof, to support the Constitution of the United States, shall have engaged in insurrection or rebellion against the same, or given aid and comfort to the enemies thereof, unless such person shall by a two-thirds vote of both houses of Congress have such disabilities removed; (4) the prohibition to the States of the power to deny or abridge the rights of citizens of the United States to vote, on account of race, color, or previous condition of servitude. The legislative powers of the United States are declared not to extend to the suspension of habeas corpus unless required by the public safety in cases of rebellion or invasion; to the passage of bills of attainder or *ex-post facto* laws; to the levying of capitation or other direct tax, except in proportion to the population of the several States; to the levying of export duties, or to the

MAP OF
UNITED STATES
Drawn and Engraved on Copper-Plate
EXPRESSLY
FOR
JOHNSON'S UNIVERSAL CYCLOPÆDIA
Longitude West 93 from Greenwich
Longitude West 16 from Washington
BRITISH POSSESSIONS
DOMINION OF CANADA
QUEBEC
NEW BRUNSWICK
MAINE
ONTARIO
SUPERIOR
MONTANA
DAKOTA
WYOMING
NEBRASKA
COLORADO
ARIZONA
NEW MEXICO
TEXAS
ILLINOIS
ARKANSAS
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
ALABAMA
FLORIDA
GULF OF MEXICO
YUCATAN
MEXICO
Tropic of Cancer
Tropic of Cancer

giving of preference to the ports of one State over another; to the establishment of religion; to the abridgment of freedom of speech, of the press, of religious worship, of public assembly, or of petition. The legislative powers above enumerated are vested in a Congress, which consists of a Senate and House of Representatives. The Senate is composed of two members from each State, chosen by the legislature for the term of six years. The House of Representatives is composed of Representatives from each State, in number proportioned to the population thereof, the aggregate number of Representatives to be apportioned being determined from time to time by law. Representatives are chosen by the people for the term of two years. The House of Representatives elect their Speaker; the Vice-President presides over the Senate. The House of Representatives has the power of impeachment; the Senate tries all impeachments. On the trial of the President upon impeachment, the chief justice presides. Judgment in cases of impeachment extends no further than to removal from office or disqualification for office, the party convicted being, nevertheless, subject to trial and punishment according to law.

The President has the power of veto upon the legislation of Congress, but bills are passed over the veto if they secure a two-thirds vote in both houses.

The number of Representatives in Congress is fixed by law at 293, divided among the States as follows, on the basis of the population in 1870: Alabama, 8; Arkansas, 4; California, 4; Colorado, 1; Connecticut, 4; Delaware, 1; Florida, 2; Georgia, 9; Illinois, 19; Indiana, 13; Iowa, 9; Kansas, 3; Kentucky, 10; Louisiana, 6; Maine, 5; Maryland, 6; Massachusetts, 11; Michigan, 9; Minnesota, 3; Mississippi, 6; Missouri, 13; Nebraska, 1; Nevada, 1; New Hampshire, 3; New Jersey, 7; New York, 33; North Carolina, 8; Ohio, 20; Oregon, 1; Pennsylvania, 27; Rhode Island, 2; South Carolina, 5; Tennessee, 10; Texas, 6; Vermont, 3; Virginia, 9; West Virginia, 3; Wisconsin, 8. The aggregate vote of the States in the electoral college is 369, each State having two more votes than it has members of the House of Representatives.

The executive powers of the United States are vested in a President, who holds his office for a term of four years, and, together with a Vice-President, is chosen by electors, the number appointed in each State being equal to the whole number of Senators and Representatives to which the State may be entitled in Congress. If no person receive the votes of a majority of the electoral college for the office of President, the House of Representatives, voting by States, chooses the President from the persons having the highest number, not exceeding three, on the list of those voted for. If there be a failure from the same cause to elect a Vice-President, the Senate proceeds to a choice between the two highest candidates on the list. The President is commander-in-chief of the army and navy, and of the militia of the several States when called into the actual service of the United States; he has power to grant reprieves and pardons for offences against the United States, except in cases of impeachment; with the consent of the Senate he appoints ambassadors, judges, and all other officers of the United States whose appointments are not otherwise provided for, and all vacancies occurring during the recess of the Senate he may fill without the concurrence of the Senate; he is to take care that the laws be faithfully executed, and to commission all officers of the United States.

Administration of Justice.—The judicial power extends to all cases in law or equity arising under the Constitution, the laws of the United States, and treaties made under their authority; to all cases affecting ambassadors, other public ministers, and consuls; to all cases of admiralty and maritime jurisdiction; to controversies to which the United States are a party; to controversies between two or more States; between citizens of different States; between citizens of the same State claiming lands under grants of different States; and between the citizens of any State and foreign states, citizens or subjects. Within the limits of the several States the ordinary care of the peace, protection of person and property, and punishment of crime are left to the States, together with the regulation of all social and domestic interests and relations. The agencies established in the several States for the administration of justice are described under the appropriate heads. No statistics of any considerable value have ever been compiled relating to the commission or punishment of crime throughout the United States.

The judicial organization of the United States comprises district courts, circuit courts, and the Supreme Court. There are 58 district courts. Twenty-one States constitute each a judicial district: Alabama, New York, and Tennessee comprise each three districts; Arkansas, Florida, Georgia, Illinois, Michigan, Mississippi, Missouri, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, Virginia, and Wisconsin, comprise each two districts. Except in Alabama, Georgia, Mississippi, South Carolina, and Tennessee, where a single judge acts for both or all the districts of the State, there is appointed for each district a United States judge, attorney, and marshal. The judicial districts of the United States are divided into nine circuits, as follows: 1st, Rhode Island, Massachusetts, New Hampshire, and Maine; 2d, Vermont, Connecticut, and New York; 3d, Pennsylvania, New Jersey, and Delaware; 4th, Maryland, Virginia, West Virginia, North Carolina, and South Carolina; 5th, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas; 6th, Ohio, Michigan, Kentucky, and Tennessee; 7th, Indiana, Illinois, and Wisconsin; 8th, Nebraska, Minnesota, Iowa, Missouri, Kansas, and Arkansas; 9th, California, Oregon, and Nevada. The chief justice and the associate justices of the Supreme Court are allotted among the circuits by order of the court, while for each circuit is appointed a circuit judge having the same power and jurisdiction therein as the justice of the Supreme Court allotted thereto. Circuit courts are held by the circuit justice of the Supreme Court, or by the circuit judge of the circuit, or by the district judge of the district sitting alone, or by any two of the said judges sitting together. The Supreme Court consists of a chief-justice and eight associate justices, who have power to appoint a clerk, a marshal, and a reporter of the court. The court holds one term at Washington annually, and such adjourned or special terms as are found necessary for the despatch of business. The original jurisdiction of the United States is divided among the three classes of courts named. Original jurisdiction in the majority of cases is vested in the district courts. The Supreme Court has exclusive jurisdiction in all civil controversies where a State is a party, except between a State and its citizens, or between a State and citizens of other States, or aliens, in which latter cases it has original but not exclusive jurisdiction. It has also exclusively all such jurisdiction of suits or proceedings against ambassadors and public ministers and their servants as is consistent with their privilege under the law of nations; also original but not exclusive jurisdiction of suits brought by ambassadors or public ministers, or in which a foreign consul is a party. The trial of all issues of fact, in all actions at law against citizens of the United States, must be by jury. The Supreme Court also has power to issue writs of prohibition to the district courts when proceeding as courts of admiralty and maritime jurisdiction, and writs of mandamus to all inferior courts and officers of the United States where a State or an ambassador or other public minister or a consul is a party. The circuit courts have original jurisdiction of all suits of a civil nature at common law or in equity when the matter in dispute exceeds $500 and an alien is a party, or the suit is between the citizens of different States; of all suits in equity where the amount in dispute exceeds $500 and the United States are petitioners; of all suits at common law where the United States, or any officer thereof suing under authority of an act of Congress, are plaintiffs; of all suits and proceedings arising under certain acts of Congress relating to tonnage dues, the slave-trade, patents and copyrights, banking associations, etc.; of suits to recover possession of office, and of all proceedings by writ of *quo warranto;* and of all suits authorized to be brought under the acts of Congress for enforcing the later constitutional amendments. The circuit courts have exclusive jurisdiction of all crimes and offences cognizable under the authority of the United States except as otherwise provided by law, and concurrent jurisdiction with the district courts of crimes and offences cognizable therein. The circuit courts hear and determine appeals from the decrees of the district courts in causes of equity or of admiralty and maritime jurisdiction when the matter in dispute exceeds $50. All final judgments of district courts in civil actions when the matter in dispute exceeds $50 may be re-examined upon a writ of error by the circuit court holden in the same district. Jurisdiction of cases civil or criminal may also be transferred from a district court into the circuit court by reason of the disability, from sickness, interest, or other cause, of the district judge. And suits commenced in State courts wherein the matter in dispute exceeds $500 may in cases provided be removed into the circuit court on petition, for the purpose of protecting the rights and interests of aliens or citizens of States other than those in which such suits are instituted, and also where parties claim land under titles from different States. Suits against revenue and registration officers of the United States, and against corporations organized under acts of Congress, may also be removed on petition to the circuit courts of the United States.

In 1855 a United States court of claims was organized, the court being directed to hear and determine claims against the United States, and report the cases and facts to Congress, with the opinion of the court thereon. In

1863 the court of claims was authorized to render final judgments, with right of appeal to the Supreme Court.

The executive departments of the United States government are seven—the departments of state, of the treasury, of war, of the navy, of the interior, of justice, and the post-office department. There is also the so-called department of agriculture, which is of somewhat anomalous constitution, being independent, though corresponding otherwise to the numerous bureaus of the several departments. The functions of several of the executive departments named are so clearly indicated by their titles that it is not necessary to describe their organization and operations.

The department of the interior was created in 1849, and embraces the following bureaus: Indian office, pension office, patent office, general land office, census office, and the educational office or bureau. Each of these bureaus has its proper chief, from whose decisions appeals, regulated by law or custom, may be taken to the department. The secretary of the interior is also charged with the control of the public buildings and the penal and charitable institutions of the District of Columbia, with the administration of the grants of the United States to railways, and with the conduct of the geological and geographical survey of the Territories. The officers of the interior department, besides the secretary, are an assistant secretary and a solicitor.

Pensions.—The pension-roll of the United States on July 1, 1875, embraced 234,821 pensioners, whose annual pensions aggregated $26,289,520. The army pensioners numbered 210,363, of whom 105,478 were invalids and 104,885 widows and dependent relatives. The navy pensioners were 3420, of whom 1636 were invalids and 1784 widows, etc. A third class, 21,038 in number, were pensioners of the war of 1812, of whom 15,875 were survivors and 5163 widows. The following table shows the movement of the pension-lists from 1861 to 1875:

Year ending June 30.	No. of invalids.	No. of widows and dependents.	Whole No. of pensioners.
1861	4,337	4,299	8,636
1862	4,341	3,818	8,169
1863	7,821	6,970	14,791
1864	23,479	27,656	41,135
1865	35,880	50,106	85,986
1866	55,652	71,070	126,722
1867	69,565	83,618	153,184
1868	75,957	93,686	169,643
1869	82,859	105,104	187,963
1870	87,521	111,165	198,686
1871	93,394	114,101	207,495
1872	113,954	118,275	232,229
1873	119,500	118,911	238,411
1874	121,628	114,613	236,241
1875	122,989	111,832	234,821

Indians.—Indians "not taxed"—*i. e.* in tribal relations—are excluded by the Constitution from the basis of political representation. The several tribes are regarded as "domestic, dependent nations," governed by their own laws, yet subject to the sovereignty of the United States; having a right of occupancy in their lands, yet without the power to cede those lands except to the United States alone. Between the formation of the government and 1871 nearly 400 treaties had been made between the government and various Indian tribes, being largely treaties of cession. Except in the case of the Sioux in Minnesota after the massacre of 1862, the United States had never, without at least the formality of a treaty, taken possession of undoubted Indian lands within the limits of territory acquired by treaty with England or France. On territory acquired from Mexico the claims of Indian tribes to the occupancy of the soil have not been regarded as of equal validity, the theory of the Mexican law differing in this respect from that of the English, the French, and the Dutch. In 1871, however, Congress put an end to this system by declaring by law that no Indian tribe should thereafter be recognized as a nation capable of making a treaty.

The policy of removing the Indians to the W. of the Mississippi was inaugurated about 1825, and largely carried out in the twenty years following, especially in respect to the Southern or Appalachian Indians—the Creeks, Choctaws, Chickasaws, Cherokees, and Seminoles. The Indian Territory, so called, contains about 70,000 Indians, mainly of the tribes named, all in a somewhat advanced condition socially and industrially. Other large reservations have been set apart for Indian occupation, especially in Montana and Dakota, the aggregate amount of land being 258,953 sq. m. The total number of Indians, exclusive of those in Alaska, is about 280,000; 42,638 males, representing not far from the same number of Indian families, labor for their own support in more or less civilized fashion. The number of Indians attending school in 1875 was 10,598. The number of schools upon reservations supported by the government was 329, with 418 teachers.

Formerly, under the treaty system, a United States Indian agent was a sort of minister resident, while the tribes were governed according to their own traditions and customs by their own chiefs. By the act of 1871, already spoken of, the authority of the chief is practically destroyed, yet no agencies for administering justice and preserving the peace among the tribes have been instituted to take the place of the system thus abrogated. In consequence, the administration of the internal affairs of the Indian tribes has been thrown into much confusion.

Census.—The census of the United States is taken, under an express provision of the Constitution, every ten years. The first census was taken in 1790, eleven years before the first English census. The scope of the enumeration was greatly enlarged by successive enactments until 1850, when, by the act of May 23, the existing system was constituted. The United States judicial districts are made census districts, and the marshal of each district directs and supervises its enumeration. In 1870 there were 64 such districts, including one for each Territory. The marshals appoint assistants, who perform the actual enumeration. In 1870 there were about 6400 assistant marshals. The lists of names, ages, occupations, etc., are sent to the superintendent of the census at Washington, who conducts the compilation and publication of the statistical results. In addition to the personal details usually demanded in a census, the inquiries authorized by the act of 1850 relate to agricultural and manufacturing industry and to a large number of social facts—pauperism, crime, public education, public worship, etc. The machinery of the census, as erected by the act of 1850, is not generally regarded by statisticians as well adapted to secure results of the degree of exactness required by the demands of modern statistical science. No national system of registration exists for obtaining the facts of birth, marriage, and death as they occur, while only a few States have provided, and these but inadequately, for obtaining information on these points. In consequence, the vital statistics of the United States are partial, and at the best doubtful, comparing unfavorably as to range and completeness with those of almost every European country.

Public Lands.—The total area of lands belonging to the United States government in the States and Territories, exclusive of Alaska, was originally, as computed, 1,465,468,800 acres. Of this, there had, to June, 1875, been surveyed 680,253,094 acres. The area of Alaska is estimated at 369,529,600 acres, the title of which is in the United States. Under the bounty-land laws of 1847, 1850, 1852, and 1855 the total issues have been 60,936,230 acres. The land concessions by Congress to States for canal purposes since 1827 amount to 4,405,986 acres. The lands conceded for railroad and wagon-road purposes since 1850 are estimated to amount to 210,756,807 acres, of which 38,211,088 have been certified or patented under the grants. Large amounts have also been approved to States as swamp-lands, or certified to States for educational and other specific purposes. Apart from such special grants the public lands of the United States may be acquired by individuals in the following ways: First, under the Homestead act, by which a tract of 80 acres, at $2.50 an acre (called double minimum land), or 160 acres at $1.25, may be obtained through the payment of certain fees and commissions, ranging from $7 to $22, on condition that the applicant resides upon and cultivates the land for five years. An applicant relinquishing his "claim" under the Homestead act cannot acquire another. The public lands remaining in the Gulf States, Florida, Alabama, Mississippi, Louisiana, and Texas, can be acquired under the Homestead act alone. Second, under the Pre-emption act, through which a person may, by "entering" at the appropriate land-office a tract of 80 or 160 acres, secure a right to take the land at government rates whenever it shall be offered for sale. Third, by auction, whenever offered by proclamation of the President or public notice from the general land-office at Washington. Fourth, after a failure to sell by auction, the lands remain subject to purchase by what is called private entry at any subsequent period. No foreigner can avail himself of the privileges of the Homestead or Pre-emption acts of Congress without declaring before the courts his intention to become a citizen.

There are seventeen land-surveying districts, each with a surveyor-general, and ninety-seven land-offices. During the year 1874–75 public lands were disposed of as follows: Cash sales, 754,062 acres; military-warrant locations, 137,000; homestead entries, 2,357,058; timber-culture entries, 464,870; agricultural college scrip locations, 9432; approved to States as swamp, 47,721; certified to railroads, 3,107,643; to agricultural colleges, 22,321; for common schools, 142,388; for universities, 16,451; to States for internal improvements, 8611; Indian half-breed scrip locations, 12,718; total, 7,071,271 acres.

In their patent system the United States are far in advance of any other country. (For laws, etc., see PATENT LAWS, HISTORY OF, and PATENTS, LAWS RELATING TO.) During the year 1874–75, 21,189 applications were filed with the commissioner of patents, and 14,230 patents, including reissues and designs, were issued; 12 applications were made for extensions of patents, and 81 patents were extended; 951 applications were made for the registration of trade-marks, and 993 trade-marks were registered. The total amount received during the year from fees was $732,286.

Department of Justice.—The head of this department is the attorney-general, who with several assistant attorney-generals has the supervision of United States district attorneys and marshals throughout the United States. The number of civil suits to which the United States was a party pending in the circuit and district courts of the United States on July 1, 1875, was 7211, of which 1128 arose under the customs laws, 2196 under the internal revenue laws, 88 under the postal laws, the remainder being classed as miscellaneous. During the year then closing judgment had been obtained in favor of the government for $1,894,149. The number of criminal cases pending at the same date was 7667, of which 115 were customs prosecutions, 5525 internal-revenue prosecutions, 211 post-office prosecutions, 299 prosecutions under the so-called enforcement acts, etc. The total number of convictions during the year then closing had been 2804. The number of suits to which the United States was not a party which were commenced during the year 1874–75 in the circuit and district courts of the United States was 15,316—2474 being in admiralty, and 4021 under the bankruptcy acts. The number of suits terminated during that year was 9517, of which 1771 were in admiralty, and 1708 under the bankruptcy acts. The total amount of judgments for plaintiffs was $30,550,156. The number of suits brought before the court of claims between 1855 and 1862, inclusive, was 1877, upon which the court made 293 reports; between 1863 and 1875, inclusive, 8845, on which the court rendered judgments in 503 cases for defendants, and in 2955 for claimants, in a total amount of $17,032,879, leaving as apparently pending in Dec., 1875, 5247 suits, the total amount claimed being $53,630,249. The judges of the court of claims consist of a chief-justice and five associate judges.

The Treasury Department.—The officers of the treasury, besides the secretary and two assistant secretaries, are two comptrollers, six auditors, commissioners of customs, of internal revenue, and of the currency, a treasurer, a solicitor, and a register. The coast survey, the lighthouse board, and the bureau of statistics are also embraced within the treasury department. The following is a statement of the net receipts of the treasury during the fiscal year 1874–75 from each principal source of revenue:

Customs	$157,167,722
Internal revenue	110,007,494
Sales of public lands	1,413,640
Tax on circulation, deposits, etc., of national banks	7,268,379
All others	12,112,816
Total	$288,000,051

The net disbursements of the year on each principal account were as follows:

Civil list	$17,346,930
Foreign intercourse	3,195,237
Indians	8,384,657
Pensions	29,456,216
Military establishment	41,120,646
Naval establishment	21,497,626
Miscellaneous, including public buildings and cost of collecting revenue	50,528,536
Interest on the public debt	103,093,545
Redemption of the public debt	19,405,936
Total	$294,029,329

The Public Debt.—The debt resulting from the war of the Revolution was $75,463,476. In 1812 it had been reduced to $45,209,738. At the conclusion of the war with England it stood at $127,334,934. In 1835 the debt was extinguished. With the crisis of 1837 indebtedness was again incurred, and at the beginning of the war with Mexico the debt stood at $15,550,203. In consequence of war-expenditures and payments for territory acquired it stood in 1849 at $63,061,859. Since 1860 it has been as follows:

1860	$64,842,288	1868	$2,611,687,851
1861	90,580,874	1869	2,588,452,214
1862	524,176,412	1870	2,480,672,428
1863	1,119,772,139	1871	2,353,211,332
1864	1,815,784,371	1872	2,253,251,329
1865	2,680,647,870	1873	2,234,482,993
1866	2,773,236,174	1874	2,251,690,468
1867	2,678,126,104	1875	2,232,284,532

Of the principal of the public debt at the close of the year 1875, about six hundred and seven and a half millions bore 5 per cent. interest, fourteen millions (naval pension fund) 4 per cent., while four hundred and ninety-eight millions bore no interest, consisting of legal-tender notes, fractional currency, coin certificates, and certificates of deposit. The remainder of the debt was almost wholly at 6 per cent.

Revenue.—The custom duties of the United States are collected on a wide range of imported articles. The following table shows the proportion of customs receipts to the total value of imported goods in each year from 1791 to 1871:

1791	15.07	1818	14.10	1845	23.48
1792	10.89	1819	23.28	1846	21.95
1793	13.68	1820	20.16	1847	17.57
1794	11.27	1821	20.78	1848	20.18
1795	8.01	1822	21.13	1849	19.19
1796	8.17	1823	21.61	1850	22.27
1797	10.02	1824	22.19	1851	22.67
1798	10.37	1825	20.56	1852	22.73
1799	8.31	1826	27.17	1853	21.99
1800	9.95	1827	24.80	1854	21.30
1801	9.66	1828	28.31	1855	20.28
1802	16.29	1829	30.45	1856	20.35
1803	16.21	1830	30.93	1857	17.69
1804	13.06	1831	23.47	1858	14.79
1805	10.73	1832	28.17	1859	14.64
1806	11.35	1833	19.30	1860	14.68
1807	11.49	1834	14.99	1861	12.08
1808	28.71	1835	15.33	1862	23.83
1809	12.22	1836	12.32	1863	27.27
1810	10.02	1837	7.92	1864	31.05
1811	24.93	1838	14.21	1865	36.23
1812	11.63	1839	14.27	1866	40.91
1813	60.09	1840	12.60	1867	42.22
1814	46.27	1841	11.32	1868	41.25
1815	6.41	1842	18.15	1869	41.18
1816	24.69	1843	10.88	1870	42.07
1817	26.18	1844	24.14	1871	38.09

Only three times has a system of "internal revenue" been resorted to: first, in the second term of Washington; next, during the war of 1812–15; and lastly, in the war of secession, 1861–65. In the latter period a large number of subjects were taken for taxation, including incomes, manufacturers' sales, receipts of railway, canal, gas, express, and other companies, patent medicines, matches, spirits, and tobacco. Of these taxes nearly all were repealed prior to 1873, leaving the internal revenue to be collected mainly from spirits and tobacco. The receipts from the several sources relating to distilled spirits were $52,081,991 in 1875, while the receipts from taxes on tobacco were $37,303,462. The following table shows the receipts from internal-revenue duties in the three periods. In no other years than those mentioned have the receipts from this source risen above $100,000:

First period.		Second period.		Third period.	
Year.	Revenue.	Year.	Revenue.	Year.	Revenue.
1792	$208,943	1814	$1,662,985	1863	$37,640,788
1793	337,706	1815	4,678,059	1864	109,741,134
1794	274,090	1816	5,124,708	1865	209,464,215
1795	337,755	1817	2,678,100	1866	309,226,813
1796	475,290	1818	955,270	1867	266,027,537
1797	575,491	1819	229,594	1868	191,087,589
1798	644,358	1820	106,261	1869	158,356,461
1799	779,136			1870	184,899,756
1800	809,397			1871	143,098,154
1801	1,048,043			1872	130,642,178
1802	621,899			1873	113,729,314
1803	215,180			1874	102,409,785
				1875	110,007,494

Direct taxes have been but seldom resorted to in the financial legislation of the United States. The Constitution provides that such taxes shall only be laid upon the States in proportion to population; but as the States vary widely in wealth (as at 1870 from, perhaps, $200 to $1500 per capita), it follows that if a rate of taxation be taken which really draws severely upon the resources of the old and wealthy States, it will be absolutely ruinous, or indeed impossible, in the newer and needier States. On the other hand, if the rate of taxation be limited to what the latter class of States can contribute, it will afford but a contemptible revenue from the former class of States. Consequently, direct taxes have been but seldom resorted to in the financial history of the United States, and then with but slight success. The following table shows the receipts from direct taxes in the three periods in which they have been imposed. In no other years than those given have the receipts from this source risen above $50,000:

First period		Second period.		Third period.	
Year.	Revenue.	Year.	Revenue.	Year.	Revenue.
1800	$734,224	1814	$2,219,497	1862	$1,795,332
1801	534,343	1815	2,162,673	1863	1,485,104
1802	206,565	1816	4,253,635	1864	475,649
1803	71,879	1817	1,834,187	1865	1,200,573
1804	50,198	1818	264,333	1866	1,974,734
		1819	83,651	1867	4,200,234
				1868	1,788,146
				1869	765,686
				1870	229,103
				1871	58[illegible],255

Commerce and Navigation.—The following table shows the value of the foreign trade of the United States for each

year from 1790 to 1875. The imports are stated after deduction of foreign goods re-exported:

Year.	Net imports.	Exports.	Year.	Net imports.	Exports.
	$	$		$	$
Sept. 30, 1790	22,460,844	19,666,000	Sept. 30, 1833	88,295,576	70,317,698
1791	28,687,959	18,500,000	1834	103,208,521	81,024,162
1792	26,716,902	19,000,000	1835	129,391,247	101,189,052
1793	28,970,128	21,000,000	1836	168,233,675	106,916,689
1794	28,073,767	26,500,000	1837	119,134,255	95,564,414
1795	61,266,796	39,500,000	1838	101,264,669	96,033,821
1796	55,136,161	40,764,097	1839	144,397,607	104,533,891
1797	48,379,406	29,850,206	1840	88,951,207	113,895,634
1798	35,551,700	28,527,097	1841	112,477,096	106,382,722
1799	33,546,118	33,142,522	1842	88,140,549	92,969,996
1800	52,121,891	31,840,903	June 30, 1843*	58,201,102	77,793,783
1801	64,720,790	47,473,201	1844	96,950,168	99,715,179
1802	40,558,362	36,708,189	1845	101,907,734	99,299,776
1803	51,072,594	42,205,961	1846	110,345,174	102,111,893
1804	48,768,403	41,467,477	1847	138,534,480	150,637,464
1805	67,420,981	42,587,002	1848	133,870,918	132,904,121
1806	69,126,761	41,253,727	1849	134,768,574	132,666,955
1807	78,856,442	48,699,592	1850	163,186,510	136,946,912
1808	43,992,586	9,433,546	1851	194,526,639	196,689,718
1809	38,602,469	31,405,702	1852	195,656,060	192,368,984
1810	61,008,705	42,366,675	1853	250,420,187	213,417,697
1811	37,377,210	45,294,048	1854	279,712,187	252,047,806
1812	68,534,873	30,032,109	1855	233,020,227	216,708,553
1813	19,157,155	25,008,152	1856	298,261,364	310,586,330
1814	12,819,831	6,782,272	1857	336,914,524	338,985,065
1815	106,457,924	45,974,403	1858	251,727,008	293,758,279
1816	129,961,444	64,781,896	1859	317,873,053	335,894,385
1817	79,891,931	68,313,500	1860	335,233,232	373,189,274
1818	102,323,301	73,854,437	1861	315,004,726	228,692,486
1819	67,959,317	50,976,838	1862	188,902,263	210,688,615
1820	56,141,971	51,683,640	1863	226,796,336	241,997,474
1821	41,283,246	43,671,894	1864	309,305,955	243,977,589
1822	60,955,339	49,874,079	1865	216,441,495	201,558,372
1823	50,035,645	47,155,408	1866	430,770,041	420,161,476
1824	55,211,850	50,649,500	1867	397,222,067	332,618,089
1825	63,719,432	66,944,745	1868	349,023,682	353,135,875
1826	60,434,865	53,055,710	1869	412,140,841	318,082,663
1827	56,080,932	58,921,691	1870	431,950,428	400,500,275
1828	66,914,807	50,669,669	1871	513,033,809	512,892,267
1829	57,854,049	55,700,193	1872	617,569,017	501,285,371
1830	56,484,441	59,462,029	1873	635,467,636	578,938,455
1831	83,157,598	61,277,057	1874	572,080,910	639,039,054
1832	76,980,593	63,137,470	1875	531,472,529	613,094,767

* Nine months.

The following table exhibits the distribution of the foreign trade of the United States among the principal foreign countries during the year ending June 30, 1875:

Country.	Imports.	Domestic exports.	Foreign exports.	Total trade.
Argentine Republic	$5,834,709	$1,301,294	$138,324	$7,274,327
Belgium	6,189,098	12,387,590	331,778	18,918,466
Brazil	42,033,046	7,631,865	110,494	49,778,405
China	13,480,440	1,465,934	90	14,946,464
France	63,342,631	50,133,711	620,200	114,096,542
Germany	40,893,386	52,517,913	1,244,332	94,655,631
England	144,195,531	321,014,343	4,722,108	469,931,982
Scotland	11,615,139	17,457,991	126,401	29,199,531
British Australasia	3,755,590	3,505,435	76,180	7,337,205
British America	29,763,870	34,309,761	1,795,859	65,869,490
British West Indies	4,642,891	7,587,218	171,497	14,401,606
British East Indies	15,584,099	473,049	.....	16,058,148
Hong-Kong	1,202,816	7,293,070	1,408,023	9,906,909
Italy	9,190,182	7,226,554	1,515	16,418,251
Japan	7,772,302	1,647,197	14,736	9,434,235
Mexico	11,634,983	3,895,792	1,874,991	17,405,766
Netherlands	2,353,658	7,483,010	60,064	9,895,732
Dutch East Indies	6,775,399	1,034,159	.....	7,809,558
Russia, European	1,340,458	11,323,478	.....	12,663,936
Spain	4,534,073	7,540,086	27,290	12,103,249
Cuba	66,745,527	15,586,658	6,374,351	88,706,536
Porto Rico	6,930,082	2,377,757	108,963	9,416,802
U. S. of Colombia	12,942,303	4,272,950	226,349	17,441,602
Venezuela	5,690,224	2,423,254	56,075	8,169,553

The following table exhibits the distribution of the tonnage of the United States merchant marine from 1871 to 1874 inclusive:

Year.	In foreign trade.	In coastwise trade.	In whale fisheries.	In cod fisheries.	Total.		
					Sail.	Steam.	Total.
1871	1,363,652	2,764,600	61,490	92,865	3,194,970	1,087,637	4,282,607
1872	1,359,040	2,929,552	51,608	97,547	3,326,194	1,111,553	4,437,747
1873	1,378,533	3,163,220	41,755	109,519	3,539,584	1,156,443	4,696,027
1874	1,389,815	3,293,439	39,108	78,290	3,615,042	1,185,610	4,800,652

The following table exhibits the number of merchant vessels and the aggregate amount of tonnage belonging to the ports of the several geographical sections of the United States, June 30, 1875:

Districts.	Sailing vessels.		Steam vessels.		Unrigged vessels.		Total vessels.	
	Number.	Tons.	Number.	Tons.	Number.	Tons.	Number.	Tons.
I. Atlantic coast	14,258	1,915,421	1859	613,670	5,894	607,338	22,011	3,136,430
II. Gulf coast	1,028	31,037	253	47,130	16	2,409	1,297	80,576
III. Western rivers	2	79	843	197,368	826	176,419	1,671	373,866
IV. Northern lakes	1,631	328,957	890	198,433	2,234	225,326	4,755	752,716
V. Pacific coast	828	107,781	245	63,165	89	12,696	1,162	183,642
Vessels not geographically distributed	.....	.....	.....	.....	1,680	198,116	1,680	198,116
Total United States	17,747	2,383,275	4090	1,119,766	10,739	1,222,304	32,576	4,725,346

The following is a list of the more important customs districts of the United States, with the trade of each during the fiscal year 1874–75:

Customs Districts.	Imports.	Domestic exports.	Foreign exports.
Baltimore, Md	$27,788,992	$27,515,657	$100,165
Beaufort, S. C	122,318	1,047,257	.....
Boston and Charlestown, Mass.	51,982,226	29,187,165	1,678,868
Brazos de Santiago, Tex	2,002,748	833,312	997,658
Brunswick, Ga	4,778	750,610	.....
Buffalo Creek, N. Y	2,499,004	727,366	39,579
Cape Vincent, N. Y	409,469	330,425	10,698
Champlain, N. Y	1,944,504	1,047,612	85,499
Charleston, S. C	680,343	19,635,966	.....
Chicago, Ill	561,549	3,427,759	1,596
Corpus Christi, Tex	322,803	205,557	243,966
Cuyahoga, O	348,025	747,360	6,032
Detroit, Mich	1,329,326	2,272,736	79,030
Galveston, Tex	1,218,034	15,876,632	349,275
Genesee, N. Y	324,653	791,439	1,290
Huron, Mich	891,365	5,030,754	303,472
Key West, Fla	751,412	591,856	17,270
Miami, O	164,525	1,729,187	.....
Milwaukee, Wis	56,616	1,390,179	.....
Minnesota, Minn	459,954	838,697	3,521
Mobile, Ala	1,087,745	10,131,260	928
New Haven, Conn	1,174,921	2,925,631	1,080
New Orleans, La	12,356,487	71,461,272	152,710
New York, N. Y	368,637,580	329,201,913	15,502,056
Niagara, N. Y	2,425,783	503,838	44,068
Norfolk and Portsmouth, Va.	18,929	5,243,986	.....
Oregon, Or	1,591	972,981	.....
Oswegatchie, N. Y	1,410,221	758,761	58,000
Oswego, N. Y	5,775,127	1,438,677	43,519
Passamaquoddy, Me	478,649	1,488,598	3,586
Pensacola, Fla	15,718	1,330,536	.....
Philadelphia, Pa	24,236,387	28,588,019	23,635
Portland, Me	1,782,987	3,119,923	343,638
Richmond, Va	433,905	2,944,642	.....
San Francisco, Cal	29,697,483	28,949,886	2,288,457
Savannah, Ga	755,901	29,666,666	.....
Vermont, Va	6,911,691	2,496,830	.....
Willamette, Or	454,764	1,672,811	5,571
Wilmington, N. C	151,925	3,015,069	.....

The remaining customs districts are:

Alaska, Al.,
Albemarle, N. C.,
Alexandria, Va.,
Annapolis, Md.,
Aroostook, Me.,
Bangor, Me.,
Barnstable, Mass.,
Bath, Me.,
Beaufort, N. C.,
Belfast, Me.,
Bristol and Warren, R. I.,
Castine, Me.,
Delaware, Del.,
Duluth, Minn.,
Dunkirk, N. Y.,
Erie, Pa.,
Fairfield, Conn.,
Fall River, Mass.,
Fernandina, Fla.,
Frenchman's Bay, Me.,
Georgetown, D. C.,
Georgetown, S. C.,
Gloucester, Mass.,
Machias, Me.,
Marblehead, Mass.,
Michigan, Mich.,
Middletown, Conn.,
Montana and Idaho,
Newark, N. J.,
New Bedford, Mass.,
Newburyport, Mass.,
New London, Conn.,
Newport, R. I.,
Pamlico, N. C.,
Paso del Norte, Tex.,
Pearl River, Miss.,
Perth Amboy, N. J.,
Petersburg, Va.,
Plymouth, Mass.,
Portsmouth, N. H.,
Providence, R. I.,
Puget Sound, Wash.,
Salem and Beverly, Mass.,
Saluria, Tex.,
San Diego, Cal.,
Sandusky, O.,
St. Augustine, Fla.,
St. John's, Fla.,
St. Mark's, Fla.,
St. Mary's, Ga.,
Stonington, Conn.,
Superior, Mich.,
Teche, La.,
Waldoborough, Me.,
Wiscasset, Me.,
York, Me.

The Post-Office Department.—By the Constitution, Congress has power "to establish post-offices and post-roads." Under this provision Congress has forbidden all carrying of mails except by the authority of the general government. The officers of the post-office department are the postmaster-general and three assistant postmaster-generals. The sixth auditor of the treasury is auditor for the post-office department. The postal service of the United States in 1875 employed 51,177 persons, 384 being in the post-office department at Washington, 35,547 postmasters, 6280 contractors, 4467 clerks in post-offices, 2195 letter-carriers, besides route-agents, etc. The ordinary receipts of the department during the fiscal year 1875 were $26,671,218, and the expenditures of all kinds, $33,611,309. The num-

ber of ordinary postage stamps issued during the year was 682,342,470, valued at $18,271,479, besides which there were issued 2,209,215 newspaper and periodical stamps, 126,916,150 stamped envelopes, 22,850,250 newspaper wrappers, 107,616,000 postal cards. The value of postage-stamps, stamped envelopes, etc., issued for the use of the government officers was $1,189,192. The number of authorized mail-routes at the close of the fiscal year 1875 was 8283, aggregating in length 277,873 miles, and in annual transportation 133,822,216 miles. The railroad routes aggregated 70,083 miles, with an annual transportation of 75,154,910 miles, the cost being about 12.26 cents per mile; the annual transportation, 3,958,852 miles, the cost about 17.28 cents per mile. Other routes aggregated 192,002 miles, with an annual transportation of 54,708,454 miles, at an annual cost of 9.97 cents per mile. The number of post-offices in operation June 30, 1875, was 35,517, of which 3401 were "money-order" offices. The total appointments of postmasters during the year had been 9871, of which 6017 had been on resignation, 971 on removal, 187 on changes of names and sites, 380 on death, and 2313 on establishment of new offices. The number of letters exchanged with foreign countries, exclusive of Canada, during the year 1874–75, was 25,135,581. The number of money-orders issued was 5,702,573, of the aggregate value of $79,395,826. A free delivery of mail-matter is established in 87 cities.

War Department.—The head of the war department is the secretary of war. The relations of the secretary to the general of the army are ill-defined and the subject of much controversy. In 1869 the general of the army announced the heads of the several corps of the army and bureaus of the department as of his staff, but this order was rescinded. There are eight corps, the chiefs of which are the following officers: the adjutant-general, the quartermaster-general, the commissary-general, the paymaster-general, the surgeon-general, the chief of engineers, the chief of ordnance, the chief signal-officer. By the Constitution, Congress has power to provide for calling forth the militia of the several States to execute the laws of the Union, suppress insurrections, and repel invasions, and also for the organizing, arming, and disciplining the militia, and for governing such part of them as may be employed in the service of the States; to the States respectively being reserved the appointment of officers and the authority of training the militia according to the discipline prescribed by Congress. The President is commander-in-chief of the militia when called into the actual service of the United States.

The aggregate strength of the line of the army is 1510 officers and 24,031 enlisted men, made up as follows:

	Officers.	Men.
5 regiments of artillery	270	2504
10 " cavalry	422	7206
25 " infantry	848	11,000
Available recruits, hospital stewards, ordnance sergeants, etc.	.....	3321
	1540	24,301

Including the staff, the cadets of the Military Academy, Indian scouts, etc., the aggregate force of the army is 27,488. The higher officers consist of a general, a lieutenant-general, 3 major-generals, 6 brigadier-generals, and 7 chiefs of departments with the rank of brigadier-general. The army of the United States is mainly employed in keeping up the fortifications on the coast and lakes, in watching the movements of hostile or suspected Indians, and in guarding the Mexican frontier. One hundred and two signal-stations are maintained for recording meteoric changes and giving warning for the benefit of commerce and agriculture of the approach of storms. The protection and improvement of rivers and harbors are directed by the engineer department of the army under authority of Congress.

The arsenals of the United States are located at Kennebec, Watertown, Springfield, Mass., Allegheny, Watervliet, Fort Monroe, Augusta, Ga., Washington, Pikesville, Frankford, Detroit, Columbus, Indianapolis, St. Louis, Rock Island, and Benicia. The Military Academy is situated at West Point. The number of cadets in 1875 was 312. On graduation the cadets are appointed to second lieutenancies in the army.

The organized militia of the States aggregates 84,721 rank and file—the unorganized militia, 3,701,977. An annual appropriation of $200,000 for arming and equipping the militia has been made since 1808. This is manifestly inadequate to the original object of the appropriation—viz. to provide arms and military equipments for the whole body of the militia of the United States.

The Navy Department.—The navy, originally a branch of the war department, was made a distinct executive department in 1798. The head of it is the secretary of the navy. The naval force of the United States comprises 147 vessels, carrying in all 1195 guns, and of an aggregate measurement of 152,492 tons. Of these vessels, 26, carrying nominally 266 guns, are sailing vessels without steam power. The steam vessels of the navy, as distinguished from iron-clads and torpedo-ships, number 95, of which 25 are tugs employed as towing, ferry, or torpedo boats. The iron-clad fleet consists of 26 vessels. Of these, 21 are of the monitor type, 2 are iron torpedo-ships, while the remaining 3 are described as wholly inefficient. Of available ships in the navy, the number is given as 80, including 16 iron-clads and 2 torpedo boats. The total force of the navy is limited by law to 8500 men and boys. The navy-yards of the United States are located at Kittery, Boston, Brooklyn, League Island (Pa.), Washington, Norfolk, Pensacola, Mare Island (Cal.), and New London. The Naval Academy is located at Annapolis.

Railroads.—The following table exhibits the mileage of railways in each group of States, with ten-year intervals:

Group of States.	1842.	1852.	1862.	1872.
New England	811	2,973	3,751	5,653
Middle	2006	4,328	7,263	13,199
Western, including the Territories	211	2,126	11,657	32,503
Southern	965	3,181	9,122	14,112
Pacific	.....	.....	27	2,137
Total	3536	12,908	32,120	67,104

The aggregate capital accounts of 57,323 miles of road are thus stated in Poor's *Railway Manual:* Capital stock, $1,647,844,113; funded and other debt, $1,511,578,944; total, $3,159,423,057. Cost of railways per mile in New England States, $50,118; in Middle States, $79,127; in Western States, $50,550; in Southern States, $36,575; in Pacific States, $98,300; aggregate annual receipts of all roads, $473,241,055; operating expenses, $307,486,682; net earnings, $166,754,373; dividends paid, $64,418,151.

Agriculture.—The statistics of agriculture at the census of 1870 showed the number of farms in the Middle States to be 2,659,985, against 2,044,077 in 1860, and 1,419,073 in 1850. Of the farms of 1870, 6875 were under 3 acres, 172,021 were of between 3 and 10 acres, 294,607 of between 10 and 20 acres, 847,614 of between 20 and 50 acres; 754,221 of between 50 and 100 acres; 565,051 of between 100 and 500 acres; 19,593 of 500 acres and over. The average size of farms in 1870 was 153 acres; in 1860 it had been 199; in 1850, 203. The total number of acres of improved lands in 1870 was 188,291,099. The present cash value of farms was returned at $9,262,803,861; the value of farming implements and machinery at $336,878,429; the value of live-stock at $1,525,276,457. The total amount paid in wages to farm-laborers during the year had been $310,286,285; the aggregate value of the product for the year, including betterments and additions to stock, was estimated at $2,447,538,658. The number of horses upon farms was given at 7,115,370; of mules and asses, 1,125,415; of milch cows, 8,935,332; of working oxen, 1,319,271; of other cattle, 13,556,005; of sheep, 28,477,951; of swine, 25,134,569. The amounts raised of the principal crops were, in bushels, as follows: wheat, spring, 112,549,733; winter, 175,195,893; rye, 16,918,795; Indian corn, 760,944,549; oats, 282,107,157; barley, 29,761,305; buckwheat, 9,821,721; potatoes, Irish, 143,337,473; sweet, 21,709,824. Of cotton there was raised 3,011,996 bales; of tobacco, 262,735,341 pounds; of rice, 73,635,021 pounds. The wool-crop of the same year is estimated at about 160,000,000 pounds, which was inadequately represented in the census.

Of the tobacco produced in 1870, 20 millions of pounds were raised in the North Atlantic region, 61 millions in the South Atlantic region, and 177 millions in the Mississippi Valley, of which 148 millions were raised in the Ohio Valley alone. Of the corn, 51 millions of bushels were raised in the North Atlantic and 56 millions in the South Atlantic region, 36 millions in the northern lake region, 32 millions in the region drained by rivers flowing into the Gulf of Mexico E. of the Mississippi, 18 millions in the region drained by rivers flowing into the Gulf W. of the Mississippi, and 569 millions in the Mississippi Valley, of which 232 millions were raised in the basin of the Ohio, 77 in the basin of the Mississippi, and 193 millions in the aggregate in the basins of smaller streams emptying into the Mississippi above St. Louis. Of the wheat, 29 millions of bushels were raised in the North Atlantic and 17 millions in the South Atlantic region, 36 millions in the northern lake region, 57 millions in the basin of the Ohio, 15 millions in the basin of the Missouri, 95 millions in the basin of the Mississippi above the junction with the Missouri, 20 millions on the Pacific coast. In 1870, 575,000 bales of cotton were produced in the South Atlantic region, 861,000 in the region drained by streams flowing into the Gulf of Mexico to the E. of the Mississippi, 1,241,000 in

the Mississippi Valley, and 331,000 in the region drained by streams flowing into the Gulf of Mexico below the Mississippi and the Rio Grande. Of the 1,241,000 bales produced in the Mississippi Valley, 110,000 were produced in the basin of the Ohio, 340,000 in the basin of the Red, and 112,000 in the basin of the Arkansas, 679,000 in the aggregate being produced in the basins of the smaller rivers.

The quantities, number of acres, and aggregate value of the principal crops of the farm in 1874 are estimated by the department of agriculture as follows:

Crops.	Number of bushels.	Number of acres.	Value, dollars.
Indian corn, bushels....	850,148,500	41,036,918	550,043,080
Wheat, " ...	309,102,700	24,957,027	291,107,895
Rye, " ...	14,990,900	1,116,716	12,870,411
Oats, " ...	240,369,000	10,997,412	125,047,530
Barley, " ...	32,552,500	1,580,626	29,983,769
Buckwheat, " ...	8,016,500	472,590	6,477,885
Potatoes, "	105 981,000	1,310,041	71,823,330
	1,561,161,200	81,361,330	1,087,353,900
Tobacco, pounds.....	178,355,000	281,662	23,362,765
Hay, tons.....	24,133,900	21,760,772	331,420,738
Cotton, bales.....	3,800,000	.....	256,215,000

Manufactures and Mining.—The statistics of manufactures in the United States in 1870 showed the number of establishments to be 252,148, employing 2,053,996 hands, of whom 1,615,598 were males above 16, 323,770 were females above 15, and 114,628 were children and youth. The total amount paid in wages during the year was $775,584,343. The number of steam-engines employed was 40,191, of an aggregate horse-power of 1,215,711. The number of water-wheels 51,018, of an aggregate horse-power of 1,130,431. The value of materials consumed was $2,488,327,242, the value of the products, $4,232,325,442. The following table exhibits the distribution of the manufacturing industry among the several States:

State.	Establishments.	Hands employed.	Wages.	Materials.	Products.
Alabama	2,188	8,248	$2,227,968	$7,592,837	$13,040,644
Arkansas.....	1,079	3,206	673,963	2,536,998	4,629,234
California.....	3,984	25,392	13,136,722	35,351,193	66,594,556
Colorado	256	876	528,241	1,593,280	2,852,820
Connecticut.....	5,128	89,523	38,987,187	86,419,579	161,065,474
Delaware.....	800	9,710	3,602,195	10,206,397	16,791,982
Florida.....	659	2,719	989,592	2,330,873	4,685,403
Georgia.....	3,836	17,871	4,844,508	18,583,731	31,196,115
Illinois.....	12,597	82,979	31,100,244	127,600,077	205,620,672
Indiana.....	11,847	58,852	18,366,780	63,135,492	108,617,278
Iowa.....	6,566	25,032	6,893,292	27,682,096	46,534,322
Kansas.....	1,477	6,844	2,377,511	6,112,163	11,775,833
Kentucky	5,390	30,636	9,444,524	29,497,535	54,625,809
Louisiana.....	2,557	30,071	4,593,470	12,412,023	24,161,905
Maine.....	5,550	49,180	14,282,205	49,379,757	79,497,521
Maryland.....	5,812	44,860	12,682,817	46,897,032	76,593,613
Massachusetts.....	13,212	279,380	118,051,886	334,413,982	553,912,568
Michigan.....	9,455	63,624	21,235,355	68,142,515	118,394,676
Minnesota.....	2,270	11,290	4,053,837	13,842,902	23,110,900
Mississippi.....	1,731	5,941	1,547,423	4,364,206	8,154,758
Missouri.....	11,871	65,354	31,055,145	115,513,269	206,213,429
Nebraska.....	670	2,665	1,429,913	2,902,074	5,738,512
Nevada	330	2,859	2,498,473	10,315,984	15,870,539
New Hampshire....	3,342	40,783	13,823,091	44,577,967	71,038,249
New Jersey.....	6,636	75,552	32,618,409	103,415,215	169,237,732
New York.....	36,206	351,800	142,466,758	452,065,152	785,194,651
North Carolina.....	3,612	13,622	2,195,711	12,824,693	19,021,327
Ohio	22,773	137,202	49,056,188	157,131,697	269,713,610
Oregon.....	969	2,884	1,120,173	3,419,756	6,877,387
Pennsylvania.....	37,200	319,487	127,976,594	421,197,673	711,894,344
Rhode Island.....	1,850	49,417	19,354,256	73,154,109	111,418,354
South Carolina.....	1,584	8,141	1,543,715	5,855,736	9,858,981
Tennessee.....	5,317	19,412	5,390,630	19,657,027	34,362,636
Texas.....	2,399	7,927	1,787,815	6,273,193	11,517,302
Vermont.....	3,270	18,686	6,264,581	17,007,769	32,184,606
Virginia	5,933	26,974	5,343,099	23,832,384	38,364,322
West Virginia.....	2,414	11,672	4,322,164	14,593,701	21,102,201
Wisconsin.....	7,013	43,910	13,575,642	45,851,266	77,214,326

The statistics of mining for the same period showed 7971 establishments, employing 154,328 hands, of whom 66,178 were men above ground, 77,221 men under ground, 6916 boys above ground, 4013 boys under ground. The amount paid in wages during the year was $74,464,044.

Education.—The interests of education are left to the several States. The general government has, however, encouraged the establishment of common schools in the new States by grants of land, and in a single instance has by the same means provided for higher institutions through the endowment of a college in each State for instruction in agriculture and the mechanic arts. The educational institutions of each State will be found described under the appropriate title. The following summaries may be given

Class of Schools.	Schools.	Teachers.	Pupils.
Normal schools.....	124	966	24,405
Business colleges	126	577	25,892
Academies and preparatory schools.	1,122	6,163	109,693
Scientific and agricultural colleges..	72	609	7,244
Colleges for women..... ..	209	2,285	23,445
Colleges.....	343	3,783	56,692
Theological schools.....	113	579	4,350
Medical schools.....	99	1,121	9,095
Law schools.....	38	181	2,585

for the United States: Of a school population of 13,735,672, 8,030,772 were in 1874 enrolled in public schools; the number of teachers was 239,873: the public-school income, $81,277,686, mainly derived from taxation, the permanent school fund being only $75,251,008. The preceding table of higher institutions is given by the U. S. commissioner of education.

The following are among the largest and best known of the higher institutions of the United States: Harvard College, Cambridge, Mass.; Yale College, New Haven, Conn.; Columbia College, New York City; Michigan University, Ann Arbor; University of Virginia, Charlottesville, Va.; College of New Jersey, Princeton, N. J.; Dartmouth College, Hanover, N. H.; Cornell University, Ithaca, N. Y.; University of Pennsylvania, Philadelphia, Pa.; University of the City of New York; La Fayette College, Easton, Pa.; Brown University, Providence, R. I.; Bowdoin College, Brunswick, Me.; University of Missouri, Columbia, Mo.; University of Wisconsin, Madison, Wis.; University of Kentucky, Lexington, Ky.; University of Iowa, Iowa City; Amherst College, Amherst, Mass.; Williams College, Williamstown, Mass.; University of Boston; Wesleyan University, Middletown, Conn.; Ohio Wesleyan University, Delaware, O.; University of Mississippi, Oxford; University of California, Oakland; Industrial University of Illinois, Champaign; Massachusetts Institute of Technology, Boston, Mass.; Rutgers College, Brunswick, N. J.; Stevens Institute, Hoboken, N. J.; Rochester University, Rochester, N. Y.; Johns Hopkins University, Baltimore, Md. (See also article COLLEGE.)

Ladies' Schools.—Vassar College, Poughkeepsie, N. Y.; Mount Holyoke Seminary, Mount Holyoke, Mass.; Wellesley College, Wellesley, Mass.; Smith College, Northampton, Mass.

Agricultural Schools.—Massachusetts Agricultural College, Amherst; Michigan State Agricultural College, Lansing; Iowa State Agricultural College, Ia.

The statistics of illiteracy show that at 1870 there were 4,528,084 persons ten years of age and over in the United States who could not read, and 5,658,144 of the same age who could not write. This latter aggregate was composed as follows:

Native.....	4,880,271
Foreign.....	777,873
	5,658,144

Excluding Chinese and civilized Indians, this aggregate may be further distributed as follows:

	10 to 15 years.		15 to 21 years.		21 years and over.	
	Male.	Female.	Male.	Female.	Male.	Female
White...	294,422	245,690	207,578	209,533	748,970	1,145,718
Colored.	243,083	227,510	237,021	273,500	862,243	946,332
	537,505	473,200	444,599	483,033	1,611,213	2,092,050

Religion.—The Constitution provides that "Congress shall make no law respecting an establishment of religion or prohibiting the free exercise thereof." No inquiry concerning religious belief has ever been incorporated in the census. The relative strength of the several communions is left to be deduced from the statistics of churches and of church accommodation. At 1870 the number of separate organizations or parishes, church edifices, and the aggregate sittings provided by each religious denomination were as follows:

Denominations.	Organizations.	Church edifices.	Sittings.	Value of church property.
Baptists.....	15,829	13,962	4,360,135	$41,608,198
Christians.....	3,578	2,822	865,602	6,425,137
Congregationalists.....	2,887	2,715	1,117,212	25,069,698
Episcopalians	2,835	2,601	991,051	36,514,549
Evangelical Association.....	815	641	193,796	2,301,650
Friends	692	662	224,664	3,939,560
Jews	189	152	73,265	5,155,234
Lutherans.....	3,032	2,776	977,332	14,917,747
Methodists	25,278	21,337	6,528,209	69,854,121
Moravians.....	72	67	25,700	709,100
Mormons.....	189	171	87,808	656,750
New Jerusalem.....	90	61	18,755	809,700
Presbyterians.....	7,821	7,071	2,698,244	53,205,256
Reformed Church in America (late Dutch Reformed).....	471	468	227,228	10,359,255
Reformed Church in the U. S. (late German Reformed).....	1,256	1,145	431,700	5,775,215
Roman Catholics.....	4,127	3,806	1,990,514	60,985,556
Second Adventists.....	225	140	31,555	306,240
Shakers.....	18	18	8,850	86,900
Spiritualists.....	95	22	6,970	100,150
Unitarians.....	331	310	155,471	6,282,675
United Brethren in Christ.....	1,415	937	265,025	1,819,810
Universalists.....	719	602	210,884	6,692,325
All others.....	462	596	172,062	1,798,745
Total.....	72,459	63,082	21,665,062	$354,483,581

The value of church property, as stated above, is probably far below the fact. The agencies of the census are ill adapted to the prosecution of such an inquiry, and it is not

easy at the best to fix the principles upon which church property, having no secular uses, bringing no income, and not subject to sale, should be appraised.

The following table shows the four denominations having the largest church accommodation in each of the States:

States.	First.	Second.	Third.	Fourth.
Alabama	Methodist.	Baptist.	Presbyterian.	Episcopal.
Arkansas	Baptist	Methodist.	Presbyterian.	Christian.
California	Ro. Catholic.	Methodist.	Presbyterian.	Baptist.
Connecticut	Congrega'l.	Methodist.	Episcopal.	Baptist.
Delaware	Methodist.	Presbyterian.	Episcopal.	Ro. Catholic.
Florida	Methodist.	Baptist.	Presbyterian.	Episcopal.
Georgia	Baptist.	Methodist.	Presbyterian.	Christian.
Illinois	Methodist.	Presbyterian.	Baptist.	Ro. Catholic.
Indiana	Methodist.	Baptist.	Presbyterian	Christian.
Iowa	Methodist.	Presbyterian.	Ro. Catholic.	Baptist.
Kansas	Methodist.	Presbyterian.	Baptist.	Ro. Catholic.
Kentucky	Baptist.	Methodist.	Christian.	Presbyterian.
Louisiana	Ro. Catholic.	Baptist.	Methodist.	Episcopal.
Maine	Baptist.	Congrega'l.	Methodist.	Univer alist.
Maryland	Methodist.	Ro. Catholic.	Episcopal.	Lutheran.
Massachusetts	Congrega'l.	Baptist.	Ro. Catholic.	Methodist.
Michigan	Methodist.	Baptist.	Ro. Catholic.	Presbyterian.
Minnesota	Ro. Catholic.	Methodist.	Lutheran.	Presbyterian.
Mississippi	Methodist.	Baptist.	Presbyterian.	Episcopal.
Missouri	Methodist.	Baptist.	Presbyterian.	Ro. Catholic.
Nebraska	Methodist.	Baptist.	Episcopal.	Presbyterian.
Nevada	Ro. Catholic.	Methodist.	Episcopal.	Presbyterian.
New Hampshire	Congrega'l.	Baptist.	Methodist.	Ro. Catholic.
New Jersey	Methodist.	Congrega'l	Baptist.	Dutch Refor.
New York	Methodist.	Presbyterian.	Baptist.	Ro. Catholic.
North Carolina	Methodist.	Baptist	Presbyterian.	Lutheran.
Ohio	Methodist.	Presbyterian.	Baptist.	Christian.
Oregon	Methodist.	Presbyterian.	Baptist.	Christian.
Pennsylvania	Methodist.	Presbyterian.	Lutheran.	Baptist.
Rhode Island	Baptist.	Ro. Catholic.	Congrega'l.	Episcopal.
South Carolina	Baptist	Methodist.	Presbyterian.	Episcopal.
Tennessee	Methodist.	Baptist.	Presbyterian.	Christian.
Texas	Methodist.	Baptist.	Presbyterian.	Ro. Catholic.
Vermont	Congrega'l.	Methodist.	Baptist	Ro. Catholic.
Virginia	Methodist.	Baptist.	Presbyterian.	Episcopal.
West Virginia	Methodist.	Baptist.	Presbyterian.	Ro. Catholic.
Wisconsin	Ro. Catholic.	Methodist.	Congrega'l.	Baptist.

Newspapers and Periodicals.—The census of 1870 showed the aggregate number of newspapers and periodicals in the United States to be 5871, having an aggregate circulation of 20,842,475, and issuing 1,508,518,250 copies annually. The following table exhibits the distribution of this aggregate by classes and by periods of issue:

Journals.	Number.	Circulation.	Copies annually issued.
Classes.			
Advertising	79	293,450	4,689,800
Agricultural and horticultural	93	770,752	21,511,904
Benevolent and secret societies	81	237,080	6,518,550
Commercial and financial	142	690,200	31,120,600
Illustrated, literary, and miscellaneous	503	4,422,235	160,061,408
Devoted to nationality	20	45,450	4,671,000
Political	4,333	8,781,220	1,134,789,082
Religious	407	4,764,358	125,959,496
Sporting	6	73,500	3,222,000
Technical and professional	207	744,530	15,974,400
Periods of Issue.			
Daily	574	2,601,547	806,479,570
Three times a week	107	155,105	24,195,380
Semi-weekly	115	247,197	25,708,488
Weekly	4,295	10,594,643	550,921,436
Semi-monthly	96	1,349,820	32,395,680
Monthly	622	5,650,843	67,810,116
Bi-monthly	13	31,650	189,900
Quarterly	49	211,670	846,680

Literary and Scientific Institutions.—Of these, the United States possess but two of importance which derive a national character from acts of Congress, the Smithsonian Institution and the National Academy of Sciences. An account of the history and work of the former appears separately. (See SMITHSONIAN INSTITUTION.) The National Academy of Sciences was established by act of Congress during the dark days of the civil war, and was intended to include the most eminent men in the various departments of natural and physical science, who should, at need, serve as a body of unpaid advisers or experts to aid the government. The first president was Prof. A. D. Bache, after the death of whom Dr. Joseph Henry was appointed. It was at first limited to 50 members, but an amendment to the constitution of the Academy permits the election of five new members annually. The annual stated meeting of the Academy is, in accordance with the charter, held at Washington in April, besides which a second meeting is held in November at some place chosen annually for the purpose. This Academy is not, as might be inferred, confined to the study of technical questions, but receives papers on all subjects of theoretical science; and indeed, if its development in this direction its original character has been to a great extent lost sight of. Unfortunately, it is without any government endowment or other funds, save a bequest from its late president, so that it has not the pecuniary means of publication, and its usefulness is thus greatly curtailed.

Among other literary and scientific societies which, though having no support or recognition from the government, require to be mentioned in any sketch of the institutions of the United States, are—the American Association for the Advancement of Science, originally the American Association of Geologists and Naturalists, but reorganized in 1848 on a wider basis; the American Philosophical Society, founded by Franklin; the American Social Science Association; the Boston Society of Natural History; the Peabody Academy of Salem, Mass.; the American Academy of Arts and Sciences of Boston; the Franklin Institute of Philadelphia; the St. Louis Academy of Sciences; the Connecticut Academy of Arts and Sciences; the New York Academy of Sciences, lately the Lyceum of Natural History; the American Geographical Society; the Philadelphia Academy of Natural Sciences; the American Antiquarian Society of Worcester, Mass.; the New England Historical and Genealogical Society; the Massachusetts Historical Society; the Institute of Civil Engineers; the Institute of Mining Engineers. Most of the above societies publish occasionally their proceedings and papers. Some publish actively. The American Association meets annually. The following have been the presidents for the last six years: Prof. T. Sterry Hunt, 1871; Prof. Asa Gray, 1872; Prof. J. S. Lovering, 1873; Prof. J. L. Le Conte, 1874; Prof. J. E. Hilgard, 1875; Prof. W. B. Rogers, 1876.

History.—The details of colonial history will be found under the titles of the several States of the Union. The political history of the United States begins in 1774. The mother-country had provided no common government in which the colonies should take part, and the relations into which these occasionally entered under the stress of Dutch, French, and Indian wars were voluntary and transient. Planted along the Atlantic coast, each having its own harbors and river systems, the colonies had felt no drawings toward general union. To this statement of geographical independence an exception may seem to have existed in the case of Delaware and Pennsylvania; but as these colonies remained, even after the legislative secession of 1703, under a common governor, the antagonism of interests which might otherwise have arisen out of conflicting claims to navigation was wholly suppressed. With this possible exception no colony depended on the consent of any other for the exercise of any vital privilege. One or more of the colonies had taken advantage of superior harbors to tax the products of their neighbors going out through their ports: Connecticut and Massachusetts quarrelled for a while (1647–50) over the dues levied by the former at Saybrook on goods destined for Springfield in the latter colony; Virginia and Maryland long maintained a dispute concerning their respective rights to the navigation of Chesapeake Bay and the Potomac River; while even the adoption of the Constitution has not wholly prevented controversy between New York, New Jersey, and Connecticut in the matter of the control of New York Bay, as in the case of the claim of certain patentees of New York to the monopoly of steam navigation within those waters. But none of these issues were vital, while the exigencies of a common defence against the savages were held to be sufficiently met by an occasional common armament and joint expedition of two, three, or four contiguous colonies. One exception, indeed, is found. In 1643 the four colonies of Massachusetts Bay, Plymouth, Connecticut, and New Haven, which afterward formed two of the thirteen original States, united in a confederation, known as the United Colonies of New England, for defence against the savage tribes. In this confederation the four colonies, though very unequal in size and population, were to have equal power, but all war-expenses, which were to be a common charge, were to be apportioned according to the number of male inhabitants in each colony. Runaway servants and fugitives from justice were to be mutually delivered up, and the judgments of courts of law and probates of wills in each colony were to receive full faith and credit in every other. This confederation, thus limited in extent, had but a feeble existence, and expired after about half a century with the exigency in which it had its rise.

No other attempt at confederation was made until 1754, though in the interval colonies were temporarily or permanently consolidated by the Crown of England, sometimes with and sometimes without their consent. In the year named a convention was held at Albany in New York in view of the approaching hostilities with the French and Indians, and on the instance of the British board of trade. Commissioners were present from New York, Pennsylvania, Maryland, and the four New England colonies. Delegates were also present from the famous "Six Nations" of New York. Under the leadership of Benjamin Franklin, a plan of permanent union for the colonies was adopted, to be dependent for effect on the sanction of the British Parliament. The scheme comprised a president-general, named and supported by the Crown, and a council of forty-eight members, to be chosen every three years by the legislatures of the colonies. Each colony was to have

representation in proportion to its contributions to the general cause, no colony, however, to have less than two or more than seven members of the council. The council was to undertake the common defence, apportioning quotas of men and money therefor, controlling the forces raised, and enacting ordinances of general interest. The president-general was to have a negative on all acts of the council and the appointment of all military officers. Civil officers were to be appointed by the council, with the consent of the president. This promising scheme was, however, rejected by the board of trade as conferring dangerous powers on the colonies, and by the colonies themselves as giving too much authority to the Crown in matters which they had jealously reserved to themselves; so that the colonies had to sustain the ensuing war, which broke the power of France upon the continent, with no other concert than that derived from the voluntary concurrence of the several legislatures or executives.

The forces which thus for more than a century withstood union were not found alone in the indifference growing out of the natural independence which has been noted. There was also a decided repugnancy, if not between individual colonies, between groups of colonies, arising out of differences in race, religion, and political institutions. New England was almost purely English; the populations of the middle colonies were most curiously and variously composed of a great number of nationalities. New England was chiefly Puritan; in the middle colonies the Quakers and Lutherans dominated; at the South, the Church of England had formally established its offices. But the repugnancy caused by differences of race and religion was probably less than that due to differences in the political franchises and institutions of the several sections. The charter governments of New England (excepting New Hampshire) were strongly contrasted with the proprietary governments of Maryland, Pennsylvania, and Delaware and the provincial governments of the South. The political habits and aptitudes which resulted were widely diverse, especially in respect to the forms in which political power was exercised and to the modes of taxation in use. Evidence abounds that the total effect of all these causes was to produce a strong disinclination to confederation among the colonies, and especially that the Episcopal and aristocratic prejudices against the levelling spirit of New England, and the Quaker opposition to war, to which the New England colonies were from the first exceedingly prone, constituted an obstacle to union which no cause but the single one which actually brought the colonies together could for more than one generation have overcome.

In 1765, the general opposition to Grenville's Stamp act led to a congress of delegates from nine colonies, appointed by various authority, which met at New York and formed a union for the purpose of resisting taxation by Parliament. This congress, however, assumed no powers of government; its proceedings were limited to deliberation and remonstrance, and the union expired with the repeal of the obnoxious law in 1766. In 1774, however, the opposition to Charles Townshend's measures for raising a British revenue within the colonies, inflamed by the stirring events at Boston—the "massacre" of 1770 and the "tea-party" of 1773—resulted in a congress of the colonies, which met at Philadelphia on the 5th of September. Twelve colonies were soon represented, Georgia being "the missing link," though, it is to be noted, a link at the end of the chain. This congress was in reality an assemblage of committees. The colonies voted as entire bodies, casting single votes, the question of proportional representation being waived for the sake of harmony. The congress undertook to exercise no coercive powers. Separation from England was not then determined on, and was not even generally in contemplation. The important measures of the congress of 1774 were a declaration which based the rights of the colonies on the laws of nature, the principles of the British constitution, and the several charters or compacts between the colonies and the Crown, and denied expressly and completely the right of Parliament to tax the colonies, though recognizing its power of commercial regulation; and, secondly, non-importation and non-exportation agreements, the article of tea being particularly named in the former, while rice, the product of Carolina, was specially excepted from the prohibitions of the latter. The congress adjourned in October, recommending that another congress be held in 1775, should the grievances of the colonies not meantime have been redressed. During the winter which followed, rapid progress was made toward revolution in Massachusetts. The governor, on the part of the Crown, dissolved the general assembly, and called new councillors into office by mandamus, under authority of an act of Parliament revoking so much of the charter of the colony as authorized the assembly to elect the council. The governor's councillors were compelled by a show of popular violence to resign, while a new assembly, elected by the people in defiance of an executive proclamation, met at Salem and resolved themselves into a provincial congress, whose recommendations had all the effect of law throughout the colony. On Apr. 19, 1775, occurred the battle of Lexington, an unforeseen collision between the royal troops marching to seize military stores at Concord and the militia and citizens.

The second Continental Congress met at Philadelphia on May 10, following. Most of the delegations had been chosen before the battle of Lexington, when armed resistance to the obnoxious acts of Parliament was not in contemplation. "They were," says Mr. Bancroft, "committees from twelve colonies, deputed to consult on measures of conciliation, with no means of resistance to oppression beyond a voluntary agreement for the suspension of importations from Great Britain. They formed no confederacy; they were not an executive government; they were not even a legislative body." Such, indeed, they were in theory, but the course of events threw upon this body of committees the duties of a revolutionary congress. Blood had been shed; the British troops were besieged in Boston by the militia of New England; Congress, by the necessity of the situation, became the organ of the common resistance. A Continental army was raised; a commander-in-chief, George Washington of Virginia, was chosen, in whose commission the phrase "United Colonies" was first used; a Continental currency was created; a general treasury and post-office established; while the whole management of Indian affairs was assumed by Congress. Here we see emerge most of the parts of government. What, meanwhile, had become of the governments of the colonies? Much stress has been placed by some writers on the fact that the revolutionary governments of the colonies were generally not organized until after the Continental Congress had assumed powers of legislation, and had recommended the establishment of new governments in the several colonies. But no inference can justly be drawn from this fact adverse to the full political rights of each colony. The priority noted was a priority in time, not in logic. It was due to the urgent military necessity of the situation, and intimated no supremacy on the part of the Continental Congress. It is not conceivable that the latter body should have assumed to disregard the entity of a single colony, even the smallest, or have proceeded to do anything authoritatively in respect to the organization of colonial governments, or to take territory from one colony for the benefit of another. The colonies in no respect owed their existence or their political rights to the Continental Congress, which was their creature, the organ of their voluntary common action.

On June 17 was fought the battle of Bunker Hill, between the garrison of Boston and the besieging provincials. Though this action was not, as now, regarded as a substantial victory for the Americans, it did much to strengthen the purpose of resistance and to quicken the growth of revolutionary ideas. The progress of the popular mind of the colonies toward independence of Great Britain was hastened by the refusal of Parliament to receive the petition of Congress; by the bombardment of the town of Falmouth, now the city of Portland; by acts of Parliament prohibiting trade with the colonies and authorizing the capture of their vessels; and by the active impressment of seamen on the North American coast. The military operations of the autumn and winter had not been decisive. The expedition of Montgomery and Arnold against Canada had resulted disastrously; on the other hand, the British garrison had been compelled to evacuate Boston, and a British fleet had been beaten off Charleston in the action at Fort Sullivan.

On June 7, 1776, a resolution of independence was introduced into the Continental Congress by Richard Henry Lee of Virginia, and referred to a committee consisting of John Adams, Thomas Jefferson, Benjamin Franklin, Roger Sherman, and R. R. Livingston. The Declaration of Independence was drawn by Jefferson, and on the 4th of July was promulgated, the delegations being generally instructed to that end by their colonies. On the same day on which the committee was appointed to prepare the Declaration, a committee was appointed to prepare Articles of Confederation, it being fully recognized that independence of Great Britain necessitated union among the colonies, now become States. Yet this committee did not report a plan for confederation until Nov., 1777, nor were the Articles adopted by all the States before Mar. 1, 1781. During the whole of this period the States, united only by their free consent, were carrying on war with Great Britain at a distinct disadvantage by reason of the absence of authoritative government. This long delay in such an exigency affords a measure of the difficulties of union. One obstacle, however, additional to those previously mentioned, requires to be stated. Seven States, Massachusetts, Connecticut,

New York, Virginia, South Carolina, North Carolina, and Georgia, possessed considerable bodies of land to the W. of their present limits. The six States more closely defined objected to signing the Articles until these unoccupied lands, which were to be defended by the arms and resources of the Confederation, should be ceded for the benefit of the Confederation. This objection was, however, maintained with less vigor by some of these States than by others. Before the close of July, 1778, ten States had ratified the Articles. New Jersey acceded Nov. 26, 1778; Delaware May 5, 1779; Maryland remained out until Mar. 1, 1781. The contention of Maryland was that without such cession the landed States would pay their war-expenses by sales of lands, instead of by taxation; and, secondly, that when this Western territory should be settled, the communities there formed would become politically and socially the satellites of the States under whose laws and administration they had grown up. The contest was finally settled by the patriotic action of New York, which authorized (Feb. 19, 1780) its delegates to cede its Western lands. This action was accepted by Maryland as an earnest of what she had claimed, and she joined the Confederation as stated. Sooner or later, all the landed States followed suit in cession—Virginia, 1784; Massachusetts, 1785; Connecticut, 1786; South Carolina, 1787; North Carolina, 1790; Georgia, 1802.

Meanwhile, the war had been prosecuted without a government having coercive power. The States, when called upon by Congress for contributions of men and money, responded in their own time and way. The British troops under Sir William Howe defeated the American army on Long Island Aug. 27, 1776, and soon afterward occupied the city of New York and the country of the lower Hudson. Before the close of the year Washington had been obliged to retire behind the Delaware River with a small, ill-provided army, but by the brilliant surprises of Trenton and Princeton the British were thrown back and New Jersey mainly recovered. During the summer of 1777, Sir William Howe transferred the greater part of his force by water to the neighborhood of Philadelphia, which city he captured, after defeating the American army on the Brandywine, Sept. 11. A bold attack by Washington on the British forces at Germantown (Oct. 4) was repulsed. At the North, however, the cause of independence found this year a better fortune. Gen. Burgoyne, in command of an army composed of British regulars, Canadians, and Indians, in July captured Ticonderoga and Whitehall, and began a movement intended to gain possession of the Highlands of the Hudson, and by opening that river from its source to its mouth to isolate New England. The expedition was, however, wholly disastrous. A strong detachment was defeated by a militia force under Gen. Stark at Bennington Aug. 16, and in September, Burgoyne was brought to bay near Saratoga, on the right bank of the Hudson, and after two severe actions (Sept. 19 and Oct. 7) was compelled to surrender (Oct. 16) to Gen. Gates.

The decisive victory at Saratoga gave great reputation abroad to the American arms, and decided the French king to join in treaties of alliance and commerce with the United States, which were signed in Paris in Feb., 1778. Meanwhile, Washington had been reduced to straits in keeping the field against the British, and his army encountered the greatest hardships at their encampment of 1777–78 at Valley Forge, a day's march N. of Philadelphia. The want of an authoritative government was severely felt in the slow and partial responses made by the States to the requisitions of the Congress. In this strait the issue of bills of credit was resorted to. The depreciation was of course rapid. Mar. 1, 1778, $1 in specie exchanged for $1.75 in paper; Sept. 1, for $4; Mar. 1, 1779, for $10; Sept. 1, for $18; Mar. 18, 1780, for $40; Dec. 1, for $100; May 1, 1781, for $200–$500. During the operations of 1778 the co-operation of the French fleet under D'Estaing proved delusive, but the conduct of the British armies was ineffective; Sir Henry Clinton, who succeeded Howe, evacuated Philadelphia and retired on New York. During the movement an indecisive action was fought at Monmouth, the army of Washington remaining in possession of the field. The British forces still held Rhode Island, which they had occupied two years before. Toward the close of 1778, Sir Henry Clinton sent a force against the city of Savannah, which fell Dec. 29. This determined toward the South the efforts of both armies. During the summer of 1779 the British overran the whole of Georgia, but were compelled to abandon Rhode Island in view of an expected expedition by the troops and fleets of France and Spain, the latter country having declared war against England in June. In September the Americans under Lincoln, assisted by the French fleet, made a futile attack on Savannah, being repulsed with heavy loss. In Apr., 1780, Clinton in person invested Charleston, which was held by Gen. Lincoln. The defence was weak, and the city was surrendered with the garrison in May; South Carolina was completely overrun, and Cornwallis, who was left in command by Clinton, threatened North Carolina. In this emergency troops were detached from the Northern army under the command of Gen. Gates, who was reinforced by the militia of Virginia and North Carolina, but was routed with great loss at Camden, while the partisan corps of Sumter, who since the conquest of South Carolina had not ceased to harass the British outposts, was destroyed by Tarleton on the banks of the Wateree. The three southernmost States were now held by the British, while to the disaster at the South was nearly added the capture of the strongholds on the Hudson through the treachery of Benedict Arnold. In October, however, a considerable detachment of the British army was destroyed by militia at King's Mountain, inducing Cornwallis to retire into South Carolina; and in December, Gen. Greene arrived from the North, superseding Gates. The close of the year found Holland also in arms against England, though not taking part in the military operations in America.

The campaign of 1781 was destined virtually to close the war in favor of the Americans. Jan. 17, the British, under Col. Tarleton, were defeated at Cowpens, S. C., by Gen. Morgan; Mar. 15 a severe action was fought at Guilford Court-house between Greene and Cornwallis, by which the British, though they held the field, were so far weakened as to compel them to retire; on Sept. 8 was fought the severe action of Eutaw Springs, in which the Americans had the advantage. The effect of these actions, combined with the activity of the American partisans under Marion, was to compel the abandonment of North Carolina and nearly all of South Carolina by the British, who were content to hold a few places by garrisons. Meanwhile, Cornwallis, moving into Virginia with a view to forming a junction with Sir Henry Clinton, was hemmed in at Yorktown by the troops of Washington and Rochambeau, and after a siege of about three weeks was compelled to surrender his whole force, about 8000 men, Oct. 19. The surrender of Cornwallis practically ended the war. No operations of importance followed. In July, 1782, the British evacuated Savannah; a preliminary treaty of peace was signed Nov. 30 of that year at Paris; Dec. 14, Charleston was evacuated; the definitive treaty was signed Sept. 3, 1783; New York was evacuated by the close of November; in December, Washington resigned his commission as commander-in-chief.

The government which, as recited, had been brought into existence Mar. 2, 1781, was a pure federation. The States entered it as equal bodies. Its single organ was a congress of delegates. The powers of the government were limited to certain purposes. Nominally, these extended to the right to declare peace or war, to send ambassadors and envoys, to make treaties and alliances, to dispose of captures and prizes, and provide for the punishment of piracies and felonies on the high seas. In respect to internal concerns, Congress was vested with the determination in the last resort of disputes between States regarding boundaries, with the regulation of weights, measures, and coins, with the control of the postal service and of the trade with the Indians, with the government of the land and naval forces. The State quotas of contribution both of men and of money were to be fixed by Congress, which should make requisition on the States therefor. The consent of nine States was, however, necessary to all important acts of legislation or administration. The government thus formed remained the government of the United States during two years of war and six years of peace. It was, however, early shown to be a hopeless failure. It had no coercive power over States or individuals. It could not even command the attendance of its own members. In consequence, the States ordinarily neglected or refused to comply with the requisitions of Congress, and settled their disputes or contended over them without regard to the authority of the United States; while Congress itself sank to be, in the language of Mr. Curtis, "a feeble junto of about twenty persons," moving about from city to city as circumstances required.

Feb. 21, 1787, Congress called upon the States to send delegates to a convention at Philadelphia for the purpose of revising the Articles of Confederation, "to render the Federal Constitution adequate to the exigencies of the government and the preservation of the Union." The convention met in May, George Washington being president. Among the most eminent members were Benjamin Franklin, Alexander Hamilton, James Madison, Edmund Randolph, George Mason, Gouverneur Morris, John Rutledge, C. C. Pinckney, Rufus King, Roger Sherman. Rhode Island was not present by delegates. The convention was dissolved in September, having submitted a form of constitution es-

sentially different from the Articles of Confederation. The main features of the plan of government thus proposed have already been given under the title *Political Institutions and Government.* The order of ratification by the conventions of the States was as follows: Delaware, Dec. 7, 1787, unanimously; Pennsylvania, the same day, by a vote of 46 to 23; New Jersey, Dec. 12, unanimously; Georgia, Jan. 2, 1788, unanimously; Connecticut, Jan. 9, by a large majority; Massachusetts, Feb. 7, 168 to 187; Maryland, Apr. 28, 63 to 11; South Carolina, May, by a large majority; New Hampshire, June 21, 57 to 46; Virginia, June 25, by a majority of 10; New York, July 26, 30 to 27. The ratification of nine States being sufficient, the new government went into operation before Rhode Island and North Carolina had acceded, which they did shortly after. Ten amendments to the Constitution were immediately proposed and adopted, constituting a sort of "Bill of Rights" desired by some of the ratifying States.

The new government was inaugurated, nominally, on the 4th of March, really on the 6th of Apr., 1789. George Washington of Virginia was found to have received the entire number of votes in the electoral college, and was declared President, John Adams of Massachusetts, having received a plurality of second choices, was declared Vice-President. The cabinet was announced as follows: Thomas Jefferson, secretary of state; Edmund Randolph, attorney-general; Alexander Hamilton, secretary of the treasury; Henry Knox, secretary of war. At the election party distinctions had not been formulated, though it was not to be doubted that the divisions of sentiment which had been developed in the Constitutional convention would eventuate in the formation of parties within the Constitution. The cabinet even gave testimony to fundamental differences of political belief between North and South. Hamilton and Knox were pronounced advocates of what became known as Federalism; Jefferson and Randolph were strong asserters of those views of the powers of the general government, and of its relations to the States, which characterized the Republican party. Two measures of Washington's first term especially promoted the division of the country by party lines. These were the creation of a national bank by act of Congress, and the assumption by the United States of the war-debts of the several States. The former measure was opposed in the cabinet by Jefferson and Randolph, and supported by Knox and Hamilton, the latter being the author of the scheme. Washington, who had strong Federal associations and proclivities, though disowning party obligations, gave the bill his approval. The bank went into operation in 1791, the charter having twenty years to run. The State debts were assumed in a limited amount ($21,500,000) after an embittered contest in Congress, in which the party asserting the utmost fulness of national powers under the Constitution triumphed. During the administration of Washington the United States progressed steadily toward industrial and financial prosperity, and entered into diplomatic relations with several of the principal powers of Europe. War was, however, waged with the Miami confederation of the Ohio, over which, after two successive disasters to our armies under Gens. Harmer and St. Clair, Gen. Anthony Wayne, the hero of Stony Point in the Revolutionary war, won a decisive victory, which led to peace and the cession of nearly the whole of Ohio by the Miamis in 1795. No opposition was made to the re-election of Washington in 1793, but during his second term the antagonism of the Federalists and Republicans became intense. The Republicans sympathized strongly with the progress of the Revolution in France, and the more forward, incited by the acts and appeals of Genet, minister from France, strove to commit the United States to an active support of that cause, which the Federalists, who were popularly charged with English sympathies, as strongly opposed. The treaty negotiated by Chief-Justice Jay as special envoy to England was resented by the Republicans as a surrender of American rights, and the debates thereon in Congress were marked by extraordinary bitterness. This treaty, while it secured the surrender of the posts in the Western territory held by Great Britain for twelve years in violation of the articles of the treaty of peace in 1783, left other questions open to remain the cause of alienation and dissatisfaction, to ripen many years later into war. The financial policy of Congress, which was controlled by the Federalists, also experienced much factious opposition from the Republicans, which culminated in 1794 in open rebellion against the whisky tax in Western Pennsylvania, only suppressed by the levy of the militia of Maryland and Pennsylvania. The increasing bitterness of feeling in the second term of Washington led to the disruption of his cabinet, in which the eminent statesmen who originally constituted it were replaced by Oliver Wolcott, secretary of the treasury, Timothy Pickering of state, James McHenry of war, Charles Lee, attorney-general.

At the Presidential election of 1797, Washington declining to be a candidate, Jefferson was supported by the Republicans and Adams by the Federalists. The latter was elected by a vote of 71 to 68. As the second choices of the Federalists were divided, Jefferson, receiving the highest number next to Adams, became, under the Constitution as it then was, the Vice-President and the leader of the opposition. Adams's administration was an unfortunate one throughout. He mistakenly retained Washington's secretaries, who gave him no hearty support or intrigued against him in the interest of Hamilton, his rival as a Federal leader and an aspirant for the succession. Adams was finally compelled to dismiss Pickering and McHenry. The President further alienated his own party by renewing negotiations with France after that power, deeming itself outraged by the Jay treaty with Great Britain, had ordered the United States minister out of her territory, and had insulted the special envoys, Marshall, Pickering, and Gerry, who had been sent to adjust the difficulties which threatened war between the two powers to the extent that both nations prepared for action and captures and conflicts occurred on the ocean. In the United States the war-spirit ran so high among the Federalists, especially those who supported Hamilton, that the course of the President in despatching other envoys on what was deemed insufficient evidence of the better disposition of France, provoked deep hostility to Mr. Adams, and was an important cause of his subsequent defeat. The embassy was, however, successful, and a treaty was concluded in 1800. But while Mr. Adams was thus alienating sections of his own natural supporters, the Federal party as a whole was sowing the wind from which it was to reap the whirlwind by the enactment in Congress, which that party still controlled, of the Alien and Sedition laws—acts authorizing the summary removal by the executive of suspected aliens, and providing severe penalties for seditious publications. These measures, which were an excellent imitation of those by which Pitt was striving to keep down the growth of revolutionary sentiments in England, were resented as inconsistent with the genius of republican institutions, and led to the famous declarations of the right of nullification known as the "Virginia and Kentucky resolutions" of 1798–99, those of Virginia being drawn by Madison, those of Kentucky by Jefferson. During the preparations for war with France in 1798, the navy department was created, and Benjamin Stoddert of Maryland was appointed secretary. The policy of a large naval force had always been advocated by Mr. Adams from the earliest days of the Revolutionary war.

At the fourth Presidential election Adams was defeated, receiving only 65 votes against 73 for Jefferson. As, however, Aaron Burr, the intended Vice-President, received also 73 votes, there being no designation on the ballots as to which should be President and which Vice-President, the election was thrown into the House of Representatives, where the States, in such an event, have equal power, each casting a single vote. After thirty-five ballots, in which the Federalists, in order to defeat Jefferson, who was peculiarly obnoxious to them, supported Aaron Burr, Jefferson received the votes of ten States and was elected; Mr. Burr became Vice-President. This unnecessary contest, which was complicated by much personal intrigue, led to the adoption of the 12th Amendment to the Constitution, which provided that the candidates for President and for Vice-President should be voted for separately.

The defeat of the Federalists had been decisive—so much so that Mr. Jefferson was accustomed to speak of "the revolution of 1800" in referring to the election of that year; and in 1804, Jefferson was re-elected, with George Clinton as Vice-President, the Federal candidates receiving but 14 votes against 162. Jefferson's cabinet consisted of James Madison, secretary of state, Samuel Dexter of the treasury, Henry Dearborn of war, Benjamin Stoddert of the navy, and Levi Lincoln, attorney-general. Dexter was afterward replaced by Albert Gallatin, and Stoddert by Robert Smith. Consistently with his theory of government, Jefferson sat and voted with the secretaries in cabinet session upon equal terms, so that the executive resembled a directory. The President and his cabinet were, however, perfectly harmonious, and the Republican party continued to gain power rapidly in every section except New England. The principal measures and events of Jefferson's administration concerned the foreign relations of the United States.

In 1801 war was declared against the United States by the bey of Tripoli, to whom the United States had paid tribute for the privilege of navigating the Mediterranean. Hostilities continued with slight practical result, though much to the credit of the American navy, till peace was made in 1805. In 1803, Robert R. Livingston and James

Monroe, as envoys of the United States, concluded a treaty with Napoleon, by which the whole of the vast possessions of France W. of the Mississippi, embracing, as computed, 1,171,931 sq. m., were ceded to the United States for about $15,000,000. This cession greatly exasperated Spain, which deemed her possession of Florida threatened thereby. Friendly relations between the two nations were interrupted, and some acts of hostility took place. In her desperate efforts to stay the progress of Napoleon, then fast overrunning the continent of Europe, England at that period exercised with unwonted severity her always disputed rights of search and impressment, while by her orders in council neutral trade was greatly crippled. On his side, Napoleon retaliated by successive decrees—from Berlin, from Milan, and from Rambouillet—aimed at American commerce, for which not a shadow of justification could be found in the law of nations. But while France and England were equally in the wrong as regarded their attitude toward the United States as a neutral power, the superior naval force of the latter rendered her practically the more injurious. It was this view, we must assume, which constrained Jefferson and his successor more and more to overlook the wrongs done by France, and to seek to direct the public thought of the nation toward England as the real enemy of the United States, though at times the suggestion of a "three-cornered war" was made with more or less seriousness. In 1806, James Monroe and William Pinkney, as envoys, negotiated a treaty with England, by which it was sought to remove or reduce the points in dispute, but the treaty was rejected as insufficient by the President without reference to the Senate. In 1807 occurred the affair of the Chesapeake and the Leopard, which did much to arouse those feelings of exasperation which made war possible. A British frigate, in asserting the British claim to recover British seamen wherever found, attacked an American public armed vessel in American waters, and after compelling a surrender took off from her four seamen, three of whom were undoubted Americans. Reparation for this outrage was delayed four years. In Dec., 1807, on the recommendation of the President, an embargo was declared by Congress, all vessels being prohibited from sailing for foreign ports, while the coastwise trade was placed under stringent restrictions. This policy was continued until Mar. 1, 1809, the commercial interests of the country suffering meanwhile the deepest distress. The blow fell with especial severity on New England, where the exasperation of the community was carried almost to the point of open resistance to the law. Three days after the repeal of the embargo—which, though still approved by the President, could no longer be sustained against the force of public feeling—Mr. Jefferson, having declined re-election, went out of office, leaving the settlement of the disputes with England to his successor, James Madison of Virginia, who had long been his pupil in politics and his secretary of state during the eight years of his administration. Mr. Madison, with George Clinton for Vice-President, had been elected in 1808 over the Federal candidates, C. C. Pinckney and Rufus King, by a nearly three-fourths vote. The cabinet was constituted of Robert Smith, secretary of state, Albert Gallatin of the treasury, William Eustis of war, Paul Hamilton of the navy, Cæsar A. Rodney, attorney-general. For the embargo prohibiting all foreign trade were now substituted acts prohibiting trade with England and France, but containing provisions intended to induce one of those powers to seek a restoration of intercourse at the expense of the other. This policy of inviting the belligerents to bid against each other for the privilege of open trade with the United States was continued through three years, with the effect that France, after one ambiguous announcement—which the Republican party welcomed as satisfactory, while the Federal party and the English minister denounced it as insufficient and insincere—repealed her obnoxious decrees. England followed by a repeal of her orders in council; but five days before—viz. on June 18, 1812—Congress had declared war upon the recommendation of Pres. Madison, who, though personally averse to extreme measures, was urged forward by younger men now rising into power, notably Henry Clay and John C. Calhoun. The arrival of the news of the repeal led to a renewal of negotiations, but the United States feared to give time for the strengthening of the fortifications of Canada, and hostilities commenced.

The war was to be fought upon the very issues which had been evaded in the Jay treaty of 1794, but the eighteen years that had elapsed had brought a great gain of numbers and resources to the United States. The population had grown from four and a half to eight millions, and the wealth of the nation had trebled or quadrupled in the interval. The number of States was now eighteen, Vermont having been admitted in 1791, Kentucky in 1792, Tennessee in 1796, Ohio in 1802, Louisiana in 1812. The war was fought on three faces—viz. along the lakes, on the North Atlantic shore, and along the Gulf of Mexico. It opened in the N. by the invasion of Canada from Detroit by Gen. Hull, governor of the Territory of Michigan. In about a month Hull had surrendered his entire force without fighting, and Michigan and parts of Ohio were overrun by the British, whose progress was withstood by Gen. William Henry Harrison, who in the preceding year had earned distinction by defeating the Shawnees under their chief Tecumseh and his brother the Prophet. The campaign of 1813 gained little credit to the American arms. Gen. Jacob Brown successfully defended Sackett's Harbor, and Harrison routed the British and their savage allies on the Thames, killing Tecumseh; but other attempts at invasion by Wilkinson and Hampton resulted in disgraceful retreats, while the British overran Western New York and burned several towns in retaliation for the burning of Toronto (then York). In September, however, Lieut. O. H. Perry of the United States navy, in command of an extemporized fleet, defeated and captured the British squadron, giving the Americans complete control of Lake Erie. The campaign of 1814 witnessed a marked change. On the one hand, the British forces in Canada were heavily reinforced by veteran troops from Europe; on the other, the American soldiery were acquiring discipline, and able young commanders were coming to the fore. Under Jacob Brown and Winfield Scott the Americans won the victories of Chippewa and Bridgewater (or Lundy's Lane). On the other end of the Canada line the invasion of a powerful army under Sir George Prevost was defeated through the destruction, off Plattsburg, of the supporting squadron by an American fleet under MacDonough. This practically closed the war on the northern frontier. On the Atlantic coast the years 1812 and 1813 were marked by the gallant efforts of the six or eight American frigates, and as many sloops of war, to sustain themselves against the numerous cruisers, and, later, the powerful fleets, of England. In spite of victories in single combat which reflected the highest credit on American seamanship and courage, the few armed vessels of the United States were one by one captured by superior force or blocked up in the northern harbors, and in 1814 the British fleets cruised pretty much unhindered along the whole coast, depredating and destroying at will, though American privateers still swarmed over the seas inflicting great damage upon British commerce. In Aug., 1814, a British army under Gen. Ross, supported by a powerful fleet under Admirals Cockburn and Cochrane, captured Washington after an insignificant conflict at Bladensburg, and burned the Capitol and the President's mansion. In September the same force attacked Baltimore, but both the army and the fleet were beaten off, Gen. Ross being killed at North Point. The third theatre of war was at the South-west. The Creeks of Alabama having taken up arms, Gen. Andrew Jackson with a body of Western levies invaded their country, and defeated them with great slaughter at Tohopeka in Mar., 1814, compelling the cession of the larger part of the Creek lands. In the summer of the same year a British party occupied Pensacola, then claimed by the Spaniards, and later assaulted unsuccessfully Fort Bowyer near Mobile. In December the British advanced to a formidable attack on New Orleans, and Jackson prepared for its defence. A night-attack was made (Dec. 23) on the British camp, for which considerable effect has been claimed; but on the 8th of Jan., 1815, the British commander advanced with greatly superior force against the American lines, and was repulsed, himself, his second in command, and 2000 men falling in the attack, while the American loss was less than 100. Meanwhile, peace had already been concluded at Ghent, Dec. 11, 1814. By the articles of the treaty all conquests on both sides were to be restored, while the questions of search and impressment were not mentioned.

With the war of 1812–15 closed what may be called the first era of the political history of the United States—the era when the foreign relations of the country engrossed public attention. The second era, which extended from 1816 to 1843, was the era in which financial and industrial questions assumed supreme importance before the country, and gave purpose and passion to party. The war with England had, by cutting off the foreign supply, called into existence considerable manufactures of iron, of cotton, and of wool, which on the return of peace were threatened with destruction. Moreover, England had, by the corn laws of 1815, set the example of attempting to stereotype war-prices for the time of peace. But the strongest impulse to protection came from the South, where the cotton-planting interest desired the creation of a home-market. Upon the recommendation of Pres. Madison, and under the leadership of Calhoun and Lowndes of South Carolina, the first distinctively protective tariff of the United States was enacted in 1816. The charter of the first United States

Bank had expired in 1811 without renewal. The second, with a capital of $35,000,000, one-fifth owned by the government, which had a corresponding share in the direction, was chartered by Congress, after a severe struggle, in 1816.

The course of the Federal party had been downward. At the elections of 1812 the imminence of war and the unpopularity of the Embargo and Non-intercourse acts had given them a temporary strength, and at the election of that year they had polled 89 electoral votes for DeWitt Clinton against 128 for Madison, with whom was elected Elbridge Gerry of Massachusetts as Vice-President. But the opposition of the Federalists during the war, as shown in the refusal of the Federal governors of two States to allow their militia to march at the orders of the national executive, and in the holding of the Hartford Convention in Dec., 1814, at which measures for restricting the authority of the general government were discussed, and which was charged with being in the interest of a separate New England confederation, practically destroyed the party. At the election of 1816, James Monroe of Virginia —who, upon the resignation of Robert Smith on the ground of his opposition to the war with England, had become secretary of state in 1812—was elected President by 183 votes, against 34 Federal votes for Rufus King, all from the States of Massachusetts, Connecticut, and Delaware. At the election of 1820, Mr. Monroe received every electoral vote but one, and the so-called era of good-feeling began, with party lines wholly obliterated. D. D. Tompkins of New York was chosen Vice-President. Mr. Monroe constituted the cabinet as follows: John Quincy Adams, secretary of state, William H. Crawford of the treasury, John C. Calhoun of war, B. W. Crowninshield of the navy, William Wirt, attorney-general. Among the principal events of Mr. Monroe's administration were—1st, Jackson's successful expedition against the Seminoles in 1818; 2d, the cession of Florida, embracing about 60,000 sq. m., by Spain in 1819, for the sum of $5,000,000; 3d, the enunciation by the President, in his annual message in 1823, of the so-called "Monroe doctrine"—that is, that all attempts of European governments to acquire new territory on the American continent, or to reconquer provinces that had achieved independence, would be regarded as hostile acts; the declaration being especially aimed at Spain, whose South American colonies had revolted, and had been acknowledged as republics by the United States; and, 4th, the tariff of 1824, by which the system of protection to American manufactures inaugurated in 1816 was extended and fortified. But the chief political measure of this administration was the Missouri Compromise. It was the era of new States. Indiana had been admitted in 1816, Mississippi in 1817, Illinois in 1818, and Alabama in 1819. After the preliminary steps had been taken for forming a State government in Alabama, Missouri applied for admission. Of the nine States already admitted since 1789, four had been free States, five slave States. It was now claimed to be the turn of the free States. Great opposition was made to the admission of Missouri with slavery; intense feeling became aroused North and South, and threats of disunion were loudly made. Various propositions for compromise were rejected, but the admission of Maine in 1820 as a free State formed out of the territory of Massachusetts, prepared the way for an amicable adjustment, and a compromise was reached by which Missouri was admitted as a slave State, while slavery was for ever prohibited in all unorganized territory N. of 36° 30′. This was the first, and one of the most bitter, of the struggles relating to slavery under the Constitution.

At the Presidential election of 1824 four candidates, all calling themselves Republicans, were voted for in the electoral college. Andrew Jackson of Tennessee received 99 votes; John Quincy Adams of Massachusetts, 84; William H. Crawford of Georgia, 41; Henry Clay of Kentucky, 37. The election devolved upon the House of Representatives, whose choice was by the Constitution confined to the three highest candidates. Mr. Clay being thus thrown out, his friends united with those of Mr. Adams, and the latter was elected, receiving the votes of thirteen States, while seven voted for Jackson and four for Crawford. This unexpected alliance of Clay and Adams, taken in connection with the appointment, which followed, of the former as secretary of state, led to the charge of "a corrupt coalition," which was urged with great bitterness at the time, and was reiterated at a subsequent period; the correspondence of Clay, Jackson, and Buchanan, together with the speeches in Congress on the subject, forming a conspicuous feature in the political literature of the United States. The other members of the cabinet were Richard Rush, secretary of the treasury, James Barbour of war, S. L. Southard of the navy, William Wirt, attorney-general. The chief events and measures of Mr. Adams's administration were—1st, the appointment, against violent opposition in Congress, of envoys to represent the United States at Panama in a proposed congress to be composed of representatives of the principal American states—a scheme in the spirit of the Monroe doctrine, but which was abandoned, through, first, the death of the United States envoy, and subsequently through revolutions in Central America; 2d, a controversy with the State of Georgia, arising out of the action of the general government in protecting the Creek Indians against the efforts of the State authorities to extrude them under cover of a pretended treaty, during which Gov. Troup threatened open war and the State militia were embodied; 3d, a series of complications, resulting, fortunately, in the negotiation of the Gallatin treaty, by which trade was opened between the United States and the English West Indies; and 4th, the tariff of 1828, by which the protective system instituted in 1816 and extended in 1824 was carried to the highest point, the position of the several sections on this question being now reversed—New England, under the lead of Daniel Webster, advocating high duties, while the South, under the lead of Calhoun, who was the virtual author of the tariff of 1816, denounced the existing system and its proposed extension as unconstitutional.

Mr. Adams, a former Federalist, and the son of a Federal President, had been elected President in 1824, the distinction of Federalist and Republican being no longer formally maintained. But grave differences of political feeling and of constitutional theory did not lose their power for want of names to characterize them. From the day of Mr. Adams's election he was the subject of unceasing attacks having in view his defeat in 1828. Especially in the Senate, where the ablest leaders were in opposition, was the war of resolutions, motions, and speeches most fiercely carried on. The President, on his side, instead of assuming the initiative, promptly occupying the field, and by the use of his power and patronage recruiting as largely as possible that as yet unnamed political entity which was to become known as the Whig party, sought to remain the President of the whole country. As a result, the opposition by its aggressiveness won over all the loose elements of the political field, especially among young men having no party traditions, and acquired at this time that power and cohesiveness which has characterized the Democratic party. For at this period the word "Democrat," which at an earlier date had been almost a term of offence, self-assumed by only the most advanced French sympathizers, had come to supplant the word "Republican." At the election of 1828, Mr. Adams, styling himself a National Republican, was defeated by Gen. Jackson, who received 178 out of 261 votes in the electoral college. Calhoun, who in 1824 had been elected Vice-President with Adams, was re-elected. The cabinet was constituted of Martin Van Buren, secretary of state, Samuel D. Ingham of the treasury, John Eaton of war, John Branch of the navy, John M. Berrien, attorney-general. Heretofore, the postmaster-general had not been a member of the cabinet, but Gen. Jackson now appointed William T. Barry postmaster-general, with a seat at the council-board. Immediately, the maxim "to the victors belong the spoils" was put in force. Hundreds of removals from office took place in the first six months of this administration, and the civil service became, as it has remained, prostituted to the purposes of party.

The Southern States had been deeply dissatisfied at the tariff of 1828, having become convinced that a home-market for their cotton-crop was a matter of indifference, while the protection of cotton, woollen, and hempen goods and of iron manufactures at the North was in no small degree at their expense. South Carolina and Georgia had, as States, formally protested against a tariff for protection as unconstitutional. In 1832, South Carolina held a convention which proceeded to "nullify" the obnoxious acts as an invasion of the rights of the States. The ground of the "nullifiers" was that of the resolutions of 1798–99—viz. that there being "no common judge" between the States and the nation (the office of the Supreme Court, in this regard, being disowned by this party, as it invariably was by Jefferson), each State remained the proper judge for itself both "of the fact of an infraction" of the terms of "the Federal compact" and "of the mode and measure of redress." The tariff acts were declared null and void, the collection of customs duties within South Carolina was prohibited, and the convention announced that any attempt by the United States to enforce such collection would be deemed a dissolution of the Union. It was in this emergency that Jackson issued his famous proclamation, drawn by Edward Livingston, who had succeeded Van Buren as secretary of state, in which the rights and powers of the government of the United States were asserted in the fullest degree. Everything portended war. The governor of

South Carolina, Robert Y. Hayne, the antagonist of Webster in the debate on Foot's resolution in the Senate three years previous, put the State in a condition for defence, while United States troops were forwarded to reinforce the garrison of Charleston. At this juncture Virginia offered her mediation, in the very act of doing so corroborating the position of South Carolina, that a State may assert itself, by its own agencies, against the general government, instead of seeking redress and relief through the Supreme Court. At the same time, Henry Clay, in the Senate, appeared as the advocate of concession, and succeeded in carrying through the compromise tariff of 1833, by which the duties of 1828 were to be reduced in ten years, by a sliding scale, to a general rate of 20 per cent. This concession and the mediation of Virginia were accepted by South Carolina, and the ordinance of nullification was repealed.

The second Bank of the United States, chartered, as has been said, in 1816, for twenty years, had still seven years to live when Gen. Jackson was inaugurated, but its doom was sealed. The President's hostility was shown in his first message, and the bill for recharter which passed Congress in 1832 was vetoed. In the face of favorable reports from the treasury and from committees of both Houses of Congress, Gen. Jackson determined that the United States deposits should be withdrawn. This, however, by law, could be the act of the secretary of the treasury alone. Mr. McLane, who had succeeded Ingham in the treasury department, and had shown himself moderately favorable to the bank, had opportunely been translated to the state department. William J. Duane, who succeeded, refused to do the President's bidding in the matter of the deposits, and was replaced by Roger B. Taney, who had succeeded Berrien as attorney-general in the general cabinet overturn of 1831. Taney did the task for which he was appointed, and in 1833 the government deposits were placed in State banks. The United States Bank, as a national institution, had received its deathblow; after a brief struggle against the enmity of the administration, it accepted a charter from Pennsylvania, and went down in the great storm of 1837–41. The bank was charged by Gen. Jackson with many technical violations of its charter, with expending money for political purposes, and with using its vast power of discount with favoritism toward some and malignity toward others.

Gen. Jackson was re-elected in 1832 by 219 electoral votes, against 49 for Henry Clay of Kentucky, 11 for John Floyd of Virginia, and 7 for William Wirt of Maryland, the latter being the candidate of the anti Masonic party. For years, under the high tariff of 1824 and the higher one of 1828, together with the large sales of public lands, the revenue had been in excess of the ordinary expenditures by 25, 50, and even 100 per cent. As a result, the public debt, which at the close of the war in 1815 had amounted to 127 millions, was rapidly reduced, and in 1835 was extinguished. This excess of revenue had proved a powerful weapon in the hands of the advocates of tariff-reduction in the struggle of 1828–33. It now became a serious embarrassment to the administration. What to do with the surplus was the great question of 1833–36. In the latter year the monstrous expedient of depositing $28,000,000 in the several State treasuries was resorted to. The division of this sum was according to population, although the money, having been largely raised by indirect taxation, had originally been contributed according to the consumption of taxed articles, which varied greatly among the several States and sections. The occurrence of the financial crisis in 1837 relieved the government from any further embarrassment of this nature.

During the administration of Pres. Jackson the two domestic questions of Masonry and slavery led to great agitation of the public mind. The abduction and presumed murder of Morgan in New York for betraying the secrets of the Masonic order led to the formation of an anti-Masonic party, which, however, proved unable to sustain itself in the face of a more exciting issue. No political party was yet formed adverse to slavery, but anti-slavery societies had commenced the agitation of the subject at the North and the "moral invasion of the South" through pamphlets and newspapers, leading to many riotous acts, and to efforts, through Congress and the administration of the post-office, to suppress the circulation of "incendiary documents." Two Indian wars—one (1832) known as the "Black Hawk war," against the Sacs and Foxes of the North-west, the other (1835–36) against the Seminoles of Florida under their leader Osceola, extending later to the Creeks—had their origin in the prosecution of the policy inaugurated by Pres. Monroe of removing the Indians W. of the Mississippi. In each the Indians were subdued, though in the latter case not without some dishonor to the United States on the score of treachery. The foreign policy of Gen. Jackson was throughout vigorous. Denmark, Naples, Spain, and Portugal satisfied claims of long standing for spoliations on American commerce, while France, after diplomatic complications which at one time threatened war, paid over $5,000,000 on account of depredations committed more than thirty years before.

Gen. Jackson, though declining a third term in deference to the example of his predecessors, was able to determine the succession, and Martin Van Buren of New York was elected President in 1836, receiving 170 votes against a divided opposition—now known as the Whig party, corresponding in many features to the Federal party of the earlier time. William Henry Harrison of Ohio received 73 votes, Hugh L. White of Tennessee 26, Daniel Webster of Massachusetts 14, W. P. Mangum 11. No one having received a majority of the votes for Vice-President, Richard M. Johnson of Kentucky was chosen by the Senate out of the two highest names on the list, this being the only occasion on which the Senate has been so called to act. Upon Van Buren's administration fell the financial distress which had been generated in the preceding administration, whether due, as the Whigs claimed, to the removal of protection from American manufactures by the compromise tariff of 1833, to the shock given by the war on the bank, and the excess of worthless issues by the State banks when that great regulative institution was destroyed, or due, as the Democrats claimed, to the speculation induced by the operations of the bank before the deposits were withdrawn, which operations, in their opinion, justified that withdrawal. In May, 1837, the banks of New York and other cities suspended payment, and widespread bankruptcy ensued. A second and more severe commercial shock occurred in 1839. The ordinary agencies of trade and exchange were largely destroyed, industry was paralyzed, and the revenue of the government fell sharply off. It was not until 1842 that prices and wages reached the minimum, and a revival of business with a restoration of confidence began. During the later years of this crisis eight States in whole or in part repudiated their obligations, either as to the interest or the principal. Except Lewis Cass, secretary of war, Mr. Van Buren retained all the members of Gen. Jackson's latest cabinet—namely, John Forsyth, secretary of state, Levi Woodbury of the treasury, Mahlon Dickerson of the navy, B. F. Butler, attorney-general, and Amos Kendall, postmaster-general, though he subsequently made several changes. His secretary of war was Joel R. Poinsett. The chief financial measure of Van Buren's administration was the establishment of the sub-treasury system, by which the public moneys were to be kept in government offices until required for current expenses, instead of being kept in banks, State or national. This scheme was proposed in Mr. Van Buren's first annual message (1837), but only adopted in 1840, to be repealed the next year, when the Whigs came into power. A serious difficulty, threatening the peace of the United States, arose from the acts of certain American sympathizers with the insurrection which took place in Canada in 1837. A steamer (the Caroline) in this interest was destroyed on the American shore by a detachment of British troops, and the act avowed by the British government as done in self-defence. Three years later a Canadian sheriff was arrested in New York on the charge of murdering an American citizen who had perished on the Caroline, and tried by the State authorities against the protest and threats of the British government, which demanded his release on the ground that the act was done under its authority. Fortunately, the prisoner was acquitted on the evidence.

The long-continued financial and industrial distress of Van Buren's administration had lost the Democratic party, for the time, its hold on the country, and Gen. William Henry Harrison of Ohio, with John Tyler of Virginia as Vice-President, was chosen in 1840 by 231 electoral votes, against 60 for Van Buren. At this time a "Liberty party" was formed in the anti-slavery interest, which polled about 7000 of the nearly 2,500,000 votes cast. From the inauguration of the government under the Constitution, the scheme of nominating candidates for the Presidency and Vice-Presidency had been by a caucus of the members of Congress of each party, but this had become discredited when the Republican party in 1824 repudiated the nomination of Crawford. By 1840 the scheme of national conventions, consisting of delegates chosen by the voters of the party throughout the United States, had been fully inaugurated, and has continued the accepted method of nomination ever since.

The Whig party, having come into power on the issue of opposition to the sub-treasury and a demand for protection to American manufactures, repealed the sub-treasury—or, more properly, the independent treasury—act in 1841, and in 1842 enacted a tariff by which the existing duties were largely increased. But in other respects that party

was doomed to disappointment. Gen. Harrison had scarcely constituted his cabinet when, within one month of his inauguration, he died. Mr. Tyler, who succeeded to the Presidency, had never been a Whig, but had been selected by the Whigs for his antagonism to Mr. Van Buren, the leader of the Northern and more moderate wing of the Democratic party. His veto of a bill chartering a new national bank led to an open quarrel with the party which elected him, and to the resignation of the entire cabinet except Daniel Webster, secretary of state. For his course in remaining in office Mr. Webster was severely blamed, but he was able afterward to point for his justification to the so-called Webster-Ashburton treaty, which he negotiated with England in 1842, by which the claims of the United States in several important particulars were fully conceded, and every question in dispute between the two nations, excepting that relating to Oregon, was finally adjusted. For this much was due to Mr. Webster, more perhaps to the logic of events. The thirteen States had become twenty-six (Arkansas having been admitted in 1836, Michigan in 1837, the first since Missouri in 1821), the four millions of people had become eighteen. What was denied to Jay, Madison, Monroe, Pinckney, Adams, and Gallatin was easily conceded to Webster.

A motive was now found sufficient to restore the Democratic party to power. Texas had been largely colonized between 1821 and 1835 from the Southern States. In the latter year it revolted from Mexico, and the next year asserted independence, with the unquestioned purpose of ultimately joining the United States. Independence in fact was soon achieved under the leadership of Houston, and Texas in 1837 offered herself for admission to the Union. The accession was desired by the Southern States, both on account of kinship and for the opportunity that would thus be afforded for extending slave-labor over new soil. The national instinct of territorial aggrandizement came to reinforce these motives, especially in view of the probability that England or France might seek to become the protector of the republic. Throughout the administration of Van Buren the movement acquired but little headway. Pres. Tyler, a man of strong Southern feelings, the only Senator who voted against the Force bill for compelling the obedience of South Carolina in the nullification contest, warmly approved of annexation, and a treaty to that effect was negotiated by Mr. Calhoun in 1844, which was rejected by the Senate. The question thus became the principal issue at the election of that year. The Whigs, having their main strength at the North, opposed the annexation of Texas in the interest of slavery, and nominated Henry Clay of Kentucky. The Democrats threw over Mr. Van Buren on account of his opposition to annexation, and nominated James K. Polk of Tennessee, a strong advocate of that measure. Polk received 170 electoral votes, Clay 105, but before the inauguration of Mr. Polk a resolution for the incorporation of Texas was passed by Congress and signed by Pres. Tyler Mar. 1, 1845. Florida and Iowa also came in as States about the same time.

Pres. Polk formed his cabinet as follows: James Buchanan, secretary of state, Robert J. Walker of the treasury, William L. Marcy of war, George Bancroft of the navy, Cave Johnson, postmaster-general, John Y. Mason, attorney-general. The annexation of Texas involved war, inasmuch as Texas and the United States claimed the territory to the Rio Grande, while the Mexican government insisted that Texas only embraced the territory bounded by the river Nueces. Upon this issue hostilities commenced early in 1846. Congress voted men and money, and Gen. Zachary Taylor, commanding the forces on the Rio Grande, entered Mexico and fought the victorious battles of Palo Alto (May 8) and Resaca de la Palma (May 9), and, after being reinforced by volunteers under Gens. Worth and Wool, captured Monterey Sept. 23. In February of the next year he was attacked in position at Buena Vista by a large Mexican force under the president, Santa Anna, who was repulsed with great loss, and retreated, leaving Taylor in full possession of the north-eastern provinces.

Meanwhile, New Mexico had been occupied by the United States troops, and an invasion of Chihuahua took place with partial success. At about the same time a band of Americans under Capt. John C. Fremont of the United States army declared the independence of California at Sonora July 4, 1846, and with the co-operation of a fleet under Com. Sloat, soon superseded by Stockton, succeeded in reducing that province. But the army which was to decide the issue of the war was gathering for a movement up the valley of Mexico. In Mar., 1847, Vera Cruz, long deemed impregnable, was reduced after three days' bombardment, and Gen. Winfield Scott, with about 10,000 troops, mainly regulars, commanded by Gens. Worth (who had been detached from Taylor's army), Pillow, Quitman, and Twiggs, moved on Cerro Gordo, where Santa Anna was posted with a superior force. This position was carried Apr. 18 and 19, but Gen. Scott awaited reinforcements, having lost many men by the expiry of their enlistments. In August he entered the valley of Mexico, which Santa Anna defended with 35,000 men. Sanguinary battles followed: Contreras, Aug. 19, 20; Churubusco, Aug. 20; Molino del Rey, Sept. 8; Chapultepec, Sept. 12, 13; and on Sept. 14, Gen. Scott, with 6500 men, all that remained of the invading column, entered the City of Mexico. The capture of the Mexican capital practically concluded the war, and by the treaty of Guadalupe Hidalgo, Feb. 2, 1848, Mexico ceded the whole of Texas, New Mexico, and Upper California, while the United States paid $15,000,000, besides assuming certain claims of its citizens against Mexico on account of long-continued depredations in the Gulf, which had been the subject of negotiations since 1837, to the amount of more than $3,000,000. The United States subsequently (1850) paid Texas $10,000,000 on account of her claims to territory not included within the limits of the State.

While war was waging with Mexico a rupture was threatened with Great Britain on account of the conflicting claims to Oregon. The United States claimed as far N. as 54° 40′; Great Britain claimed the mouth of the Columbia. The territory in question had long been in joint occupation, but all attempts at compromise had failed. At the election of 1844 one of the watchwords of the Democratic party had been "Fifty-four Forty, or Fight!" and Pres. Polk gave formal notice that the United States receded from the arrangements for joint occupation that had subsisted. At this serious juncture Great Britain offered terms which were accepted, by which the 49th parallel became the boundary-line of the United States on the N. W., while Vancouver's Island was relinquished to Great Britain. The failure in the treaty to define the status of the smaller island of San Juan led to further complications, which were not settled till 1871.

The important financial measures of Polk's administration were the permanent re-establishment of the sub-treasury system in 1846, and the tariff of the same year, by which duties were reduced. The election of 1848 found a third party in the field. The Liberty party had polled about 7000 votes in 1840, and over 60,000 in 1844. In Aug., 1848, a convention at Buffalo, comprising the members of the Liberty party, with others, many of them Democrats, and some Whigs, disaffected by the course of the old parties respecting slavery, put forward a declaration of principles, and presented as a candidate for the Presidency Martin Van Buren of New York, with Charles Francis Adams of Massachusetts for the Vice-Presidency. The new party succeeded in polling nearly 300,000 votes, though, as it carried no State, it cast no vote in the electoral college. Its leading principle was opposition to the extension of slavery into new territory, and to the admission of new slave States out of territory already acquired. Slavery was to be sectional, freedom national—slavery to be local and exceptional, only to exist where protected by the laws of States already members of the Union; freedom was to be the general law of the land. These principles were regarded as embodied in the "Wilmot proviso," a proposition offered in 1846 by David Wilmot of Pennsylvania in prospect of the acquisition of territory from Mexico through the war then waging. The Democrats, who had accomplished the annexation of Texas and had conducted the Mexican war to its successful termination, nominated Lewis Cass of Michigan. The Whigs nominated Gen. Zachary Taylor of Louisiana for President, and Millard Fillmore of New York for Vice-President, on a platform intended to conciliate the anti-slavery sentiment of the country. Taylor was elected by 163 votes against 127 for Cass. His cabinet consisted of John M. Clayton, secretary of state, William M. Meredith of the treasury, George W. Crawford of war, William B. Preston of the navy, Thomas Ewing of the interior (that office having just been created), Jacob Collamer, postmaster-general, Reverdy Johnson, attorney-general. A little more than a year after his inauguration—viz. on July 9, 1850—Gen. Taylor died; Mr. Fillmore succeeded to the Presidency. The cabinet was entirely reconstructed, as follows: Daniel Webster, secretary of state, Thomas Corwin of the treasury, Charles M. Conrad of war, William A. Graham of the navy, A. H. H. Stuart of the interior, N. K. Hall, postmaster-general, J. J. Crittenden, attorney-general.

Congress and the country were already in heated conflict, arising out of the proposed extension of slavery to the new territory acquired by the treaty with Mexico. California had in 1849 formed a constitution prohibiting slavery, and applied for admission as a State. The Southern State Rights party, led by Calhoun, demanded the rejection of California, as well as a guaranty, through an amendment to the Constitution, against the further pro-

scription of slavery. New Mexico also appeared as an applicant for admission, while Texas made extensive claims upon the territory of New Mexico. Another imagined crisis of the Constitution ensued, and in 1850, Henry Clay again appeared as a pacificator, proposing and carrying the Compromise measures of that year, by which, on the one hand, California was admitted without slavery and the slave-trade was prohibited within the District of Columbia, and, on the other hand, extensive concessions were made to Texas, and the rendition of fugitive slaves was sought to be secured by stringent provisions. As to Utah and New Mexico, the issue was for the time avoided by leaving them under Territorial governments and remitting the question of slavery to the inhabitants. The series of measures constituting "the Compromises of 1850" passed Congress and were approved by Mr. Fillmore in September. The most important measures concerning the foreign relations of the United States in this administration were the so-called "filibustering" expedition to wrest Cuba from Spain, which resulted in the capture and execution of many of the adventurers, and the negotiation of a treaty with Japan by Com. Perry, who had entered the waters of that country with a fleet for that purpose.

The election of 1852 found both the great political parties striving to keep out the agitation of the question of slavery, insisting on the Compromise of 1850 as "a finality." Many of the dissatisfied Democrats who had voted for Van Buren in 1848 had gone back to their party, and the "Free-Soil" popular vote of 1852 was little more than half that of the election previous. Gen. Scott, who had been nominated by the Whigs, was defeated, receiving but 42 electoral votes, all from four States, against 254 votes for Gen. Franklin Pierce, who, with William R. King of Alabama for Vice-President, had been nominated by the Democrats. Pres. Pierce's cabinet consisted of William L. Marcy, secretary of state, James Guthrie of the treasury, Jefferson Davis of war, James C. Dobbin of the navy, Robert McClelland of the interior, James Campbell, postmaster-general, Caleb Cushing, attorney-general. In 1853 the United States acquired, by purchase from Mexico, the tract S. of the river Gila in Arizona and New Mexico, containing 45,535 sq. m., known as "the Gadsden purchase." Early in 1854, Stephen A. Douglas of Illinois, the most conspicuous of the younger leaders of the Democratic party, introduced into the Senate a bill for the organization of Territorial governments in Kansas and Nebraska, preparatory to their admission as States. By the Missouri Compromise of 1820 slavery was to be for ever excluded from that region, but the Kansas-Nebraska bill repealed this provision, leaving the question to be determined by the inhabitants themselves, under the principle advocated by Mr. Douglas, known as "squatter sovereignty." This attempt to leave the Territories open to slavery encountered earnest resistance from the Whigs and the few "Free-Soilers" in Congress, and aroused intense indignation in many portions of the North. The bill was, however, firmly pressed, and became a law in May. A contest at once began for the colonization of Kansas, the more southerly of the two Territories, active efforts being made in the free States to induce migration hostile to slavery, while the opposing party sought to secure Kansas both through immigration and through periodical raids from the border counties of Missouri. Violence was freely resorted to, and many undoubted wrongs were perpetrated. This struggle, which at times amounted to civil war, continued through the presidency of Mr. Pierce, and was bequeathed to his successor. The anti-slavery sentiment of the North was still further inflamed by a conference between the American ministers to France, Spain, and England, which resulted in their issuing a circular known as "the Ostend manifesto," favoring the acquisition of Cuba in the interest of slavery, and by a violent assault made in 1856 by Preston S. Brooks of South Carolina, for words spoken in debate, upon Senator Charles Sumner of Massachusetts, who, with Chase of Ohio and Seward of New York, had led the opposition to the repeal of the Missouri Compromise. The Free-Soil party of 1848 and 1852 now passed into the Republican party, which for the election of 1856 nominated John C. Fremont on a declaration of opposition to the extension of slavery into the Territories. So strong had become the sense of the inadequacy of the Whig party to offer resistance to the encroachments of the slavery propagandists that the popular vote for Fremont rose above 1,300,000. This, while nearly half a million short of the vote for Buchanan, the Democratic candidate, was yet half a million in excess of the vote for Fillmore, the former President, who had been nominated by the Whigs. In the electoral college, Buchanan received 174 votes, Fremont 114, Fillmore, 8. This passage of the Whigs into the Republican party was assisted by a violent popular agitation in 1854 against the political influence of foreigners who had been naturalized as citizens of the United States. These generally voted with the Democratic party. This agitation again to foreign influence led to the formation of a secret political society known as the Native American, more popularly as the Know Nothing order, which in 1854 carried several States and elected many members of Congress, but in 1856 fell away in the presence of the more exciting issue of slavery, as the anti Masonic party had done in 1832. On the last day of Mr. Pierce's administration (Mar. 3, 1857), a tariff bill passed Congress which greatly reduced the customs duties of 1846. Mr. Buchanan, who as American minister to England had taken part in the Ostend conference, constituted his cabinet of Lewis Cass, secretary of state, Howell Cobb of the treasury, J. B. Floyd of war, Isaac Toucey of the navy, Jacob Thompson of the interior, A. V. Brown, postmaster-general, and J. S. Black, attorney-general.

The troubles in Kansas still continued to agitate the entire country. In the struggle between the Free State and the Slave State parties the power of the administration was thrown in favor of the latter, and the party in Congress, in spite of the opposition of a minority of its members headed by Stephen A. Douglas, carried through a bill submitting to the people of Kansas for ratification the so-called Lecompton constitution, which had been framed by the pro-slavery party, constituting an unmistakable minority of the State. Meanwhile, several of the Northern States passed acts intended to assert the personal liberty of their citizens against certain of the provisions of the Fugitive-slave laws, which were deemed unconstitutional, by securing a jury trial and the privilege of habeas corpus in the cases of alleged fugitives from service. On the other hand, the Supreme Court, of which Roger B. Taney, once Gen. Jackson's attorney-general and secretary of the treasury, was chief-justice, decided in the "Dred Scott" case in favor of the claim of the extreme Southern State Rights partisans, that the slaveholder should be allowed to carry his property with him anywhere under the protection of the Constitution. The question of slavery had now become the one question of national politics, and it was evident that, as the Whig party had been rent by the antagonisms developed by this issue, the Democratic party was to be likewise disrupted in the efforts of the Southern leaders to assert the nationality of slavery. The leader of the more conservative Democrats was Senator Douglas, by whose act in 1854 the question of slavery in the Territories had been reopened after the settlement of 1820. The approaching conflict of arms was intimated toward the close of Mr. Buchanan's administration by the attempt of John Brown, formerly a leader of the Free-State party in the Kansas struggles, to seize the United States armory at Harper's Ferry, Va., for the carrying out of certain plans he had formed for the wholesale escape of the slaves of that region. After a brief success and a fierce resistance, Brown and his party were overcome by a detachment of United States troops, and Brown and his surviving followers were given up to the State authorities for trial.

Among other events and measures of Buchanan's administration must be noted the expedition under Col. Albert S. Johnston against the Mormons in Utah, to assert the authority of the government, which had been defied by Brigham Young; the admission of Minnesota as a State in 1858, and of Oregon in 1859; but particularly the commercial and financial crisis of 1857, which began in September with the failure of a large trust company in New York, producing a panic which spread rapidly, until in two or three weeks' time the banks had generally suspended and numerous failures, mainly commercial, had occurred. The recovery from the effects of this disaster was, however, very prompt, and no long suspension of industry resulted. The disruption of the Democratic party, in consequence of the manner in which the issue of the nationality of slavery was pressed by the Southern wing, occurred at the national convention held at Charleston in Apr., 1860, for the nomination of Mr. Buchanan's successor, when the majority of the Southern delegates withdrew upon the passage of a resolution declaring that the constitutional status of slavery should be determined by the Supreme Court. In consequence of the secession, the convention was adjourned till June, when Mr. Douglas was nominated. The seceding delegates met later in convention and nominated John C. Breckenridge of Kentucky, who had been Vice-President with Buchanan. A convention representing what was called the "Constitutional Union" party, embracing many former Whigs, with what was left of the "Native American" party, nominated John Bell of Tennessee, with Edward Everett for Vice-President. The Republican national convention nominated Abraham Lincoln of Illinois, with Hannibal Hamlin of Maine for Vice-President, on a declaration of principles which, while leaving "inviolate the

rights of the States, and especially the right of each State to order and control its own domestic institutions," made freedom "the normal condition of all the territory of the United States." The geographical division of the electoral vote which resulted is, unhappily, of great significance. Mr. Douglas received 12 votes from Missouri and New Jersey; Mr. Bell received 39 votes from Virginia, Kentucky, and Tennessee; Mr. Breckenridge received all the Southern votes remaining, 72 in number; Mr. Lincoln received all the Northern votes remaining, 180 in number, and was elected.

The canvass preceding the election had been highly exciting. Extensive preparations for conflict followed at the South, with a general arming and drilling of the population. The Southern leaders declared the election of a President pledged to oppose the extension of slavery to be a moral invasion of the slave States, and a violation of their constitutional rights. South Carolina led in secession in Dec., 1860; other slave States followed, and in February their delegates met in convention at Montgomery, Ala., and framed a constitution for "the Confederate States of America." Jefferson Davis of Mississippi was chosen President, Alexander H. Stephens of Georgia Vice-President. Apr. 12 the troops of South Carolina opened fire on the United States garrison of Fort Sumter in Charleston harbor, which two days later surrendered. The news of actual conflict overcame alike the scruples of the Democrats at the North and of the Unionists at the South, and each section went into the war practically entire. Eleven States, with an aggregate population of nine millions, were arrayed against the government. Kentucky, Maryland, and Delaware remained in the Union, though the two former furnished many soldiers to the Confederate armies.

Mr. Lincoln had been inaugurated on Mar. 4. His cabinet was constituted as follows: William H. Seward, secretary of state, Salmon P. Chase of the treasury, Simon Cameron of war, Gideon Welles of the navy, Caleb B. Smith of the interior, Montgomery Blair, postmaster-general, Edward Bates, attorney-general.

The day following the surrender of Sumter, the President issued a call for 75,000 militia, which were put under arms in a surprisingly short time. The strong sympathy with secession in Baltimore led to an attack by a mob upon the 6th Massachusetts regiment, *en route* for Washington, Apr. 19, in which several soldiers were killed. A military occupation of the city soon suppressed the rebellious sentiment, and the arriving militia took position along the Potomac in defence of Washington, already menaced by the Confederates. In May a second call for men to about the same extent was made. The regular army of the United States could do little in such a contest. It mustered only about 15,000 men of all arms, and its efficiency had been greatly impaired by the resignation of many officers from the South. It had, moreover, been widely dispersed during Mr. Buchanan's administration, while large stores of arms and military supplies had been sent into the seceding States, to be seized by the Confederates or destroyed to avoid seizure. The forts in the Southern States fell at once into the hands of the Confederates, with two important exceptions—Fort Pickens at Pensacola, and Fort Monroe at Old Point Comfort, Va.

The operations of the war had, on the part of the Union commanders, two prime objects—at the East, the capture of Richmond, which had become the capital of the Confederacy; at the West, the opening of the Mississippi, which had been closed by the erection of Confederate fortifications on the banks. The former of these objects was sought through many campaigns of the Army of the Potomac under several successive commanders. Richmond might be assailed by five routes: the first, "the overland route," in which the Rappahannock and the Rapidan rivers were to be crossed, and supplies mainly drawn from Washington by rail; the second, a modification of the first, by which an army should be transported to Fredericksburg, thence take up the march across the North Anna and Pamunkey rivers, supplies being drawn from Fredericksburg, and afterward from a dépôt on the Pamunkey; the third, the Peninsular or James River route, by which troops should be transported to Fort Monroe, and thence moved up the peninsula of Virginia, its movements aided and its communications maintained through river-fleets having command of the James River on the one side, and of the York, and afterward the Pamunkey, on the other, with successive dépôts established on the latter two rivers; the fourth, a modification of the third, by which the final decisive operations should be S. of the James, directed to the capture of Petersburg on the Appomattox, severing the communications of Richmond with the South; last, and least approved, the route through the Valley of Virginia, threatening Richmond from the N. W. The transportation of supplies was here so difficult and so precarious that this route was only taken by comparatively small armies, co-operating with larger forces moving on some other route.

The first of these routes was taken by Gen. McDowell, who in July, 1861, moved with the hastily-equipped militia of that period, and was badly defeated on the 21st at Manassas or Bull Run, by the Confederates under Gens. Beauregard and Joseph E. Johnston. This defeat revealed the inadequacy of the preparations for suppressing the insurrection, and large levies were made of volunteers, raised in regiments by the States and mustered into the service of the United States "for three years or the war." Over the large army thus forming Gen. George B. McClellan, who had already conducted a successful campaign in Western Virginia, by which the Confederate occupation of that section had been terminated, was appointed commander. The autumn and winter were spent upon the organization and equipment of this army, now known as the Army of the Potomac; but in October a brigade under Gen. Stone, stationed on the upper Potomac as a corps of observation, crossed at Ball's Bluff, and was defeated with heavy loss by the Confederate general Evans.

In the spring of 1862, McClellan chose the Peninsular route for his advance with the bulk of the army, while Gen. McDowell, with 35,000 men, was to move from Fredericksburg, and Gens. Banks and Fremont were to operate in the Valley to threaten the western communications of Richmond. The latter commanders were, however, easily foiled and defeated in June by Gen. Thomas J. Jackson, commonly known as "Stonewall Jackson," the most important action being that of Cross Keys. The defeat of Banks and Fremont led to McDowell being retained for the defence of Washington, though the Confederate forces thus engaged were at once used to reinforce those operating against McClellan, who, after besieging Yorktown until its evacuation, had fought the battles of Williamsburg, May 5, and Seven Pines, May 31, the latter within 6 miles of Richmond, where the Confederate general Joseph E. Johnston was wounded, the command devolving upon Gen. Robert E. Lee. The Confederates, reinforced from the Valley, now assumed the aggressive, and drove McClellan back to Harrison's Landing on the James, a series of bloody actions, June 25 to July 1, inclusive, being fought during this "change of base." Of these actions the most important were Gaines's Mills, Savage Station, Glendale, and Malvern Hill. In August the Confederates turned upon Gen. Pope, who had advanced to the Rapidan in command of the combined forces of McDowell and Banks, and drove him in disorder to Washington, a battle very disastrous to the Union armies being fought at Bull Run Aug. 29 and 30, in which a portion of McClellan's army, brought hastily from the James, participated. Of the shattered forces within the defences of Washington, McClellan was again placed in command, though Gen. H. W. Halleck had been appointed commander-in-chief of all the armies of the United States. McClellan at once moved northward to head off Lee, who crossed the Potomac above Harper's Ferry, capturing that place with its garrison of 14,000 men under Gen. Miles. The Union army, forcing the passes of the South Mountain Sept. 14, fought three days later the bloody but indecisive battle of Antietam, which closed the invasion of Maryland. Later in the year McClellan undertook a forward movement, but was superseded by Gen. A. E. Burnside, who with his corps had been brought up from North Carolina to reinforce the Army of the Potomac. Burnside, choosing the second of the routes described, fought on Dec. 13, 1862, a terribly bloody and fruitless battle in the attempt to carry the heights back of Fredericksburg on the Rappahannock. Burnside was superseded by Gen. Joseph Hooker, one of the early division commanders of the Potomac army, who, in attempting to turn the Confederate intrenchments, fought the battle of Chancellorsville, May 1–3, 1863, which resulted in the retreat of the Union armies after great loss.

Impelled by the popular enthusiasm at the South, which was aroused by these two defeats of the Union armies, Gen. Lee in June undertook the invasion of Pennsylvania. Hooker, moving to intercept him, was superseded by Gen. George G. Meade, who three days later fought the great battle of Gettysburg, July 1–3, which compelled Lee's retreat into Virginia. During the fall of 1863, Meade made two attempts upon Richmond by the overland route without success, no important actions being fought. In the spring of 1864, Gen. Grant, having been appointed lieutenant-general after his Western victories (Gen. Halleck being assigned as chief of staff of the armies of the United States), came East to superintend in person the campaign of the Potomac Army, then lying near the Rapidan, of which Gen. Meade retained the immediate command. The forces of Gen. Butler in North Carolina and South-eastern Virginia, known as the Army of the James, were also brought into immediate co-operation. At the same time, Gen. Sigel,

who was soon superseded by Gen. Hunter, moved up the Valley of Virginia in some force, and sharp fighting took place at Newmarket May 15, and at Piedmont June 5. The Army of the Potomac, moving by the overland route, fought the desperate actions of the Wilderness, May 5–6, and of Spottsylvania, May 8–18, and after much fighting on the Tolopotomoy and the North Anna rivers, moved by its left to the S., until on June 3 it made its last attempt to enter Richmond by the direct route in a great charge at Cold Harbor against the identical positions which McClellan had sought to defend against the force of Jackson in the battle known as Gaines's Mills in 1862. After a bloody repulse at this point, Grant swung around S. of Richmond, and united the two armies of the Potomac and of the James in assaults upon Petersburg, June 15, 16, and 18. Failing to carry this place by assault, Grant sought by extending his lines toward the left to cut Petersburg off from its southern connections, and the operations on the Appomattox took on the character of a siege. Much fighting occurred both N. of the James and S. of the Appomattox upon attempts of the Union forces to extend their lines at either end or to force the enemy's positions in front. The most memorable affair was that which occurred on the explosion of a mine (July 30) on the front of Gen. Burnside, who had resumed the command of the 9th corps. The approach of winter found Grant still before Petersburg, his troops occupying a line 30 to 40 miles in length, while Lee's forces, weakened by battle and sickness and the increasing impoverishment of the Southern States, were barely able to man their intrenchments. During the autumn, however, Lee sought to effect a diversion in favor of his forces in Richmond and Petersburg by despatching Gen. Early to the Valley of Virginia, which had been the scene of a disastrous advance by Sigel. After a raid into Maryland, which for a time seriously menaced Washington, and after defeating Gen. Crook, Early was encountered by Gen. Philip H. Sheridan, who had been detached from the command of the cavalry of the Army of the Potomac. The Confederate forces were defeated at Winchester Sept. 19, at Fisher's Hill Sept. 22, and at Cedar Creek Oct. 19.

The opening of the campaign of 1865 saw the Union armies largely reinforced. On the last of March, Sheridan, who had been recalled from the Valley, turned the Confederate right and fought the victorious action at Five Forks, which compelled the abandonment of Richmond and Petersburg. The Confederate troops, retreating rapidly with the purpose to escape into North Carolina, were headed off by the sharp pursuit of Grant, brought to a stand, and compelled to surrender at Appomattox Court-house Apr. 9, bringing the war in Virginia to a close.

During the operations which have been recited of the Potomac Army from 1861 to 1865, two important attempts were made upon the Atlantic coast to effect diversions in favor of that army, and to weaken the enemy, by occupying territory from which their reinforcements and supplies were drawn, and by taking positions which should be a constant threat of movements into the interior. The first of these was the occupation of Beaufort in Nov., 1861, by land and naval forces under command respectively of Gen. T. W. Sherman and Com. Du Pont, and the subsequent investment of Charleston and the sustained bombardment of Fort Sumter and its other defences by Gen. Gillmore, during which an assault upon Fort Wagner on Morris Island (July 10, 1863) was repulsed with severe loss. In spite of all the efforts of the Union armies and fleets, Charleston sustained itself until its surrender was compelled by movements of the Western armies yet to be narrated. The second of these expeditions was that of Gen. Burnside early in 1862 against the coast of North Carolina. Feb. 7, about 2500 Confederate militia were captured, after a brief action, on Roanoke Island; Mar. 14, Newberne was taken after severe fighting, and later several towns on the coast were occupied. In the summer, however, as already related, Burnside with the main body of his troops was called to Virginia, and the occupation of North Carolina was continued by garrisons, with little effect on the Confederates, who could rapidly reinforce their small corps of observation, in case of emergency, from Lee's army, while the Union troops were practically shut off from co-operation with the Army of the Potomac.

At the West the great work of reopening the Mississippi went forward almost steadily from the beginning of 1862, though at the cost of many severe defeats in battle. In January, Gen. G. H. Thomas defeated the Confederates at Mill Spring. In February, Com. Foote of the United States navy reduced Fort Henry on the Tennessee River, and a few days later, after severe fighting, Fort Donelson, with about 15,000 men, was captured by Gen. U. S. Grant. These successes were followed up by the advance of Gen. O. M. Mitchel, and the Confederates lost possession of all Kentucky and a large part of Tennessee. In March, New Madrid in Missouri was occupied by Gen. Pope, who with the co-operation of Com. Foote in April compelled the surrender of Island No. 10 in the Mississippi, with about 7000 Confederates and large supplies, thus clearing the river down to Memphis.

Meanwhile, Grant had advanced to Pittsburg Landing on the Tennessee, where he was attacked Apr. 6, by the Confederates under Gens. Albert Sidney Johnston and Beauregard, moving out from Corinth. This battle, known as Shiloh, at first went strongly against Grant, who was reinforced the second day, and the Confederates retired, Gen. Johnston being among the killed. Gen. H. W. Halleck was now placed in command of the Union forces, and besieged Corinth until after its evacuation by the Confederates, May 29. Meanwhile Mitchel pushed down through Tennessee into Northern Alabama, occupying Huntsville in that State.

In June, Gen. Buell moved E. from Corinth, threatening Chattanooga, Tenn., a place of great importance to the Confederates on account of its railway connections. Anticipated here by Gen. Bragg, he was soon compelled to retreat rapidly to Louisville to meet Bragg's invasion of Kentucky, Nashville remaining strongly fortified and garrisoned by Union troops. The invasion came to nothing, and Buell, assuming the offensive, followed Bragg to Perryville, where an action was fought (Oct. 8) in which the Union troops suffered heavily. Meanwhile, Gen. Rosecrans had driven the Confederates under Price out of Iuka, Miss., but was in turn attacked (Oct. 3 and 4) at Corinth by Price and Van Dorn, who retreated with great loss. Rosecrans was now sent to relieve Buell, and, advancing from Nashville to Murfreesboro', fought the important battle of Stone River Dec. 31, 1862, and Jan. 2, 1863, which was followed by the retreat of the Confederates. Grant, meanwhile, in attempting to move against Vicksburg by land, was foiled through Van Dorn's capture of his supply-dépôt at Holly Springs; but Gen. W. T. Sherman with a powerful corps moved down the Mississippi from Memphis, and assaulted Vicksburg unsuccessfully.

Early in 1863 the forces of Grant and Sherman were united, under the command of the former, for the conquest of Vicksburg. After several engagements and the serious action of Champion Hills (May 16), the Confederate commander, Pemberton, was driven into the fortifications, and the siege of Vicksburg was begun with the co-operation of a fleet under Admiral Porter. Two powerful assaults were repulsed, but on July 3, the day of Lee's final repulse at Gettysburg, Pemberton was compelled by the failure of supplies to surrender with nearly 27,000 men.

While the efforts recited for opening the Mississippi were making from the North, the Union fleets and troops were forcing their way up the Mississippi from its mouth. In April, Capt. Farragut ran past Forts Jackson and St. Philip, and anchored off New Orleans, which was evacuated by the Confederate general Lovell. The lower forts surrendering, Gen. B. F. Butler took possession of the city, and later occupied Baton Rouge, while Farragut undertook the reduction of Vicksburg, running past the batteries with a portion of the force, and uniting with the fleet above. The bombardment of Vicksburg continued into July without success. Aug. 5, the Confederate general Breckenridge (who had been Vice-President with Buchanan) attacked Gen. Williams at Baton Rouge, but was repulsed, Gen. Williams being killed. At the close of the year Gen. Butler was succeeded by Gen. N. P. Banks, who in May invested Port Hudson on the Mississippi, which had been strongly fortified by the Confederates. Banks's assault was repulsed with great loss, but on July 8, Port Hudson was surrendered on the news of the capture of Vicksburg above, and the Mississippi was opened to the sea. In June, Rosecrans, who had been lying at Murfreesboro' since January, advanced on Chattanooga, driving Bragg thence to Chickamauga Creek, where (on Sept. 19 and 20) occurred one of the bloodiest battles of the war. Rosecrans being driven back into Chattanooga, and there besieged. All available troops were brought up to reinforce the army in Chattanooga, and in October, Gen. Grant took command. Nov. 25, coincidently with the advance of the Army of the Potomac on Mine Run, Grant attacked and drove Bragg into Georgia. This victory enabled Grant to detach forces which compelled the retreat from before Knoxville of the Confederate general Longstreet, who had been detached from Lee's army, and was engaged in disputing possession of East Tennessee with Gen. Burnside.

By the close of 1863 the Confederates at the West were confined practically to the Gulf States, while their forces on the two sides of the Mississippi were separated by the Union fleets.

In preparation for the campaign of 1864, while Grant was called East to direct operations in Virginia, Gen. W. T. Sherman was placed in command of the three

Western armies—the Army of the Cumberland, the Army of the Tennessee, and the Army of the Ohio. His lieutenants were Gens. Thomas, McPherson, and Schofield. Moving May 5, simultaneously with Grant at the East, he was able, through his superior force, to compel the Confederate general Joseph E. Johnston, who had succeeded Bragg, to give ground all the way to the Chattahoochee River, with but one severe engagement—that of Kenesaw Mountain. July 10, Johnston was driven, after heavy fighting, behind the Chattahoochee, when the command devolved upon Gen. Hood, who threw his army upon Sherman in several desperate assaults, but was driven into the intrenchments of Atlanta. About Sept. 1, Sherman compelled the evacuation of Atlanta, and in the middle of November, leaving an army under Thomas to observe Hood, who had moved into Northern Alabama, he began his famous "march to the sea" across Georgia with a column of 60,000. At once Hood advanced into Tennessee, fighting by the way the ferocious battle of Franklin, where the Confederate losses were of unparalleled severity, and besieged Nashville. Dec. 15, Thomas assumed the aggressive; the Confederates were routed with great loss, and pursued into Alabama. Meanwhile, Sherman, drawing his supplies from the country, had continued his march, molested only by cavalry and militia, and on Dec. 13 issued on the coast, carrying Fort McAllister on the Ogeechee by assault, and occupying Savannah on the 21st.

Other operations in this year had been less successful. An expedition into Florida under Gen. Seymour resulted in defeat at Olustee Feb. 20. In April, Plymouth, N. C., was surrendered by the United States troops to Gen. Hoke, and Washington in that State was evacuated in consequence. Fort Pillow, on the Mississippi above Memphis, was captured by the Confederate general Forrest, and Gen. Sturgis, on following up Forrest, was badly defeated June 10, and a second column despatched against Forrest was beaten at Tupelo, Miss., July 14. In December a land and naval expedition, under command of Gen. Butler and Admiral Porter, for the reduction of Fort Fisher on Cape Fear River, covering Wilmington, totally failed, but the place was taken by Gen. Terry, with the co-operation of the fleet, in Jan., 1865.

Feb. 1, 1865, while Grant was still in winter-quarters before Petersburg, Sherman moved northward from Savannah. On the 18th, Charleston was evacuated by the Confederates under Hardee, in consequence of the occupation of Columbia, which town was nearly destroyed by a fire caught from burning cotton. On Mar. 19 and 21, Sherman encountered the Confederates under Johnston, who had been restored to command, at Bentonville, N. C., and, pushing them back, pressed on toward Raleigh, where Johnston on Apr. 26 surrendered his command, Gen. Lee having surrendered, as recited, on the 9th.

In Alabama the conflict closed somewhat later. In Aug., 1864, Admiral Farragut entered Mobile Bay, reduced Forts Gaines and Morgan, and destroyed the Confederate flotilla. In Mar., 1865, Gen. Canby, with the co-operation of the fleet, reduced the forts on the E., and the city was occupied on the 12th. May 4, 1865, Gen. Dick Taylor surrendered the Confederate forces in that State.

W. of the Mississippi had occurred many conflicts which require to be mentioned. In Aug., 1861, was fought the battle of Wilson's Creek, between the Confederates and the Union troops under Gen. Nathaniel Lyon, who was killed. This action gained the Confederates possession of Southwestern Missouri. Fremont, taking command in Missouri, advanced against Price in September, but was superseded by Hunter, who fell back without a battle. In December, Gen. H. W. Halleck was appointed to the command of the department, and Price was driven into Arkansas after considerable losses. In Mar., 1862, Gen. Curtis gained a victory at Pea Ridge, Ark., over the Confederates, and in July occupied Helena on the river. Several actions were fought in Missouri and Arkansas, the most notable that of Prairie Grove, Ark., in December. The success was generally on the Union side. In October of this year an expedition was sent against Galveston, Tex., but the place was speedily retaken by the Confederates. Immediately following Sherman's repulse from Vicksburg a detachment from his army in Jan., 1863, captured Arkansas Post, on the Arkansas River, with many prisoners. In Aug., 1863, Little Rock was occupied by the Union troops.

Early in 1864, Gen. Banks undertook an expedition up the Red River, which resulted most disastrously, the army and the co-operating flotilla being barely saved from destruction. A movement by Gen. Steele from Little Rock, with a view to effecting a junction with Banks, was foiled. In September and October the Confederates under Price made a raid through Missouri, reaching Lexington, whence they were compelled to retreat, escaping into Arkansas with considerable loss. No other important operations took place in this region. The Confederate reinforcements and supplies were mainly directed to strengthening the armies of Lee and Johnston, and May 26, 1865, Gen. Kirby Smith surrendered the Confederate forces W. of the Mississippi.

We have taken no account of any naval engagements during the war. The Confederates at no time had a fleet which could keep the sea. Their efforts were directed to the construction of rams to operate on rivers and narrow waters. The most memorable appearances of the Confederate navy were the destruction of the wooden frigates Cumberland and Congress in Hampton Roads by the ironclad Merrimack, which was compelled to retire before the new Monitor; and the attack on the Sassacus at the mouth of the Roanoke by the ram Albemarle, which was subsequently blown up by a torpedo-boat commanded by Lieut. Cushing of the United States navy. But while the Confederates made no effort to keep the sea, they inflicted great loss upon the commerce of the United States through cruisers, mainly built in England, among them being the Alabama, Chickamauga, Florida, Shenandoah, Sumter, and Tallahassee. The Alabama, after doing vast damage, was destroyed off Cherbourg on the coast of France by the U. S. steamer Kearsarge, Capt. Winslow, in June, 1864.

The conduct of the war had been much embarrassed by fears of interference on the part of France and England. Such action was rendered more probable on the part of the latter power from the irritation caused by the seizure of Mason and Slidell, Confederate envoys to England and France, who were taken off the British vessel Trent by Capt. Wilkes of the United States steamer San Jacinto in Nov., 1861. War was only averted by the surrender of the envoys on the demand of England. The occupation of Mexico by the European powers and the establishment of Maximilian were also regarded by the United States government as a menace.

The whole number of enlistments (including second enlistments) into the United States forces from 1861 to 1865 was nearly 2,750,000; the aggregate strength of the army May 1, 1865, almost exactly 1,000,000; 304,000 officers and soldiers died in service of wounds and disease.

Perhaps in no war has the conduct of affairs been more affected by political exigencies. In 1862 and 1863 elections in several States went against the administration, and the necessity of resorting to a draft in the summer of 1863 led to riots in New York, which involved much loss of life and property, and required for their suppression considerable detachments from the army. The measures which were especially obnoxious were the suspension of the habeas corpus act, the abolition of slavery in the District of Columbia and in the Territories, the enlistment of colored soldiers, and the proclamation of the President (Jan. 1, 1863), declaring free all persons held as slaves in all States and parts of States in rebellion.

In 1864 the Democrats nominated for the Presidency Gen. George B. McClellan on a platform denouncing the arbitrary measures of the executive and declaring the war a failure. Mr. Lincoln was renominated by the Republican party, and elected, with Andrew Johnson of Tennessee as Vice-President, by 212 votes against 21 for McClellan. On Apr. 14, 1865, a little more than a month after his re-inauguration, Pres. Lincoln was assassinated at Washington by J. Wilkes Booth. Booth was killed by his pursuers, and four of his accomplices were executed on the sentence of the military court. Vice-President Johnson succeeded to the Presidency.

No one was criminally punished for participation in the war of secession. Jefferson Davis, President of the Confederacy, after the fall of Richmond escaped southward, was captured in Georgia, placed on trial, and released on bail. Several successive amnesty proclamations of increasing scope were issued between May, 1865, and Dec., 1868, the last being universal.

The financial legislation of the war covered the issue, in 1862 and subsequently, of notes of the United States, constituting a legal tender, the issue of interest-bearing bonds of several different descriptions; the establishment of the national banking system; the increase of customs duties from the low average under the tariff of 1857 to an average of nearly 50 per cent.; the imposition of a great variety of excise duties and a direct tax. (This legislation will be found in detail under the several titles *Banks, Currency, Taxation.*) The ordinary expenditures of the government which had to be thus provided for rose from sixty millions in 1860 to twelve hundred and seventeen millions in 1865. The table on the next page exhibits the direction of the government expenditures from 1861 to 1875.

The work of political reconstruction constitutes the great feature of the recent history of the United States. In 1863 fifty counties of Virginia W. of the Alleghanies were admitted to the Union as the State of West Virginia, being the thirty-fifth State, the required formal assent of

Years.	Civil Dist.	Foreign Intercourse.	Miscellaneous.	Military service.	Pensions	Indians	Naval establishment	Net ordinary expenditures
1861	$6,074,042	$1,147,787	$16,026,525	$23,001,531	$1,034,600	$2,865,481	$12,387,157	$66,537,222
1862	5,886,615	1,339,227	14,160,021	389,173,562	852,170	2,327,948	42,649,454	456,379,897
1863	6,291,696	1,241,325	15,662,451	603,314,412	1,078,513	3,152,033	64,261,245	691,004,576
1864	7,999,683	1,239,894	18,332,640	690,391,049	4,985,474	2,620,976	85,704,564	811,273,679
1865	10,584,604	1,251,120	27,798,655	1,030,690,400	16,347,621	5,809,361	122,617,131	1,214,349,195
1866	11,984,774	1,315,749	27,312,591	283,154,676	15,605,550	3,295,729	44,285,662	385,954,731
1867	15,128,831	1,793,308	33,876,129	98,715,832	20,939,790	4,687,716	31,074,996	206,216,371
1868	13,127,784	1,432,632	38,092,092	123,107,148	23,792,277	4,199,609	25,734,679	229,397,251
1869	*26,171,003	1,091,171	29,413,497	78,663,649	28,175,856	6,981,167	20,035,605	190,851,648
1870	15,867,336	1,491,215	36,081,809	57,615,802	28,402,241	3,110,279	21,786,592	164,658,274
1871	18,750,014	1,590,046	40,652,640	35,839,119	34,441,753	7,425,951	19,447,767	158,141,301
1872	16,085,682	1,838,388	42,935,460	35,347,495	28,533,403	7,057,887	21,259,031	153,037,346
1873	19,286,741	1,571,686	52,390,044	46,128,085	29,359,151	7,907,139	24,595,536	180,229,971
1874	17,616,253	1,522,570	†66,024,307	42,159,986	29,038,412	6,692,562	30,933,129	191,217,210
1875	17,346,930	‡3,195,237	50,528,536	41,120,646	29,456,216	8,384,657	21,497,628	171,529,818

Virginia thereto being given by a legislature gathered from a few counties adjacent to Washington. In Dec., 1863, a proclamation of the President provided for the re-establishment of civil government in any seceded State on the initiative of a number of qualified voters, not less than one-tenth of those voting at the Presidential election of 1860. Under this scheme governments were instituted in 1861 in Louisiana and Arkansas. In 1865 the 13th Amendment to the Constitution, abolishing slavery within the United States and all places subject to their jurisdiction, was ratified by three-fourths of the States, and was proclaimed by the secretary of state Dec. 18. In 1865 provisional governors were appointed by the President in most of the Southern States, the regular army of the United States still remaining in occupation of the territory, though the volunteers had been disbanded. By these provisional governors conventions were to be called to place the several States in a position to resume their interrupted federal relations, the principal conditions being the repeal of the ordinances of secession, the repudiation of public debts incurred in aid of the Confederacy, and the abolition of slavery by the authority and as the act of the States themselves. Such conventions were held and ordinances passed, but the action was not satisfactory to the Republican party in Congress, with which Pres. Johnson soon broke even more completely than Pres. Tyler had broken with the Whig party in 1842. It was alleged by the Republican leaders that the Southern whites were seeking by stringent laws of apprenticeship and vagabondage to reduce the late slaves to a condition of virtual slavery. Congress therefore refused to admit the Senators and Representatives of the reorganized governments, and in April, by a two-thirds vote, passed over the President's veto the Civil Rights bill, intended to protect the freedmen, and enlarging the jurisdiction of the United States courts to this end. In June, 1865, the two houses of Congress proposed the 14th Amendment to the Constitution, which was subsequently ratified by the requisite number of States, and proclaimed July 28, 1868. This provides in its first section that all persons born or naturalized in the United States, and subject to the jurisdiction thereof, shall be deemed to be citizens of the United States and of the State where they reside, and that no State shall make or enforce any law which shall abridge the privileges or immunities of citizens of the United States; nor shall any State deprive any person of life, liberty, or property without due process of law, nor deny to any person within its jurisdiction the equal protection of the law; and Congress is authorized to enforce these provisions by appropriate legislation. The second section of the amendment sought to induce the States to confer the right of suffrage on the blacks by providing that otherwise the representation of any State should be diminished in the proportion which the excluded classes bore to the total population; but, inasmuch as a subsequent amendment conferred the right of suffrage without distinction of color and without reference to the choice of the States, this section of the 14th Amendment remains wholly without content. The third section prohibits certain classes of persons, participants in the rebellion, from holding office under the United States or any of them until such disability shall have been removed by a two-thirds vote of both houses of Congress. Successive acts, special or general, have, however, relieved nearly every person embraced within these classes. The fourth section provides that the validity of the public debt of the United States shall not be questioned, and that the United States or any of them shall never assume or pay any debt incurred in insurrection, or any claims for the loss or emancipation of any slave.

The antagonism between the President and the Republican majority in Congress gradually increased, until Congress in Mar., 1867, passed over the veto the Tenure-of-Office act, to limit the President's power of removal from office. In Feb., 1868, the President, in defiance of this law—which he deemed an unconstitutional invasion of the executive functions—designated Gen. Lorenzo Thomas, adjutant-general of the army, as secretary of war *ad interim*, removing Mr. Stanton from the office. This led immediately to an impeachment of the President by the House of Representatives, which was tried by the Senate, the chief-justice presiding. Mr. Johnson was acquitted, the prosecution failing to secure a two-thirds vote for conviction. Secretary Stanton, resigning, was succeeded by Gen. John M. Schofield, and Mr. Stanbery, a little later, was succeeded by W. M. Evarts, who had been of the President's counsel.

The Presidential election approaching, Mr. Johnson failed of renomination by either party, the Democrats putting forward Horatio Seymour, formerly governor of New York, the Republicans nominating Gen. U. S. Grant, with Schuyler Colfax of Indiana, Speaker of the House of Representatives, for Vice-President. Grant and Colfax were elected, receiving 214 votes against 80 for their opponents; three States, Virginia, Texas, and Mississippi, not being admitted to the electoral college.

The accessions to the United States during Johnson's administration had been through the admission of Nebraska as the thirty-seventh State in 1867, Nevada having been admitted as the thirty-sixth State in 1866, and the purchase of Alaska from Russia for the sum of $7,000,000. In Feb., 1869, just before the expiry of Johnson's term of office, the 15th Amendment to the Constitution was passed by Congress over the veto. This amendment provides that the rights of citizens of the United States to vote shall not be denied or abridged by the United States, or by any State, on account of race, color, or previous condition of servitude. It received the ratification of the requisite number of States, and was proclaimed Mar. 30, 1870.

President Grant's administration has been remarkable for the number of cabinet officers at various times appointed. The most notable incumbents of the several offices have been, in the state department, Hamilton Fish; in the treasury department, George S. Boutwell and B. H. Bristow; in the war department, Gen. John A. Rawlings and W. W. Belknap; in the navy department, George M. Robeson; in the interior department, J. D. Cox and Columbus Delano; in the post-office department, J. A. J. Creswell and Marshall Jewell; as attorney-generals, E. R. Hoar and George H. Williams. In this administration the office of the attorney-general, which had previously been mainly an office of advice, was enlarged to constitute the administrative department of justice, having supervision of United States district attorneys and marshals. All the States were restored to representation in Congress. Between 1869 and 1873 the tariff duties imposed during the war suffered considerable reductions, while the internal revenue duties were mainly abolished, except as to spirits and tobacco. An effort was made to reform the civil service by making it non-political and enforcing tests of efficiency, but this was abandoned after the election of 1872. The completion of the Union Pacific and the Central Pacific R. Rs., mainly at the expense of the government, making a continuous line from the Missouri to the Pacific, was effected in 1869. Out of the connection of the government with these roads arose much scandal from the alleged corruption of certain members of Congress, who were charged with receiving stock of the Credit Mobilier Co., which built the road. The charges were investigated by Congress in winter of 1872–73, with much injury to the reputation of several members.

During the Presidential election of 1868, which was the first national election after the 15th Amendment to the Constitution, numerous outrages were perpetrated upon the colored people of several of the Southern States, and intimidation was largely exercised to restrain their political action. These acts were generally committed by masked men, supposed to belong to a widespread organization to which was popularly given the name "Ku-Klux Klan."

*This includes $7,000,000 paid for Alaska.
†This includes $15,500,000, Geneva tribunal award.
‡Includes $1,929,819 awards to British claimants.

In Apr., 1871, an act was framed, under the authority of the 14th Amendment to the Constitution, enlarging the jurisdiction of the United States courts for the punishment of such offences.

In 1871 a treaty was negotiated at Washington between commissioners on the part of the United States and of Great Britain for the settlement of the Alabama and other claims against Great Britain arising out of the depredations of the Confederate cruisers built in England, and also for the adjustment of the conflicting claims of the two countries to the islands of the San Juan group between Vancouver's Island and the continent on the North-west. The latter were referred to the emperor of Germany as arbitrator, who decided in favor of the United States. The Alabama and kindred claims were referred to a tribunal to be convened at Geneva, consisting of five arbitrators, appointed, one each, by the President of the United States, by the queen of England, by the king of Italy, by the president of the Swiss confederation, and by the emperor of Brazil. The arbitrator on the part of the United States was Charles Francis Adams, who had been minister to England during the war. The tribunal assembled in Dec., 1871, and awarded to the United States a gross sum of $15,500,000, to be distributed by the government. By the same treaty certain other claims, both of American citizens against the British government and of British citizens against the government of the United States, were referred to a joint commission of three. The commissioner on the part of the United States was James S. Frazer. The commission met at Washington in Sept., 1871, and sat nearly two years, making a net award against the United States of about $2,000,000. Still another commission was provided for by the treaty for determining the disputed rights of navigation and fishing between Canada and the United States, but this commission has not yet been convened.

The unsettled condition of affairs in Santo Domingo during the years 1869–71 led to propositions for the acquisition of that territory by the United States, and the President appointed a commission to visit Santo Domingo and report respecting the state of society therein; which they did, but with no practical result.

As the Presidential election of 1872 approached, considerable dissatisfaction was developed among a section of the Republican party in consequence of many alleged abuses of the public patronage, especially the manner in which the power of the administration had been used to sustain Republican ascendency through negro votes in several Southern States where the colored electors were nearly or quite in a majority. In May a convention of Liberal Republicans met at Cincinnati and nominated Horace Greeley of New York for President. This nomination was ratified by the Democratic convention, though a very small section of the party repudiated the action and nominated Charles O'Conor of New York. The Republicans in convention at Philadelphia renominated Pres. Grant, with Henry Wilson of Massachusetts for Vice-President. The Republican ticket received the electoral vote of twenty-nine States—in all, 286 votes. The votes of Arkansas and Louisiana were thrown out for irregularities. The remaining six States, all late slave States, went Democratic, but Mr. Greeley having died before the assembling of the electoral college, this vote was scattered according to local preferences.

In Oct., 1873, the steamer Virginius, carrying the United States flag, and having on board munitions of war and recruits for the insurgents in Cuba, was captured by a Spanish armed vessel, and a number of the prisoners shot by the authorities in Cuba. War was anticipated, and considerable naval preparations were made by the United States, but the lawless character of the Virginius was fully established, and friendly relations were restored, Spain paying a sum for the relief of the families of the victims.

The Congressional elections of 1874 went strongly against the administration, and a Republican majority of sixty or seventy in the House of Representatives was turned into a nearly equal Democratic majority. Just before the incoming of the new House of Representatives, Congress passed an act declaring that specie payments should be resumed by the United States on Jan. 1, 1879.

In the autumn of 1875 the elections in the States of Ohio and Pennsylvania were severely contested between the Democrats and the Republicans on the currency issue, popularly known as "hard money" or "soft money," the position taken by the former party being that the resumption act of 1875 was arbitrary, ineffective, and injurious to the industry of the country. Both these elections were carried by the Republicans. The Democrats coming into power in the House of Representatives for the first time for sixteen years, many investigations were made by special and standing committees into the conduct of affairs by the Republicans, and reports were made censuring the conduct of various cabinet officers and subordinate officials. On the report of a committee to examine the expenditures of the war department, W. W. Belknap was impeached as secretary of war for corruption in the appointment of a post-tradership. The impeachment was tried by the Senate, and Mr. Belknap, who had resigned from office before the vote of impeachment, was acquitted, two-thirds not voting for conviction.

In May, 1876, an international exhibition was opened at Philadelphia under the auspices of the United States government, which made an appropriation of $1,500,000 for the purpose, while the private, municipal, and State subscriptions aggregated several times that amount.

One of the features of Pres. Grant's administration is the appointment of Indian agents upon the recommendation of the religious societies and missionary boards having the spiritual charge of the tribes. This has not, however, prevented three Indian wars. The first occurred with the Apaches in Arizona, who, after numerous depredations and massacres, were severely punished by Gen. Crook. A second with the Modocs, a small band under "Captain Jack," ranging in Southern Oregon and Northern California, commenced in 1873 with the massacre of Gen. E. R. S. Canby while treating with the savages, and was closed by the utter destruction of the band after severe losses to the United States troops, from the difficult character of the lava-beds in which Captain Jack made his stand. The third began in 1876 with a large body of Sioux Indians under "Sitting Bull" in Montana, who refused to receive the terms of the government and remain at the agencies established for them. In June, Gen. George A. Custer moved against the hostile Sioux with a regiment of cavalry, and, dividing his command, attacked with five companies a camp of more than 2000 warriors. In the attack Custer and every man fell, no one remaining alive to tell the tale. The other companies of Custer's command were attacked by the Indians, but were saved by the arrival of Gen. Terry with a large body of infantry. Extensive preparations were at once made by the government for punishing this band, and a formidable expedition under Gens. Crook and Terry was sent against them, but without important result.

On the approach of the Presidential election of 1876 the Republican party in convention at Cincinnati nominated for President, Rutherford B. Hayes, governor of Ohio, with William A. Wheeler of New York for Vice-President. The Democratic convention nominated for President, Samuel J. Tilden, governor of New York, with Thomas A. Hendricks, governor of Indiana, for Vice-President, on a platform demanding the repeal of the resumption act of 1875.

(I am indebted to Profs. T. Sterry Hunt, W. H. Brewer, and S. I. Smith for valuable assistance in the preparation of portions of this article relating to the physical features and natural resources of the United States. I have also made use of the writings of Profs. J. D. Whitney and J. S. Newberry.) FRANCIS A. WALKER.

United States Bank. See BANK.

United States Christian Commission. See CHRISTIAN COMMISSION.

United States Homestead Legislation. See HOMESTEAD LEGISLATION IN THE UNITED STATES.

United States, Literature of. See ENGLISH LANGUAGE AND LITERATURE. See also JOURNALISM.

United States Lutheran Church. See LUTHERAN CHURCH IN THE U. S., by C. P. KRAUTH, S. T. D., LL.D.

United States Military Academy. See MILITARY ACADEMIES and WEST POINT.

United States of Colombia. See COLOMBIA.

United Synod of the Presbyterian Church, a former organization in the Southern U. S.; seceded in 1857 from the New School Presbyterians, and in 1864 joined the General Assembly of the Confederate States.

United Syrians. In the Eastern rite of the Roman Catholic Church the Syrian rite comprises the Chaldæans, the Maronites, the United St. Thomas Christians, and the United Syrians proper. The latter have a patriarch at Aleppo, styled patriarch of Antioch, and archbishops of Aleppo, Babylon, Damascus, and Seleucia, besides 11 bishops. They number about 30,000. They date from the seventeenth century, when a numerous party under Andreas Achigian, their first patriarch, seceded from the Jacobites and acknowledged the pope. There had, however, been for three centuries a Romanizing party in the Syrian Church. (See also MARONITES, CHALDÆAN CHRISTIANS, EASTERN RITE, UNITED CHRISTIANS OF ST. THOMAS.)

Un'ity, p.-v. and tp., Alexander co., Ill. P. 570.

Unity, tp., Piatt co., Ill. P. 934.

Unity, p.-v. and tp., Waldo co., Me. P. 1201.

Unity, p.-v. and tp., Sullivan co., N. H. P. 814.

Unity, tp., Rowan co., N. C. P. 893.
Unity, v., Oliver tp., Adams co., O. P. 36.
Unity, p.-v. and tp., Columbiana co., O. P. 2286.
Unity, tp., Westmoreland co., Pa. P. 3624.

Unity of time, of place, and of action in a drama was the fundamental rule or general idea from which the French dramatic writers and critics of the classical period derived, or to which they referred, all their practical rules for the construction of a drama. Boileau and Voltaire pretended to have found this fundamental rule prescribed by Aristotle and obeyed by the Greek tragedians. But Aristotle never mentions the unity of space, the Greek dramatists never paid any regard to the unities of time and space, and the French critics never understood, as little as the French dramatists ever practised, the unity of action in the sense in which Aristotle propounded it. Unity of time means that a drama must not represent a larger space of time than that which the actual performance occupies—that is, when carried to its last consequences, the drama must not represent anything but that which it actually is; which is nonsense. Unity of place means that a drama must not use more than one decoration, a monotony which is entirely unnecessary with the present arrangement of the scene. What unity of action means is easily understood by comparing *Othello* and *The Merchant of Venice*. The latter has two actions running beside each other, and not meeting until the last scene of the fourth act—namely, one between Bassanio and Portia, and one between Antonio and Shylock. From this play it may also be learned that the critic has no reason for objection, but so much more for admiration, if the poet has power enough to preserve the unity of impression, although pursuing a double action. But this is very seldom the case. Shakespeare failed often, and the French dramatists always. In *Cid*, *Athalie*, and *Zaire* there is a mixture of actions of love, of honor, and of religion, which in some places is irresistibly ludicrous. As a general rule, it may be said that unity of action is necessary whenever the action requires or contains a minute and precise psychological development. But although the French critics of the classical period were very much mistaken in their theory of the dramatic unities, their criticisms are nevertheless well worth reading. They contain many fine observations on scenic effect, and these observations are generally embodied in some handy and easily-remembered rule. CLEMENS PETERSEN.

Unity Plantation, Kennebec co., Me. P. 68.

U'nivalve ("one-valved") **Shells,** in conchology, are those which consist of a single piece. The term is at present of no scientific importance except as a descriptive one, for, though a large number of gasteropods are univalve, yet some cephalopods are also one-valved, and the shells of many Foraminifera, and of some Vermes and other non-molluscous organisms, are equally entitled to the name.

Univer'salism.* This term indicates the belief of those who hold the doctrine of the final holiness and happiness of all intelligent beings. This doctrine, they affirm, is a legitimate deduction from the acknowledged attributes of God and from the declared principles of the gospel of Christ. They conceive it to be utterly inconsistent to affirm that a Being of infinite benevolence will doom any of his children to irremediable woe. They argue that none but a malignant Being, having the power to reclaim those of his subjects that have wandered from him, will permit them to go on in sin, and suffer its consequent miseries for ever. Universalists believe in the infinite and immutable love of the Heavenly Father, who will not permit the sinner to elude his all-conquering grace, but will follow the lost lost soul to the deepest hell it may make for itself, and will find it and bring it back to his presence and to the joy of the celestial state (Luke xv. 1–10). Such are the meaning and purpose, they conceive, of the Christian religion. Jesus Christ was sent by the Father into the world to save his people from their sins (Matt. i. 21). They are fully persuaded that the Divine Saviour will accomplish the object of his mission by finally redeeming all from the dominion of sin and introducing them into the blessings of his kingdom, which consist in righteousness and peace and joy in the Holy Ghost (Rom. xiv. 17). The punishment of the wicked, however severe and terrible it may be, Universalists hold to be but a means to a beneficent end—not revengeful, but remedial; not for its own sake, but for the good of those who suffer its infliction (Heb. xii. 5–11). This doctrine, Universalists affirm, is not only to be inferred from the character of God; it is explicitly declared in the Holy Scriptures. The assurance of the ultimate destruction of all moral evil was given in the garden of Eden, when it was promised that the seed of the woman should bruise the serpent's head (Gen. iii. 15). It is also contained in the promise which was made to Abraham and renewed to Isaac and Jacob, that in them should all the families, nations, and kindreds of the earth be blest (Gen. xii. 3; xxii. 18; xxvi. 3, 4; xxviii. 14; Acts iii. 25). It finds expression in the fervent breathings of the inspired Psalmist, where it is said that all kings, nations, and kindreds shall worship Jehovah (Ps. xxii. 27; lxxii. 11, 17; lxxxvi. 9). All the holy prophets foretold the restitution of all things (Acts iii. 21; Isaiah xlv. 23, 24; lvii. 16; Jer. xxxi. 33, 34; Lam. iii. 31–33; Dan. vii. 14; Hos. xii. 14; Mic. vii. 18). Jesus Christ, the Divine Redeemer, declares that he came not to condemn, but to save the world (John iii. 17); that all the Father gave him shall come to him (John vi. 37); and that if lifted up from the earth, he would draw all men unto him (John xii. 32). The apostle Paul gives frequent expression to the doctrine, as when he says that as many as have sinned in Adam shall be made righteous in Christ (Rom. v. 12–21); that the whole creation shall be delivered from the bondage of corruption into the glorious liberty of the children of God (Rom. viii. 21); that the fulness of the Gentiles, together with all Israel, shall come in and be saved (Rom. xi. 25, 26); that all things shall be subject to Christ, and God shall be all in all (1 Cor. xv. 28); that it is the Divine will, good pleasure, and purpose to gather together in one all things in Christ (Eph. i. 9, 10); that at the name of Jesus every knee shall bow and every tongue confess (Phil. ii. 9–11); that Christ is the Saviour of all men, and that he gave himself a ransom for all (1 Tim. ii. 4–6; iv. 10); and that God has prospectively put all things in subjection to his Son (Heb. ii. 8). St. John's testimony is to the same effect, when he declares that Jesus is the propitiation for the sins of the whole world (1 John ii. 2), and that in the visions of Patmos he heard every creature which is in heaven and on the earth and under the earth, and such as are in the sea, saying, "Blessing, and honor, and glory, and power be unto Him which sitteth upon the throne, and to the Lamb for ever and ever" (Rev. v. 13).

Universalists affirm that the doctrine of universal salvation was the prevailing doctrine of the early Christian Church. Neander distinctly tells us in his *Church History* that it was the doctrine held and taught in the catechetical school of Alexandria, of which Clement and Origen were the brightest shining lights. A distinguished ex-president of a Western Presbyterian college, who has made the subject one of long and searching investigation, has published as the result that in four of the six catechetical schools which flourished in the first centuries of the Christian era—those of Alexandria, Cæsarea, and Antioch, and that of Edessa and Nissibis—the doctrine was believed and taught; while that of the annihilation of wicked souls was taught in the school of Ephesus, and that of endless punishment was held and inculcated in only the school of Carthage. It is a fact well known to all students of ecclesiastical history that it was formally condemned by a council assembled in Constantinople in the year 553. Unless widely prevalent, it would have hardly received such attention from a body of high ecclesiastics met in solemn conclave. Besides Clement and Origen, already referred to, the names of Marcellus, bishop of Ancyra; of Titus, bishop of Bostra; of Gregory, bishop of Nyssa; of Gregory, bishop of Nazianzus; of Diodorus, bishop of Tarsus; of Theodore, bishop of Mopsuestia; of Theodoret, bishop of Cyrus; of Evagrius, Victorinus, and others, are conspicuous among those who advocated the doctrine of the final redemption of all souls through the mission of Christ. It is certain that Universalism was very generally held in the Christian Church at a period anterior to the supremacy of Rome in the religious affairs of the world.

The doctrine of Universalism was never extinguished in the Church. It appeared among the Albigenses and the Waldenses in the twelfth century, the Lollards of Germany in the fourteenth, the "Men of Understanding" in the fifteenth, and some of the Anabaptist sects in the sixteenth. Since the Reformation it has found advocates in nearly every Protestant church in Europe. In France it has been maintained with distinguished ability by the Messrs. Athanase Coquerel, father and son. The doctrine has been widely prevalent in Germany, and numbers among its advocates men like Neander, Olshausen, Hagenbach, Hahn, Von Müller, De Wette, Schleiermacher, and others. In England, when the Articles of the Established Church were framed, the doctrine was formally denounced in the 42d article. This article, with two others, was subsequently dropped, leaving but thirty-nine. By an act of Parliament of 1648, Universalists were made liable to imprisonment, but it has been held among both churchmen and dissenters down to the present day—men like Archbishop Tillotson,

*The publisher of this work having laid upon me the responsibility of furnishing an article upon "Universalism," at my request the Rev. Giles Bailey has prepared this paper, which I have revised and submit to the readers of the NEW UNIVERSAL CYCLOPÆDIA. E. H. CHAPIN.

Bishop Newton, Dr. Burnett, Dr. Henry More, William Whiston, Prof. Maurice, Dean Stanley, Prof. Jowett, Charles Kingsley, and Stopford A. Brooke of the former, and Soame Jenyns, Jeremiah White, T. Southwood Smith, John Foster, and others of the latter.

Universalism was preached in America as early as 1741 by Dr. George de Benneville. Rev. Richard Clarke, an Episcopal clergyman of Charleston, S. C., maintained it for many years, both by preaching and writing. Dr. Mayhew, a Congregational pastor in Boston, advocated it in a published sermon in 1762. The first Universalist church in this country was organized by Rev. John Murray in Gloucester, Mass., in 1780. The first convention of Universalist ministers and parishes was held in 1785, and was the germ of the present Universalist General Convention. The present organization was adopted in 1870. Under it the body is composed of delegates from the State conventions, which in turn are made up of the ministers and delegates of the several parishes of the respective States. By it a uniform system of fellowship, ordination, and discipline is secured. The General Convention is the supreme power of the Church and the ultimate tribunal in all cases of difficulty. The State conventions have immediate jurisdiction over clergymen and parishes within their respective limits, subject to the right of appeal. Assent to the Winchester Confession of Faith, adopted in 1803, is required as a condition of fellowship, as follows: I. We believe that the Holy Scriptures of the Old and New Testament contain a revelation of the character of God and of the duty, interest, and final destination of mankind. II. We believe that there is one God, whose nature is love, revealed in one Lord Jesus Christ by one Holy Spirit of Grace, who will finally restore the whole family of mankind to holiness and happiness. III. We believe that holiness and true happiness are inseparably connected, and that believers ought to be careful to maintain order and practise good works, for these things are good and profitable unto men. Accepting this confession, the Universalist Church is thoroughly Christian in belief, holding inflexibly to the authority of the Bible, to the divine mission and office of Christ, to the absolute necessity of a holy life, to the certainty of a just retribution for sin, and to the assurance of the final triumph of good over evil and holiness over sin in all worlds and in all souls.

The General Convention holds a fund, called the "Murray fund," the interest of which is appropriated for the education of candidates for the ministry and for the support of missions. It also has sources of revenue in its missionary-boxes, which are designed to be placed in every Universalist family, and in the annual voluntary contributions of the parishes. The standing of the Church may be thus briefly summarized: 1 General Convention, 21 State conventions, 73 associations, 800 meeting-houses, 700 ministers, 5 colleges (one of which, Tufts College, College Hill, Mass., has an endowment of $1,000,000), 2 theological seminaries, 7 academies and preparatory schools (one of which, Dean Academy, Franklin, Mass., has assets amounting to $300,000), and a corps of more than 100 teachers, constantly engaged in its several collegiate, academic, and theological institutions. GILES BAILEY.

Universalists. See UNIVERSALISM.

Univer'sals are either metaphysical, *universalia ante rem*, denoting the archetypal forms of things as far as they existed in the Divine Mind before the real things were created; or physical, *universalia in rem*, denoting the archetypal forms as far as they actually exist in things created; and finally logical, *universalia post rem*, denoting the archetypal forms as far as they are abstracted by the human intellect from the things. (See REALISM.)

U'niverse, The [Lat. *universum*], a term employed to signify the grand and total aggregate of created things.*

The knowledge we have acquired of the all but boundless creation, of which the globe we inhabit is a humble and inconspicuous member, may be succinctly summed up in the following propositions:

(1) The stars are suns as truly as our own, and like ours are endowed with self-luminosity. Some of them are furnished with one or more luminous satellites; others with satellites of which, though obscure, the existence is sufficiently proved by the phenomena presented by the phases of their brightness and by their movements.

(2) These systems, which we may call systems of the first order, and which resemble our planetary system, are governed by the force of gravity residing in a principal star, and are subject to the same Keplerian laws which reign among the planets revolving around our sun. If the secondary suns which hold the relation of satellites to the principal are also themselves surrounded by dark satellites, we have cases similar to that which truly exists among the dark stars (planets) of our own system.

(3) In many cases these simple systems are replaced by systems extremely complex, forming groups and globular aggregations of which the laws of movement and of equilibrium are still unknown. These agglomerations are formed of separate masses—that is, of stars neatly separable by the power of our instruments; and by their sole multitude they form at the centre an indistinct luminosity which is still of stellar nature.

(4) Innumerable other aggregations are of a character more or less resolvable, but of greater complication; in which yet, in consequence of the distance of the bodies and the slowness of their movements, there does not appear any trace of a centre of motion nor any law of regular concentration; still, there is no need to despair that, with lapse of time, these may be yet discovered.

(5) The Milky Way is a zone constituted of an enormous agglomeration of complicated masses of stars, which may each be regarded as composed of innumerable systems of a superior order. The form of this immense aggregation is unknown, but its profundity in different directions is unequal, and we can on certain lines penetrate beyond its depth, while in others it is impenetrable.

(6) The stars which are apparently the largest are also the nearest, and greater distance is the principal cause of the smaller apparent magnitude of the others. Probably the larger, our nearest neighbors, form one of the superior systems just mentioned, and the one to which our sun belongs, multitudes of which unite to form the Milky Way.

(7) Besides the stars, there are in the heavens very numerous masses of matter luminous *per se*, not yet condensed into well-defined bodies, but simply gaseous, which form the nebulæ. Some of these are of enormous extent and of extremely irregular density; others have a uniform density; others, still, a condensation increasing toward the centre, as if they were stars just forming; some are annular, and appear destined to form systems of a more complicated character.

(8) The largest part of these nebulous masses of gradual condensation present themselves in regions independent of the Milky Way, and seem to form systems by themselves; but, notwithstanding their aëriform and gaseous, and therefore most mobile condition, all these are remarkable for their sensibly constant forms.

(9) The absolute dimensions of the stars and the nebulæ, and their reciprocal distances, are entirely unknown in consequence of the absence of parallax; and hence we can know nothing at all positive as to their real distribution in space. Yet we can be certain that the stars are not uniformly distributed, but are most numerous and most dense—not only apparently but also really—in the plane of the Milky Way. The nebulæ, on the other hand, are in greater density and number in a plane perpendicular to this.

(10) Estimating by indirect means the stellar distances, and expressing them only in relative measures, we infer that, placing the nearest stars at the smallest distance possible—that is to say, the distance corresponding to an annual parallax of an entire second—they would be remote from us by 206,265 semi-diameters of the great orbit of the earth, and their light would occupy three years and a quarter in coming to us from them. These numbers must be increased at least tenfold in order to include all the stars in our neighborhood; because it is certain that only very few have more than the tenth of a second of parallax; and hence the magnitude of the orbit which the earth describes around the sun, though 276 millions of kilomètres in diameter, would not appear from one of these more than an imperceptible point.

(11) Calculating with this proportion, according to the most probable elements of photometry and of proper motion, the distance of the other objects which the most powerful Herschelian instruments can reach, we find it such that, for these, light should occupy in coming to us, a time 312 times longer than for the stars of the first magnitude having a tenth of a second of parallax; that is to say, more than 10,000 years!

(12) Immense as this space may seem, it does not constitute the real limit of the creation, since our most powerful instruments fail to penetrate even all the galactic strata in all their profundity; hence, the firmament is for us unfathomable. It cannot, nevertheless, be called infinite; nothing composed of distinct and separate entities can be infinite.† But, though not absolutely infinite, the universe is for us as if it were so.

* What follows this definition formed originally the conclusion of the able article of Father SECCHI on the STARS, to which the reader is referred. It has been transferred to this place as presenting a view more likely to be sought under the present head.—ED.

† Because, it being always, absolutely speaking, expressible in numbers, it would be unavoidably either even or uneven; and in either case, by taking away a unit, the infinite would become finite; which is absurd.

In order to express celestial distances in concise numbers, the distance traversed by light in three and a quarter years, which would be the distance of a star having a parallax of one second, will be adopted as a unit of comparison. But is this distance itself conceivable by us, when we can by no means form a distinct idea of the distance travelled by light in 8¼ minutes only—that is to say, in coming from the sun; when even we cannot at all conceive the magnitude of our own globe, which light would pass over in some thousandths of a second? These artificial means of measurement are therefore only simple aids to our incapacity, but do not in reality in the least enable us any better to comprehend the incomprehensible. They are artifices by which we diminish the immense in order that we may adapt it to be contained in our own littleness.

It is said that the world ought to be infinite in order that the work may be worthy of its Infinite Creator. But if it were infinite and peopled to infinity with stars, the celestial vault ought to appear, in all its extent, as brilliant as the sun. Such is not the fact; and hence we must conclude that the stars are not infinite in number. On the other hand, in order to sustain the hypothesis in opposition to the testimony of the senses, it is supposed that there must be an absorbing medium which prevents the light of the distant stars from reaching us. That many opaque bodies exist in space which may intercept light is not doubtful, but these would be comparable to minute particles of atmospheric dust, which may enfeeble but cannot intercept light entirely. We limit ourselves to the fact of a finite physical world, and when, even under such limitation, the conception transcends our capacity, it does not seem worth while to dally with theories which are in their very nature beyond comprehension.

When once we give a loose rein to such ideas, there arises immediately the supposition that many worlds like ours may exist in space, and be unknown to us because separated from us by an absolute vacuum, devoid even of the ethereal medium through which light is propagated. As it is impossible to prove such conceits, and also impossible to impugn them, it is not worth while to occupy ourselves with them. What we see is already too much for us, not to mention what we do not see.

(13) The matter which composes this incomprehensible mass is yet always the same. The elements which the chemist studies in his laboratory are the very same elements which the spectroscope reveals in the stellar atmospheres and in the ultimate nebulæ. Small as may be the number of these elements which have been identified, it is still large enough to assure us that the laws which govern matter are the same with us and in that remote profundity; and daily discoveries bring new confirmation to this idea.

(14) But the creation which the astronomer contemplates is not a simple aggregation of incandescent matter; it is a prodigious organism, in which, where the incandescence of matter ceases, life begins. Though this life may not be discoverable by our telescopes, still, from the analogy of our globe, we can argue to its general existence in others. The atmospheric constitution of other planets, so greatly similar in some of them to ours, and that of the stars, so similar to that of our sun, are persuasive reasons for believing that these orbs are either at this moment in a similar condition with our own, or are passing through some one of those states through which our own system has already passed, or through which it is yet destined to pass hereafter.

(15) In the immense variety of objects of creation which have been or which still are in existence on our planet, we can argue the diversity which must exist yonder. If with us the air, the earth, and the waters are peopled with so large a variety of living things, changing also so often with the mere mutations of climate and of the medium which they inhabit, how much more ought we to find such in those immeasurable systems where the secondary bodies are lighted up sometimes not by a single sun, but by several in turn, and where climatic changes alternating from heat to cold must be extreme, both on account of the excessive eccentricity of the orbits, and because of variations in the absolute intensity of radiation, from which our sun itself is not exempt.

(16) But it would be a very narrow view to model the entire universe upon the pattern of our little globe, while in this relatively microscopic system there is presented so great a variety; nor is it philosophical to pretend that every star is inhabited like ours, and that in every system life is limited to dark satellites alone. It is true that with us life could not exist except between confines of temperature narrowly limited—that is, between zero and 40° to 45° Centigrade (104° to 113° F.)—but who can tell that these are not limits for our organisms only?* At any rate, even if with these limits there could be no life in stars in a state of flame, these greater stars would have always in the creation the grand office of sustaining life, by regulating through the attraction of their masses the courses of the secondary bodies, and by enlivening them with their light and their heat. And what should there be surprising if among so many millions there should be numbers, even great numbers, absolutely desert? Do we not see that, upon our own globe, regions extensive enough in proportion are incapable of sustaining life? This is by no means a disparagement to the immensity of the fabric, either in respect to its own proper dignity or in respect to the presumed design of the Architect.

(17) Life fills the universe, and with life is associated intelligence; and as beings inferior to ourselves abound, so may there in different conditions exist others of capacities infinitely greater than our own. Between the feeble light of that divine ray which glows in our frail structures, by help of which also it is permitted us to comprehend so many wonders, and the lofty wisdom of the great Author of all things, there may possibly be interpolated grades of created beings infinite in number, for some of whom theorems which to us are the fruit of arduous studies may be simple intuitions.

(18) But this is a sphere over which the astronomer may not extend his reign. His proper province is to study the material and mechanical development of the world—to trace it out in space, and lend aid to the geologist who studies it in time. In this also the scale is endless. The condensation of the nebulæ is so slow that the period of a little more than a century since our acquaintance with them began has not yet shown in them any certain trace of changes; and this considerable lapse of time can only be regarded as an instant. The double stars, small as their relative distances may be, still occupy centuries and centuries in completing their periods. The configuration of the constellations has not sensibly varied since man first looked upon the heavens. Such is the slowness with which movements are performed which still in real velocity many times surpass that of our earth! These configurations, nevertheless, will yet vary, and then perhaps it will at length be possible to obtain some idea of the relation to other stellar systems of the system to which our own belongs.

(19) Inasmuch as no new and conspicuous body has come to occupy a permanent place in the starry sphere, if any such body has at any time appeared instantaneously, we now know that this was not a new creation, but one of those great momentary conflagrations which are not rare even in our day, but are only difficult to demonstrate on account of the apparent minuteness of the bodies which are their seat. Are these conflagrations born of collisions from without, or from new transformations in the interior of the star? We know not; but we still see in them the evidence that in those depths of space, where eternal silence seems to reign, there exists nevertheless a prodigious activity. The long series of years which measures the celestial revolutions is parallel to the series according to which the geologist calculates the duration of the revolutions of our own globe; and in this the two extremes, the immensity of the heavens and the life-period of our little planet, touch each other.

(20) The comets, which have been the subject of so many speculations during the past century, are now recognized to be only visitors, strangers to our system, and parts of a great nebula of a special nature, containing gases very familiar to chemistry—not in elementary condition, as in the sidereal nebulæ, but combined with proteiform carbon, an element detected only in a portion of the stars. Their light is not wholly due to reflection from the sun, but is also in some degree their own. In order to produce such light there is not needed a proportional incandescence, or an elevation of temperature which would carry the body to redness, but only such a molecular structure as may render it capable of exciting certain waves in the ether; as, in many cold-blooded terrestrial insects and marine animalcules, we see the slightest force exciting luminosity without a proportional elevation of temperature. The modern ideas on the synchronism of undulatory motion between the ether and the molecules of bodies are such as to set at rest the so-much controverted question upon this point.

(21) Heat is the prime force animating the universe: its action is transmitted from one body to another by the instrumentality of a continuous medium which we call ether; and we are in contact with the remotest regions through this mysterious medium, whose vibrations constitute radiant heat, light, and vital chemical activity, and whose dis-

*The cessation of life at 0° arises from the solidification of water; in the deep seas, where the salt water freezes only at 3° below zero, life can exist at —2½°, or even at —3°. If water is not the only element necessary to life, but if life can be associated with any other liquid, who can fix bounds to its existence?

turbed equilibrium of density produces attraction. This medium is that which binds the whole together, and gives unity to the whole in spite of the immense distances.

(22) Gravity is the force which directly rules the entire creation, from the pebble falling upon the earth to the nebula gradually condensing in the profundity of space; but it is not the sole force which rules in the universe; perhaps even it is itself only a consequence of disturbed equilibrium in the ether. But the comets have given indications of some other force not yet well defined operating in space. The rapid development of the tails of these bodies is not explained by the action of heat alone, nor by that of gravity. Magnetism, electricity, have been invoked, but as yet nothing as to this is certain.

(23) The decennial vicissitudes of the sun, manifesting themselves in the variations of its spots and in the force of its eruptions, are reflected in the variations of terrestrial magnetism and in the electric displays of the aurora borealis: thus proving that another force besides gravity emanates from the sun, and expands itself through the space occupied by the planets, determining in them vicissitudes of the most abstruse nature. We are certain of this force, but are ignorant of its mode of action.

(24) We are not yet at the end of marvels; we shall be so only when we cease to study. There was a time when the solar system was limited to a central luminous body surrounded by a few of the larger non-self-luminous celestial objects. Not long after there were added to this, numerous systems of the second order (the satellites), and discovery was believed to be at an end. Now, on the other hand, the very idea of the system is itself radically changed. Now we know that around the sun, between Mars and Jupiter, there circulate as many as 164 small planets (Sept., 1876); that a gaseous envelope surrounds him which frequently extends as far as the earth, and forms the Zodiacal Light; and that there are also numerous comets permanently circulating within the domain of his attraction, and endowed with a luminosity of their own; there are recognized also numerous currents of extremely minute bodies ploughing in all directions the planetary spaces; and all this to make up the cortége of a star which placed at the stellar distance would be only of the sixth magnitude—that is to say, would be hardly visible to the naked eye!

(25) It is not so very long since it was believed that the stellar spaces were peopled only by well-defined and compact bodies; now there have been discovered those enormous masses of gas which are perhaps destined to constitute other solid bodies, if even already there are not some of them solidified, of which light has not yet brought us the announcement. The orbit of the greatest of our planets would hardly measure the extent of a planetary nebula. What, then, shall we say of so many others; as, for example, of that of Orion, which extends through so many degrees in its brighter part, to take no account of the fainter?

(26) How many other marvels ought we not to find in the immensity of that space which we are yet unable to sound? Who would have imagined, ten years ago, the wonders which the spectroscope was on the point of revealing? Every new improvement in art brings a new improvement also to science; and the astronomer, profiting by both art and science, is finding new revelations of the greatness of God, and giving new cause to exclaim with the royal prophet, "O Lord, how manifold are thy works! in wisdom hast thou made them all;" and thus, as the heavens declare his glory, and the firmament showeth forth his handiwork, so if the day astounds us with its wonders, the night opens up to us the very treasury of science.

P. A. Secchi,

Translated by F. A. P. Barnard.

University. See University Education.

Univer'sity Educa'tion. The Roman empire was divided 395 A. D. In the Eastern or Greek portion the philosophical schools at Athens, Constantinople, etc., lingered until the Turkish invasion (1453–1453). In the Western or Latin portion the dissolution of society and political organization under the conquests of the German tribes was attended by the decay of arts and letters. The imperial schools founded by Vespasian, Antoninus Pius, and Hadrian disappeared. Western Europe was undergoing a slow process of reconstruction. The little knowledge that existed was exclusively in the hands of the priests and monks, and was imparted in the cloisters and parish schools. The language employed was Latin, and the textbooks were manuals of devotion, homilies, and rudimentary expositions of Christian dogma. Charlemagne took great interest in the spread of learning, but his efforts do not seem to have met with much success. Not until the twelfth century do we find the beginnings of the modern system of higher education. Italy led the van. The great medical school of Salerno (under Constantin), and the equally great law school of Bologna (under Irnerius), became centres for many hundreds and thousands of scholars in these branches. In like manner, Paris (under the influence of Abelard) became the centre for theology and scholastic philosophy. Not much later were Oxford and Cambridge. These various institutions, be it observed, were at first private in their nature. The teachers took such pupils as offered themselves, and depended upon student-fees for support. The next step was that of incorporation. By papal bulls and royal charters the teachers and pupils of a given city were constituted into a corporation, the *universitas magistrorum et scholarium.* The conception of a "university," as an institution embracing the sum-total of studies, was of a later growth. Thus, Paris, which began with theology, rapidly assumed the foremost rank, and enlarged the range of studies so as to include also the arts (or letters), medicine, and law (1260). Certain professorships were supported from the royal purse, others by private endowment. The universities began to assume more and more the character of permanent institutions under the joint control of Church and State. Certain grades of learning in the several branches were established, and degrees conferred—*e. g.* baccalaureus, licentiate, doctor, magister. One who had obtained the highest degree, magister or doctor, had the right to teach at any university in any country. Students were grouped by "nations," according to the country from which they came. In some universities, notably in Italy, they had the right of electing the rector or president of the university. This privilege still exists in the Scottish universities. The "faculties" are to be regarded as subsequent in time to the "nations." They owe their origin to the efforts made by Church and State to put into proper shape the unavoidable classification of study, and to control the "nations." According to Meiners, the theological faculty arose out of a dispute between the doctors and magisters of theology at Paris and the mendicant orders, who also sought the privilege of teaching. The pope intervened in favor of the Dominicans and Franciscans, and conferred upon them the privilege, so that by the middle of the thirteenth century these new teachers constituted a "faculty." The example thus set in theology was followed in law and in medicine. The nations were at last merged in the faculty of arts. But the subject is involved in the greatest obscurity. The fourfold division of faculties (law, medicine, art, and theology) subsists to this day. It has given the tone to the higher education of continental Europe, especially in Germany, although in the country of its origin, France, it has been shorn of some of its best features. The "colleges" are of much later date. They were at first charitable foundations for the maintenance of poor students, especially of theology. The young beneficiaries, called bursaries (hence the modern German *Burschen*), lived together under the supervision of masters, who saw that they conducted themselves discreetly and attended lectures diligently. The masters also gave instruction intended to supplement the university lectures. This instruction consisted usually in extracts (*summæ*) from certain textbooks, to be committed to memory. In the course of time the college instruction became in many colleges the chief thing, and attendance on university lectures fell into disuse. A curriculum, or prescribed course of study, was thus established—in most cases, a dry, unproductive routine of question and answer in the so-called Socratic method. When the study of the literary treasures of classic Rome was revived by Petrarch and his associates, the colleges became the refuge of the new waning scholasticism, and declined with it. The most celebrated of all, the Sorbonne, founded 1250, which had gradually absorbed the theological faculty, was abolished in the French revolution (1789). Its buildings are now used by the professors of the present Paris faculties of theology, science, and letters; hence the university itself is not infrequently called the Sorbonne. The Collége de France, established during the Renaissance to make good the defects of the older colleges, still subsists as an institution of the highest learning, collateral with the present university. It counts among its thirty-one professors some of the most eminent scholars. As places of conjoint abode and study the "colleges" may be said to have disappeared from the continent of Europe. Their funds have been secularized and their buildings put to other uses. But in England the result has been different. The colleges and halls of Oxford and Cambridge, most lavishly endowed, succeeded in absorbing the university. They still retain the dormitory system, instruction by masters (tutors or fellows), and the enforcement of religious exercises. Each college is independent in its funds and administers its own affairs. The powers of the university corporation are practically limited to holding

final examinations and conferring degrees. The university "professors" are few in number compared with the "tutors," and attendance upon their lectures is in general not obligatory. The history of the universities of Germany affords the best example of the growth of a complete and practical system. The oldest are those of Prague (1348), Vienna (1365), Heidelberg (1386). By reason of the great number of independent states, the number of seats of learning was multiplied to excess. From 1348–1871 there were established 42 in all; many of them have disappeared or been merged in others. The existing universities (of the German empire proper) are Berlin, Bonn, Breslau, Erlangen, Freiberg, Giessen, Göttingen, Greifswald, Halle, Heidelberg, Jena, Kiel, Königsberg, Leipsic, Marburg, Munich, Rostock, Strasbourg (reorganized 1871), Tübingen, Würzburg. This list comprises only such institutions as have the four faculties. The German universities were modelled originally after the one in Paris. The common language of instruction was Latin. Students were grouped by "nations." The dissensions between the Bohemian "nation" and the Germans at Prague led to secession and the establishment of the University of Leipsic (1409). In the faculty of arts instruction was given in the trivium and the quadrivium. The former consisted of grammar, rhetoric, and dialectics, the latter of arithmetic, music, geometry, and astronomy. These seven liberal arts are summed up in the *versus memorialis*: "Lingua, tropus, ratio; numerus, tenor, angulus, astra." The course in arts was regarded as preliminary, in whole or in part, to a degree in the other faculties. In theology instruction was confined to a running commentary on the Vulgate and to the study of a few books of general authority; *e. g.* the *Sententiæ* of Petrus Lombardus. In law, the professor explained difficult passages in the *Corpus Juris Civilis* and the *Corpus Juris Canonici*. In medicine, Hippocrates and Galen were the chief authorities. The Renaissance and the Reformation revolutionized the German universities. Under the influence of Erasmus, Reuchlin, Melanchthon, and Luther—who did for Greek what Petrarch had done for Latin—a new spirit of inquiry was infused into the old seats of learning. The students learned to reject mere authority, to view with indifference the verbose disputations of the Realists and Nominalists, and to go back to the original sources of knowledge in Hebrew, Greek, and Latin. Luther, in particular, by his sermons and his translation of the Bible, labored to make the highest culture accessible to all. Subsequently, by the disputes which sprang up between Lutheranism and Calvinism, by the rise of the Jesuit reaction, but chiefly by the devastations of the Thirty Years' war, the progress of learning was retarded two centuries. The second revival came in the latter half of the eighteenth century. Outside of the universities, Lessing, Wieland, Herder, Goethe, and Schiller strove to raise the tone and tastes of the people. Within the university system, Frederick the Great and Von Zedlitz sought to effect a direct reform. The difficulty under which all the universities—not merely of Germany, but of Italy, France, and England—had at all times labored was the insufficient preparation of the students. Universities were thronged with young men who had received but scanty school-training, and were unable to make satisfactory progress in advanced studies. On this point the accounts both of the numbers of students and of their mode of life are sufficient evidence. These accounts would sound incredible were they not perfectly authenticated. In the thirteenth century there were 10,000 students of law at Bologna. In the thirteenth and fourteenth centuries one-third of the population of Paris was connected with the university in one way or another. Gambling, drunkenness, duelling, and bloodshed were of common occurrence. Although the universities professed to admit no one who had not studied three years at a grammar school, it is evident that they were thronged with ignorant and unscrupulous adventurers, who gained admission merely to abuse the immunities conferred by charter upon students. During the great religious wars in Germany the universities became almost the seats of licensed barbarism. The reform begun in the eighteenth century covered many points. Preparation for the university was taken from the hands of the local clergy, house-chaplains, and private tutors. Teaching was made a distinct vocation, for which the teacher must qualify himself specially. The schools were reorganized, and expanded so as to cover everything of a propædeutic nature. The school-teachers were appointed by the state, and the schools converted into state institutions or subjected to close supervision. Admission to the university was made to depend upon the final school-examination, which was to be controlled by state officials. These numerous and radical changes were not all effected at once. The wars with France operated as a drawback. But Frederick's successors, guided by such men as F. A. Wolf, Schleiermacher, and Wilhelm von Humboldt, succeeded in placing the university system upon its present basis. The example set by Prussia has been followed by the other German states, and perhaps surpassed even by some. Higher education in Germany, therefore, is to be regarded as the culmination of an elaborate process of preliminary training. To enter the university one must have completed a course of eight or ten years at the gymnasium or realschule, consisting of Latin, Greek, mathematics, history, German literature, one or more modern languages, and the rudiments of the natural sciences, about equal in rank to the Junior year of an American college. The university studies are professional rather than general. The student matriculates in only one of the faculties, and pursues the study of law, or medicine, or theology, or philosophy, until he applies for a degree or is examined by a state board for appointment as officeholder or teacher. In the philosophical faculty, which embraces everything not contained in the other three—viz. philosophy proper, philology, history, mathematics, the natural sciences, political economy, etc.—natural limitations are observed. The student of philology is not held to mathematics, or *vice versâ*. There are no prescribed courses of study, no term examinations, and the final degree of doctor is no longer required for state appointment except in the branch of medicine. Degrees are conferred upon passage of an oral examination and presentation of an elaborate thesis, except in theology, where the degree of D. D. is given solely *honoris causâ*. The German universities are state institutions for the professional training of clergymen, lawyers, judges, doctors, teachers in the gymnasium or realschule, and officeholders of the higher grades. They are the only places where a German can fit himself for his profession. Hence it is that the leading men in Church and State, in science and letters, are university graduates. By the new school laws (1872–73) candidates for orders in the Roman Catholic Church are no longer permitted to study in the so-called *convicta* (confessional boarding-schools) and priest seminaries, but will be held to the gymnasial and university course. At Freiberg, Munich, and Würzburg the faculties of theology are exclusively Roman Catholic. At Bonn, Breslau, and Tübingen they are paritetic—*i. e.* each system is represented by a full set of professors. The other universities are exclusively Protestant. The method of university instruction is chiefly by lecture. There are no recitations, but *seminaria* and *repetitoria*, where professor and student may discuss informally topics connected with the lectures. Attendance is not enforced. No time is prescribed within which the student must complete his work, but in most departments a minimum of three or four years is exacted. It is not necessary to remain at the same university. Students pass freely from one to another to hear particular professors. Instruction is given by full professors (*ordinarii*), half-professors (*extra-ordinarii*), and *privat-docenten*. The half-professors are not subordinates or assistants, but rather candidates for full appointment. The same is true of the privat-docenten, or resident graduates, who have habilitated themselves by special work as docents. They are free to lecture, and their lectures are received as full equivalents in the university and state examinations. Matriculation fees are very low; each set of lectures is paid for separately, the amount varying with the subject and number of hours per week, but averaging five dollars a term for a daily lecture. There are no compulsory religious exercises. Discipline is administered by a university court, composed of the rector, one or two law professors, and a state official. This body exercises the functions of a court, and has the right to imprison students for a term not exceeding two weeks, to impose small fines, to suspend or expel, and to take exclusive cognizance of actions against students for debt. The range of study is immense, and includes everything which is not of a technical nature, for which provision is made in the polytechnicums. The characteristic features of university study are liberality, thoroughness, originality, and the parity of all branches. Each university is a corporation. The professors are usually nominated by the respective faculties, but confirmed by the state. Some of the universities have large private funds, others are wholly dependent upon state subvention. But even the wealthiest rely upon the state for meeting the greater part of current expenses.

Next to Germany stands perhaps Switzerland, which has the three universities of Bâle, Berne, and Zurich and the academies of Geneva and Lausanne. The Austrian universities of Vienna, Prague, Gratz, and Innspruck are little inferior to those of Germany. In 1850 the philosophical faculty was raised from its position of subordination and placed on an equality with the others. The medical faculty of Vienna and the law faculty of Prague are renowned. Galicia has two universities, Lemberg and Cracow, and a third opened in 1875, but not yet fully organized, at Czernowitz (Bukovina). Hungary has the single university of

Pesth. Closely akin to Germany is Holland, with the universities of Leyden, Groningen, and Utrecht; Denmark, with the University of Copenhagen; Sweden-Norway, with Upsala, Lund, and Christiania. There are nine Russian universities—at St. Petersburg, Moscow, Dorpat, Kasan, Kiev, Charkov, Odessa, Helsingfors, Warsaw. The one at Dorpat, founded by Gustavus Adolphus, resembles closely those of Germany, and is frequented by large numbers of Germans from the Baltic Provinces. It has a faculty of Lutheran theology.

The present system in France is the result of many changes. The revolution of 1789 swept away the old universities. Napoleon I. reorganized higher instruction as one grand corporation, entitled the University of France. After repeated innovation the existing system was adopted in 1852. The control of all matters of education is in the hands of the minister of public instruction. There are no universities in the strict sense, but faculties for higher education in the principal provinces. Paris is the only city that has all five faculties—viz. law, medicine, theology, letters, and science—and even here they are not united in one corporate body. At Caen, Dijon, Grenoble, Poitiers, Rennes, there are faculties of law, science, and letters; at Aix, faculties of law, letters, and theology; at Toulouse, theology, law, science, letters; at Besançon, science and letters; at Bordeaux and Lyons, theology, science, and letters; at Lille, science and letters; at Montpellier, medicine, science, and letters; at Rouen, Roman Catholic theology; at Montauban, Protestant theology; at Clermont, Douai, Marseilles, and Nancy there are chairs of science and letters. At Paris, furthermore, there is the renowned school of living Asiatic languages, the no less renowned *Ecole des Chartes* for the special study of historical documents, and the Collége de France, already mentioned. Many of the professors, especially at Paris, are most eminent men. But the defects of the system are numerous and grave. The faculties in one and the same place do not constitute a homogeneous corporation, and they are too dependent on the minister of public instruction. The professors have too much the character of state officials, and there are no privat-docenten to create healthful competition and ensure the introduction of new ideas and methods. There is too much centralization and too little of scientific study. Instruction is regarded as a direct preparation for practice in law, medicine, etc., rather than as a means of promoting thoroughness and originality of research. France is inferior to Germany, not only in the quality of its learning—some brilliant exceptions aside—but also in the number of professors and in the diffusion of knowledge. The lyceums, analogous to the gymnasium and realschule, are less numerous, and teaching assumes more the form of drill. In the S. of France the illiteracy and superstition of the people are deplorable. Yet, despite these drawbacks, the number of learned men is great, the attainments of the French savants rank second to none, and the array of talent and culture in Paris is unequalled even in Germany. The Roman Catholics have obtained recently the enactment of a law permitting the establishment of a free university, to be endowed by private means and to be exempt in the main from governmental control. But this new institution under Ultramontane influence has not yet been organized.

Belgium stands between the German and the French systems, but inclined to the latter. There are two national universities, at Ghent and at Liége, a Roman Catholic at Louvain, and a free university (without a theological faculty) at Brussels. Italy has eighteen universities, of which Bologna, Florence, Naples, Palermo, Pavia, and Turin are of the first class. But in most of the Italian universities the theological faculty is wanting, the priests being trained in episcopal seminaries. The prevailing opinion is that the universities are too numerous for the population, that the professors are insufficiently salaried and appointed without due regard to qualifications, and that the schools are very backward. For the past ten years, however, there are evident signs of a revival of letters and science. Not a few of the professors at Naples, Florence, and Turin represent the most advanced thought of the day, and favor the adoption of German methods and thoroughness. Spain counts ten universities, of which the outside world hears little. The glory of these old seats of learning (Madrid (1836) is the only one of recent origin) seems to have declined with the general decay of the country. The Portuguese university at Coimbra is more prosperous. Greece has a national university at Athens (1837), modelled after the German plan. Turkey has no institution of higher learning. Roumania has the imperfectly-organized universities of Jassy and Bucharest. In India there are universities at Calcutta, Madras, and Bombay, with able professors and excellent courses in arts, law, medicine, and civil engineering. Japan, the most progressive Asiatic country, has already a number of normal schools and high schools of chemistry, technology, languages, and jurisprudence, but nothing of the nature of a university. The same must be said of Brazil.

Higher education in Great Britain, despite the prestige of English letters and science, is still defective. Oxford and Cambridge are each a congeries of colleges. Each college has its own body of students and its own buildings—not infrequently its own library. The students are not arranged so strictly in four classes as in the U. S., but the course covers practically four years. Instruction is given by the "fellows" of the college, and consists in the main of recitations upon work assigned. Candidates for honors or fellowships usually take private instruction besides from resident graduates of celebrity (whether fellows or not), familiarly called "coaches." The fellows of a college are in most instances appointed on close competitive examination; the fellowships are liberally endowed, and tenable at will or until marriage. This last feature is a relic of monasticism. Many of them are mere sinecures. Membership in the Church of England is a condition of appointment. The master and fellows of a college constitute the corporation. The public examinations for degrees and honors are held by the university at large. The course of instruction is threefold—in mathematics, in the classics, and in natural science. Until quite recently both Oxford and Cambridge were exclusively Church-of-England institutions; at Oxford no one could matriculate, at Cambridge no one could obtain a degree, without subscribing to the Thirty-nine Articles. These restrictions have been removed by act of Parliament, but the fellowships and college administration are still under the control of the Church. The number of students is small compared with the attendance at the leading universities of Germany. Neither Oxford nor Cambridge has a faculty of medicine. A few lectures on Roman law are given, but they are far from constituting an independent branch of study. The common law is studied at the inns of court in London. Even theology is rather incidental to the general course, which corresponds to that of American colleges, but is of a higher grade. So many changes have been already introduced, however, and so many more are in prospect, that it would be hazardous to foretell the condition of the English universities in the next generation. The entire system is undergoing a process of reconstruction, with a view to better utilizing the immense revenues and expanding and liberalizing the studies. The university at Durham is of much less importance. In 1826 was founded by subscription the Free University (in London), which was consolidated in 1836 with the London University, a board of examination with power to confer degrees. The present London University resembles those of Germany, but has no faculty of theology. King's College, London, was founded by Episcopalians in opposition to it. The College of Physicians and the College of Surgeons (London) are world-renowned; so also the School of Mines (London), and the Royal Institution which became famous under Young, Davy, and Faraday, and maintains its celebrity under Tyndall and Huxley. The Scotch universities of Edinburgh, Aberdeen, Glasgow, and St. Andrew's are more national in character. They are not exclusively denominational, and the students come from all classes of society. Instruction is less fettered in method, resembling somewhat the lecture system of Germany, but scholarship is not so finished as at Oxford and Cambridge. Edinburgh is renowned for its medical faculty. In general, the Scotch students do not come so well prepared as the pupils from the German gymnasiums or from the so-called public schools of England. Ireland has Trinity College, Dublin (Episcopal), the Roman Catholic University, and the Queen's Colleges at Belfast, Cork, and Galway. Trinity College resembles the English in method, but is much more liberal; the Queen's Colleges are more akin to the Scottish, but in general inferior. In Canada there are the McGill College, Bishop's College, Laval University (Quebec), and Queen's College (Toronto).

For the mere number of superior institutions the U. S. might claim the foremost rank. According to the report of the U. S. commissioner of education for 1875, there were 374 colleges and universities in operation. But close examination will show that most of them, especially in the South and West, are little more than schools, whether regard be had to the number of pupils and instructors or to the quality of the instruction. Mere titles are misleading. Thus, the institution at Forest Grove, Or., which has only four professors, three instructors, and ninety-six students—all but six of whom are in the preparatory department—has the title of "university;" whereas Yale, with a staff of ninety professors, assistants, lecturers, etc., and over a thousand students, with well-equipped departments of the arts, letters, science, law, medicine, and theology, is entitled "college." The elements of which higher education in America is composed are so heterogeneous as to render

thorough classification impossible. The chief defects are—first, the private and sectarian character of the colleges; second, the want of connection between them and the public schools. In continental Europe, as has been shown, education in all its stages is treated as a state affair. In America the state has contented itself with providing free schools for instruction in elementary so-called English branches, and has not regarded intermediate and higher education as belonging to its sphere, but has left them to private enterprise and munificence. The state requires no special training for civil appointment. Admission to the bar is often a mere form, and a diploma from any one of the numerous schools of medicine—private institutions wholly exempt from supervision—entitles the possessor to practice. The evils of this want of system are becoming more and more manifest. The college, being a close corporation, pursues its own course in disregard of the outer world. Appointments to professorships are in too many instances determined more by denominational considerations than by superiority of merit. Superficiality and narrow-mindedness are too often the result. Moreover, the great number of colleges involves a scattering of the resources of education, and a harmful because expensive rivalry. Instruction is in the form of a curriculum of four years, embracing Latin and Greek, mathematics, English studies, and the elements of political and ethical science. History is imperfectly taught. A good deal of attention is paid to physics, chemistry, and geology, but the sciences of natural history are for the most part left to special schools or subordinated to the general curriculum. The students, arranged in classes by years, usually live together in dormitories. Most of the colleges are struggling with poverty, and the funds even of the more fortunate are usually hampered by restrictions in the mode of employment. The college course, like that of England, is merely general, and not professional. Law, medicine, theology, etc., are studied at special schools. But several important exceptions to the usual system are to be noted. The University of Virginia, the work of Jefferson, does not enforce a curriculum. Students may select among several courses leading to different degrees. There are "schools" of mathematics, the languages, natural science, law, medicine, etc. Religious exercises are not compulsory, and the general tone is extremely liberal. A similar institution is the University of Michigan, the largest and most influential seat of learning in the West. Younger and less developed is the University of California. The most liberal is Cornell University, where students are not held to courses except for degrees, and are completely freed from denominational restraint. The universities of Michigan and Virginia exert an indirect but very strong influence upon the public schools of those States, and have made them virtually preparatory institutions. The State universities of Wisconsin, Iowa, and Minnesota resemble that of Michigan in tone, but are far from having attained the same degree of development. The oldest and most frequented university is Harvard. It has a very large undergraduate department, large medical and law schools, one school of Unitarian and one of Episcopalian theology, and a scientific school. The innovations made here during the past ten years are great and almost radical. The "undergraduates" have the option among numerous courses and studies. Were the so-called academic department organized as a "philosophic faculty," and a uniform and rather more advanced grade of preparation required for admission to the university at large, Harvard might rank with Göttingen or Heidelberg. The income amounted (1875) to $168,541 from student-fees and $218,715 from property. Yale is next to Harvard in prestige, but is less liberal in its policy and method. Columbia College has an undergraduate department, a school of mines, and a law school, the most frequented in the country. The College of Physicians and Surgeons is also connected with it, although not organically. The income now amounts to $205,000 from real estate and $100,000 from student-fees. It is estimated that when the present leases expire the income from this source will be doubled. The recently-established Johns Hopkins University of Baltimore (endowed with an income of $200,000) promises to become the centre of the most advanced stage of postgraduate instruction, and is thoroughly liberal in its character. But up to date several appointments of full professors have been announced, and the final plan of study is not yet elaborated. The University of Pennsylvania has an undergraduate department, a large medical school, and a school of science. Many of the colleges are founding schools of science subordinate to or co-ordinate with the old curriculum. The law, medical, and scientific schools not connected with any college—*e. g.* the Jefferson Medical (Philadelphia), the Rensselaer Polytechnic, the Boston Institute of Technology, the Stevens Institute—are numerous. Cornell University, the University of Michigan, and some others are open to women. There are also colleges exclusively for women, of which Vassar is the most notable.

The future of higher education in America is not free from perplexities, but is in the main hopeful. The most encouraging symptoms are the liberality shown by private individuals in endowing colleges and professorships ($33,000,000 were thus donated 1871–74), and the growing disposition to relax, if not to abolish, denominational restrictions and to liberalize study. But complete success is scarcely possible unless in each State one or more colleges, by reason of their wealth, liberality, and array of professors, shall attain unquestioned predominance, and thereby make themselves the resort for all classes and the final standard in matters of scholarship. (See Meiners, *Geschichte der Hohen Schulen;* Matthew Arnold, *Schools and Universities of the Continent;* *Das academische Jahrbuch* (1875); U. S. commissioner of education's *Annual Reports* (six since 1867); *North American Review*, Oct., 1875, and Jan., 1876; F. A. P. Barnard, *Report to the University of Alabama* (1854), *Letters on College Government* (1854), *Letter to Trustees Univ. Miss.* (1858), *Reports to Trustees Col. Coll.* (1870–71).) J. M. Hart.

University of Virginia, p.-v. Albemarle co., Va.

Universol'ogy is the name given to a universal science covering the whole ground of philosophy, of the sciences in their general aspects—in which sense it is called "scienta-philosophy"—and of social polity, or the collective life of the human world. As a philosophy, in the more common and general or less precise use of that term, the system is called "integralism," as that of Comte is called "positivism;" as a new science—in the exact sense as a new scientific method and as the philosophy of science—it is especially known as "universology;" and as a social polity—"the universal institute of humanity" (universal government, universal religion, universal social organization, etc.)—it is called the "pantarchy." Scienta-philosophy is the name which applies to the system especially in so far as it is a philosophy of the sciences, or a new philosophical system based on and derived from the objective point of view of the special sciences.

Universology claims to be reconciliative of all systems of philosophy, by virtue of positive new discovery and of the unity which it, for the first time, establishes between philosophy and science, and between both of these and the domains of art, religion, and practical life. Universology claims to be "a single and central science among the sciences, and that from which the integral education of mankind should hereafter take its departure. It embraces those laws of being which are common to all sciences and to all departments or domains of being, and which, when known and systematized, constitute the unity of the sciences in a sense alike new, peculiar, and important. Universology is based on analogy, resting in turn on the discovery and demonstration of a unific element in things otherwise diverse from each other through all spheres—not, therefore, analogy in a vague poetic sense, as mere superficial resemblance, nor in an occult and mystical sense, nor, in fine, in the narrow technical sense to which it has been confined in comparative anatomy as contrasted with homology. It is analogy in that essential sense in which it underlies all other possible analogies. Analogy, in the broad or universological sense, includes both homology and analogy in the narrow scientific sense, together with all resemblances which are fundamental, or such as grow out of an underlying unity of system (of outlay, organotaxis, or functions) in all spheres of being; or such, in other words, as rest upon the existence of a real, permanent, and traceable unific element in the midst of the overlying diversity of phenomena. The universologist is, therefore, by no means, one who *claims to know everything*, as is sometimes mistakenly supposed, but merely one who *knows* certain newly-discovered principles and laws of science which are common to all the sciences, and which serve to systematize and harmonize the sciences and the details within the several sciences, as well as—when applied in the practical sphere—to regulate the affairs of human life."

The three fundamental principles of universology, from which the whole logical and actual evolution of being is then to be rigorously deduced, furnishing all the sciences and the details within the sciences, are unism, duism, and trinism, defined as follows: Unism is the principle or spirit of the number one, duism of the number two, and trinism of the number three. Unism is not mere unity, nor duism mere duality, nor trinism mere trinity. If we were to consider a handful of printer's types, unity in respect to this collection of objects would mean either the handful as one, or a single one among the types, or each of the types in turn as a single one; and duality, in this connection, would mean either some two among the types, or

any two among the types, until the whole was exhausted by these couplings. Unism, as relating to this same collection of objects, would, on the contrary, mean no one of the ideas above attributed to unity, but a different idea, still related to unity—namely, the capacity of these types to be united into printer's forms which produce the printed page; so duism does not mean either of the ideas above attributed to duality, but another idea, which is, however, also related to or allied with two-ness—namely, the capacity of these types for being separated and distributed, each one apart from every other one, as a preparation, it may be, for other new combination or unity. So, again, trinism does not mean a mere trinity, which would consist of any three types united, but it means another idea, compounded of the unism and the duism, and related, therefore, to one and two, and indirectly therefore to three. Trinism is, in other words, the new and higher unity of the unism and the duism; that is to say, of the capacity of the types to be united for a unitary purpose, and to be separated or distributed for a dispartive purpose—the compound character, in other words, of this collection of objects enabling them to act in two opposite and contradictory methods, hinging, nevertheless, upon the inherent unity in the constitution of each type. Unism, duism, and trinism are, therefore, three *qualities* which inhere in, or pertain to, every type individually, and the sum of which qualities is the total character of the type. They are, nevertheless, qualities which are derived from quantitative discriminations, and specifically from one, two, and three; but they must by no means be confounded with the common ideas of unity, duality, and trinity.

Duism has a close relationship with Spencer's "differentiation," but it differs from it in the fact that it is the lowest or most elementary term of differentiation; that it offers, for that reason, the broadest generalization of the idea; and that it is, at the same time, more fundamentally exact. Unism and trinism are confusedly represented by Spencer's "integration."

Unism and duism crop out and reappear under many forms, and in the absence, heretofore, of any sufficiently compendious generalization, they have received a variety of namings; thus, unism is called unity, sameness, centralizing or centripetal tendency, gravitation, arrival, conjunction, thesis or synthesis, integration, combination, contraction, generality, simplicity, etc. It is the tendency to *unite* or toward *unity*, or the manifestation of the presence or results of that tendency, in thousands of modes in every sphere of being. Duism is called diversity, difference or variety, decentralizing or centrifugal tendency, repulsion, departure, separation, antithesis, analysis, differentiation, diffusion, expansion, specialty, complexity, etc. It is the tendency to *disparting* or *dividing*, or the manifestation of the presence or results of that tendency in thousands of modes in every sphere of being. Trinism is the principle symbolized by the *totality* of being, or of any particular being. It is compounded of unism and duism as its factors, constituents, or elements. Hence it is a cardinated or hingewise principle, entity, or manifestation, the type or representative of *all-concrete* or real being, unism and duism being *abstract elements of being merely*.

All orderly numbers capable of count or of falling into regular series constitute collectively unismal number, being characterized by unity in the sense in which we speak of the unity of a poem, a play, or other work of art. All chaotic and irregular numbers are then duismal, and the totality of number, embracing these two opposite aspects under one head or in one domain, is trinismal. Within the unismus of number—that is to say, within the domain of orderly numbers—the odd numbers, headed by the number one, are unismal; the even numbers, headed by the number two, duismal; and the combined series of odd and even numbers, headed by the number three, is trinismal. So all orderly, regular, or commensurable form is unismal; all disorderly, irregular, and incommensurable form is duismal; and the total domain of form as constituted of these two is trinismal. But within the proper unisms or domain of regular form, all round form, that which is constituted around one centre or regulative point, is unismal; all elongated form, the lowest term and type of which is the straight line, as that which is constituted with reference to two regulative points (the ends of the line), is duismal; and regularly modulated form, as Hogarth's line of beauty, triangular forms, and the like, as being constituted by reference to three regulative points, is trinismal form. To these elementary varieties all other forms are reducible.

In respect to position, the perpendicular, as central and uniaxial, is again unismal: the horizontal, measured by two axes, is duismal; and the incline from perpendicularity to horizontality, as relating at the same time to the one axis and to the two axes, is trinismal. As all these, however, are orderly, they are within the larger unisms of position, the corresponding duismus then being disorderly or chaotic position, and the larger trinismus being the totality of this domain of being.

It results from what has been said that orderly numeration, orderly form, and orderly position are three special instances of unism, and fall together into a new class or domain of being, which is the general unismus; that disorderly or chaotic numbers, disorderly or chaotic form, and disorderly or chaotic position are special instances of duism, and fall together into another special class or domain, which is the duismus of being at large; and that the conjunction of orderly and disorderly number, the conjunction of orderly and disorderly form, and the conjunction of orderly and disorderly position are special instances of trinism, and fall, in like manner, into a new class or domain, which is the trinismus of being at large. Unism, duism, and trinism become, therefore, the basis of a new and crosswise distribution and classification, taking in, as in this instance, a part of each particular sphere of being, as of number, of form, and of position, and uniting it with a corresponding part or portion of each of the other related spheres or departments of being.

And, again: within the unismus, odd numbers, round forms, and perpendicular positions are thrown together as allied analogically with each other; even or regular numbers, even or regular forms, and horizontal postures or positions (also called "even," then meaning level), are thrown in like manner into a special class as related analogically with each other; and finally, the combined series of numbers, odd and even, modulated form, partly round and partly elongated, and pyramidal or dome-like position, convergent from base to apex, are likewise thrown into a new special class or domain, as also analogously related to each other. This cross-division, as allied with classification, *is analogous with comparative science*, which takes a part out of each of the sciences compared, and classifies anew with reference to the relationship of these parts. The further signification and importance of this new basis of universological classification can only be exhibited in the special treatises devoted to the subject.

Abstract morphology is to universolgy, and to the rectified classification of all spheres, what the mathematical element is in geography, establishing definite lines of latitude and longitude, or what Mercator's projection is to navigation. It furnishes types and models for every variety of conception, and maps them out with a wonderful precision. *Uprightness* of character and the *inclinations* of the mind are no longer figures of speech, but scientific verities relating the phenomena of mind to the domain of form. Ethics, the science of government, sociology at large, and even theology and religion, are by this new method rendered rigorously amenable to scientific treatment. In a word, universolgy claims to be literally the science of the universe, or of all possible departments of thought, fully in accordance with the idea implied in its name.

STEPHEN PEARL ANDREWS.

Unleavened Bread. See BREAD, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Unleavened Bread, Feast of. See PASSOVER.

Un'na, town of Prussia, province of Westphalia, manufactures stockings, hosiery, tobacco, chemicals, and tiles. In the vicinity are the rich saltworks of Königborn. P. 6117.

Unst, the northernmost of the Shetland Islands, Scotland, in lat. 60° 45′ N., comprises an area of 36 sq. m. and a pop. of 3042, mostly engaged in fishing and agriculture. The island is covered with rude memorials of the old Scandinavians.

Un'terwalden, canton of Switzerland, bordering N. on Lake Lucerne, comprises an area of 263 sq. m., with 26,116 inhabitants, who are Roman Catholics and speak German. It is surrounded and traversed by mountain-ranges, forming two long, narrow valleys which open toward Lake Lucerne. Pasturage and dairy-farming are the chief employments, cheese and timber the principal exports. Unterwalden is properly divided into two cantons—Upper and Lower Unterwalden, each with its own government; the capital of the former is Sarnen, of the latter Stanz.

Upanishad. See SANSKRIT LANGUAGE AND LITERATURE, by PORTER C. BLISS, A. M.

U'pas Tree [*Antiaris toxicaria*, from the native word *antiar*]. This tree grows in the forests of Java, where it is called *Bohun upas*. The viscid juice of the plant dries into a resinous mass termed by the Javanese *antiar*. This exudation is extremely poisonous, and when introduced into the circulation of an animal, death speedily ensues. The stories of the early travellers respecting the pernicious character of exhalations from the foliage of this tree are believed to be gross exaggerations. Specimens of the plant are cultivated in the conservatories of all large

botanic gardens. The plant belongs to the bread-fruit family. The leaves are ovate or obovate, four or five inches long, and conspicuously veined. The minute flowers are monœcious. The fruit is drupaceous. Other species of *Antiaris* are known to be innocuous. ASA GRAY.

Up'cott (WILLIAM), b. in Oxfordshire, England, in June, 1779; served an apprenticeship to a London bookseller, became purchasing agent for several book collectors, and on the foundation of the London Institution in the Old Jewry, 1806, was appointed sub-librarian, the celebrated Porson being librarian. He directed his attention to the formation of a collection of works on British topography; made preparations for a history of Oxfordshire, never completed; made the most extensive known collection of autographs, which comprised more than 36,000 letters; was the discoverer and first editor of Evelyn's *Memoirs*; furnished most of the originals for the publication of the *State Letters* (1820) of Henry Hyde, second earl of Clarendon, and Ralph Thoresby's *Diary and Correspondence* (4 vols., 1830–32); wrote a continuation of Edmund Carter's *History of the County of Cambridge* (1819), and a considerable part of a *Biographical Dictionary of Living Authors of Great Britain and Ireland* (1816), and published *A Bibliographical Account of the Principal Works relating to English Topography* (3 vols., 1818). He resigned his position at the London Institution 1834, and spent his remaining years at Autograph Cottage, Islington, where he d. Sept. 23, 1845. Catalogues of his collection of autographs were printed in 1836 and in 1846. It was dispersed at auction in the latter year, but a large part was secured by the British Museum.

Up'fold (GEORGE), M. D., D. D., LL.D., b. at Shemley Green, near Guilford, England, May 7, 1796; came to the U. S. 1802; settled at Albany, N. Y.; graduated at Union College 1811, and in medicine in New York 1816; commenced practice at Albany, but soon entered upon the study of theology; was ordained in the Protestant Episcopal Church 1818; was minister at Lansingburg, N. Y., 1818–20; rector of St. Luke's, New York, 1820–28, being at the same time assistant minister of Trinity church 1821–25; rector of St. Thomas's church, New York, 1828–31, and of Trinity church, Pittsburg, Pa., 1832–50; and was consecrated bishop of Indiana Dec., 1849. D. at Indianapolis, Ind., Aug. 26, 1872.

Up'ham (CHARLES WENTWORTH), b. at St. John, New Brunswick, May 4, 1802, son of a loyalist refugee, judge of the supreme court of the province; graduated at Harvard College 1821, at Cambridge Divinity School 1824; colleague of Dr. Prince, pastor of the First church in Salem, 1824–44; left the profession on account of bronchial weakness; edited the *Christian Register*; travelled and lectured as agent of the Massachusetts board of education; was elected mayor of Salem; was member of the Massachusetts house of representatives in 1849, of the State senate 1850–51, of the national Congress from the 6th district 1854–55; State senator 1858, representative 1859–60. D. in Salem, Mass., June 15, 1875. During his ministry, which fell in controversial times, Mr. Upham made his mark as a writer by his *Letters on the Logos* (1828) and *Prophecy as an Evidence of Christianity* (1835), both written in the Unitarian interest. The *Lectures on Witchcraft, comprising a History of the Salem Delusion of 1692*, afterward, in 1867, rewritten and expanded into an elaborate work, in 2 vols., appeared in 1831. Mr. Upham was a diligent student of New England times and men. For Sparks's *American Biography* he wrote the *Life of Sir Henry Vane* (1835). In 1856 appeared from his pen the *Life, Letters, and Public Services of John Charles Fremont*. His last work was a *Memoir of Timothy Pickering* (3 vols.). He was also a frequent contributor to magazines and reviews, religious and secular. O. B. FROTHINGHAM.

Upham (NATHANIEL GOOKIN), LL.D., b. at Rochester, N. H., in 1801; graduated at Dartmouth College in 1820; studied law, and began practice at Bristol, N. H., but removed to Concord in 1829; was judge of the supreme court of the State 1833–43, and connected with the Concord R. R. 1843–63. He was a leading member of the Democratic party in his State, and in 1853 was appointed by Pres. Pierce one of the commissioners at London to adjust claims pending between citizens of the U. S. and British subjects; but at the opening of the civil war he left the Democratic party; was a member of the State legislature 1865–66. D. at Concord, N. H., Dec. 11, 1869.

Upham (THOMAS COGSWELL), D. D., b. at Deerfield, N. H., Jan. 30, 1799; graduated at Dartmouth College 1818, and at Andover Theological Seminary 1821; became assistant teacher of Hebrew in the seminary, and translated Jahn's *Biblical Archæology*; in 1823 became associate pastor of the Congregational church in Rochester, N. H.; in 1825 was chosen professor of mental and moral philosophy in Bowdoin College. His principal works are—*Manual of Peace* (1830), *Elements of Mental Philosophy* (1839; abridged ed. 1864), *Outlines of Disordered and Imperfect Mental Action* (1840), *Life of Faith* (1848), *Philosophical and Practical Treatise on the Will* (1850), *Treatise on the Divine Union* (1851), *Religious Maxims* (1854), and *Method of Prayer* (1859). D. in New York Apr. 2, 1872.

Upham (TIMOTHY), b. at Deerfield, N. H., in 1783; was in 1812 appointed major in the U. S. army, and placed in command of the forts and harbor of Portsmouth; joined the army in the field at Plattsburg; was made lieutenant-colonel in 1813, and commanded the reserve in the sortie from Fort Erie; was collector of the port of Portsmouth 1816–29, navy agent 1841–45, and major general of the State militia. D. at Charlestown, Mass., Nov. 2, 1855.

Upjohn (RICHARD), b. in England in 1802, came to America in 1829, and d. in New York Aug. 17, 1878. His first building in America was the cathedral of Bangor, Me.; in New York he built Trinity, St. Thomas's, and Grace churches, besides a great number of private residences.

Up'land, p.-b., Delaware co., Pa. P. 1341.

Upolu', one of the NAVIGATOR'S (or Samoan) ISLANDS, in the Pacific Ocean (which see), is a missionary station and annually visited by English and American whalers. Its area is estimated at 60 sq. m.; its pop. at 25,000, of whom two-thirds are Christians. Cotton and cocoanuts are the principal products.

Up'per, tp., Crawford co., Ark. P. 357.

Upper, tp., Sebastian co., Ark. P. 3666.

Upper, tp., Cape May co., N. J. P. 1183.

Upper, tp., Chowan co., N. C. P. 1176.

Upper, tp., Lawrence co., O. P. 2116.

Upper Al'len, tp., Cumberland co., Pa. P. 1341.

Upper Al'loway's Creek, tp., Salem co., N. J. P. 3062.

Upper Al'ton, Madison co., Ill., on Chicago and Alton and Rockford Rock Island and St. Louis R. Rs., 2 miles N. of Alton City, has 4 churches, a college and female institution, a handsome park, 2 newspapers, 1 pottery, a street railway, and 1 hotel. P. about 2500.
E. ENGLISH, ED. "QUI VIVE."

Upper Augus'ta, tp., Northumberland co., Pa. P. 1246.

Upper Bern, p.-v. and tp., Berks co., Pa. P. 2008.

Upper Chich'ester, tp., Delaware co., Pa. P. 539.

Upper Cone'to, tp., Edgecombe co., N. C. P. 1437.

Upper Creek, tp., Burke co., N. C. P. 1736.

Upper Dar'by, tp., Delaware co., Pa. P. 3130.

Upper Dub'lin, p.-v. and tp., Montgomery co., Pa. P. 1588.

Upper Fair'field, tp., Lycoming co., Pa. P. 770.

Upper Fish'ing Creek, tp., Edgecombe co., N. C. P. 2061.

Upper Fork, tp., Burke co., N. C. P. 594.

Upper Free'hold, tp., Monmouth co., N. J. P. 3610.

Upper Guinea. See GUINEA.

Upper Han'over, tp., Montgomery co., Pa. P. 2197.

Upper Hom'iny, tp., Buncombe co., N. C. P. 1323.

Upper Lafaye', tp., Yell co., Ark. P. 715.

Upper Lea'cock, tp., Lancaster co., Pa. P. 1961.

Upper Le'high, p.-v., Luzerne co., Pa.

Upper Lisle, p.-v. and tp., Broome co., N. Y. P. 247.

Upper Lit'tle Riv'er, tp., Harnett co., N. C. P. 1221.

Upper Loutre, tp., Montgomery co., Mo. P. 2458.

Upper Macun'gie, tp., Lehigh co., Pa. P. 3061.

Upper Mahanoy', tp., Northumberland co., Pa. P. 878.

Upper Mahantan'go, tp., Schuylkill co., Pa. P. 761.

Upper Make'field, tp., Bucks co., Pa. P. 1505.

Upper Marl'boro', p.-v., cap. of Prince George's co., Md.

Upper Mer'ion, tp., Montgomery co., Pa. P. 3870.

Upper Mil'ford, tp., Lehigh co., Pa. P. 2015.

Upper Mount Beth'el, tp., Northampton co., Pa. P. 3761.

Upper Naz'areth, tp., Northampton co., Pa. P. 740.

Upper Ox'ford, tp., Chester co., Pa. P. 1079.

Upper Pax'ton, tp., Dauphin co., Pa. P. 1371.

Upper Penn's Neck, tp., Salem co., N. J. P. 3178.

Upper Petts'grove, tp., Salem co., N. J. P. 2087.

Upper Pig'eon, tp., Haywood co., N. C. P. 1066.

Upper Prov'idence, tp., Delaware co., Pa. P. 758.

Upper Providence, tp., Montgomery co., Pa. P. 3202.

Upper St. Clair, tp., Alleghany co., Pa. P. 810.

Upper Sal'ford, tp., Montgomery co., Pa. P. 1705.

Upper Sandus'ky, city, cap. of Wyandot co., O., on Pittsburg Fort Wayne and Chicago and Columbus and Toledo R. Rs., and on the W. bank of Sandusky River, 64 miles N. W. of Columbus, contains 8 churches, excellent schools, 3 banks, 2 newspapers, and several manufactories. P. 2564. P. CUNEO, ED. "REPUBLICAN."

Upper Sau'con, tp., Lehigh co., Pa. P. 3487.

Upper Swata'ra, tp., Dauphin co., Pa. P. 1991.

Upper Towamen'sing, tp., Carbon co., Pa. P. 913.

Upper Town Creek, tp., Edgecombe co., N. C. P. 1092.

Upper Tulpehock'en, tp., Berks co., Pa. P. 1196.

Upper Tur'keyfoot, tp., Somerset co., Pa. P. 1011.

Upper Uweh'lan, tp., Chester co., Pa. P. 781.

Up'perville, p.-v., Scott tp., Fauquier co., Va. P. 422.

Upper Wind'sor, tp., York co., Pa. P. 2021.

Upper Yel'lowleaf, tp., Shelby co., Ala. P. 438.

Upsa'la, town of Sweden, 45 miles N. W. of Stockholm, has a beautiful cathedral and a flourishing university. The cathedral was built between 1260 and 1457, and is 370 feet long, 128 feet broad, and 92 feet high. Its interior is magnificent and richly decorated, but its exterior has suffered much from fire. The university is attended by over 1200 students, and has an excellent library of 100,000 vols., a botanical garden, an observatory, and several museums and collections. P. 12,138.

Up-sar-o-ca, The, or **Crow Indians,** live in Montana Territory, and number about 3000, being divided into what is known as the Mountain and River Crows. They have a fine reservation, lying along the Yellowstone River, distant about forty miles from Bozeman City. These Indians are brave, hardy, and warlike, and on many occasions have got the better of their hereditary enemies, the Sioux. Their lodges, made of dressed buffalo skins, are roomy and comfortable, and seem well adapted to the rigorous climate of Montana. During the autumn season they go to the eastward, to the buffalo-grounds, and kill great numbers of these animals, the flesh being cured and dried for winter food and the skins dressed to be used as bedding, clothing, or sold to the traders. The skins which are used for the lodges have the hair entirely removed by the adzes, or little scrapers, in the hands of the squaws, who do all the work. Deer skins are used for clothing, and bear, beaver, otter, and antelope skins are sold to the traders, or used for clothing. These Indians have a great number of horses, which they are very proud of, and their villages absolutely swarm with dogs who seem to be but one remove from wolves. They are as contented and happy a tribe of Indians as can be found on this continent.

A. G. BRACKETT.

Up'shur, county of N. E. Texas, lying N. of Sabine River; surface level, soil well timbered and fertile. Cattle and swine are very numerous. Staples, cotton and Indian corn. Cap. Gilmer. Area, 945 sq. m. P. 12,039.

Upshur, county of Central West Virginia, bounded E. by the Middle fork of Monongahela River, and intersected by the Buckhannon; surface generally rolling, but in some parts hilly, soil productive in the valleys. Cattle and sheep are the principal live-stock. Staples, Indian corn, wool, dairy products, and a little tobacco. Cap. Buckhannon. Area, about 500 sq. m. P. 8023.

Upshur (ABEL PARKER), b. in Northampton co., Va., June 17, 1790; studied law under William Wirt at Richmond, where he practised 1810–24; was representative in the legislature, and in 1826 was appointed a judge of the general court; in 1829 was a member of the State constitutional convention, and in 1843 was appointed secretary of the navy; was killed by the bursting of a gun on board the U. S. steamer Princeton Feb. 28, 1844. He published several essays, reviews, and addresses, and an *Inquiry into the Nature and Character of our Federal Government* (1840).

Upshur (JOHN A.), U. S. N., b. Dec. 5, 1823, in Virginia; entered the navy as a midshipman Nov. 4, 1841; became a lieutenant in 1855, commander in 1860, captain in 1872; served in the naval battery at Vera Cruz during the Mexican war, and in the frigate Wabash at the capture of Port Royal, and commended for gallantry on both occasions.

FOXHALL A. PARKER.

Up'son, county of W. Georgia, bounded S. W. by Flint River, and partially traversed by Upson County R. R., which terminates at the county-seat; surface hilly, soil moderately productive. There are some manufactories of cotton goods. Swine and cattle are the principal live-stock. Staples, cotton, Indian corn, and dairy products. Cap. Thomaston. Area, 384 sq. m. P. 9430.

Up'ton (P. O. name ST. EPHREM D'UPTON), v. of Bagot co., Quebec, Canada, has a mine of copper and lead-bearing limestone. It is on Grand Trunk Railway, 48 miles E. of Montreal. P. about 350.

Upton, p.-v. and tp., Oxford co., Me. P. 187.

Upton, p.-v. and tp., Worcester co., Mass. P. 1989.

Upton, tp., Texas co., Mo. P. 642.

Up'ton (EMORY), b. at New York 1840; graduated at the U. S. Military Academy May, 1861, and commissioned second lieutenant of artillery. In the Peninsular campaign of 1862 he commanded his battery at Yorktown, Gaines's Mill, and Glendale; in command of artillery brigade at South Mountain and Antietam; appointed colonel 121st New York Vols. Oct., 1862, and engaged at Fredericksburg, Salem Heights, Gettysburg, and in command of a brigade during subsequent Rapidan campaign. In the Richmond campaign of 1864 he led his brigade (6th corps) through the Wilderness battles to the front of Petersburg; transferred with his corps to the Shenandoah July, 1864, he was wounded at Opequan Sept. 19, while in command of a division. Returning to duty in December, he was assigned to a division of cavalry in the West, and was engaged in the expedition into Alabama and Georgia in the spring of 1865 resulting in the capture of Selma, Columbus, etc. Mustered out of the volunteer service Apr., 1866, he was in July transferred to the 25th Infantry with rank of lieutenant-colonel, and engaged in perfecting a *System of Infantry Tactics*, which was adopted in Aug., 1867, for the use of the army and militia of the U. S.; transferred to the 18th Infantry in 1869, and to the 1st Artillery 1870. Was commandant of cadets at West Point 1870–75. For gallantry in the field during the war he was brevetted from major to major-general.

Upup'idæ [from *Upupa*—a proper name—the representative genus], a family of birds typified by the common hoopoe of Europe. The form has nothing peculiar, but is essentially similar to that of most passerine and related birds—*e. g.* American cuckoos, larks, thrushes, etc.; the bill is rather elongated, slender, curved from base to tip, and laterally compressed; the culmen is keeled; the mandible within, toward tip almost plane; the nostrils are basal, and partially covered each by a membranaceous scale; the wings are long and rounded; the tail long; the tarsi moderate (shorter than the middle toe), and covered with broad scales; the toes moderate, three anterior and one posterior, the outer longer than the inner, and united at the base to the first joint; the claws of the anterior toes are moderate, curved, and compressed, that of the posterior almost straight. The singing apparatus is wanting. The osteological and other characteristics indicate that the family is related to the "coccygomorph" birds (Bucerotidæ, Meropidæ, Cuculidæ, etc.), but that it is in some respects quite distinct, and to such an extent that A. Milne-Edwards and Murie have isolated it as the type of a distinct major group (super-family) under the name Epopinæ or Epopomorphæ. According to Murie, the family is nearly related to the Bucerotidæ, and the distance between it and the living forms of that family is in some degree bridged over by the extinct genus *Cryptornis*. The family is confined to the oldest known continents (Europe, Asia, and Africa), and mostly to the warmer regions. The best discussion of the affinities and structure of the type is to be found in an article by Murie on the Upupidæ and their relationships in the *Ibis* for 1873 (pp. 181–211, pl. 5–7). (See also HOOPOE.)

THEODORE GILL.

U'ral, river of Russia, rises in the Ural Mountains, flows S., forming the boundary between Europe and Asia, and enters the Caspian Sea after a course of 1040 miles. It is not navigable on account of sandbanks, but is very rich in the finest kinds of fish.

Ural Mountains, The, a range of plateaus rather than a chain of mountains, rising from 3000 to 5000 feet, and with a breadth of from 16 to 66 miles. They begin at the Arctic Ocean, in lat. 70° N., and stretch southward to lat. 50° N., forming the natural boundary between Europe and Asia. They are exceedingly rich in metals. In 1862 6660 pounds of gold, 5328 pounds of platinum, 8,959,140 pounds of copper, and 4,365,348 cwts. of iron were extracted. Of precious stones, beryl, topaz, amethyst, and diamonds are found; coal is abundant.

Uralsk', town of Russia, government of Orenburg, on the Ural, trades much in fish, cattle, tallow, and caviare. P. 10,822.

Ura'nia, in Grecian mythology, one of the nine Muses, the goddess of astronomy, and a daughter of Zeus and Mnemosyne, was generally represented by art as holding a celestial globe in the one hand and pointing at it with the other.

Ura'nium [Gr. either from οὐράνιος, "celestial," or from Οὐρανία, a name of Venus, probably the first; named from the extreme beauty of its compounds]. Klaproth in 1789 gave this name to a metal whose oxide he discovered in the mineral called *pitchblende* (*uraninite* of Dana), which contains sometimes as much as 85 per cent. of uranoso-uranic oxide, U_3O_4. It was not until as late as 1840, however, that metallic uranium was first discovered by Peligot, what had previously passed for the metal having been ascertained by him to be only the monoxide, UO. There are quite a large number of mineral species that contain uranium, but the only one occurring in sufficient quantity to be available for the extraction of uranic compounds is pitchblende, which is found at Joachimsthal in Bohemia in sufficient quantity to furnish it to commerce, in which it is in demand chiefly for coloring porcelain and glass. One American locality only is as yet known, from the N. side of Lake Superior, of a variety called *coracite*, found by Dr. Genth to contain about 62.5 per cent. of U_3O_4. Several other mineral species containing uranium are known, mostly very rare, and unknown as yet in America. One locality exists on the Schuylkill River just above Philadelphia, where *autunite*, a hydrated phosphate of lime and uranium, a micaceous mineral of a beautiful lemon-yellow color, occurs in small quantity. Other localities are doubtful.

To obtain uranium compounds from pitchblende it is pounded and washed to remove impurities, roasted to remove sulphur and arsenic, and dissolved in nitric acid, evaporated then to dryness, which decomposes the ferric nitrate. Water dissolves from the dried mass little but the pure uranic nitrate, which is farther purified by crystallization, and several recrystallizations when required perfectly pure. From this exceedingly beautiful salt (see URANIUM, COMPOUNDS OF) pure U_3O_4 may be obtained by ignition alone, and the protoxide, UO, by ignition with reducing agents, and the dichloride, UCl_2, by heating with charcoal in chlorine gas. The metal was obtained by Peligot from the dichloride by heating with metallic potassium or sodium. It is hard, but somewhat malleable, and scratchable by a file. The maximum density was 18.4; the color approached that of iron. It tarnishes to a yellowish color in air. It takes fire, when in powder, at a quite low temperature, about 500° F., burning with great brilliancy to U_3O_4, of a dark-green color. It does not decompose water in the cold, but evolves hydrogen with dilute acids, dissolving with a green color. It combines directly with sulphur and chlorine. HENRY WURTZ.

Uranium, Compounds of. This metal forms with oxygen four compounds, UO, U_4O_5, U_3O_4, and U_2O_3. A hydrate has also been obtained of an oxide, U_4O_3. The protoxide, UO, supposed to be the metal itself before Peligot first obtained the latter, is procurable by igniting oxalate of uranium in hydrogen; is brown or copper-red, with a metallic lustre, with density = 10.15. It may be obtained in regular octahedral crystals (microscopic), somewhat translucent, by igniting in hydrogen the double chloride of uranium and potassium. There are other methods. Its compound with water is precipitable from uranous salts by alkalies.

Uranoso-uranic Oxide (U_3O_4), which chiefly constitutes pitchblende, when obtained by ignition of the uranic nitrate, is a green, velvet-like powder, of density about 7.4. Dilute acids dissolve it with difficulty, but concentrated with ease.

Uranic Oxide (U_2O_3).—The nitrate, when cautiously heated not above 480° F., leaves pure uranic oxide as a beautiful yellow powder. If the heating goes too far, green U_3O_4 is formed. A so-called "hydrate," $O_4H_2U_2$, of a fine lemon-yellow color, and density 5.93, is obtainable by heating the nitrate gently in a sand-bath, and then washing with water, as well as by other methods. When the uranic nitrate is precipitated by an alkali, instead of this body we obtain its compound with the alkali, a *uranate* of the latter.

The uranates are a class of very beautiful compounds. Those with soluble bases are readily obtainable as above, but those of lime, baryta, and some metallic oxides, not so easily. The present writer many years ago devised a simple method of obtaining these by digesting the carbonate of the base with uranic nitrate. Products were thus obtained, particularly with baryta and some other bases, which constituted pigments, yellow and orange-colored, surpassing any others known: but the expense of uranium compounds prevents their application in this way.

Uranium forms two chlorides, UCl_2 and U_4Cl_6, and an oxychloride, $U_2O_2Cl_2$. The dichloride, UCl_2, is formed, as stated under URANIUM, by passing chlorine gas over an ignited mixture of charcoal with an oxide of uranium in a tube of hard glass. It sublimes in red vapor, and condenses as dark green octahedrons of metallic lustre. It is deliquescent, fumes in the air, and is very soluble in water with great heat to an emerald green liquid. This solution, which is decomposed by boiling, has great reducing power, precipitating gold and silver from their solutions and reducing ferric salts to ferrous.

Uranic Nitrate. This is one of the commonest commercial compounds of uranium. It crystallizes in lemon yellow prisms, which exhibit a greenish fluorescence peculiar to many uranium salts. Its composition is $U_2O_3.N_2O_5.6H_2O$, and its density 2.837. In vacuo the crystals lose half their crystal water, and effloresce also slightly in dry air. They dissolve in half their weight of water, also in alcohol and ether. When heated, they melt in their water of crystallization, and at a little higher heat decompose. Ordway states that decomposition does not commence till $4H_2O$ has been expelled.

Uranic oxide and the nitrate are used for communicating to glass a very rich greenish-yellow fluorescent color, which is accompanied by a slight opalescence, and which is inimitable in any other way. A black color, under the glaze, is communicated to porcelain by uranic compounds; for which purpose, however, pitchblende is used directly, or uranoso-uranic oxide prepared therefrom. H. WURTZ.

U'ranos [Gr. for "heaven"], in the Greek mythology, the son of Gæa, the earth, and by her the father of the Titans, Cyclopes, Hecatoncheirians, etc. He hated his children, and confined them in Tartarus, but on the instigation of Gæa, Cronos, the youngest of them, overthrew and dethroned him.

Uranoscopoi'dæa [from *Uranoscopus*—Gr. οὐρανός, "heaven," and σκοπεῖν, to "look up"—the oldest established genus], a super-family of fishes of the order Teleocephali and sub-order Acanthopteri, distinguished by the more or less cuboid form of the head, and the situation of the eyes on the dorsal surface, and their consequent visual direction upward; whence the name. There are three families, which are, however, generally combined in one, or divorced and relegated to two widely-different families. The following characters, however, will show their essential general agreements and differences:

(1) *Uranoscopidæ.*—In these the body is quite moderately elongated; the scales are very small and cycloid, or absent; the lateral line runs abruptly upward to the dorsal region, and is continued under the fin to its end, and thence deflected downward to the base of the caudal; the head is cuboid, and leaves more or less exposed to view the bony framework; the eyes are on the upper surface; the preoperculum is generally armed, sometimes entire; the mouth is almost vertically cleft; the teeth are acute, and on the jaws as well as palate; the branchial apertures are large and confluent below, where the membrane is doubled and forms a transverse flap between the rami of the jaws; branchiostegal rays six; the dorsal fin is diversiforia, typically represented by two fins, a short anterior spinous and a long posterior rayed fin, but sometimes the two are confluent in one; the anal is long and opposite the second dorsal; the caudal distinct; the pectorals large, with wide oblique bases, and with the inferior rays rapidly decreasing in length downward; the ventrals are jugular, and each has a spine and five rays; the intestinal canal has a few pyloric cæca. The family has seven or eight genera, represented in the European and eastern American seas, as well as those of Africa and Asia. The North American species is *Astroscopus y-græcum;* it attains a considerable size (sometimes nearly two feet in length), and is not very rare along the southern coast.

(2) *Leptoscopidæ.*—In this family the body is comparatively elongated; the scales are moderate in size, cycloid, and regularly imbricated; the lateral line at first runs along the side of the back, but is soon decurved, and continued along the middle to the base of the caudal fin; the head is cuboid, and more or less invested in the skin; the eyes are dorsal; the opercula are unarmed, but the operculum is fringed; the mouth is very obliquely and almost vertically cleft; the lips are fringed; the teeth are acute, and developed always on the jaws, sometimes on the palate, and sometimes not; the branchial apertures are ample, but partly covered below by a fold of the branchiostegal membrane; the branchiostegal rays are in six pairs; the dorsal fin is very long and entire, but with its anterior rays spinous, and the rest articulated; the anal is also elongated; the caudal distinct; the pectorals have their rays branched; the ventrals are jugular, and composed each of a spine and five rays. The stomach is siphonal, and the pyloric cæca obsolete. The vertebræ are in increased number. The representatives of the family are confined, so far as known,

to the Australasian seas, and constitute two genera, *Leptoscopus* and *Crapatalus*.

(3) *Dactyloscopidæ*.—The form in the representatives of this group is also elongated, as in the last, and the scales are moderately large and imbricated; the lateral line also near its origin runs on the back, and is soon deflected, and thence median; the head is diversiform (typically cuboid, sometimes conic), but always invested in the skin; the eyes are on the superior surface; the several opercular bones unarmed, the operculum fringed; the mouth with a subvertical or oblique cleft; the lips fringed; the teeth acute on the jaws, wanting on the palate; the branchial apertures continuous below, but covered there by a fold of the membrane; branchiostegal rays six; the dorsal fin is long and undivided, with its anterior portion sustained by spinous rays, and the rest by articulated ones; the anal is long, the caudal distinct; the pectorals have the rays unbranched; the ventrals are jugular, and each composed of a spine and three unbranched articulated rays. The stomach is siphonal; pyloric appendages undeveloped. The vertebræ are in increased number. The known species belong to three genera—*Dactyloscopus*, *Dactylagnus*, and *Myxodagnus*—and inhabit the littoral waters of the tropical portions of America on the Atlantic and Pacific sides. THEO. GILL.

U'ranus, the seventh planet in order of distance from the sun, and, with the exception of Neptune alone, the outermost member of the planetary family. Uranus travels at a mean distance of 1,753,869,000 miles from the sun, but, his orbit being considerably eccentric, his greatest distance, 1,835,561,000 miles, exceeds his least distance, 1,672,177,000 miles, by nearly 163,400,000 miles, or not much less (relatively) than the entire span of the earth's orbit. Since the earth's mean distance from the sun is 91,430,000 miles, the opposition distance of Uranus varies from about 1,744,100,000 miles to about 1,581,700,000 miles; and as the planet is farther from the sun in the former than in the latter case, and therefore less brightly illuminated, there arises a considerable variation in the apparent brightness of Uranus. In fact, Uranus is more favorably situated for telescopic study when in opposition near perihelion than when in opposition near aphelion, in the proportion of $(17,441)^2 \times (18,356)^2 : (15,817)^2 \times (16,723)^2$, or nearly as 3 to 2 (more exactly as 63 to 43). The eccentricity of the orbit of Uranus is 0.0466. The planet completes a sidereal revolution in 30686.8208 days, or in 84 years 6.5 days. His synodical period is 369.656 days, exceeding a year by little more than four days. The inclination of the orbit to the ecliptic is about 46'.5. The mean diameter of Uranus is estimated at about 33,000 miles; the compression of his globe is not known. His volume exceeds the earth's about seventy-four times, but his mean density is so small (0.17—the earth's as 1) that his mass exceeds hers only about twelve and one-half times. It has been said that he rotates on his axis in 9½ hours, but no reliance can be placed on the assertion, as the most powerful telescopes fail to show any clearly-defined markings on this distant globe. Uranus was discovered by Sir W. Herschel Mar. 13, 1781, when he was examining the small stars in the neighborhood of η Geminorum. He was led by the apparent size of a star in this region to suspect that it was a faint comet. Examining the object with higher powers, and finding its disk enlarged (which would not have been the case with a fixed star), he was confirmed in this suspicion. But soon after the discovery had been announced, the mathematicians who had undertaken the calculation of the stranger's orbit found the path to be an ellipse of moderate eccentricity, and concluded that the new orb was a member of the planetary family. This was placed beyond doubt before long; and in 1787 two satellites were discovered whose motions indicated that the supposed comet had a mass many times exceeding that of our earth. Sir W. Herschel proposed to call the new planet Georgium Sidus, in honor of George III. Continental astronomers for a long time called it Herschel, but the name Uranus, suggested by Rode of Berlin, is now universally adopted by astronomers. Herschel, during his later observation of Uranus, supposed that he had discovered four new satellites, but his observations were unsatisfactory, though Prof. Holden of the Washington observatory finds reason for believing that the two satellites subsequently discovered by Mr. Lassell of England were really seen by Sir W. Herschel. Four satellites are now recognized as forming the family ruled over by Uranus. Neither telescopic nor spectroscopic observation has revealed anything of interest in the physical condition of Uranus, though Secchi, Higgins, and Vogel find that the spectrum differs from that due to reflected sunlight. R. A. PROCTOR.

Urari. See CURARI.

U'rates, or **Lithates** [Ger. *Harnsäure Salze*], the compounds of URIC ACID (which see) with bases. Both neutral and acid urates are known of most metals. They are sparingly soluble in water, but dissolve in warm alkaline solutions and in solution of borax. The acid ammonic, sodic, and calcic urates are frequent ingredients of URINARY CALCULI (which see), the proportion of the calcic salt being, however, very small. The lithic is the most soluble of the urates; for this reason lithia-water is sometimes used as a remedy for gout and for superabundance of uric acid in the system. Ammonic urate is occasionally applied medicinally, in chronic cutaneous affections, in the form of an ointment; but urates should be taken internally very cautiously, as they may give rise to the formation of oxalic acid in the urine. J. P. BATTERSHALL.

Ur'ban, the name of eight popes, of whom the most remarkable were: (1) URBAN II. (1088–99). His true name was OTHON DE LAGNY, and he was born at Châtillon-sur-Marne, France, about 1042. After studying at Rheims, he became a Benedictine monk and prior of Cluny, and by Pope Gregory VII. was created bishop of Ostia and sent as a legate to the emperor Henry IV. to negotiate concerning the investiture. After the death of Pope Victor III., in 1088, he was elected pope by the Gregorian party at Terracina, while the imperial party at Rome elected Clement III. But in 1089, Clement III. was expelled by the Romans, and the council which Urban II. convoked in the same year at Rome excommunicated both him and the emperor. In 1091, however, Henry IV. appeared in Italy with a large army, and reinstated Clement III. Meanwhile, Urban II., who lived as an exile at the court of Count Robert of Apulia, had concluded a marriage between Matilda of Tuscany and Duke Guelf of Bavaria, and by the intrigues of Matilda he succeeded in drawing over to his side Conrad, the son of the emperor. Conrad revolted, and was crowned king of Italy at Monza by Urban II.; Clement III. was again expelled. In the spring of 1095, Urban convoked the Council of Piacenza, and in the fall of the same year that of Clermont in Auvergne. Here his stirring address to the assembled noblemen caused the formation of the first army of crusaders, which he very cunningly used for the final overthrow of the antipope. He held in all twelve councils, and contributed much to the consolidation of the papal power by his firm opposition to the emperor and the king of France, and by his vigorous enforcement of the laws of celibacy, investiture, etc. D. in Rome July 20, 1099.—(2) URBAN V. (1362–70). His true name was GUILLAUME DE GRIMOARD, and he was born at Grisac, France, in 1309. In 1353 he became abbot of Auxerre, in 1358 of Marseilles, and Oct. 28, 1362, on the death of Innocent VI., was elected pope at Avignon. He was the last pope who resided at Avignon, and made an attempt to remove the papal see back to Rome. In 1367 he returned to Rome, where he received the East Roman emperor, John Palæologus, who abjured the separatistic tenets of the Greek Church and acknowledged the supremacy of the pope; but he soon found the affairs of Italy in such confusion that he left the city, and d. at Avignon Oct. 18, 1369.—(3) URBAN VI. (1378–89), whose true name was BARTOLOMMEO RUTILLI-PRIGNANO, b. at Naples in 1318. After the death of Gregory XI. he was elected pope Apr. 8, 1378, under somewhat tumultuous circumstances, and in September of the same year a number of cardinals assembled at Anagni, declared his election invalid, and elected Clement VII. antipope. Thus began the great schism in the Roman Catholic Church. Clement VII. took up his residence at Avignon, and the two popes reciprocally excommunicated and condemned each other. Urban VI. changed the term of the celebration of the jubilee year from fifty to thirty-three years; d. at Rome Oct. 15, 1389.—(4) URBAN VIII. (1623–44). His true name was MAFFEO BARBERINI, and he was born at Florence in 1568; studied at Rome and Bologna; entered the service of the Roman curia under Sixtus V.; was created archbishop of Nazareth by Clement VIII. in 1604, and archbishop of Spoleto by Paul V. in 1608; and was elected pope Aug. 6, 1623, after the death of Gregory XV. His reign bore the general character of that of an Italian prince of that time. He organized armies, built fortresses, founded collections of arms and antiquities, had literary tastes, and wrote epigrams and paraphrases of the Bible in the metres of Horace, which were published at Antwerp in 1634 and at Paris in 1642. In politics he sided with France and Richelieu in their contest with Austria, and thus came indirectly into alliance with the Protestants of Germany. In ecclesiastical matters he condemned Galilei and Jansen, and forbade the priests the use of snuff in the churches under penalty of excommunication. But all the manifold troubles which surrounded him he took in an easy and elegant manner. D. July 29, 1644. CLEMENS PETERSEN.

Urba'na, p.-v. and tp., cap. of Champaign co., Ill., on Indianapolis Bloomington and Western R. R., and at the terminus of Monticello R. R., has 2 private banks and a

newspaper, and is the seat of the State Industrial University. P. of v. 2277; of tp. 3325.

Urbana, tp., Monroe co., Ia. P. 887.

Urbana, p.-v. and tp., Frederick co., Md. P. 2359.

Urbana, tp., Steuben co., N. Y. P. 2082.

Urbana, city and tp., cap. of Champaign co., O., at the crossing of Atlantic and Great Western, Cincinnati Sandusky and Cleveland, and Pittsburg Cincinnati and St. Louis R. Rs., 100 miles N. of Cincinnati and 46 miles W. of Columbus, is the centre of a rich agricultural district. The place is very elegantly improved. The business centres chiefly at Monument Square, in the middle of which is an elegant granite monument surmounted by a bronze statue of a private soldier, erected at a cost of $15,000 by the people of Champaign co. in commemoration of the fallen soldiers of the war of 1861–65. The free schools include 4 fine buildings, one of which, the high school, was erected at a cost of $125,000. The Urbana University, the only Swedenborgian school in the U. S., is located here, and has an attendance from many States of the Union. The city contains 12 churches, 3 national banks, a public library, 1 life and 1 fire insurance company, and the manufactories include the shops of the U. S. Rolling Stock Co., the Urbana Machine-works, manufacturers of ploughs, water-wheels, and corn-planters; 2 carriage-factories, 2 wagon factories, 2 broom-factories, 1 shoe-factory, a stove-foundry, 1 steam tannery, 1 steam furniture-factory, 2 door and sash factories, 1 woollen-factory, 4 newspapers, etc., altogether employing over 600 mechanics. P. of city, 4276; of tp., 1827. J. F. Brand, Ed. "Citizen and Gazette."

Urbi'no (*Urbinum Hortense*), town of Italy, province of the same name, on two steep and lofty hills of the Umbrian chain, between the Metauro and the Foglia, about 25 miles S. W. of Pesaro. The walls were erected by the celebrated mathematician F. Commandini, and the town was afterward further strengthened with a castle and towers by the lords of Montefeltro (1213). The large cathedral, which contains some good works of art, is of the seventeenth century, the ancient church on this site having been destroyed by an earthquake. Other churches contained frescoes and oil paintings by Salimbeni, by Barocci, by the father of Raphael, and by Titian, but the movable pictures have been mostly transferred to the municipal gallery. The ducal palace (begun 1447) is a noble edifice in the early Renaissance style, and, besides much striking mediæval ornament, contains ancient inscriptions and bas-reliefs of great interest. Several of the private palaces also possess rare artistic treasures, especially that of the Staccoli Castracane, where Ghirlandajo, Guido Reni, G. Bellini, Barocci, Raphael, Luca della Robbia, etc., are all more or less well represented, and where there is a fine collection of the famous ceramics of Urbino, Casteldurante, and Gubbio. One of the chief points of interest here is the modest house in which the immortal Raphael Sanzio was born (1483), a fact which is commemorated by a somewhat long inscription, beginning *Nunquam moriturus.* Urbino is among the most ancient cities of Italy, acquired the rights of Roman citizenship in 89 B. C., and suffered many vicissitudes during the breaking up of the Roman empire. It recovered some importance in the early part of the thirteenth century, but the first who assumed the title of duke of Urbino was Federico di Montefeltro (1471), and he and his immediate successors, as wise and virtuous as they were prosperous, made Urbino famous in the history of the mediæval world. In 1508 the duchy passed to the Della Rovere house; in 1631 it became the direct property of the Church, and so remained, with the brief exception of the French domination, till united to the kingdom of Italy. Urbino is distinguished for the number of remarkable men to whom it has given birth, and for the general intelligence and activity of its citizens. Both rural and manufacturing industries are flourishing. P. 16,194.

Urchin-Fish, or **Porcupine-Fish.** See Diodon.

Urchin, Sea. See Echinus.

Ure (Andrew), M. D., F. R. S., b. at Glasgow, Scotland, May 17, 1778; educated at the universities of Glasgow and Edinburgh, where he also graduated in medicine; became professor of chemistry at the Andersonian Institution at Glasgow 1804, and director of the Glasgow Observatory 1809; removed to London 1830; was appointed analytical chemist to the board of customs 1834; acquired a high reputation by his original scientific researches, and especially by his successful application of chemical discoveries to the arts and to manufactures. D. in London Jan. 2, 1857. Author of *A New Systematic Table of the Materia Medica* (1813); *A Dictionary of Chemistry* (2 vols., 1821; republished in the U. S. by Drs. Robert Hare and Franklin Bache, Philadelphia, 1821)—a work which until the appearance of that of Watts was the undisputed standard; *A New System of Geology* (1829); *The Philosophy of Manufactures* (1835); *The Cotton Manufacture of Great Britain* (2 vols., 1836; new ed. 1861); and *A Dictionary of Arts, Manufactures, and Mines* (2 vols., 1837–39), which, as rewritten and enlarged by Dr. Robert Hunt (3 vols., 1859–60; 7th ed. 1875), still enjoys a high reputation.

Urea [Fr. *urée*; Ger. *Harnstoff*; *Ureoxyd Ammoniak*], (CH_4N_2O), an isomere of ammonium cyanate, was first obtained by Rouelle in 1773, afterward in a state of greater purity by Fourcroy and Vauquelin in 1799. It is an essential constituent of the urine of mammiferous animals, particularly of the Carnivora, but is also found in that of birds and of Amphibia. Urea also occurs, to some extent, in human blood and perspiration, in the vitreous humor of the eye, and in the lymph and chyle of various animals. It is the chief outlet for the oxidized nitrogen of the tissues of the system, a healthy adult excreting more than an ounce daily. It is not formed in the kidneys, which appear merely to separate it from the blood in which it is pre-existent. Urea may be formed artificially in several ways, but its preparation by the action of cyanic acid on ammonia (discovered by Wöhler in 1828) possesses special interest as being the earliest synthetic formation of an organic compound:

$$\underset{\text{Ammonium cyanate.}}{H_4N.CNO} = \underset{\text{Urea}}{CH_4N_2O}.$$

It is also obtained from cyanamide (CN_2H_2) by the addition of 1 equivalent of water, and by the decomposition of numerous complex organic compounds, such as creatine, guanine, and Uric Acid (which see); likewise by the action of phosgen gas ($COCl_2$) on ammonia; but in the laboratory it is usually prepared either from urine or by the evaporation of a solution of ammonium cyanate. In the former process the urine is evaporated to dryness on the water-bath, and the residual mass exhausted with alcohol, which is evaporated to dryness. The second residue is then extracted with pure alcohol, which, upon evaporation, leaves the urea in a slightly-colored state; or the urine is concentrated by evaporation, and nitric or oxalic acid added, by which a precipitate of nitrate or oxalate of urea is formed, from which the urea is obtained by decomposition with baric or calcic carbonate, filtering the solution, and purifying the urea by repeated recrystallization from alcohol. Urea is, however, most readily and abundantly prepared from ammonium cyanate in the following manner: Potassium cyanate is first formed by heating a mixture of 56 parts of carefully-dried potassic ferrocyanide and 28 parts of dry black oxide of manganese to dull redness. The residue, when cold, is treated with cold water, and 41 parts of ammonic sulphate are added, when ammonium cyanate and potassic sulphate are formed. The solution is then evaporated, treated with hot alcohol, from which, on cooling, the urea crystallizes out. A still more advantageous method is to digest plumbic cyanate with its equivalent of ammonic sulphate at a low heat, and evaporate the filtered liquid.

Urea has a sp. gr. of 1.30 (Bödeker) or of 1.35 (Proust and Schabus). It crystallizes in colorless striated prisms, which fuse at 248° F., but are decomposed at a higher temperature. It is very soluble in water and in hot alcohol, but is nearly insoluble in ether. Its solution possesses a neutral reaction and a cooling, bitter taste. When heated in a sealed tube to about 284° F., urea combines with 2 molecules of water, and is converted into ammonic carbonate:

$$CH_4N_2O + 2H_2O = (H_4N)_2CO_3.$$

An analogous change takes place in the organism, owing to the action of the mucus of the bladder, to which the ammoniacal odor of stale urine is due. When it is heated above its melting-point, *biuret* ($C_2O_2H_5N_3$) and *cyanuric acid* ($C_3O_3H_3N_3$) are formed, with evolution of ammonia. Urea combines with acids, forming crystalline compounds, and also with metallic oxides, such as those of mercury and silver. Numerous substitution-derivatives of urea (*compound ureas*) have also been obtained. It is easily detected in animal fluids by precipitating the alcoholic extract with nitric acid, and examining the crystalline laminæ thrown down with the microscope goniometer. They should exhibit an angle of 82°. (For the quantitative estimation of urea in urine see Urine, Chemical Composition and Analysis of.) J. P. Battershall.

Uredin'eæ [Lat. *urere*, to "burn"], an order of Fungi to which belong the rusts and many of the mildews which attack living plants. With regard to the species of this order, two different views are held by mycologists. The more recent continental writers consider that many of the so-called species of the older mycologists are nothing but different forms of the same species, while nearly all British and some of the older continental writers on Fungi do not consider that there is any essential connection between the

different forms. As the subject is not a little perplexing, we shall illustrate with the common black mildew of grains, found also on most of the grasses. The black spots known as mildew are found late in summer and in autumn in streaks on the leaves and stems, and occasionally on the glumes, of grasses. The black color is caused by the spores of a fungos to which the name *Puccinia graminis* has been given. The mycelium or vegetative threads of this species extend throughout the stem and leaves, and sometimes even into the roots, of the grass. They burst finally through the epidermis, and bear dark-colored spores, consisting of two cells, as shown in Fig. 1, *a*. In the following spring, or during the winter if kept sufficiently moist and warm, each of these cells germinates and pushes out a tube, as in Fig. 1, *b*, which tube quickly divides into three or four parts by cross-partitions, and bears the bodies represented in

Fig. 1.

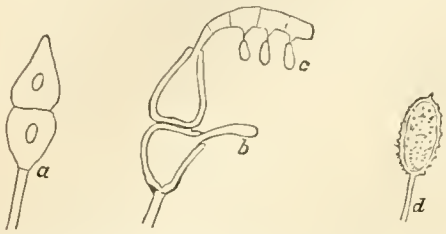
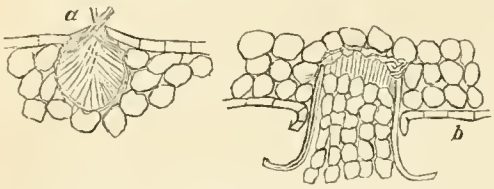


Fig. 1, c. The latter, if placed on moistened leaves of grass, grow by pushing out a tube for a short time, but soon perish. If, however, they are placed on leaves of the common barberry, and kept in a sufficiently moist position, the tubes may be seen to penetrate into the interior of the barberry leaf, on which, at the end of a few days, a red spot appears, and the tissue of the leaf becomes thickened. In this red spot there appears on the upper surface of the leaf a number of dark-colored bodies, which, when examined by the microscope, exhibit the structure shown in Fig. 2, *a*. Shortly afterward there grow out from the under surface of the leaf a number of cup-shaped bodies (Fig. 2, *b*), con-

Fig. 2.



taining orange-colored spores, at first arranged in rows, but soon breaking up into powder. These cup-shaped bodies are commonly called cluster-cups, and are found on the barberry in spring and early summer. The spores contained in the cluster-cup germinate at once by pushing out a tube; but if sown on barberry leaves, the germinating tubes soon perish without entering the leaves. When, however, the spores produced in the cluster-cups on the barberry are sown on moistened leaves of grass, the germinating threads which they give out penetrate into the leaves, and in a few weeks burst through the epidermis and bear a number of spores, as in Fig. 1, *d*. The spores are oval, of an orange color, slightly granulated, and borne singly on a short stalk. The spots caused by the orange-colored spores are known as rust. The rust spots are later in the season succeeded by the black spots already described as mildew. The mildew spots are produced either by the growth onward of the same mycelial filaments which have produced the rust spots, or by the germination of the rust spores.

From the above account it will be seen that the fungus growing on grain and producing the mildew has four different states—first, that represented in Fig. 1, *a*, found on grain and grasses; second, the body, represented in Fig. 1, *c*; third, the form found on barberry leaves, composed of the two bodies represented in Fig. 2, *a*, found on the upper surface, and Fig. 2, *b*, found on the under surface of the leaves; fourth, the form known as rust, found on grains and grasses, Fig. 1, *d*. The following terms have been given to the different states mentioned above:

I. Teleutospores (Fig. 1, *a*).—On grains and grasses in autumn; spores two-celled, dark colored, generally known as black mildew.

II. Promycelium (Fig. 1, *b*) and Sporidia (Fig. 1, c).—Growing directly from spores of first state.

III. Æcidium (Fig. 2).—On barberry leaves in spring, consists of *spermogonia* (Fig. 2, *a*) and *æcidia* (Fig. 2, *b*), which are vulgarly known as cluster-cups.

IV. Uredo (Fig. 1, *d*).—On grains and grasses in midsummer. Spores one-celled, orange-colored; vulgarly called rust.

Formerly—and the view is still maintained by British and some continental botanists—it was supposed that each of the forms above mentioned was a distinct species of fungus, and a specific name was given to each. The teleutospore state was called *Puccinia graminis*, and placed in the order Pucciniæi; the second, or sporidial state, was unknown until discovered by Gasparrini in 1848; the æcidial state was known as *Æcidium berberidis*, and placed in the order Æcidiacei; the uredo state as *Uredo rubigo*, and placed in the order Uredinei. The connection between the different forms, however, had been for a long time suspected, and De Bary in 1863 (see *Annales des Sciences*, 4me série, tome xx.) showed that the teleutospores of certain species of Uredineæ, when sown on the leaves of appropriate plants, caused in a short time an æcidium to appear. In this way an explanation was found of the fact observed by farmers, that barberry bushes growing near grain seemed to cause rust. He also showed that æcidial spores of *Æcidium berberidis* germinate upon, and make their way into, the leaves of different grains.

With the previous description of the development of *Puccinia graminis* the general characteristics of the order can be understood. The species of the order pass through different stages, either on the same or different species of phanerogams. The stages are usually four in number, as in *Puccinia graminis*, but in some cases one or more stages are omitted in the development of the fungus. Thus, in the genus *Podisoma* the stages are reduced to two, teleutospores and æcidial spores. It will easily be understood that with such a complicated system of development any attempt, at present, to classify the Uredineæ scientifically must be very imperfect. The species included under the order are very numerous, and there is scarcely any order of phanerogams which they may not attack. They are perhaps more injurious to grain than other plants, and cause damage not by attacking the grain itself, but the stalks and leaves. The Rosaceæ are very liable to their attacks, as are also the Coniferæ. Among the more curious members of the order are the species of *Podisoma*, the most striking of which is *Podisoma macropus*, which attacks the red cedar, and is known as cedar-apple. The fungus is the teleutospore or final state of a species which has no uredo state, and whose æcidium state, represented by a member of the so-called genus *Rœstelia*, is probably found on some of the Rosaceæ. Oersted first published observations to show that the Rœsteliæ were states of species of *Podisoma*. His observations, however, did not extend to the American species. The spores of the cedar-apple consist of two cells, as in the mildew of grain, and are packed together in a sort of jelly. In damp weather the jelly expands, and the juniper trees look as if covered with bright yellow flowers.

The genus *Phragmidium* differs in its perfect state from *Podisoma* and *Puccinia* in having its spores three or more celled. The species of this genus are most frequent on species of *Rosa* and *Rubus*. *Uromyces* has its final spores one-celled, and attacks frequently leguminous plants, particularly beans. But of all the genera of the order, *Puccinia* is the most injurious. *Puccinia graminis* is the common grain mildew, *Puccinia malvacearum* the hollyhock mildew, and *Puccinia zeæ* attacks the leaves of Indian corn. The spores of many of the Uredineæ germinate at once: others require a period of rest, generally ripening in the fall and germinating the following spring. This is notably the case with the species of *Melampsora*, which inhabit the thick leaves of willows and poplars, and cannot be made to germinate until after a period of repose. As yet, no sexual organs have been found in the Uredineæ. It has been supposed, but not yet certainly shown, that the spiral body sometimes found in young æcidia corresponds to the solecite or vermiform process of the *Ascomycetes*.

Those desirous of studying the general structure of this order are referred to the following monographs: Tulasne, L. R., *Annales des Sciences naturelles*, 3me série, tomo vii. (1847), and 4me série, tome ii. (1851); De Bary, Anton, *Untersuchung über die Brandpilze* (1853); *Annales des Sciences naturelles*, 4me série, tome xx. (1863). (See also Ustilagineæ.) W. G. Farlow.

Uredines. See Uredineæ.

Uredo. See Uredineæ.

Ure'ter [Gr. οὐρητήρ], the excretory duct of the kidney. In man it is a cylindrical membranous tube about seventeen inches long, and as large as a goosequill, passing from the pelvis of the kidney to the base of the bladder. It has a fibrous (or outer), a muscular, and a mucous (or inner) coat. Each kidney normally has a distinct ureter.

Ure'thra [Gr. οὐρήθρα], the name of the membranous canal by which the urine is emptied from the bladder. In the

female it is but a short passage opening below the clitoris. In the male it is a canal of about 8–9″ in length, and of a somewhat complicated structure, conducting not only the urine, but also the semen. Going from the bladder outward, the urethra is divided into three parts: (1) the prostatic part, surrounded by the prostatic gland, in which (part) are the openings of the seminal ducts; (2) the membranaceous part, 8‴–10‴ long; and (3) the cavernous or spongy part, surrounded by the spongy tissues of the penis. The calibre of the urethral canal is different in the different parts and different individuals, and ranges from 3‴ to 7‴ in diameter, the orifice being the narrowest part. The urethra is lined throughout with a delicate coating of mucous membrane, which is a direct continuation of the mucous membrane of the bladder. (For obstructions of the urethra see STRICTURE.) F. ZINSSER.

Urfah. See ORFA.

Ur'ga ["palace"], the Russian name of the Mongolian **Bogdo-Kuren** or **Da-Kuren** ("holy camp"), the capital of Northern Mongolia, has 30,000 inhabitants, and is on the Tola, in lat. 17° 58′ N., lon. 106¾° E., at an elevation of 4370 feet, on the line between Kiachta and Peking which forms the principal caravan-route between Russia and China. Urga consists, like all Mongolian towns, of a Mongolian and a Chinese quarter. The latter, which contains the fort, is also called *Mai-mai-chen* ("trading-place"), and stands 2½ miles from Bogdo-Kuren. Both places are disgustingly dirty. Bogdo-Kuren contains large Booddhistic monasteries and temples, and is the seat of the supreme Mongolian Kutukhtu, who is considered the terrestrial representative of Booddha, and ranks in holiness next to the Dalai-Lama of Lhassa and the Panchess Rinpocho of Shigartse, both in Thibet. The monasteries are extensive structures of stone, and contain numerous shrines and relics, which are subjects of the deepest veneration; the occupants, the monks, are called *lama*, and number about 10,000. The other houses are miserable huts or tents of felt, incredibly dirty and swarming with clouds of parasitic insects. The custom is to not bury the dead, but to leave them, in accordance with Booddhistic doctrines, to be devoured by the dogs and birds of prey; the corpses of poor people are simply thrown into the streets; those of people better off are carried to a place outside the city; only those of priests and princes are interred. The Mongols settled here belong to the Khalka tribe. During summer, numerous pilgrims from all parts of Mongolia gather to the city, and a brisk trade springs up. The unit of value is the tea-brick. Tea, mixed with cows' blood, is moulded into the form of bricks, and from 12 to 15 such bricks are paid for a sheep, from 120 to 150 for a camel. The surrounding country has a South Siberian character; the mean temperature of the year is 25.70° F.; the number of rainy or snowy days is 41. A Russian consul is stationed here, with a small detachment of Cossacks for his protection. Russian merchants and scholars often visit Urga, and undertake from here extensive journeys into Northern Mongolia. EMIL SCHLAGINTWEIT.

U'ri, one of the forest cantons of Switzerland, bordering N. on Lake Lucerne, and having St. Gothard on its southern frontier, comprises an area of 422 sq. m., with 16,107 inhabitants, who are Roman Catholics and speak German. It consists of one valley, enclosed by lofty mountains and traversed by the Reuss. Rearing cattle and dairy-farming are the principal employments. Chief town, Altorf.

U'ric Acid, or **Lith'ic Acid** [Fr. *acide urique*; Ger. *Harnsäure*], ($C_5N_4H_4O_3$), first discovered by Scheele in 1776, and subsequently more thoroughly investigated by Wöhler and Liebig in 1838. More recently Bäyer has given special attention to the uric group of compounds. Uric acid occurs in a small proportion in human urine, but is much more abundantly contained in the excretions of insects, land-reptiles, and birds, usually as the ammonic salt. It is extensively found in the guano-beds of the Pacific islands, also in the form of ammonic urate, and is said to be contained in the human spleen, liver, and lungs; also in the blood, which latter, in certain diseases, as gout and albuminuria, contains a very considerable amount; indeed, in persons suffering from the former affection it often accumulates around the joints, forming what are commonly but incorrectly termed "chalk-stones," which consist chiefly of sodic urate. When secreted in excess, it is discharged by the kidneys, and is deposited from the urine as *red gravel*, or it accumulates in the bladder and forms a constituent of URINARY CALCULI (which see).

Uric acid is most advantageously prepared from the dried urine of serpents, by dissolving the powdered mass in a large quantity of boiling water, to which caustic potash enough to dissolve all the acid is added, and heating until ammoniacal vapors cease. The fluid is then filtered, and the potassic urate decomposed by hydrochloric acid, uric acid appearing in minute white crystals. It can also be obtained by boiling guano with a weak borax solution, whereby a solution of sodic urate is formed, from which the uric acid is precipitated by hydrochloric acid. Uric acid crystallizes in small white rhombic prisms; but if slowly deposited from a dilute solution, it frequently separates in large crystals containing 2 molecules of water; when obtained from animal fluids, its crystalline form is often very much modified. It is almost insoluble in water, requiring 10,000 parts of cold water, and is quite insoluble in alcohol and in ether. It dissolves in concentrated sulphuric acid, from which it is precipitated in a hydrated form by the addition of water. When dry uric acid is heated, it is decomposed without fusion, and hydrocyanic acid is evolved, a sublimate, consisting of cyanuric acid, urea, with ammonia cyanate and carbonate, being formed.

The most remarkable property of uric acid is the facility with which it is altered by oxidizing agents, such as nitric acid, plumbic dioxide, etc., and transformed into numerous well-defined crystalline compounds, some of which, however, are obtained from the immediate products of oxidation by the action of reducing agents, acids, and alkalies. More than thirty of these compounds (many of which are termed *ureides*) have been prepared, including the following: *alloxan, alloxantine, uramil, allantoin, glycoluril, murexide*; also the acids *uroxanic, barbituric, bioluric, thionuric, oxaluric, parabanic*, and *mesoxalic*. If the last-named acid is submitted to the action of reducing agents, *tartronic acid* is obtained: upon oxidation it furnishes oxalic acid. Uric acid, as yet, has not been synthetically produced. According to Gerhardt, it is the *diureide* of tartronic acid, but all attempts to prepare it from tartronic acid and urea have been unsuccessful, although, as stated above, tartronic acid is obtained from its dehydrogenized product (mesoxalic acid) by taking up 2 atoms of hydrogen.

Uric acid is dibasic, and forms both normal and acid salts. (See URATES.) Its presence can often be recognized with the aid of the microscope by its peculiar crystalline structure—rhombic tablets, frequently associated with dumb-bell-shaped crystals. When moistened with nitric acid and gently heated, a residue is obtained, which, upon treatment with ammonia, assumes a fine violet-red color (*murexide*), and when treated with potassa acquires a violet-blue color (*potassic purpurate*). It may also be detected by dissolving in sodic carbonate, and placing a drop of the solution on paper moistened with argentic nitrate, upon which it produces a brown spot, caused by the reduction of the silver. (For the quantitative estimation of uric acid in urine see URINE, CHEMICAL COMPOSITION AND ANALYSIS OF.) One of the uric acid series (*murexide*) has received practical application in the dyeing of silks and cotton, to which it imparts a fine purple color. Silks are dyed by simple immersion in a mixture of the dye with corrosive sublimate; cotton goods are mordanted with plumbic nitrate. J. P. BATTERSHALL.

U'rim and Thum'mim [Hebrew plu. abstracts, signifying "enlightenment and fulfilment" or "completion"], the name of that sacred symbol of the high priest of Israel which was given at Sinai (Ex. xxviii. 30), but lost for ever at the destruction of the first temple (Ez. ii. 63; Neh. vii. 65). It was placed either *upon* the *choshen* or breastplate of the high priest, thus being the four rows of precious stones (*Kalisch*), or else *within* its pocket. In the latter case it was composed of two precious stones (*Fürst*), or even three (*Gesenius*), and used to cast lots; or else of two symbolical images like the corresponding Egyptian ones (*Plumptre*); or, more probably, one object, either stone or parchment, bearing the most sacred name of the God of Israel (*Saalschütz*); or else, still better, a sacred pledge of "complete enlightenment" (*Bähr*), occupying the same relative position to the *choshen* and high priest's garments that the tables of the Law did to the ark and the tabernacle. C. A. BRIGGS.

Urinary Calculi and Deposits. *Deposits.*—Urine in disease often deposits on standing various kinds of sediments, which differ in properties and composition according to the causes which induce their formation. Both morphological and chemical bodies are thus separated. The former class includes such substances as blood, pus, and mucus-corpuscles, epithelial scales, spermatozoa, etc.; to the latter class belong urates, uric acid, phosphates, calcic oxalates and carbonates, hippuric acid, cystine, leucine, xanthine, tyrosine, etc. These deposits form light flocculent powders or compact grains (*gravel*), or they collect in larger concretions, forming calculi. The most common sediments contain uric acid. This often separates in a free state, forming *red gravel* (see URIC ACID), or it is deposited in the form of ammonic or sodic urates, which sometimes appear in perfectly healthy urine. A crystal-

line or amorphous deposit, consisting of ammonio-magnesic phosphate, forms what is known as *white gravel*.

Calculi in the Bladder.—These vary greatly in size and composition, and are frequently composed of concentric layers of different composition, arranged around a clot of blood or a foreign substance as a nucleus: the exterior layer is often phosphatic, but never uric, in character. The most typical forms have the following composition:

Uric.

Uric acid	92.8
Urates	3.2
Extractive matters	1.0
Water	3.0

Phosphatic.

Sodic urate	9.77
Calcic phosphate	34.74
Ammonio-magnesic phosphate	38.35
Calcic carbonate	3.14
Magnesic carbonate	2.55
Extractive matters, etc	6.87

Oxalic.

Calcic oxalate	63.5
Calcic phosphate	6.2
Water and organic matters	30.3

As a rule, the oxalic calculi are the hardest, the phosphatic being the softest. The following are the best characterized forms of calculi: *Uric acid calculi*, of a brownish-red color and smooth surface. When heated they fuse, and emit a peculiar odor, leaving but a little ash. They give the reactions for URIC ACID, mentioned under that head. *Ammonic urate calculus* is rare in occurrence. It is more easily soluble in water than the preceding, and dissolves in hot potassa solution, with evolution of ammonia. *Calcic oxalate* constitutes the *mulberry calculus*, which has a dark-brown color and is very hard. When heated before the blowpipe, it first blackens, then burns to a white ash consisting of calcic carbonate. It dissolves in hydrochloric and in nitric acids, but not in acetic acid. *Calcic phosphate* forms the *bone-earth calculus* ($O_8P_2Ca_3$), which is of rare occurrence, and often consists of laminæ of crystals radiating from a nucleus. It is of a light-brown color, dissolves in hydrochloric acid, but is infusible before the blowpipe. *Ammonio-magnesic phosphate*, or *triple phosphate calculus* ($O_8P_2Mg_2Am_2$), is white and brittle; fuses with difficulty, emitting an ammoniacal odor, and readily dissolves in acids. *Fusible calculus*, which appears to be a mixture of the two preceding varieties, forms white friable masses which often acquire a large size. It fuses readily, and is easily soluble in acids. *Xanthine calculi* (see XANTHINE) are of a pale-brown color, have a lamellar fracture and a polished surface, which acquires a high lustre when rubbed. They dissolve in potash solution and in nitric acid, but very sparingly in hydrochloric acid. *Cystine calculi* are semi-transparent, and have a dark-yellow color and a crystalline texture. The last two forms are of unfrequent occurrence. *Compound calculi*, consisting of a succession of laminæ composed of several of the foregoing varieties, also occur. J. P. BATTERSHALL.

Urine, Chemical Composition and Analysis of. Urine in health possesses a light-amber color, a slight acid reaction, a peculiar odor, and a bitter saline taste. During the process of digestion it sometimes acquires an alkaline reaction. It has a sp. gr. of 1.024, but this also changes with the diet and state of health of the individual. It becomes more strongly alkaline on standing, owing to the formation of ammonic carbonate. (See UREA.) The urine excreted in the morning has a different composition from that passed in the evening, which has absorbed various substances taken into the stomach during the day. An average sample of healthy human urine has the following composition:

In 1000 parts, water = 956.80 parts.
In 100 parts of solid matter:

Organic matters	Urea	33.00
	Uric acid	0.86
	Alcoholic extract	29.03
	Aqueous "	5.80
	Vesical mucus	0.37
Fixed salts	Sodic chloride	16.73
	Phosphoric pentoxide	4.91
	Sulphuric trioxide	3.94
	Lime	0.49
	Magnesia	0.28
	Potash	4.47
	Soda	0.12
		100.00

Besides the above constituents, the following compounds are occasionally contained in healthy urine, usually in minute quantities: *iron*, *ammonia*, *sugar*, XANTHINE (which see), *creatine*, *creatinine*, and *lactic*, *succinic*, *oxalic*, *formic*, *phenylic*, and *hippuric* acids. Free gases also occur: in 100 cubic centimètres of urine, Planer found 0.87 nitrogen, 0.06 oxygen, 4.54 free and 2.07 combined carbonic acid. Certain pigments, the composition of which is uncertain, are likewise present. According to Thudichum, the normal coloring-matter consists of a yellow amorphous mass, which he terms *urochrome*, but to which Schunck gives the name *urian* and the formula $C_{43}H_{51}NO_{26}$. *Indigo-blue* appears to be a product of the decomposition of this or other pigments, as it occurs in urine which has been exposed to the air for some time. Among the other bodies said to be contained in urine may be mentioned certain *ferments* and *albuminoid matters*, *caseine*, *leucine*, *tyrosine*, *taurine*, *acetone*, and *taurocholic*, *glycocholic*, and *cholic* acids, which latter are present only in the abnormal or diseased excretion. The acidity of urine is due to the presence of hydric-sodic phosphate, and hippuric and lactic acids. Numerous substances appear to pass unchanged through the urine, such as many alkaline salts and numerous compounds of metals, alkaloids and organic acids, while others suffer a partial or complete transformation; thus, malic acid is converted into succinic acid; sulphites and sulphides are changed into sulphates; tannic acid is converted into gallic acid; benzoic, cinnamic, and quinic acids are transformed into hippuric acid; iodine changes to alkaline iodides, potassic ferrocyanide to the ferricyanide; and indigo-blue is reduced to indigo-white. In the disease *diabetes* a large amount of grape-sugar (glucose) is contained in the urine, owing to an incomplete digestion of the food, sometimes in the proportion of over a pound in the liquid voided during twenty-four hours. In *albuminuria* a large quantity of albumen is secreted, the formation of which is due to a lack of secretive power on the part of the kidneys.

ANALYSIS OF URINE.—*Urea* may be determined in a variety of ways. *Liebig's volumetric method* is executed as follows: Dissolve 100 grammes of pure mercury in 500 grammes of nitric acid, evaporate to a syrup, add a little nitric acid, and dilute to 1400 cubic centimètres: this forms the standard mercury solution, 1 cubic centimètre of which is equal to 1 centigramme of urea. Its strength should be actually determined by estimating a known weight of urea in the manner described further on. A baryta solution is next prepared by mixing 2 volumes of baryta-water and 1 volume of a solution of baric nitrate, both saturated in the cold; 15 c. c. of this baryta mixture are then added to 30 c. c. of the urine to be tested; the liquid is well stirred, and then filtered through dry paper: 15 c. c. of the filtrate (= 10 c. c. of the original urine) are now measured off in a beaker-glass, and the standard mercury solution is slowly added from a burette as long as any precipitation occurs, the precise end of the operation being determined by adding a drop of the mixture to a solution of sodic carbonate contained in a watch-glass, when a distinct yellow color should be produced. The number of cubic centimètres of the mercury solution used is read off, each cubic centimètre indicating 1 centigramme of urea in the 10 cubic centimètres of urine. In this method the presence of an excess of urea and of sodic chloride affects the accuracy of the result, and renders a correction of the figures obtained necessary. *Bunsen's method* is based upon the decomposition of urea into carbonic acid and ammonia. A known quantity of the prepared urine is mixed with a solution of baric chloride containing ammonia; the filtered liquid is heated in a sealed tube to 400° F.; and the baric carbonate formed weighed: 1 gramme of the carbonate = .3041 gramme of urea. In *Heintz and Ragsky's method*, 20 c. c. of the urine are precipitated with platinic tetrachloride; the precipitate is washed with alcohol, dried, and weighed. From 2 to 5 c. c. of the same urine are then heated in a platinum capsule with an equal amount of sulphuric acid, and the mixture, when cold, is diluted with water, filtered, and the filtrate likewise treated with the platinic salt. Both precipitates are calculated for 100 c. c. of urine, and the weight of the first is subtracted from that of the second: the difference, multiplied by .13423, gives the percentage of urea. *Davey's method* consists in adding a small quantity of the urine to a graduated glass tube, filled one-third with mercury, completely filling the tube with sodic hypochlorite, and immersing it in an inverted position in a concentrated solution of sodic chloride, in which position it is allowed to remain for several hours, after which the quantity of gas (nitrogen) evolved is read off: 1.549 cubic inches of nitrogen at 60° F. = 1 grain of urea.

Uric acid is best determined by adding to about 200 c. c. of the urine 10 c. c. of hydrochloric acid, and allowing the mixture to stand for two days, when the precipitate formed is collected on a small filter, washed, dried, and weighed. Care should be taken not to use more than about 30 c. c. of water in washing the precipitate, as otherwise a partial solution of the uric acid is to be feared; and all albumen present should at first be removed by coagulation with dilute acetic acid, in which case this acid, in a concen-

trated form, should be employed as the precipitant of the uric acid.

Sugar (*glucose*) is estimated by its reducing action on a boiling cupric solution in presence of an alkali, or it can also be determined by adding a small quantity of yeast to the urine, and measuring the amount of carbonic acid formed by the fermentation of the sugar. (See URINOMETER.) *Albumen* is separated by heating the urine to boiling, and adding a few drops of acetic acid until complete coagulation takes place. The precipitate is dried until its weight remains constant. *Chlorides* may be estimated by a volumetric method (as with silver and potassic dichromate solutions); *phosphates* by the uranic oxide process; *ammonia* by placing 20 c. c. of the urine in a shallow dish, over which is placed a similar vessel containing 10 c. c. of a standard solution of sulphuric acid, both being covered by an air-tight bell-jar; 10 c. c. of milk of lime are then added to the urine, and the bell-jar is placed over it. In two days the ammonia will have been absorbed by the acid, and is estimated by titrating and comparing the residual acidity with that of the standard acid. (See VOLUMETRIC ANALYSIS.) J. P. BATTERSHALL.

Urine, Retention of. See RETENTION OF URINE, by E. J. BERMINGHAM, M. D.

Urinom'eter [Gr. οὖρον, "urine," and μέτρον, "measure"], an instrument used in the determination of the specific gravity of URINE (which see), by means of which the presence of albumen or other foreign matters is often indicated. Quite recently a method for estimating quantitatively the amount of grape-sugar present in urine by the loss of density which is caused by the fermentation of the same has been proposed. It is executed as follows: Determine the specific gravity of the urine; add a little dry yeast; allow the mixture to remain at rest for twenty-four hours, and then take the specific gravity again. A urinometer can be used, each degree of which corresponds to 1 grain of grape-sugar in 1 fluid ounce of urine. J. P. BATTERSHALL.

Uropelt'idæ [from *Uropeltis*—οὐρά, "tail," and πέλτη, "shield"—the chief genus], a family of reptiles of the order Ophidia. The body is cylindrical, the head short and pointed, and not separated by constriction from the body; the eyes are very small; the cleft of the mouth is comparatively narrow; teeth are in both jaws, but none on the palate; there are no rudiments of posterior extremities; the tail is short and blunt, and has a naked terminal shield or keeled scales; the skull has the cranial walls partly constituted by the mastoids; ectopterygoids and prefrontals are developed; the maxillaries are horizontal, and in contact with the prefrontals, and have alveolar ridges. The family is composed of several genera, mostly confined to the East Indies and the Philippine Islands. A monograph was published in 1861 by Dr. Peters (*De Serpentium Familia Uropeltacerum*, Berlin). THEODORE GILL.

Ur'quhart (DAVID), b. at Braeklanwell, co. Cromarty, Scotland, in 1805; educated at St. John's College, Oxford; entered the diplomatic service; travelled extensively in the East; was secretary of legation at Constantinople 1835–36; resigned that post in consequence of his opposition to Lord Palmerston's Eastern policy, which he denounced as subservient to the ambitious views of Russia; made a vigorous warfare upon that policy in the press for several years, and continued it in Parliament, where he sat as a Conservative member for Stafford 1847–52. Author of *Turkey and its Resources* (1833), *England, France, Russia, and Turkey* (1835), *The Spirit of the East, a Journal of Travels through Roumeli* (2 vols., 1838), *Diplomatic Transactions in Central Asia* (1840), *The Mystery of the Danube* (1844), *The Pillars of Hercules, a Narrative of Travels in Spain and Morocco* (2 vols., 1850), *The Progress of Russia in the West, North, and South* (1853), *Letters and Essays on Russian Aggressions* (1853), *Recent Events in the East* (1854), *The War of Ignorance, its Progress and Results* (1854), *The Lebanon, a History and a Diary* (2 vols., 1860), and other works and pamphlets, some of them directed against the U. S. in reference to boundary difficulties and the annexation of Texas.

Urqui'za, de (JUSTO JOSÉ), b. in the province of Entre Rios, viceroyalty of Buenos Ayres, in 1800, of mixed Spanish and Indian blood; rose into prominence as a leader of the Guachos or half-nomadic herdsmen in the frequent revolutions which followed the independence of the Argentine Confederation; attached himself to the "federal" party as represented by the dictator Rosas, by whom he was favored and promoted to be a general of division; became governor of his native province 1842; commanded the Argentine forces in Uruguay 1843–45, and gained over Rivera, at India Muerta, Mar. 28, 1845, an important victory, which he stained by numerous executions of prisoners; found himself in 1851 an object of jealousy and suspicion to ROSAS, against whom, in self defence, he revolted; terminated the nine-years' siege of Montevideo by the capitulation of the besiegers; made a treaty of alliance with Brazil and Uruguay; crossed the Parana Jan., 1852; defeated ROSAS at the decisive battle of Monte Caseros, forcing him to flee to Europe; was recognized at Buenos Ayres as provisional dictator; called a congress at Santa Fé to form a constitution; was forced to retire from Buenos Ayres by the revolution of Sept. 11, which established the independence of that province from the confederation; was chosen president for six years 1854–60; established his capital at Bajada del Paraná; declared the Paraná, Uruguay, and La Plata rivers free to the flags of all nations; carried on alternate warfare and diplomatic negotiations with the semi independent province of Buenos Ayres, which he ultimately added to the confederation by the treaty of Nov. 11, 1859, as the result of a victory gained at Cepeda; was appointed commander-in-chief on the expiration of his presidential term 1860, and shortly after elected governor of Entre Rios; was defeated by Mitre, the governor of Buenos Ayres, at the battle of Pavon, Sept. 17, 1861—an event which led to the reorganization of the "Argentine Republic;" retired from the governorship of Entre Rios 1864, and took little subsequent part in political affairs. He was assassinated at his country-seat of San José, Entre Rios, in May, 1870, by his son-in-law, Gen. Lopez Jordan, who headed a revolution. He possessed immense wealth in lands, cattle, and horses, lived in baronial style at his *estancia*, and had little education, but considerable political sagacity and strong passions. PORTER C. BLISS.

Urra'ca, queen of Castile, b. about 1070, was the only legitimate child of Alfonso VI. by his queen, Constance of Burgundy; married, about 1090, Raymond of Burgundy, count of Galicia, who d. in 1108; married Alfonso I. the Warrior of Aragon 1109; succeeded to the throne the same year; was imprisoned by her husband, and rescued by her lover, the count of Lora, 1110; was repudiated by Alfonso and their marriage declared null by the papal legate 1111; was defeated and retired into Galicia 1111; raised there a new army, with which she seized Burgos, and held an assembly there 1113; drove Alfonso back into Aragon; associated her son, Alfonso Raymond, in the government, but quarrelled and made war upon him 1116; made war also upon her half-sister Theresa, countess of Portugal, and ravaged Portugal 1121. D. at Leon Mar. 8, 1126.

Ur'sa, p.-v. and tp., Adams co., Ill. P. 1111.

Ur'sa Ma'jor [Lat., "Greater Bear"], the first of Ptolemy's northern constellations, including the fine group of seven stars known as "Charles's Wain," "The Dipper," or the "Butcher's Cleaver," near the N. pole, formerly called also *Septentriones* (likewise *Septemptriones*) and the "Plough."

Ur'sa Mi'nor [Lat., "Lesser Bear"], one of Ptolemy's northern constellations, containing the North Star (*Polaris*) and the group anciently known as Cynosura, the "Dog's Tail." Polaris is a double star of the second magnitude.

Urs'idæ [from *Ursus*, the ancient Latin name of the bear, the typical genus], a family of placentiferous mammals of the order Feræ, embracing all the species of bears. These have the body heavy, the hair abundant, the head conic, and with the snout short, but more or less pointed, the feet plantigrade (*i. e.* with the palms and soles applied to the ground in walking or resting), and each with five digits fully developed and armed with sharp non-retractile claws; the teeth in adult 36 to 42 (M. $\frac{2}{3}$, P. M. $\frac{4}{4}$ ($\frac{3}{3}$), C. $\frac{1}{1}$, I. $\frac{3}{3}$ ($\frac{2}{3}$) × 2); last true molar of the upper jaw is oblong and exceeds the first; the last premolar of the upper jaw, as well as the succeeding true molars, is tubercular; the first true molar in the lower jaw is narrow, but longest; the second oblong and broader; the skull is distinguished by its foramina, the foramen lacerum posticum being introrse and behind the postero-internal angle of the tympanic bone, and the carotid canal is little in advance of the foramen lacerum posticum. The family is widely distributed, and has representatives in the extreme arctic regions as well as in the temperate and torrid zones—in America, Europe, and Asia, and in the N. of Africa. About 15 species are known, which have been distributed by recent systematists under six genera—viz. *Thalarctos* (polar bear), *Ursus* (ordinary bears), *Tremarctos* (South American), *Helarctos* (Indian, etc.), *Melursus* (the *Ursus labiatus* of India), and *Æluropoda* (Thibetan): the last two are very distinct; the others closely related. North America has one species of *Thalarctos* (*T. maritimus*), and two or three of *Ursus* (*U. horribilis*, *U. americanus*, and perhaps *U. Richardsonii* or *U. arctos*). (As to habits, etc., and for figures, see the article BEAR.) THEODORE GILL.

Ursula, SAINT. See URSULINES.

Ur'sulines, an order of celibate women in the Roman Catholic Church, named in honor of St. Ursula, who, according to legend, suffered martyrdom in the third, fourth, or fifth century, being massacred, together with her army of virgins, by the Huns near Cologne. The order was founded by St. Angela Merici of Brescia, who in 1537 became its first superior. In 1544, Paul IV. approved the order, and Gregory XIII. and Clement VIII. gave it their sanction. St. Charles Borromeo was another powerful friend of the Ursulines. They have houses in various countries, and are chiefly devoted to the training of females.

Urtica'ceæ [from *Urtica*, one of the genera], a natural order of exogenous trees, herbs, and shrubs. As at present constituted, it contains (1) the Ulmeæ, or elm family; (2) the Artocarpeæ, or bread-fruit family; (3) the Urticeæ, or nettle family; (4) the Cannabineæ, or hemp family. This is a large and important order, including a very great number of useful species, mostly tropical.

Uruguay', or **Banda Oriental del Uruguay,** a republic of South America, between lat. 30° and 35° S., and between lon. 53° and 58° 30′ W., and bounded N. by Brazil, E. by the Atlantic, S. by the Rio de la Plata, and W. by the Uruguay, which separates it from the Argentine Republic. Area, 63,300 sq. m. P. 454,478 in 1872. The native population is a blending of Indian, European, and African blood, the aborigines having entirely disappeared. More than one-half of the inhabitants are foreigners, however—mostly Italians, 60,000; Spaniards, 30,000; French, 30,000; Basques, 30,000; Brazilians, 20,000, etc. The language is Spanish. The prevailing religious denomination is the Roman Catholic, having 47 churches, while Protestantism has only 3. The government is a republic after the model of the U. S. of North America, but the history of the country is an alternation of despotism and anarchy. For administrative purposes the country is divided into the following thirteen departments:

	Area.	Population.	Capital.
Cerro Largo	7,530	33,000	Villa de Melo.
Colonia	1,900	22,508	Colonia.
Durazno	4,850	16,281	Durazno.
Florida	4,100	19,900	Florida.
Guadalupe	1,600	48,000	Canelones.
Maldonado	5,150	18,750	Maldonado.
Minas	4,985	27,163	Minas.
Montevideo	225	127,704	Montevideo.
Paysandú	7,360	33,052	Paysandú.
Salto	8,125	32,602	Salto.
San José	3,890	20,115	San José.
Soriano	3,125	21,403	Soriano.
Tamarembo	10,460	34,000	San Fructuoso.

The capital is Montevideo, with 110,000 inhabitants; other principal towns are Salto, with 10,000, Villa de Melo and San José, each with 5000 inhabitants. The Atlantic coast, about 200 miles long, is low, sandy, and without safe harbors; the shore of the Rio de la Plata, about 155 miles long, is higher, rocky, and affords several good harbors; the shore of the Uruguay, about 270 miles long in a straight line, presents alternately low plains and more elevated table-lands. The interior is not well known. Several ridges traverse the country, such as the Cuchilla Grande, Carapy, Castellos, and Yerbal. They are low, and covered with forests of walnut, cedar, laurel, and myrtle trees, and contain much valuable timber, hard woods, dyewoods (such as the scarlet willow and the quebracho), and numerous medicinal plants—the poppy, sarsaparilla, balsam, liquorice, etc. Numerous streams descend from these ridges in all directions. The largest is the Rio Negro, which rises in the Sierra Santa Anna, traverses the country from N. E. to S. W., and joins the Uruguay after a course of about 350 miles. The Dayman, Queguay, San José, Santa Lucia, etc., have a length of 100–150 miles, but are not navigable for more than 15–25 miles. The general character, however, of the country is that of wide, open, grassy plains, sometimes of an elevation of 2000 feet, but generally lower. The climate is mild and healthy, though very changeable. The general range of the thermometer is from 32° to 88° F. In July and August severe frosts occur on the table-lands; in February the heat in the lowlands often reaches 100° F. Rain falls in sufficient quantity in all seasons; snow is rare. But a change in the temperature of from 20° to 40° within a few hours is of frequent occurrence. The soil is very rich, and could produce large crops of grain, vegetables, fruits, sugar, and cotton if properly cultivated; but agriculture is still in a very backward state, though progressing; the principal occupation is cattle-breeding. In 1874 the country possessed 7,254,000 cattle, 1,463,000 horses and 18,476,000 sheep of a superior breed. The principal articles of exportation are hides, wool, tallow, skins, salted and jerked beef, etc., and in 1874 the value of the exports amounted to $15,240,000, according to official records, but was in reality much larger, as many tricks are resorted to in order to avoid the heavy export duty. Gold, silver, copper, iron, marble, etc., are found, but very few mines are in operation. Of manufactures there are almost none; some coarse articles are produced, but only for home use. The principal articles of import are textile fabrics, furniture, utensils, tools, colonial wares, and coal. The value of the imports amounted in 1874 to $16,320,000. The commerce of the country is principally carried on with Great Britain, France, Brazil, and the U. S. In 1874, 1888 vessels of 986,827 tons burden entered the harbors, and 1821 of 954,712 tons burden cleared thence. 176 miles of railway lines are in operation, and 1300 miles of telegraph lines, connecting Montevideo with Buenos Ayres, Valparaiso, and Rio Janeiro. On Jan. 1, 1875, the public debt amounted to $42,357,695; the receipts for 1874 to $6,375,000; the expenses to $8,500,000.

The first European settlement was made in this territory in 1622 by the Spanish Jesuits, but soon after both Spanish and Portuguese colonies were established, and as the Portuguese wished to make the Rio de la Plata the boundary of their Brazilian dominion, the country was for a long time the subject of violent contention between the two nations. The Portuguese founded Montevideo and Colonia, but in 1724 the Spaniards were victorious; the country became Spanish, and was made a province of the vice-royalty of Buenos Ayres, under the name of Banda Oriental del Uruguay—that is, "the eastern side of the Uruguay." When in 1811 the war of independence broke out in the Spanish colonies, the Portuguese renewed their attacks on the Banda Oriental, and succeeded in 1816, and again in 1821, after the death of José Artigas, in annexing it to Brazil. But in 1825 a revolution broke out in Montevideo, and an independent republic of Uruguay was established, which in 1828 was recognized by Brazil, and in 1830 adopted its present constitution. It has suffered very much, however, during this period of freedom. The unsettled state of the national character, in which old Spanish and old Roman Catholic ideas are mixed together with the wildest vagaries of modern times, has made it possible for a long series of political adventurers to victimize the people.

Uruguay, river of South America, rises in lat. 28° S., lon. 50° W., in the Brazilian province of Santa Catharina, on the western slope of the Sierra do Mar; flows first W., then S., forming the boundary between the Argentine provinces of Corrientes and Entre-Rios on the one side, and Brazil and the republic of Uruguay on the other, and joins the Parana, after a course of 1020 miles, in lat. 34° S., lon. 61° 40′ W. In its lower course, up to the cataract of Salto Grande, 250 miles from its mouth, it is navigable for steamboats and minor vessels. Salto Grande, however, is frequently passed during high floods by steamers, and for vessels drawing not more than five feet the river is navigable up to the cataract of Salto Mberuy, in lat. 27° 20′ S., about 550 miles from the mouth. But as northern winds prevail in the basin, it generally takes a sailing vessel from fifty to sixty days to ascend the river as far as San Borja, about 500 miles from the mouth, and the traffic is not yet so great that it would pay to employ steam-tugs. The river is more remarkable for the volume of water it carries than for its length. It receives a great number of affluents, especially from the republic of Uruguay (which see). It is 600 yards wide at its junction with the Ibicuy, 1500 after its junction with the Quaraim, which in lat. 30° 14′ S. forms the boundary between Brazil and the republic of Uruguay, and about 100 miles from its mouth it expands almost into a lake. It rises in September and October, on an average, 20 feet, but often its risings take place very rapidly—5 and 8 feet in one night.

Urume'yah, town of Persia, province of Azerbaijan, is on an elevated plain 12 miles W. of Lake Urumeyah. It is well built, and is in a densely-peopled and well-cultivated district, which by European travellers has often been compared with Lombardy. The Protestant mission has here a very prosperous station, with a printing-press, which in 1872 issued 3230 volumes in the old and new Syriac languages, and 7 native preachers and teachers. P. estimated at from 25,000 to 50,000.

Urumeyah (or **Urmeah**), **Lake,** in the province of Azerbaijan, Persia, 64 miles S. W. of Tabreez, covers an area of nearly 1900 sq. m. It receives several large rivers, but has no outlet. Its waters are so impregnated with saline substances that neither fish nor mollusca can live in it.

Urumt'si, city of Central Asia, with a population estimated at 150,000, is at the northern foot of the Thian Shan Mountains. It is the capital of the Chinese Mongolian province of the same name, and since 1862 has formed the centre of the Dungan rebellion. In the commerce of Central Asia, Urumtsi formerly occupied the same position as Nizhnee-Novgorod in that of Eastern Russia. Goods from

Russia, Turkestan, Persia, and Cashmere flowed to this place, 140 merchants' offices and 65 Chinese banks were established here, and by its well-stocked magazines Urumtsi held a perpetual fair. But the uncertainty consequent on the Dungan rebellion put an end to this traffic. Dungan, a corruption of *Tungut*, is the name of the 4,000,000 Mussulmans of Turkish-Tartarian descent who inhabit the northern provinces of China, and who on account of the enormous taxes rose in revolt in Shen-Seo in 1862, and pushed, devastating and destroying, into Southern Mongolia, where they took Urumtsi. In 1864 they also occupied the valley of the Ili, with the capital of Kulja, which, however, the Russians have held since 1871. But they never succeeded in forming an organization or agreeing concerning the leadership, and in 1871–73 the loose bands in Eastern Mongolia were massacred by the Chinese. South-western Mongolia, however, is still in their hands, and on account of the secluded location of the country it will be difficult to overthrow them. According to Russian reports, the chief of East Turkestan has attacked and subdued Urumtsi. EMIL SCHLAGINTWEIT.

U'rus [Lat.], a great and fierce animal of the ox kind mentioned by Cæsar as inhabiting the forests of Germany. It is generally conceded that the animal concerning which these exaggerated accounts reached Cæsar was the wild ox, such as still exists in a few European parks, or possibly the Aurochs (which see).

Us'age, in law, denotes the collective habits, practices, manners, and methods of business-men in the transactions and operations either of all trades and occupations or of some particular trade or calling. The words "usage" and "custom" are often employed interchangeably by legal writers, but the latter term is more restricted in its meaning, and may apply to the habits and modes adopted by some particular individual or in some particular place. A usage to be available must be shown by competent evidence to be common, certain, definite, and not *contrary* to law; it may, of course, consist in acts which the law does not *require*, but not in those which the law forbids. Usage is only resorted to as an aid in the interpretation of contracts. If an agreement is expressed in ambiguous terms, or contains technical words, or is inferred from the acts of parties, its meaning may be explained by the usage of the business with which it is connected, for it is presumed that the parties knew of that usage and contracted with reference to it. If, however, the language of an agreement is clear and the intention plain, no such explanation is possible.

JOHN NORTON POMEROY.

Usbeks, or **Oozbeks,** a people of mixed Turkish blood inhabiting nearly all parts of Turkestan, where they are the dominant race. Intellectually and morally, they are the superiors of those about them. They are zealous Mohammedans, mostly non-nomadic, and pride themselves on their culture and civilization, which are, however, but scanty. In 1862 the Chinese Usbeks revolted from that empire, and under Yakoob Ushbegi (Ooshbegi, Kushbegi, or Yushbegi) founded a new Mohammedan empire, with 1,000,000 inhabitants and 740,000 sq. m. of territory.

Use [Lat. *usus*], in law, is an equitable estate in lands of a special nature, which can better be described than defined in an abstract manner. At an early day the English ecclesiastics, in order to avoid the statutes of mortmain, contrived a new mode of transfer, which was undoubtedly borrowed by them from the *fidei commissa* of the Roman law. The land was conveyed to some person in the ordinary manner, but in the deed of feoffment or in some accompanying writing there was inserted a declaration that he was to hold the land to the use of or for the benefit of a named religious corporation. This practice began during the reign of Richard II., and, proving successful, it in time became very common even in transactions between private persons. The common-law courts treated the feoffee to whom the conveyance was directly made, and who held the legal title, as the only one possessing any interest. But the equity courts enforced the trust placed in this feoffee, and regarded the beneficiary or *cestui que use* as the real owner, entitled to the possession, profits, and complete control of the land. This estate of the beneficiary was the "use." Being utterly unknown to the common law, and being the creature of the equity tribunals, it was freed by them from all the incidents and restraints of the feudal tenures; it could be devised by will, transferred without any public delivery of possession, and was not subject to any pecuniary exactions from the superior lords. Equity looked upon the legal holder as having no interest but the bare title, and would compel him to convey it as directed by the beneficial owner. In the 27th year of Henry VIII. Parliament attempted to destroy uses by a statute called the "statute of uses." This celebrated enactment provided, in substance, that whenever lands should be conveyed in fee to A for the use or benefit of B, the complete title, legal and equitable, should at once vest in B free from any use, and that no interest should remain in A. The whole statute, however, was drawn so loosely, and contained so many provisos and exceptions, that the courts of equity soon evaded it, and revived the system of uses under the name of "trusts," which has existed to the present day. Another result of this legislation was the invention of certain forms of deed, which came to be the ordinary means of conveying land in England, and so continued until Parliament by a recent statute (1845) substituted the simpler conveyance by "grant" in their stead. (See BARGAIN AND SALE. For further particulars consult the articles on ESTATE and TRUST.) Uses have been expressly abolished in many States, and it is probable that they have never existed as independent estates distinguished from trusts in any American commonwealth. JOHN NORTON POMEROY.

Use and Occupation. Whenever the land or building, or portion thereof, belonging to one person is occupied by another, either under an express agreement or under such circumstances that the law will infer an agreement, but without any stipulation as to the amount of rent, the owner may recover from the tenant such compensation in the nature of rent as the occupation is reasonably worth. The action under these circumstances is said to be for the "use and occupation." The right to recover is based upon the notion that the possession was taken and held in pursuance of a contract, express or implied, and is necessarily brought upon the tenant's implied promise to pay, so that the relation must resemble that of lessor and lessee. If, therefore, the entry is tortious, and the land is held adversely and not in subordination to the owner's right, no action for use and occupation can be maintained, since no promise can be inferred; the remedy of the owner is damages resulting from the unlawful trespass.

JOHN NORTON POMEROY.

U'sedom, a low, irregular, and little productive island belonging to Prussia, is situated at the mouth of the Oder, between the Baltic and the Stettiner Haff, and comprises an area of 148 sq. m. On its north-eastern shore is the port of Swinemünde.

Uses. See USE.

Uses, Charitable. See CHARITABLE USES.

Ush'ant [Fr. *Ouessant*], the largest of a group of islands of the same name, lies off the coast of Brittany, France, and belongs to the department of Finisterre. It is fertile, and has 2271 inhabitants, engaged in the rearing of cattle and in fisheries.

Ushas. See HINDU RELIGIONS, by PROF. JOHN DOWSON.

Ush'er, or **Ussher** (JAMES), D. D., b. at Dublin, Ireland, Jan. 4, 1580; educated at Trinity College, Dublin, where he became a fellow; took orders in the Church of England 1601; became chancellor of the cathedral of St. Patrick 1607; was professor of divinity at the University of Dublin 1607–20; drew up the Articles of Faith of the Irish Church 1615; became bishop of Meath 1620, archbishop of Armagh and primate of Ireland 1623; had his house destroyed by the Irish rebels 1641, while visiting England, in which country he thenceforth remained; was appointed by Charles I. bishop of Carlisle, and was preacher of Lincoln's Inn 1647–54, residing chiefly at Oxford. D. at Ryegate, Surrey, Mar. 21, 1656, and by order of Cromwell was buried with great magnificence in Westminster Abbey. Author of numerous theological treatises, mostly in Latin, of which a complete edition was published by the University of Dublin (17 vols., 1841–64), with a *Life* by Rev. C. R. Elrington. His *Annales Veteris et Novi Testamenti* (2 vols., 1650–54) contain a scheme of biblical chronology, since printed in the margin of the authorized version of the Bible, and generally adopted by English and continental historians, though now admitted to be inexact. Another *Life*, with that of John Selden, was written by Dr. John Aikin (1811). His library now belongs to Trinity College, Dublin. He was a learned antiquarian, and the Epistles of Polycarp and Ignatius were first published by him. He was twice elected by the Long Parliament to the Westminster Assembly of Divines, but did not attend, from loyalty to the king. He prepared the Irish Articles of Religion (1615), and proposed a system of reduced episcopacy as a compromise between Episcopalians and Presbyterians.

Usher of the Black Rod. (1) The gentleman usher of the black rod, one of the dignitaries of the British court, is also usher to the order of the Garter and to the House of Lords, in which he has executive duties. (2) Yeoman usher of the black rod is deputy of the foregoing. (3) The usher of the order of Knights of St. Patrick is called the usher of the black rod. The usher of the green rod serves the order of the Thistle, and the usher of the red rod the order of the Bath. The governments of Newfoundland, Queensland, New South Wales, Tasmania, etc.,

have ushers of the black rod, after the example of the home government.

Us'kup, or **Scopia,** town of European Turkey, eyalet of the same name, on the Vardar, has many fine mosques and important manufactures of leather. P. 12,000.

Us'tick, tp., Whitesides co., Ill. P. 1026.

Ustilagin'eæ, an order of Fungi to which belong the smuts. The species of this order grow upon living phanerogams, and attack most frequently some part of the floral organs, although some species are limited to leaves and young stems. In all the species the spores are very numerous and of a black or dark-purplish color, seen with the naked eye. After producing more or less distortion of the mother-plant they rupture the epidermis, and appear in the form of powdery spots or masses, which cover with a blackish dust all bodies which come in contact with them, from which fact they derive the name of smuts. The mycelium or mass of threads from which the spores are produced is in all the species of the order comparatively minute, and easily escapes notice, being often concealed by the preponderating mass of spores. The mycelium is not provided with any proper suckers, such as are found in some orders of Fungi, and is almost entirely limited to the part of the mother-plant where the smutty spots are to make their appearance. The spores are produced directly from the mycelium, without the intervention of any sexual organs, none of which have been found, with any certainty, in the Ustilagineæ. Very little is known of the development of the members of this order, which, although comparatively few in number, includes a large proportion of injurious species. The spores when ripe are either free from one another or else united in clusters of two, three, or more together. The spores of some of the species, as *Tilletia caries* and *Ustilago fœtens*, have a disagreeable odor. The germination has been studied in several species. In some, after a period of repose, the contents of the spore simply grow out in the form of a tube. In *Tilletia caries* the germinal tube, which is short, is crowned at the tip with a whorl of cells, which unite with one another in pairs by a cross-partition, thus forming a sort of conjugation. After this lateral union has taken place, certain of the cells begin to elongate into a mycelium. A similar process was observed by De Bary in *Protomyces microsporus*. In the genus *Ustilago* the spores are produced in masses, but are all free from one another. To this genus belong *U. maydis*, which is the common smut of Indian corn; *U. fœtens*, which grows on wheat in this country; and *U. carbo*, found on oats and also on wheat. The species just named produce, at first, more or less swelling and distortion of the grains, which afterward become completely atrophied, their place being filled with masses of spores. *Ustilago longissima* attacks the leaves of *Phragmites*, and has more the habit of a *Puccinia* than an *Ustilago*, as it forms long black lines on the leaves and stem. In the genus *Tilletia* the surface of the spores is reticulated, and they have generally a very short stalk. *Tilletia caries* is the common wheat-bunt of Europe. It is also found in this country, and to the naked eye cannot be distinguished from *Ustilago fœtens*. In *Urocystis* (*Polycystis* of some writers) the spores are aggregated together in small numbers and surrounded by a number of small cells. The latter are said by De Bary not to constitute a part of the spores proper, but to be portions of the mycelium which were wound closely around them. *Urocystis occulta* is the smut of rye. It attacks principally the stem just below the fruit, causing the ears of grain to droop in a peculiar manner. *Urocystis cepulæ* is the onion-smut, which has caused great harm, particularly in Connecticut. It is closely related to *Urocystis colchici* of Europe, which attacks the meadow-saffron. The other genera of Ustilagineæ present little of interest to any but the special mycologist. (See also UREDINEÆ.) W. G. FARLOW.

Usting' Veli'ki, town of European Russia, government of Vologda, at the confluence of the Yug and Sukhona, has three cathedrals and many benevolent and educational institutions, and manufactures tallow, candles, soap, leather, tiles, jewelry, silver goods, copperware, and vinegar. Its transit-trade with Asia is very considerable. P. 13,000.

U'sury and Usury Laws [Fr. *usure*; Lat. *usura*, from the root *uti*, to "use"]. The term "usury" was originally equivalent to "interest," the compensation paid for the use of money. Present usage restricts the term to *illegal interest*, the payment or the stipulation to pay for the use of money a rate higher than that established by law. In former times, when money was borrowed chiefly to be spent on immediate consumption, to take interest seemed to imply the taking advantage of men's necessities, and the business of money-lending came into bad repute. The ban of society was upon those who engaged in it, and they were driven to demand exorbitant rates as an offset to the odium under which they lived. This in time prompted the enactment of laws to restrict and regulate interest. (See INTEREST, HISTORY OF, and INTEREST, LAW CONCERNING.) With the development of industry and trade, the co-operation of capital and labor has become a necessity, and when money is borrowed to be employed in production it is apparent that generally the borrower is, after paying interest, more benefited than the lender. The law of entire freedom to both parties in such transactions is a first principle of sound political economy. Yet the old ideas of extortion as connected with interest still linger, and perpetuate in most states usury laws—that is, laws which define a certain rate as the highest rate of interest permissible. Experience has clearly shown that such laws are not only ineffective but mischievous. There are natural causes whose normal action determines what can profitably be paid for the use of capital, the fruit of past labor, just as the wages of present labor and the price of wheat or any other commodity are determined. What money in use is worth is always indicated by a market-rate of interest adjusted to various contracts according to the form, the period, the risk, etc., involved. If the law fixes the highest rate allowed considerably above the ordinary market-rate, it will have no effect. If the legal rate is fixed precisely at the lowest market-rate at a particular time, it interferes with the adjustment of contracts to suit the fluctuations of supply and demand and the circumstances and convenience of the parties concerned. If the legal rate be fixed below the market-rate, it is equivalent to a prohibition of interest, and leads on the one hand to a withdrawal of considerable capital from use, to the detriment of general industry, and on the other to manifold evasions of the law, and to diminished respect for the obligations of law generally. Usury laws can never be thoroughly enforced. They work injury to honest and prudent people, both borrowers and lenders, for the benefit of sharpers and reckless adventurers. They offer a premium for the defiance of law, and confer a monopoly on unscrupulous extortioners. The reasons given for their enactment apply with equal force to all other things, and would require the law to fix arbitrarily the prices of commodities; which would be as absurd and futile as to attempt by legislation to regulate the tides of the ocean. Legal sanction and security for all reasonable contracts in loaning capital encourage free competition, and constitute the surest safeguards against excessive interest. The abrogation of usury laws in Great Britain and in Massachusetts may be welcomed as first steps in a reform destined soon to be universal. A. L. CHAPIN.

U'tah, a Territory of the U. S., lying mostly in the great Wahsatch basin between the Rocky Mountains and the Sierra Nevada, extending from the 37th to the 42d parallel of N. lat., and from the 109th to the 114th meridian of W. lon. from Greenwich. It is bounded on the N. by Idaho and Wyoming Territories, on the N. E. by Wyoming, on the E. by Colorado, on the S. by Arizona Territory, and on the W. by Nevada. Its greatest length from N. to S. is about 350 miles, and its greatest breadth nearly 300. Its area in 1870 was about 84,476 sq. m., or 54,065,075 acres; but in 1871 the county of Rio Virgin in the S. W., around the head-waters of the Rio Virgin River, was set off to Nevada by act of Congress, and the area is thereby diminished to about 84,000 sq. m.

Face of the Country and Geology.—The Wahsatch range of mountains, which form the eastern wall of the Great Basin, traverse the Territory from N. to S., trending southwestward as they approach the Arizona line. They form a continuous and nearly unbroken chain from the Uintah Mountains at the N. E. to the Iron Mountain in the S. S. W. W. of this range the rivers have no outlet, and fall into the Great Salt Lake or some of the other fresh or salt lakes of the basin. E. of the Wahsatch Mountains there is a plateau 30 or 40 miles in width, sloping down to the elevated valley or plain in which the San Rafael, Uintah, Dirty Devil, White, Green, Grand, and San Juan rivers have their sources. All these rivers cut their way through the easily-eroded rocks, and form cañons varying in depth from 2000 to 5000 feet, and, after reaching a lower plain, spread out in broad streams, which in turn unite to form the Rio Colorado of the West, and again force their way through the mountains in the Great Cañon of that river. Though elevated from 6000 to 7000 feet above the sea, a part of this eastern section is fertile and largely productive. Western Utah is also elevated, the summits of the Wahsatch rising from a plain varying from 4250 to 6000 feet in height, and attaining a further elevation of from 6000 to 7000 feet above the valley. Mount Nebo, the Twin Peaks, and some others are from 12,000 to 13,000 feet in height. In the N. W. and W. much of the elevated plateau is a barren alkaline desert,

yielding little except the sagebush or greasewood; yet even these desert lands, under the influence of irrigation, where it can be applied, may be made to yield large crops. W. of the Great Salt Lake and the other lakes of the central valley there are several chains of mountains running nearly parallel with the Wahsatch, but of lower elevation, and walling in the central valley from the desert lands farther W. These mountains, beginning at the N., bear the names of Raft River, Promontory, Oquirrh, Onaqui, Cedar, Thomas, Champlin, Goshoot, House, Beaver River, Wah-Wah, Piñon, and Needle mountains. The chains E. of the Wahsatch range are mostly portions of the Colorado Mountain system; the most prominent of them are the Uintah, the Roan or Book Mountains, the Little Mountains, the Sierra la Salle, Sierra Tucan, Sierra Panoche, and in the extreme S. E. the Sierra Abajo and the Orejos del Oso. The Wahsatch and Uintah mountains, their foothills on the western slope, and the parallel ranges W. of them are Eozoic, though a portion of their summits are crowned with Silurian and Metamorphic rocks; the elevated valleys and plains of the Great Basin are Tertiary, deposited when the Great Basin, now covering Western Utah and nearly the whole of Nevada, was a vast lake with mountainous islands. Eastern Utah is, except the immediate valley or cañon of the Rio Colorado and its larger tributaries, Cretaceous; the Colorado cuts through the Cretaceous, Jurassic, and Triassic, Carboniferous, and slightly-developed Devonian systems, down to the rocks of Silurian age, which form its bed.

Rivers, Lakes, etc.—Eastern Utah is drained solely by the Colorado and its affluents already enumerated. The valley, or rather the succession of valleys, lying between the Wahsatch range and the lower chain wholly within the Great Basin, abounds in lakes. The Great Salt Lake is 100 miles in length and about 50 miles in width. Its area is about 1900 sq. m. Its waters contain nearly 22 per cent. of pure salt, and no fish can exist in them. It receives the Bear and Jordan rivers and some smaller streams. Forty-five miles S. of this lake, and connected with it by the Jordan River, is Utah Lake, 22 miles long and 10 wide: it has an area of about 130 sq. m. Its waters are fresh and pure. It receives the Timpanagos, Provo, and Spanish Fork rivers. Other large lakes farther S. are Sevier, Little Salt, Preuss, and Fish lakes, none of which have any apparent outlet, though they receive considerable streams. Sevier River, which rises in Fish Lake 6674 feet above the sea, and passes through a slight depression of the Wahsatch Mountains, discharges its waters into Sevier Lake, forming an almost complete ellipse. The Preuss River, emptying into Preuss Lake, and the Rio Virgen, a tributary of the Colorado, drain the S. W. part of the Territory.

Mineralogy.—Gold, silver, and lead ores exist in large quantities in Utah, but hitherto the policy of the Mormon leaders has been to avoid opening mines of the precious metals. The products of gold and silver have, however, been steadily increasing for the past few years; ninety mining districts had been opened in 1876, and in 1874 the production of bullion amounted to about $5,000,000. The Territory is richer in iron ores of all qualities than any other portion of the U. S. There are ten separate deposits or mountains of hæmatite and magnetite in a distance of 10 miles in Iron co., estimated to contain about 130 million tons of iron ore, averaging from 65 to 70 per cent. of pure iron. In the Castle Valley region, on Green River, is another deposit, said to be equally extensive. Other deposits of vast extent have been found in Cache, Box Elder, Weber, and Davis counties, in the N. part of the Territory. These ores are all very rich, and both lignite and excellent bituminous coking coals are found in the immediate vicinity, as well as fluxes and the other requisites for smelting the ores. The lignites of the Great Basin are very valuable coals for fuel, but do not coke. In San Pete co. and along the cañons of Green and Grand rivers is a bituminous coal belonging to the Upper Coal-Measures, which is of great value for the furnace, and is in thick workable seams. Copper and zinc are metals which abound in the Territory. Rock-salt in vast quantities, as well as the salt procured by evaporation from Salt Lake, sulphur in extensive beds, carbonate of soda, alum, borax, etc., are among the other mineral treasures of Utah.

Climate.—The yearly mean temperature ranges from 48.65° to 51.51° in the N. and S. of the Territory. The spring means at Coalville were 45.9°; at Salt Lake City, 51.7°; summer, 69.2° and 75.9°; autumn, 48.9° and 54.8°; winter, 21.9° and 32.1°. The rainfall is about 15.10 inches annually.

Zoology.—The wild animals are those common to Nevada and to the Rocky Mountain region. They include the grizzly bear, panther, California lion, the black bear, wolf, lynx, fox, raccoon, California skunk, etc., and among the game animals the buffalo, possibly the moose, antelope, black-tailed deer, hares, especially the sage hare, and the singular animal known as Baird's rabbit; squirrels, marmots, etc. 176 species of birds belonging to the Territory have been described.

Vegetation and Agricultural Productions.—The mountains in the S. are wooded to near the snow line, but the Territory contains, it is said, only about 4000 sq. m. of timber. The forest growths of the mountains in the Great Basin are those of the Pacific slope, though not generally attaining the height of the Nevada and California trees, and having a smaller proportion of hard wood growths. The alkaline plains are treeless and destitute of shrubs, except the sage-bush. Eastern Utah belongs to the Rocky Mountain region, and its sylva and flora are similar to those of Colorado. In 1874 over 250,000 acres of land were under cultivation, much of it irrigated, the Mormon system of irrigation being admirably effective. The crops of that year were stated by Surveyor-General Kiteball to have been, in round numbers, 2,000,000 bushels of wheat, 350,000 bushels of barley, 700,000 bushels of oats, 375,000 bushels of Indian corn, 2,000,000 bushels of potatoes, 300,000 tons of hay, and an immense crop of apples, apricots, peaches, pears, figs, and grapes, being more than sufficient for the supply of the Territory. The agricultural products of the year were valued at over $6,000,000. We have no later statistics of the live-stock of the Territory than those of the census of 1870. It has materially increased since that time, as much attention has been given to stock-raising. In 1870 the value of live-stock was stated to be $2,149,814; it included 14,281 horses, 2879 mules and asses, 190,934 neat cattle, 59,672 sheep, and 3150 swine. Some attention has been paid to silk-culture.

Manufactures.—In 1870 there were 533 manufacturing establishments in the Territory, employing 1534 hands and a capital of $1,391,898, paying $395,365 in wages, using $1,238,252 of raw material, and producing goods valued at $2,343,019. Flour and meal, sawed lumber, and woollen goods were the principal articles manufactured. In 1874 the capital employed was over $4,000,000, and many furnaces, foundries, and ironware foundries were added to the manufacturing industry of the Territory.

Mines.—In 1870, Utah had 6 mining establishments, reporting $14,800 capital and $14,950 product. Her mines have now more than $4,000,000 capital and over $7,000,000 product.

Railroads.—In 1875, Utah had 596.5 miles of railroad in operation, costing for roads and equipment $41,308,222. Of this 44 miles was narrow-gauge and built by the inhabitants of the Territory. There are about 350 irrigating canals in the Territory, several of them of considerable length and size; they have been constructed at a cost of about $2,225,000.

Finances, Commerce, Banks, etc.—The Territorial government is supported by taxation. The taxes (not national) in 1870 amounted to $167,355, of which $39,402 was for Territorial, $80,419 for county, and $47,534 for city and town purposes. There is no Territorial debt. The commerce of the Territory in the exportation of its bullion, ores, wool, hides, lumber, coal, etc., and the importation of general merchandise, is large in proportion to its population, amounting to not less than $45,000,000. There are 3 national banks, having a capital of $450,000 and an outstanding circulation of about $400,000; and 6 private banks and banking-houses. There are no fire or life insurance companies in the Territory.

Population.—Surveyor General Kimball in 1874 estimated the population, exclusive of tribal Indians, from the assessors' returns, at 130,000.* The following table gives the census statistics of 1850, 1860, and 1870:

Census year.	Total population.	Males.	Females.	Whites.	Indians and negroes.	Natives.	Foreigners.	Density.	Ratio of increase.	Number of families.	Persons to a family.	Number of dwellings.	Persons to a dwelling.	Illiterate.	Of school age, 5 to 20.	Of military age, 18 to 45, males.	Of voting age, 21 and upward, males.	Citizens, males.
1850	11,380†	6,016	5,334	11,330	50	9,326	2,054	0.05	.....	2,322	4.90	2,322	4.90	154	4,076	2,569	2,765	[illegible]
1860	40,273‡	20,255	20,018	40,125	149	27,519	12,754	0.18	255.0	9,500	4.96	10,763	3.75	323	13,788	6,744	8,[illegible]	[illegible]
1870	99,581	44,121§	42,065§	86,014	13,538§	56,084	30,702	1.03	147.25	17,210	5.04	18,290	4.75	7,363	33,367	14,603	18,042	[illegible]

* Of this 130,000, less than 15,000 are non-Mormons.

† Of these, 12,795 were Indians sustaining tribal relations.

‡ In 1850 and 1860 tribal Indians were not enumerated.

§ Sex of tribal Indians not reported.

Education.—The following are the statistics of the public schools of Utah for the year ending Jan. 1, 1875, the latest date we have been able to obtain: Receipts, $109,836.70, of which $33,883 was from Territorial and local taxation, and $75,953.70 from rate-bills; amount paid for teachers' salaries, $90,953.70; amount of available school fund, $15,000; number of youth in Territory of school age (4 to 16 years), 33,164 (16,635 males, 16,529 females); number enrolled, 17,742; average daily attendance, 12,916; number of school-houses and school-rooms, 260; average duration of schools, 134 days, or about 6 months and 6 days; number of teachers employed, 398 (males 209, females 189); average monthly wages of male teachers, $40, of female teachers, $16. There were 12 private schools, having 1264 scholars and 37 teachers. There are no public-school lands yet granted, and thus far no free schools. There is no normal school, though an effort is making to establish one. Several of the private schools have high school departments. The University of Deseret, at Salt Lake City, chartered in 1850, but not organized till 1869, has not yet gone beyond a preparatory department. It has in this department 8 instructors, 179 students (110 males and 69 females), and its total receipts were $5380, of which $2880 was from tuition fees. It had 2300 volumes in its library. It is wholly under Mormon control. The Protestant Episcopal Church has 4 good schools in the Territory; the Methodists and the Presbyterians, each 1. There are no scientific or professional schools. There are no charitable institutions for the deaf and dumb, blind, or insane in the Territory. The Territorial penitentiary is at Salt Lake City.

Newspapers.—In 1870 there were 10 newspapers in Utah, having a circulation of 14,250 and an annual issue of 1,578,400. Of these, 3 were dailies, with 2700 circulation; 3 semi-weekly, 2900 circulation; 3 weekly, 8400 circulation; and 1 monthly, 250 circulation. In 1875 the number of newspapers had increased to 20, of which 5 were dailies.

Churches.

Denominations.	Church organizations, 1870.	Church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Church organizations, 1875.	Church edifices, 1875.	Ministers or clergymen, 1875.	Church members or communicants, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations	165	164	86,110	$674,600	195	195	203	70,363	86,600	$1,070,900
Baptists	.....	.....	.....	.....	1	1	1	16	100	2,000
Protestant Episcopalians	2	2	460	39,800	3	3	6	150	500	42,500
Methodists	2	1	300	1,200	3	3	3	130	600	16,000
Mormons	160	161	85,350	642,000	185	185	190	70,000	85,000	1,000,000
Presbyterians	1	.....	.....	600	3	3	3	67	400	10,400

Constitution, Courts, etc.—The governor and secretary of the Territory are appointed for four years by the President of the U. S., but are removable at pleasure. The legislative assembly is composed of a council of 13 members, elected for two years, and a house of representatives of 26 members, elected for one year. The judicial power is vested in a supreme court, consisting of one chief-justice and two associate justices (appointed by the President), which holds a term in each of the three judicial districts each year; in district courts, probate courts, and justices of the peace. The Territory sends a delegate to Congress, who has the right to speak, but not to vote.

Counties.—There are twenty counties, as follows:

Counties.*	Total pop., 1870.	Males, 1870.	Females, 1870.	Total pop., 1860.	Assessed valuation, 1870.‡	True valuation, 1870.
					$	$
Beaver	2,007	1,010	997	785	95,000	118,750
Box Elder	4,855	2,842	2,013	1,608	500,000	600,000
Cache	8,229	4,068	4,161	2,605	728,195	873,000
Davis	4,459	2,232	2,227	2,904	648,655	618,655
Iron	2,277	1,123	1,154	1,010	275,000	343,750
Juab	2,034	1,027	1,007	672	272,641	340,801
Kane	1,513	776	737	.....	248,000	269,105
Millard	2,753	1,429	1,324	715	250,000	502,855
Morgan	1,972	995	977	.....	320,000	320,000
Piute	82	69	13	No	report.	
Rich	1,955	1,020	935	.....	307,950	307,950
Salt Lake	18,337	9,019	9,318	11,295	4,210,990	5,614,654
San Pete	6,786	3,274	3,512	3,815	386,385	1,134,987
Sevier	19	19	No	report.		
Summit	2,512	1,349	1,163	198	263,592	263,592
Tooele	2,177	1,159	1,018	1,008	371,736	464,670
Utah	12,203	6,174	6,029	8,218	1,252,006	1,649,131
Wahsatch	1,244	642	602	.....	145,027	145,027
Washington	3,084	1,532	1,552	691	500,000	772,194
Weber	7,858	4,112	3,746	3,675	1,750,000	1,750,000
Totals	86,786	44,121	42,665	40,273†	12,565,842	16,159,995

Principal Towns.—The capital of the Territory is Salt Lake City, which had in 1870 a population of 12,854. The other large towns and cities are Ogden, 3127 inhabitants in 1870; Provo, 2384 in 1870; and Logan, Ephraim City, Manti, Iron City, and Mount Pleasant, which had from 1300 to 2000 each.

History.—Utah derives its name from the Utes, a tribe of Indians originally inhabiting it. It was originally a part of Upper California, and was conveyed to the U. S. by Mexico by the treaty of 1848. The Mormons (see Mormons), driven from Illinois and Missouri, emigrated hither in 1847 and 1848, and established themselves in a region remote from other inhabitants. In 1850 it was organized as a Territory. There have been serious difficulties between the Territory and the U. S. government, growing out of the claims of the Mormon prophet, Brigham Young, to the supreme authority, and also from the recognized practice of polygamy in the Territory. In 1857 a party of settlers, while passing through Utah, having incurred the suspicion of the community at Salt Lake City, were surrounded in Mountain Meadows, Santa Clara co., Ut., by a band of Indians, who were under the control of the Mormons, and subsequently massacred, a few children alone being spared. The government in 1875 begun an investigation to bring to justice the leaders in the massacre, and has already elicited much information. In 1862 the Mormons formed a State constitution and demanded admission to the Union as the "State of Deseret." It was refused, and much trouble followed for several years. Probably five-sixths of the inhabitants are still Mormons, and their legislature is wholly composed of Mormons, but the power of the prophet is waning. The great development of their mines has brought in many settlers who are not Mormons.

Governors of the Territory.

Brigham Young	1850-54	Charles Durkee	1865-69
Edwin J. Steptoe	1854-57	J. Wilson Shaffer	1870-71
Alfred Cummings	1857-61	George L. Woods	1871-73
Stephen S. Harding	1861-64	Samuel B. Axtell	1873-75
James D. Doty	1864-65	George W. Emery	1875-77

L. P. Brockett.

Utah, county of Central Utah, lying E. of the Wahsatch Mountains, comprising the most valuable portion of the Territory, containing Utah Lake, and traversed by Utah Southern and American Fork R. Rs.; surface somewhat hilly, and containing some valuable gold-mines; soil very productive when irrigated. There are saw-mills, flour-mills, and manufactories of sorghum-molasses. Sheep and cattle are the principal live-stock. Staples, wheat, potatoes, sorghum, wool, lumber, and dairy products. Cap. Provo City. Area, about 1000 sq. m. P. 12,203.

Utah Lake. The largest body of fresh water in the Territory of Utah; N. lat. 40° 15′, W. lon. (from Greenwich) 111° 45′. Its altitude above the sea is 4475 feet; its length from N. to S. is 25 miles; its extreme width 13 miles; its area 150 sq. m. It has no island. The valley in which it lies is part of a great trough formed by the uplift of the Wahsatch range of mountains at the E. and the Oquirrh, Lake, and Tintic ranges at the W. The eastern range is the loftier, and all the tributaries of the lake come from that side. Corn Creek, Hobble Creek, and the American Fork rise in the Wahsatch Mountains, but the Spanish Fork and Provo River head to the E. of the range, and pass through it in deep defiles. Its outlet is the river Jordan—appropriately so named, since, like the river of Palestine, it runs from a fresh lake to a salt one. The Jordan of Utah is 40 miles in length, and flows northward into Great Salt Lake. Utah Lake abounds in trout and other fish, and is visited by a great variety of water-fowl. On its eastern shore stand the Mormon towns of Lehi, American Fork, Pleasant Grove, Provo, and Springville. G. K. Gilbert.

Utahs, or **Utes,** a tribe of American Indians of the Shoshone family, living in New Mexico, Utah, Colorado, and Nevada. They practice hunting and fishing, and also live largely upon berries, roots, and herbs, and possess a few horses, but rarely engage in agriculture. They number about 15,000, and have latterly sold most of their lands to the U. S. government, retaining a large reservation in the S. W. corner of Colorado.

* The county of Rio Virgen, reported in the census of 1870 as having a population of 450 (250 males and 200 females), was in 1871 set off to Nevada.

† This includes 1044 in counties since absorbed in others.

‡ Assessed valuation in 1873, $21,548,348.

Uterine Diseases. Diseases of the womb or uterus, so-called "female diseases," are comparatively infrequent in the women of aboriginal and savage tribes, and in civilized races among the women of rural districts who labor, are much in the open air, and free from artificial and effeminate habits of dress and living. For the most part, they exist in delicate women, those whose health is impaired by some other and primary disease, and relatively more often in women resident in great cities. The predisposing causes of a majority of all uterine diseases are the constant recurrence during the greater part of adult life of the menstrual period, the complications and sequelæ of child bearing, and the intimate nervous and vascular sympathy connecting the uterus with every part of a woman's organism. Uterine diseases comprise also the derangements of the appendages of the uterus—the ovaries, vagina, and peri-uterine connective tissue and ligaments which maintain the organ normally *in situ*. The uterus is subject to congestion and to inflammation from many causes, as suppressed menstruation, catching cold, falls, blows upon the abdomen. Congestion and inflammation are indicated by a sense of fulness, weight, warmth, and pain, with tenderness on pressure in the lower part of the abdomen, especially in standing or walking; and relieved by lying down. The disease may be limited to the inner mucous membrane, to the body of the organ, or the exterior investing loose tissue, or rarely involve all. The term metritis denotes inflammation of the body proper of the organ, endo-metritis of the mucous interior, peri-metritis of the surrounding elastic tissues which fill the cavity of the pelvis. This tissue, when extensively inflamed, is often infiltrated with new plastic matter, the product of the vascular engorgement, and this, becoming set, "fixes" the uterus for a time, so that it is rigid and immovable—a condition termed pelvic cellulitis and peri-uterine cellulitis. This loose tissue is occasionally the seat of profuse hæmorrhage from a ruptured vessel, as in lifting, jumping, or falling. The effused blood remains fluid or semi-fluid, and gravitates in the pelvis; this blood-tumor, termed "pelvic hæmatocele," often presents in the vagina.

The normal uterus is a symmetrical organ, with a straight axis, and the cavity of its body and neck slightly open; its normal position is that of slight anteversion, or upright and from above inclining slightly backward. But attacks of congestion and inflammation change its shape, size, symmetry, and position. Thus, either from external pressure or adhesions, or from softening or thickening of its own walls, it may be drawn down—either backward, forward, or to either side; the organ as a whole may be tilted, giving rise to "version;" or the body may be bent on the neck, a condition termed "flexion." According to the direction which the displacement or deformity of the uterus takes, we have anteversion, retroversion, right and left lateral version, and anteflexion, retroflexion, and right and left lateral flexion. Flexions of the uterus are a common cause of "dysmenorrhœa," or difficult menstruation, since by the bending of the uterus its canal is bent and constricted, and the free escape of menstrual blood is prevented; this flexion of the uterine canal is also a cause of sterility, since seminal elements cannot enter the organ and produce conception. Whenever the uterus is enlarged, as by congestion or inflammation, is the seat of a polypus or tumor, or is pressed down by growths in the cavity of the abdomen, and also whenever in debilitated persons its ligaments and outside supports are weakened and relaxed, it tends to gravitate below its natural position in the pelvis, and even to project from the body. This "falling of the womb" is termed "prolapse," and, when extreme, "procidentia." The lower end of the uterus, the neck or cervix, is often ulcerated as the result of congestion, inflammation, contact of its end with the floor of the pelvis, and the irritation of the acrid mucus discharged in endo-metritis. Tumors may develop within the cavity of the uterus, in the substance of its walls, or upon its outer surface, either beneath its serous coverings or loosely attached by pedicles. The uterus is occasionally the seat of cancer, and chiefly at the climacteric period or "change of life." The ovaries—whose functional work, the production and periodic discharge of the ovules, is the paramount physical feature of woman's sex—are subject to attacks of congestion, inflammation, hæmorrhage, and intense neuralgia. The fibrous framework of these organs may increase and develop fibrous tumors; but especially frequent and important are "ovarian cysts" or "ovarian dropsy." The ovisac (see OVARIES) becomes distended with fluid in order to rupture and eject the ovule; it then, again, is filled by the serum of the coagulated blood from the hæmorrhage consequent upon the rupture. The ovisac is liable to fill, and by a process of vascular activity and growth in its wall becomes a cyst of greater or less size: cysts may be present of small size and in numbers, never attracting attention, or reversely, grow either by secretion or dropsical transudation to contain ten, twenty, sixty, or more pounds of serous fluid. Such ovarian cysts may be single sacs, or divided by partitions into compartments. (See OVARIES.) The broad ligaments on either side of the uterus less often are the seat of dropsical cysts developed between their folds. The vagina, the intervening passage which connects the surface of the body with the womb within, is the frequent seat of catarrhal inflammations, in which mucus is more or less profusely secreted, causing a discharge termed "leucorrhœa" (Gr. λευκος, "white" (matter), and ῥεῖν, to "flow"). It may also be acutely inflamed, "vaginitis;" the seat of ulcers, and also of spasm, with or without pain, a condition termed "vaginismus." This passage is, very exceptionally, anatomically defective, being wholly or partially wanting or constricted. Most common of all uterine diseases are merely functional derangements or irregularities of menstruation. By amenorrhœa is understood absence of menstruation; dysmenorrhœa is characterized by pain, sickness, and deficient flow at the period; and menorrhagia is a prolonged and excessive menstrual flow, or persistent loss of blood from the uterus, as when cancer or polypus exists. In the treatment and cure of uterine diseases correct diagnosis is essential at the outset. True, most of them are benefited by use of general tonics, by rest, corrected habits, and by supporting the abdominal viscera; but many are not even alleviated by these general measures. Physical exploration, both manual and by aid of the speculum, will often reveal an unsuspected disease, and point to the special topical treatment or surgical procedure which is the essential means of cure.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Utes. See UTAHS.

Utica, an ancient city of Africa, was on the river Bagradas, near its entrance into the Mediterranean, and occupied the site of the modern village of Duar. When Carthage was taken and destroyed by the Romans, Utica rose in importance and became the capital of the Roman province. The remains of its temples, amphitheatre, and aqueduct show that it must have been a magnificent place. In the latter part of the seventh century it was taken and destroyed by the Arabs.

Utica, p.-v. and tp., La Salle co., Ill. P. 1145.

Utica, p.-v. and tp., Clarke co., Ind. P. 1598.

Utica, tp., Chickasaw co., Ia. P. 931.

Utica, p.-v., Macomb co., Mich.

Utica, tp., Winona co., Minn. P. 1370.

Utica, p.-v., Green tp., Livingston co., Mo.

Utica, city, one of the caps. of Oneida co., N. Y., 96 m. W. of Albany. A tract in the Mohawk country, afterward known as Cosby's Manor, was granted by George II. in 1734. It included a ford over the Mohawk, near which on S. bank, in 1758, Fort Schuyler was built. Here was for this vicinity the chief crossing of the river, where three log cabins were put up in 1787, and a store and an inn in 1790. The village of Utica was incorporated Apr. 3, 1798; it was chartered as a city Feb. 13, 1832, and is a half-shire town with Rome. It received an impetus from the construction of the Erie Canal, and is the northern terminus of the Chenango Canal. The New York Central R. R. skirts the city on its northern limits, while the Utica and Black River R. R. runs northward to the St. Lawrence; the Delaware Lackawanna and Western R. R. connects with the coal-regions and Philadelphia, and one of the chief branches of the New York Midland R. R. commences here. The population was derived at the beginning largely from New England, but the descendants of the Netherlanders on the lower Mohawk were also early settlers, while English, Irish, and Welsh came in considerable numbers in the first years, and with Scotch, and in later years Germans especially, and a few French and Swiss, have increased and multiplied. Enterprising citizens early established stage-routes from Utica; they were pioneers in the maintenance of packets on the Erie Canal. The first electric telegraph company (the New York Albany and Buffalo) was organized and had its chief office here. Five woollen and 7 cotton factories and 2 knitting-mills are in the city and vicinity. Rich beds of iron ore lie just S., and 2 blast furnaces are run, mainly by Utica capital, a few miles distant. Ready-made clothing is extensively manufactured. Six establishments turn out annually 630,000 pairs of boots and shoes. In stoves, steam-engines, locomotive-lamps, farm-wagons, agricultural implements, millstones, and drain-tile considerable capital and labor are employed. The farms about Utica are devoted in good part to the dairy, and it is the chief market for cheese in the U. S., 200,000 boxes having been sold in 1875, at a value of $1,735,592. The waterworks have a capacity of 400,000,000 gallons a year. Three parks lie within the city, and a fine driving-park on its eastern boundary. Four national banks, 1 State bank, a savings bank, and 2 private banks are sus-

tained. Horse railroads cross the city, and connect with the adjacent villages S. and W., and with the driving-park on the E. The fire department is paid, and has an alarm telegraph. The churches are 32—5 Episcopalian, 8 Methodist, 5 Presbyterian, 4 Roman Catholic, 4 Baptist, 2 Lutheran, 1 Reformed, 1 Moravian, 1 Congregational, 1 Universalist—and the Spiritualists maintain regular services in a public hall. Of these churches, 4 conduct worship in the Welsh, and 6 in the German language. Three hospitals, 4 orphan asylums, 2 homes for the aged, a home for women, and a dispensary express the public charity. New York State supports a lunatic asylum here, with 640 patients. The Utica Mechanics' Association owns a commodious opera-house. The public library contains 6055 volumes. The common schools are graded, and in the academy the higher branches are taught; in 1875 the pupils numbered 4711. Among private schools the Utica Female Academy holds a high rank. The bar of Utica and of Oneida county has been eminent always, and its jurists have adorned the bench of the State and the nation. In politics its citizens have won their full share of distinction. There are 2 daily newspapers and 3 weeklies, a German tri-weekly, a Welsh weekly, and 2 Welsh monthlies. P. in 1870, 28,804; in 1875, 32,070. ELLIS H. ROBERTS,

ED. "UTICA MORNING HERALD AND GAZETTE."

Utica, p.-v., Washington tp., Licking co., O., has a private bank. P. 384.

Utica, p.-b., Venango co., Pa. P. 225.

Utica, tp., Crawford co., Wis. P. 1260.

Utica, tp., Winnebago co., Wis. P. 1039.

Utilita'rianism [Lat. *utilitas*], a peculiar political and moral theory based on the assumption that happiness is the ultimate principle of all human actions, and characteristically symbolized by its fundamental maxim, "The greatest happiness to the greatest number." Ethical systems refusing to acknowledge any moral obligation in a postulated revelation of the will of God, denying the existence of any innate organ in the human soul by which to distinguish absolutely between right and wrong, and establishing the natural self-love of the individual as the necessary principle of his whole conduct, seem to have existed as far back in time as there existed any comprehensive reasoning on moral subjects; but in the peculiar form in which this theory has received the name of utilitarianism it originated with Jeremy Bentham. With great boldness, and not without a corresponding power of argument, he substituted in politics utility for abstract right; or, rather, the usefulness of an institution or a law was the only criterion of its justness, of its right to be, which he acknowledged. In this principle he thought he had found the means of abolishing all those laws and institutions which, although once useful, had now become a plague, and of carrying out all reforms necessary to the progress and development of mankind, without risking a revolution and a temporary relapse of society into anarchy; and, generally, his application of the principle to legislation met with approbation. But as the political system developed toward completion, the necessity arose of bringing it into harmony with the moral system which governed, or was to govern, the actions of the individual. It was necessary to apply the same principle in morals as in politics, and on this point the utilitarian theory—for it cannot be said as yet to have developed a complete moral system—met with much ridicule, and subsequently also with bitter opposition. It sounded rather harsh when Bentham declared in the face of the whole Christian civilization that happiness was and had always been the fundamental principle of human actions; and the utterance became still more provoking when he defined happiness simply as happiness on earth, and wrapped up in a bundle all the loftiest and most disinterested aspirations of the human soul, marked it as asceticism, and sent it to the waste-basket. The coarse egotism which, at least in the vulgar conception of them, characterized similar systems of past ages he succeeded in breaking by substituting the greatest happiness of the greatest number for the mere gratification of the cravings of the individual; but this very sentence has an external, arithmetical strictness, and an internal, practical vagueness, which made it a fit subject of ridicule. Moreover, Bentham's own writings on the subject—*An Introduction to the Principles of Morals and Legislation, etc.*—are sketchy and rather confused. Nevertheless, on this point also he found very able disciples—James Mill, John Stuart Mill, Sir James Mackintosh, Alexander Bain, and others—and many valuable analyses, psychological and strictly ethical, have issued from the labors of the school.

Utlateca Indians. See QUICHE INDIANS.

Uto'pia [Gr. οὐ, "not," and τόπος, "place"], an imaginary island, the abode of a people free from care, folly, and the common miseries of life, described by Sir Thomas More in his *Utopia* (1516), translated from the Latin by Burnet (1683), by Robynson (1551), and by Cayley (1808).

Utopia, tp., Clermont co., O. P. 80.

U'traquists, a Hussite sect, so called because they demanded the Lord's Supper administered to them *sub utraque specie*—that is, both bread and wine. They were also called Calixtines.

U'trecht, province of the Netherlands, bounded N. by the Zuyder-Zee and S. by the Rhine and Leek, comprises an area of 532 sq. m., with 176,524 inhabitants, of whom 64,143 are Roman Catholics and the rest Protestants. The surface is diversified by low hills along the Rhine, the soil is very fertile, and the climate drier and brighter than in the other provinces. Wheat, barley, oats, and tobacco are extensively cultivated; cattle, sheep, and bees are reared, and several branches of manufactures, such as the making of tiles, bricks, and pottery, are carried on on a large scale.

Utrecht, town of the Netherlands, capital of the province of the same name, on the Old Rhine, where the Vechte branches off from it. It is well built, traversed by canals, and surrounded with finely-planted promenades, and has, among other educational institutions, a celebrated university, with which are connected a botanical garden, a chemical laboratory, an observatory, and different museums and scientific collections. Its manufactures of plush, velvet, and carpets, of leather, soap, salt, and brandy, of metal ware and cigars, are very extensive, and it carries on an active trade in grain, cattle, and its own manufactures. It is the oldest town of the Netherlands, called by the Romans *Trajectum ad Rhenum* or *Ultrajectum*, from which latter appellation its present name is derived. Here the fusion between the seven provinces which formed the Dutch republic was organized in 1579, and here the treaty was signed (Apr. 11, 1713) between France, England, Holland, Prussia, Portugal, and Savoy, which ended the war of the Spanish succession. P. 64,275.

Utre'ra, town of Spain, province of Seville, is well built and pleasant; has several oil-mills and manufactures of soap, leather, and pottery, and is in a rich and beautiful district, famous for its excellent horses and ferocious bulls. P. 12,441.

Utricularia. See BLADDER-WORT and INSECTIVOROUS PLANTS.

Uttara Mimansa. See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

Uval'de, county of S. W. Texas, drained by the Rio Frio and its affluents. The soil is well adapted for stock-raising, but on account of the dryness of the climate not favorable for agriculture unless irrigated. Cattle are numerous, and constitute the principal live-stock. Staples, a little Indian corn, wool, and butter. Cap. Uvalde. Area, about 1000 sq. m. P. 851.

Uvalde, p.-v. and tp., cap. of Uvalde co., Tex. P. 163.

Uvaroff (SERGEI SEMENOVITCH), COUNT, b. at Moscow in 1785; studied at Göttingen; was made curator of the University of St. Petersburg in 1811, president of the Academy of Science in 1818, director of the department of commerce and industry in 1822, minister of public education in 1832; retired in 1848, and d. at Moscow Sept. 16, 1855. He was the founder of the Oriental School and the Asiatic Museum in St. Petersburg, and exercised a great and beneficial influence on all educational affairs of the empire. His writings have been collected and published under the titles *Etudes de Philologie et de Critique* (1843) and *Esquisses politiques et littéraires* (1849).

Uvic Acid. See RACEMIC ACID.

Uvula. See PALATE, by PROF. J. W. S. ARNOLD, M. D.

Uwch'lan (yook'lan), p.-v. and tp., Chester co., Pa. P. 794.

Ux'bridge, p.-v., Ontario co., Ont., Canada, on Toronto and Nipissing Railway, 43 miles N. N. E. of Toronto. It has important manufactures and a weekly newspaper. P. about 1600; of sub-district, 4762.

Uxbridge, p.-tp., Worcester co., Mass., on Providence and Worcester R. R., 18 miles S. E. of Worcester, contains good schools, 1 newspaper, and large cotton and woollen manufactories. P. 3058. SPENCER BROTHERS,

PUBS. "WORCESTER SOUTH COMPENDIUM."

Uxmal', a ruined city of Yucatan, 15 miles S. of Merida. (See ARCHITECTURE OF THE AMERICAN ABORIGINES, by LEWIS H. MORGAN.)

Uzbeeks. See USBEKS.

Uzes', town of France, department of Gard, manufactures silk hosiery and trades in silk, oil, grain, and brandy. P. 6242.

Uzziah. See AZARIAH.

V.

V, a consonant letter formerly interchangeable with U in writing and printing. In power also V is to some extent interchangeable with the vowel U, and with the consonants B, P, F, and W. V is in English a labio-dental. V has the power of English *w* in Latin and Anglo-Saxon, from both of which we get the *w* of *wine*, *wind*, while the *v* of *vine*, *vent*, is due to Norman. V is in martyrologies an abbreviation for *virgin*, V V for *virgins*; *v* stands for *versus*, "against." V represents the numeral 5, and in chemistry is the symbol of vanadium.

Vaca, de (Caveza). See Nuñez (Alvar).

Va'ca Sta'tion, tp., Solano co., Cal. P. 120.

Va'caville, p.-v. and tp., Solano co., Cal. P. of v. 313; of tp. 1701.

Vaccaj (Nicolo), b. at Tolentino, in the Papal States, in 1791; studied music under Paisiello at Naples, and began to compose operas for the Italian stage in 1811; lived as a singing-master successively at Venice, Trieste, Vienna, Paris, and London, and was appointed professor of composition in 1838 at the Conservatory of Milan, where he d. in 1849. The most remarkable of his many operas are *Pietro il Grande*, *Zadig ed Astarten*, and *Giulietta e Romeo*.

Vaccina'tion [Lat. *vacca*, "cow"], the act of inoculating an individual with *vaccinia*, or cow-pox, a disease occasionally met with in milch cows. It is done for the purpose of protecting the system against small-pox, having superseded variolation or Inoculation (which see). The subject was first systematically investigated by Edward Jenner, an English physician, who in 1798 published the results of his researches and established the practice. Cow-pox has many points in common with small-pox, and with certain varioliform diseases of several of the lower animals, particularly with horse-pox, but it differs radically from them all in that it is communicable only by actual inoculation (never by effluvium); that its cutaneous manifestations are, with very rare exceptions, confined to the point of inoculation; and that the illness to which it gives rise is ordinarily trifling in degree and of very short duration.

When a child is vaccinated, no result is observed until after the lapse of a period of incubation, generally comprising three or four days, when a pimple-like elevation of the skin forms at the point of inoculation. In two or three days more this papule has increased in size and become a flattened vesicle or "pock," with a depressed centre (umbilication). On the eighth or ninth day (inclusive) it has become still larger, is surrounded by a sharply-defined circular, bright-red disk, from one to two inches in radius, technically termed the *areola*; its central depression is more marked; the contained fluid, which was clear at first, has become somewhat turbid, and the central depressed portion has become converted into a brown crust; at this period there is slight fever. The pock continues to increase in size until the fourteenth or fifteenth day, when it has become wholly dried into a blackish-brown crust; there is little or nothing to be seen of the areola, which has faded from the centre toward the circumference, and there is no more fever. The crust remains attached until somewhere between the twenty-first and thirty-fifth days. On falling off it leaves a reddened surface, which gradually becomes paler than the surrounding skin, depressed, and sometimes "foveolated" (*i. e.* indented, like the surface of a thimble), and remains as a permanent scar. In cases of revaccination (vaccination of a person who has before been vaccinated successfully) the pock usually runs an accelerated course, and is not completely developed, although the constitutional disturbance is apt to be more marked, with chilliness, nausea, headache, pain in the back, etc.

The structure of the vaccine pock is the same as that of the vesicle or pustule of Small-pox (which see). The contained fluid is termed lymph, and is used for transferring the disease from one person to another. For this purpose it should be taken not later than the eighth day. This lymph may be directly transferred from the subject of the pock (vaccinifer) to the person to be vaccinated, constituting arm-to-arm vaccination, or it may be preserved in a liquid state sealed up in capillary glass tubes or between plates of glass, or allowed to dry on slips of quill, ivory, whalebone, and the like. Dried lymph is the most trustworthy form of stored vaccine. The fallen crusts have been used for the purpose of propagating the disease, but they are very unsatisfactory. In whatever form vaccine virus be preserved, great care should be taken to prevent its undergoing septic decomposition, as its use in such a condition is liable to produce serious results, to say nothing of its failure to convey vaccinia. In particular, it should be kept away from the action of moisture and heat. Of late years, lymph direct from the cow or calf (bovine virus) has been much used, and with very satisfactory results, since it is found to be more successful in communicating vaccinia, to produce finer pocks, to do away altogether (when properly used) with the danger of conveying syphilis and other inoculable diseases, and to furnish an abundance of vaccine available at any time in case of the sudden outbreak of small-pox. Animal vaccine can now be obtained in any of the large cities of the U. S. and continental Europe. The supply is kept up by calf to calf vaccinations, starting from a case of natural cow-pox. Experience does not warrant positive statements in regard to the advisability of using variola vaccine (from a variolated cow), retro vaccine (from a cow vaccinated with humanized lymph), horse-pox lymph, etc.

The best mode of vaccinating is as follows: Make one or more abrasions of the skin by scraping off the outer cuticle with a sharp lancet or some similar instrument. Each abrasion should be of about the size of a split pea, and they should not be less than one inch distant from each other. The best situation is on the left arm, at or near the insertion of the deltoid muscle. The skin should not be punctured, cut, or scratched, but simply *scraped*, and on no account should the true skin be wounded. When the abrasion is found to present a moist surface (no matter whether or not it shows the color of blood), it is deep enough, and the lymph may now be applied. If tube-lymph be used, it is simply to be blown on to the abrasions, but dried lymph, especially if it have been kept long, should first be moistened with a drop of cold water, and then rubbed upon the abrasions for a full minute or more. No plaster or dressing of any sort need be applied; but after the pock has formed, care should be taken that it be not scratched, rubbed, or otherwise injured.

There are facts which seem to show that the efficiency of vaccination against small-pox is in direct proportion to the amount of vaccinal efflorescence—two pocks giving more protection than one, three more than two, and so on. If energetic virus be used, two insertions will generally suffice. It is safe to vaccinate a child at any age, but, unless there have been actual exposure to small-pox, it is well to wait until it is about three months old. It is desirable that it should not be teething or ill in any way, and especially that it should be free from any cutaneous eruption. It is not well to vaccinate children in very hot weather or when erysipelas is prevailing, unless in case of necessity.

Vaccinia usually runs its course without complications, and does not call for special treatment. Excessive erythema (falsely called erysipelas) sometimes occurs, but always yields readily to simple local treatment. True erysipelas occasionally follows vaccination, as it does any other wound, and in infants it is very dangerous. Eczema, as well as certain other affections of the skin, sometimes arise soon after vaccination, and are perhaps, in certain cases, caused by it. Inflammation of the glands and of the cellular tissue is not very uncommon if the true skin be wounded; otherwise, it is rare. Multiple abscess is rare. It may be due to wounding the true skin, to the use of putrid lymph, or to injury of the pock, or it may have no connection with the vaccination. Ulceration of the pock (generally due to its being injured) is sometimes troublesome, but very rarely dangerous. Much fear has been felt that certain constitutional diseases might be conveyed by vaccination. In very rare instances this has occurred in the case of syphilis. It may be prevented with certainty by using animal vaccine and a *perfectly* clean instrument. In persons already tainted with latent scrofula or syphilis, vaccination may rouse the disease to activity.

The protection which vaccination affords against small-pox is sometimes absolute and permanent, but in most persons revaccination should be performed, as a matter of precaution, about once in five years, and in addition whenever small-pox is epidemic, when setting out on a voyage, upon undertaking military duty, etc. Modified small-pox (varioloid) frequently occurs in vaccinated persons, but severe small-pox after a recent and thorough vaccination

is exceedingly rare, except in cases in which the vaccination was done after the system had already become infected with small-pox. "Suppose an unvaccinated person," says Mr. Marson, "to inhale the germ of variola on a Monday: if he be vaccinated as late as on the following Wednesday, the vaccination will be in time to prevent small-pox being developed: if it be put off until Thursday, the small-pox will appear, but will be modified; if the vaccination be delayed until Friday, it will be of no use." Vaccination has been used for other purposes than the prevention of small-pox, but experience has not proved its efficiency for such purposes. Vaccine lymph has been given internally and injected under the skin to assist in the *cure* of small-pox. There is no evidence that such a practice has the slightest effect. FRANK P. FOSTER.

Vacherot' (ÉTIENNE), b. at Langres, department of Haute-Marne, France, July 29, 1809; studied at the normal school of Paris, where he became professor of philosophy in 1833; in 1839 succeeded Cousin at the Sorbonne, but was dismissed in 1852, because he refused to take the oath to Napoleon III., and was condemned to three months' imprisonment in 1859 for his *La Démocratie*. In 1871 he was elected a member of the National Assembly. His principal works are—*Histoire critique de l'École d'Alexandrie* (3 vols., 1846–51), which was furiously attacked by the Ultramontane party, especially by the Abbé Gratry in his *Étude sur la Sophistique contemporaine*, to which Vacherot answered with a *Lettre à l'Abbé Gratry*, *La Métaphysique et la Science* (2 vols., 1858), *Essais de Philosophie critique* (1864), and *La Religion* (1868).

Vac'uum [Lat.], in physics, a portion of space void of matter. Whether a perfect vacuum is possible or not was a much-debated question in the ancient philosophy between the Atomists and the Peripatetics. The *Torricellian* or barometric vacuum is nearly perfect, but contains the vapor of mercury. If a receiver filled with pure carbonic acid gas be exhausted by means of a good air-pump, a small vessel having been previously introduced containing moist caustic potash, and another containing concentrated sulphuric acid, a vacuum will be produced so nearly absolute that the electric spark fails to pass through it.

Vacuum (or **Geissler's**) **Tubes.** See ELECTRICITY, by PRES. HENRY MORTON, PH. D.

Va'ga, del (PERINO), whose true name was PIETRO BONACCORSI, b. at Florence in 1500; received his first instruction in painting from Ridolfo Ghirlandajo, from Vaga and Perino, from whom he derived his two surnames. Subsequently, he went to Rome, where he became an intimate friend of Raphael, and was generally considered his most gifted pupil next to Giulio Romano. After the death of Raphael, he lived for some time in Genoa, where he decorated the palace of Doria, but finally returned to Rome, where he formed a great school; worked much for Paul III. D. in 1547. The best of his pictures are the *Creation of Eve*, in the Vatican, and the *Singing-Match between the Muses and the Pierides*, in the Louvre.

Vagrant and **Vagrancy.** See MENDICITY, by REV. C. L. BRACE.

Va'gus Nerve, Par Vagum [Lat., "wandering pair," so called from its irregular course], names given—the first to either one, the second to both together—to the two pneumogastric nerves, now considered as the twelfth pair of cranial nerves, but by older anatomists reckoned a part of the ninth pair. (See PNEUMOGASTRIC NERVE.)

Vaiden, p.-v., Carroll co., Miss.

Vaigats', an island in the Arctic Ocean, between Nova Zembla and the northern coast of Russia, belongs to Russia. It is inhabited by a few Samoyeds and their herds of reindeer, but it is annually visited by a great number of Russians, who come hither during the summer to fish and to hunt.

Vaile's, tp., Pickens co., Ala. P. 456.

Vaillant, Le. See LEVAILLANT (FRANÇOIS).

Vaiseshika. See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

Vaishn'avas. The Vaishn'avas are a sect of Hindus, who regard as their peculiar patron, and as the most especial object of their veneration, the second person in the Indian Trimûrti—namely, Vishnu. The Vaishn'ava sect is itself subdivided into almost innumerable sects, all of which are only bound together by the one idea—that, above all other gods of the Hindu pantheon, Vishnu stands supreme. Roughly speaking, these sects of Vaishn'avas may be classed in bulk as the "Northerners" and the "Southerners," according to the *ipsissima verba* of Hindu theology. But the tone of Vaishn'ava opinions is constantly changing, and we find the so-called Northerners constantly contending nowadays, in the Deccan and extreme S. of India, with the Southerners. So, in reality, no hard and fast line can be drawn, and no grouping of the hundreds of sects comprising the Vaishn'ava sect can be satisfactorily made. The term *Vaishn'ava* is as elastic as that of Christian. Even the mark on the Vaishn'ava's forehead, which is shaped like a trident, cannot invariably be depended upon. One sect prolongs the central prong, so to speak, of the trident to the tip of the nose, and holds that it is necessary to salvation that this should be done. The opposing sect stops short at the eyebrows. Many a bloody feud between Vaishn'avas has arisen on account of this one controversy, with a fervor resembling that when the whole world of Christendom was convulsed about an *iota*—whether *homoousion* or *homoi-ousion* was the orthodox term to use. Then some of the sectarian marks differ in the thickness of the lines; and even that, in the watchful eye of a scrupulous Hindu, is of immense importance. So are also the necklaces and rosaries, the forms of the garments worn, and, above all, the sacred initiatory *formulæ*. The Vaishn'ava mark on the forehead is called in Sanskrit the *tilaka*, and in the Northern vernaculars *tilak*. In Tamil it is called *nâmam*, literally, "the name," or *tiru-nâmam*, "holy name;" and in fact it is the outward designation of the worshipper of Vishnu. Though in some form or other it is to be seen on the Vaishn'ava's forehead, yet its varieties are so peculiar in the chief six sects of the votaries of Vishnu that we must remark on these differences ere proceeding further. But in passing it should be mentioned that the differences of the sects themselves chiefly consist in the character of the supremacy which they assign to Vishnu as a member of the Trimûrti, in the nature of which they believe him to be possessed, in their mode of worship and pious exclamations, and in the light in which they regard their priests and the authority they wield.

The distinctive mark of the Northerners, of which we have spoken, is formed by two white perpendicular streaks, or two streaks converging like the lines of a V from the roots of the hair, across the forehead, to the eyebrows. These streaks are of powdered sandal-wood made into an adhesive paste. From between the eyebrows another white streak is drawn, connecting the lower portion of the V to the tip of the nose, thus making the mark resemble a Y. Some of the sectaries of these sectaries make the line along the nose stop at the middle of its ridge. The streaks of sandal on the forehead are called *gopîchandana*. The Vaishn'avas using this mark are sometimes called the "Bengal Vaishn'avas," as they most abound in that province. They also sometimes have the name of Krishna impressed with paint on their foreheads and bodies, and are also to be sometimes distinguished by "a close necklace of tulasî stalk of three strings, and a rosary of 108 or 1000 beads made of the stem of the tulasî. The distinctive mark of the Southerners consists of two white lines of chalk, perpendicular and parallel, from the roots of the hair to the eyebrows, with a streak of similar color joining the base of the lines, and running at right angles to them above the nose. In the middle, between the two perpendicular white lines, is drawn, parallel with them, a line of red paste composed of turmeric and lime, or simple red chalk. The white lines are sometimes traced by means of a fine white clay, much prized by potters. This subdivision of Vaishn'avas pay peculiar regard to the lotus, and often bear on their bodies the representations of it. Like other Vaishn'avas, they hold the basil sacred to Vishnu (the tulasî—*i. e.* sacred basil). The Vaishn'ava adores Vishnu as the personification of everything lovable, and basil is everywhere the emblem of love. The reader, for instance, will remember Shelley's lines:

> "Madonna, wherefore hast thou sent to me
> Sweet *basil* and mignonette,
> *Embleming love* and health, which never yet
> In the same wreath might be?" etc.

In the great valley of the Ganges we come to the Vaishn'ava sect of the *Râmânanda*, whose distinctive mark is similar to that of the sect we have just referred to, only the central red mark is made as narrow as possible. The Vaishn'ava followers of Vallabha Âchârya bear on their foreheads two parallel perpendicular lines, generally of white, and joined together at the eyebrows with a semicircular line of the same color. Between the parallel lines no other line is drawn, but it is replaced by a dot of red, generally made by a paste composed of turmeric and lime. They smear themselves with black clay, which they mould on their breasts and arms in devices indicating the usual emblems of Vishnu. The Kabîr Panthis are a sect of Vaishn'avas who, as a distinctive emblem, adopt the "*tilaka*" or distinctive mark simply as a form, and are utterly careless as to its size, shape, or color. The last sect of the principal six whose distinctive religious marks need be referred to are the Mâdhwâchârayas of Central India. "The marks common to them are the symbols of Vishnu upon

the shoulders and breast, and the frontal mark consisting of two perpendicular lines made of the white clay *gopî chandana*, and joined at the root of the nose; but instead of a red line in the centre, they make a straight black charcoal line from incense offered to Nârâyana." This black line terminates at the root of the nose in a red round dot, made of lime-turmeric paste.

So much for the marks on the foreheads of Vaishn'ava Hindus. What do these marks mean? and what is meant by the Saiva marks? One latest born of ingenious theories is that all such frontal marks, though intended to be distinctive from the first one from the other, were primarily used by the cunning Hindu to draw away any fixed gaze into his eyes from the eyes of another. These extraordinary daubs on the foreheads of men certainly do attract the eye, and at least tempt it to wander from that steady stare of blunt fearless Anglo-Saxon honesty which so few Orientals can face. Some Orientalists consider that the marks signify the weapons of Vishnu; others think that the threefold character of the marks hint at the oneness in the person of Vishnu of the trinity of the Trimûrti. These are merely vague speculations. Of the basis of many Hindu symbols the wisest know nothing. For example, what is the real *raison d'être* of the *gopras?* There they stand, those lordly towers, a necessary adjunct of every Hindu temple. But what first prompted the Brahmans to build them? To what especial use were they designed from the very first to be put? We cannot answer such questions; we can at best only offer plausible conjectures. (See Mrs. Belnos, *The Sandhya.*)

We must now turn our attention to the differences between various Vaishn'ava sects. Let us first take the Northerners. They number more than 45,000,000 in the India of the present day. Two out of three Vaishn'avas in Bengal are of this sect. In the course of such a brief summary as this it is impossible to trace their origin or to refer to more than their most distinctive tenets. The first conspicuous doctrine we come to in the teaching of those "*Vadakalei*" Vaishavites, is that of *bhaghti* or *bhakti*—*i. e.* "faith." They believe that *faith* in Vishnu will save more swiftly, surely, and effectually than ever any *works* can. The virtues of pious meditation and abstraction are not to be compared to the virtues of belief. Knowledge is of little account; faith is all in all. It is good to subjugate the passions, to practise the *yoga*, to give alms, to be of a mind filled with charity, to call on the sacred name, to wear the sacred symbols on the person, to be honorable, virtuous, and meek; but FAITH is the sole and supreme fount of salvation. And yet these mild Hindus, who worship the Preserver, and believe that by *belief* alone in the nine-times-incarnate-One they shall attain heaven, coolly tell their Southern brethren of the Râmânûja sect that the latter cannot be saved unless they lengthen the middle stroke on their foreheads to the tip of their noses! The Southerners naturally reply that the performance of this lengthening of the line as a requisite for salvation is in itself a "work," so that the Northerners are inconsistent with regard to their avowed creed. In older days these theological disputes used to lead to exhibitions of physical force. Temples used to be hurled down, cities depopulated, women and innocent children butchered—all to prove whether the distinctive central mark of a Vaishn'ava's forehead should stop at his eyebrows or whether it should elongate itself to the root of his nose!

But, after all, the Northerners must be considered the most liberal. To take a very apt illustration, used by an eminent Orientalist, they are the *Protestants* of Vaishn'ava theology. They insist on *faith* as the supreme requisite. They are not so ground down by usages and multitudinous *formulæ* as are the followers of Râmânûja Âchârya. The latter are more in the hands of their priests; the former own as their great high-priest conscience. The Northerners adhere as much as possible to the simplest tie which can possibly bind them to the worship of Vishnu as a distinctive connecting link—that is, the repetition, the oftener the better, of the name of the god in the person of the greatest of his avatârs, "KRISHNA! *Krishna!* Krishna!" Only repeat this, and your worship is complete, and all ceremonial observances are wholly needless. A great prophet of this subdivision of Vaishn'avas, Haridâs, lived in a jungle-brake for many years, and uttered the holy name 300,000 times a day. But the Southerners have a far grander invocation—one that in the mouth of a Brahman is certainly as fine and pithy and suggestive as any similar adjuration in India. It is, "*Om! Râmâya Namâ!*" which might be freely translated, "O triple God! by the name of the Incarnate!" This, even if not verbally an accurate translation, elucidates the true inner spirit of the original. It is as an ejaculation only inferior to that marvellous one of the Lama priests of Thibet: *Om! Mani Padmé! Haun!*" (See A. Wilson's *Abode of Snow.*) This Buddhist prayer is not only one of the oldest, but is certainly the one above all others most frequently offered up in some fashion or other, not excepting our own Lord's Prayer. It means, "*God! the jewel in the lotus. Amen!*"

But the Northern Vaishn'avas are, in several of their dogmas, more degraded than any other class of their fellow worshippers of Vishnu. Their priests are worshipped by them deliberately. Nay further. They cannot approach to worship their god, Vishnu, unless they first approach and pay divine honors to his priest. They are expressly taught and enjoined to believe that "first the *guru* (priest) is to be worshipped; then Vishnu is to be worshipped." This servility is fortified by other texts which the Bengal Vaishn'ava Brahman regards as sacred. One of these is, "When Vishnu is in anger, the priest will protect us; but when the priest is angry, who can deliver us?" Again: "The prayer is made manifest in the priest, and the priest is God himself." It is perfectly plain that, with all their freedom of thought, and belief in faith rather than in ceremonious observances, the Vaishn'ava Bengalis are exceedingly priest-ridden. Still, it must be granted that, if anything, they are freer from superstitious shackles of many kinds than are their brethren of the S. of India, who look upon outward formalities as the kernel of true religion.

The Southern Râmânûja Vaishn'avas are especially fond of worshipping Lakshmi, the consort of Vishnu. Sitâ is even a greater favorite with them than Râma, and many a wild orgie is often carried out under the supposed sanction of the lovely goddess "with the fish-bright eyes." No South Indian Vaishn'ava will allow any one to look on his food whilst he is eating it. A look would be pollution, and he at once would treat it as ordure and bury it out of sight. He believes that Vishnu is the spring, centre, foundation, cause, and creator of all. Matter and spirit unite in him as God and as the Incarnate. In Southern India the Râmânuja Vaishn'avas number many tens of millions, and their temples are amongst the most splendid in India. They are more Vedantist in their bent of religious thought than the Bengal Vaishn'avas, who do not believe in final absorption into the Divine Essence.

We now come to the intermediate sects. The *Vallabha-Âchâryas* are a strong, well-organized sect of Vaishn'avas, and hold their own in Central India against most influences. Their head priests are called *mahârâjas*, and some of them —nearly a dozen—live in Bombay. They have made a strange name for themselves as spiritual teachers. (See Kursandas Mulji's work on *The Sect of Mahârâjas of Western India.*) They live the most debased and debauched lives, owing their position purely to their parentage, being utterly without erudition themselves, ready to poison, cheat, forge, lie, or swindle, all under the cloak of religion. Mr. Kursandas Mulji said this, and printed his opinions publicly. A trial for libel was the result. Mr. Kursandas was honorably acquitted. The votaries of this sect of Vaishn'avas are bound to reverence the teacher as God. It is said, "The priest or mahârâjah is Vishnu himself: he is Krishna incarnate: the true believer must bestow on the priest his body-organs of sense, life, heart, faculties, wife, house, family, property, and all his own self." It need hardly be added that the grossest abuse has been made of this iniquitous and execrable tenet.

The *Madhwâ Achârya* sect are numerous amongst the Vaishn'avites in the Telugu country. They believe in Vishnu as the great invisible First Spirit, the Prime Cause, the Originator of the Universal, the primeval Sole and Supreme, perfectly good, omnipotent, and of nature totally indescribable. This sect *brand* themselves with Vaishn'ava symbolic emblems as a preventive against schism. As a part of their worship they demand that virtue shall be invariably practised, alms freely offered, truth always told, and that kindness and protection and courtesy be shown to all men, especially strangers. This sect deny the doctrine of absorption, and so differ in a vital point of doctrine from a large number of their co-religionists. Brahma, they believe, grew out of a lotus, which itself grew out of Vishnu's navel. Their idea of heaven is that of final liberation from future births, and sharing with Vishnu in every respect the glories and felicities of his heaven. The true believer, after ascending thither, will not only be perfectly happy, but will be endued with omnipotence. The sacred color of this sect is a deep saffron. Their supreme authority is the Veda. Their priests pretend to strict asceticism.

The *Kabir Panthis* are a very numerous sect of Vaishn'avas in Northern and Central India. They are strict unitarians, believing in one sole Creator of the universe, perfect in holiness, omnipotent, irresistible, yet with corporeal form; endowed with the three senses or qualities, and embodied by a combination of five elements. All that is good in earth resembles him. The perfect man after death shares equally with Vishnu his perfection of character, blissful-

ness, and power. Indeed, God and man are identical. The whole visible creation is also God, begot by the female form, *Mâya*, created by God, to relieve his loneliness and give birth to nature. There are, however, several theories on this point, and Prof. Goldstücker's, which is best known, relies on the most ancient forms of the legend. The Kabir Panthis are very careful to teach that pure morality is the highest good and the way to God. However, one thing should be especially noted: the Kabir Panthis prefer to term the Supreme "the God-Thing," rather than "Vishnu." Indeed, they suppose some infinite, indefinable, omnipotent essence higher than any person of the Trimûrti. But of the Hindu triad they regard Vishnu as the leading power. It is said that of late years many members of this rather latitudinarian sect have joined the Brahmo Somâj, and thus become pure deists. Of all Vaishn'avas they are certainly regarded as being most liberal, especially as to the truest and best name which may be given by mortals to the Supreme.

In conclusion, a few words may be written. They are words which even ripe scholars should take to heart and expatiate upon. It has become the fashion amongst those who have a smattering of Oriental learning to praise Vaishn'avas at the expense of Sâivas. The worshippers of Siva, say they, adore a remorseless divinity, the Destroyer; but, say they again, Vishnu is the benignant preserver, and his votaries set before themselves a higher example of deity. Nothing of the sort! The Purânas tell us that from his infancy Vishnu was the patron of thieving, and that the god in his manhood was accomplished as a superb liar and very extensive fornicator and adulterer. It is a late myth which assigns to him the duties of preservation, whilst Brahma creates and Siva destroys. He is simply an embodiment of human passion without check. Generous at times, he is cunning and lustful and profligal after the Hindu's own heart. In any case, with all his vice and all his magnanimity, he is perhaps the most striking figure in the Hindu pantheon. But, for a god, he is certainly rather diabolical. R. C. CALDWELL.

Valais' [Ger. *Wallis*], canton of Switzerland, bounded N. by the cantons of Vaud and Berne and S. by Savoy, consists of one valley enclosed by the Bernese and Pennine Alps, which are the highest mountains of Europe, and traversed by the Rhone, which at the western extremity of the valley enters the Lake of Geneva. Area, 1665 sq. m. P. 96,887, of whom 67,300 speak French, 21,900 German, and 8000 Italian. They are all Roman Catholics. Cattle-rearing and dairy husbandry are the chief occupations; at the bottom of the valley, where the summer heat is intense and the ground along the river level and fertile, wheat, wine, and fine fruits are cultivated with success.

Val'atie, p.-v., Columbia co., N. Y.

Valc'kenaer (LODEWIJK CASPER), b. at Leeuwarden, Holland, in 1715; studied the classical languages and literatures under Hemsterhuys, and became professor of the Greek language and antiquities at Franeker in 1741; removed in 1766 to Leyden. D. there Mar. 14, 1785. He gave good editions of various Greek authors, accompanied by excellent notes. His *Opuscula Philologica, Critica, Oratoria*, were published in 2 vols. in 1808 by Erfurdt.—His son, JAN VALCKENAER, b. at Leyden in 1759; studied law, and was appointed professor of jurisprudence, first at Franeker, afterward at Utrecht, but was compelled to leave the country in 1787 as leader of the anti-Oranian party. In 1795 he returned with the French army; became a member of the republican government; went to Spain as ambassador in 1796, and again in 1801, and held various governmental positions until the abdication of King Louis in 1810, when he retired into private life. D. at Haarlem Jan. 25, 1821.

Valda'gno, town of Northern Italy, province of Venice, on the right bank of the torrent Agno, about 6 miles S. E. of Recoaro, is a small place of unusual rural, industrial, and commercial activity, and a ferruginous spring, discovered in 1845 about 2 miles from the village, brings hither many strangers in summer. The waters, known as *aqua dei Vegri* or *aqua Felsinea*, are beginning to be exported. P. 6789.

Valdegamas. See DONOSO CORTÉS.

Valdepe'ñas, town of Spain, province of Ciudad Real, is celebrated for its red wine, which is considered the best produced in Spain. P. 10,768.

Valdés, de (JUAN), b. at Cuenca, Spain, about 1500, of a noble and wealthy family, and was early introduced at the court of Ferdinand and Isabella; after serving a short time as *camarero* to Pope Adrian VI. (1522), joined the imperial service in Germany, where he became a convert to the Reformation; took up his residence at Naples; was for a time secretary to the king, and gathered around him a small circle of congenial friends, with whom he pursued the study of the Bible untrammelled by the interpretations of the Roman Catholic theologians, and wrote commentaries and several religious works, some of which were subsequently printed and secretly circulated. D. at Naples in 1540. After his death his friends, among whom were Peter Martyr, Bernardino Ochino, Vittoria Colonna, and Giulia Gonzaga, were accused by the Inquisition of having formed a sect called "Valdesians," and some of his followers were put to death and others had to take refuge in foreign countries. The books of Valdés and his influence upon religious thought had fallen into almost complete oblivion, when his memory, like that of several other Spanish Reformers, was revived by an English Quaker, Mr. Benjamin B. Wiffen (a brother of the translator of Tasso), who began in 1848 the publication of a series of *Reformistas Antiguos Españoles* which extended to 20 vols., and included, besides works of Tomas Carrasco and Dr. Juan Perez, several by Valdés—viz. *Dos Dialogos* (1850), *Zineto y Diez Consideraciones* (1550; reprinted 1855), *Alfabeto Cristiano*, from the Italian edition of 1546, with two modern translations in Spanish and English (1861), *Dialogo de la Lengua* (1546; reprinted 1860), and *La Epistola de San Pablo á los Romanos i la I á los Corintios, ambas traduzidas i comentadas* (1556; reprinted 1856). The second of these works had been translated into French and Dutch, and had appeared in an English version by Nicholas Ferrar, with the title *Considerations on a Religious Life* (Oxford, 1638). Mr. Wiffen also published *The Life and Writings of Juan de Valdés, otherwise Valdesso, Spanish Reformer in the Sixteenth Century* (1865), with a translation from the Italian of his *Hundred and Ten Considerations* by John T. Betts. Valdés was not a Lutheran, nor did he question any doctrine of the Church, his title to the name of "reformer" resting upon his comprehensive spiritual fellowship with all genuine Christians. (See an elaborate article by Dr. E. Böhmer in Herzog's *Real-Encyklopädie für protestantische Theologie und Kirche*, vol. xvii. (1863), and the same writer's *Cenni Biografici sui Fratelli Giovanni e Alfonso di Valdesso* (1861).) PORTER C. BLISS.

Valdez (MELENDEZ). See MELENDEZ VALDEZ.

Valdie'ri, small town of Northern Italy, province of Cuneo, 2700 feet above the sea in the grand and picturesque valley of the Gessa, about 12 miles S. W. of Cuneo. This town is remarkable for the variety and efficacy of the mineral waters, both cold and hot, which are found near it, but higher up the valley and at a height of 4425 feet above the sea. These baths were known and prized by the ancients, but fell into disuse during the Middle Ages, and first acquired a modern reputation about 1560. They are now very much frequented, especially by Italians, for various affections, such as scrofula, rheumatism, paralysis, osseous tumors, etc., and particularly for diseases of the eye. The *muffa* (a gelatinous substance found on the rocks) and *mud baths* are much employed. The marble-quarries of this neighborhood are also very valuable. P. 2700.

Valdi'via, de (PEDRO), b. in Spain about 1505; served with credit as a soldier in Italy, participating in the battle of Pavia 1527; accompanied Pizarro to Peru as one of his captains 1532; took part in the conquest of Venezuela 1535; aided Pizarro in his civil war with Almagro, contributing largely to the decisive victory over the latter Apr. 6, 1538; was rewarded with the assignment of the province of Chili, previously conferred upon Almagro; led an expedition thither, and effected the conquest of that region 1540; founded the cities of Santiago Feb. 12, 1541, and Coquimbo 1544; was recalled to Peru by the troubles consequent upon the murder of Francisco Pizarro; took part at first with Gonzalo Pizarro against the viceroy Blanco Nuñez de Vela (1546), but subsequently aided President la Gasca in suppressing the rebellion of Gonzalo; was appointed captain-general of Chili and all the regions S. of Peru which he might be able to conquer (1548); made a series of daring campaigns in Southern Chili (1550), where he founded the cities of Concepcion, Villa Imperial, Villa Rica, and Valdivia (1551), and gained many victories over the Araucanians, but was ultimately taken prisoner by them and put to death in 1559.

Valdosta, p.-v., cap. of Lowndes co., Ga. P. 1199.

Valeg'gio sul Min'cio, town of Italy, province of Verona, about 5½ miles E. of Villafranca, is one of the prettiest towns on the Mincio, the old dismantled fortress, erected by the Scaligeri for the defence of the passage of the river, having a fine effect when seen at a distance. Within the town there are some noteworthy public and private buildings, and also some valuable works of art. In the Palazzo Nuvolini (formerly Maffei) Carlo Alberto lodged in 1848, also Napoleon III. in 1859 after the battle of Solferino. Near Valeggio sul Mincio may be seen the ruins of the famous bridge of Borghetto (rather a causeway),

erected (1393) by Gian Galleazzo to divert the Mincio from Mantua and thus reduce the place by famine. This neighborhood has, from its geographical position, been the theatre of much desperate fighting. In 1796, Bonaparte, while resting in a little farmhouse near Valeggio sul Mincio, narrowly escaped being made prisoner by the Austrians. It was here also that the disastrous battle of Custoza (1866) was in part fought. P. 5415.

Vâḷei. One of the great homes of the plantain (see PLANTAIN) is Southern India. There it is termed the *vâḷei*. The *ḷ* (under dotted) is the most peculiar of letters, probably, in the whole range of the alphabets of the globe. To transliterate the letter *ḷ* is merely an orthographical shift at best. It is like no *l* in any European alphabet. It has a peculiarly soft, strange sound, a compound, as some have deemed it, of the sounds of *z*, of *r*, of *m*, of *h*, and of *y*, and what not, combined with the permeating "intonating" undercurrent of the *l* sound. There is no word, amongst twenty millions of Indians, much more frequently upon the tips of their tongues, than *vâḷei*. The weird, melting sound of the word itself seems to be mimetic in origin. The tree and fruit of which it is the name is amongst the tenderest of trees and softest of fruits. It is certainly, next only to rice, the prime vegetable of Southern India. The plantain to the Madras aborigine is as the turnip is to the English agriculturist, or the potato to the Irishman, or the maize to the North American Indian. There are sheets of plantain-gardens in India ten times broader and longer than any of the wheat-fields of English counties. The Tanjore and Tinnevelly rice-fields are plains of fertility resembling the prairies of America in extent, without being, like them, undulatory, and resembling the richest farm-lands of England for productive capabilities. Here we have, in mute nature, the size of the giant united as it were with the wit of the dwarf. Rice may be to India what wheat is to Europe. The *vâḷei* to Southern India is what sugar and cotton combined are to the Southern States. It is the morning relish of the Anglo-Indian; it is the food of the wild animal; and the Hindu often feeds upon it solely and wholly for half each year. The large coarse plantain is plucked green by the natives and used as curry. When ripe, it is either eaten by itself as a fruit or mashed up with milk. The smaller kinds of plantains are prized for their exquisite taste as delicacies. Europeans value the smaller varieties the most. There is a green plantain, long and thin in shape, which is extremely agreeable in taste. A *vâḷei* only bears once, but sends out many shoots from its roots. All save one being cut down, a new tree springs up. But the plantain is a most exhausting growth to the soil. It requires much manure, a light sandy ground, and plenty of water. The leaf of the healthy *vâḷei* is of the deepest green, and its great size and breadth are well known. The plant absorbs an immense amount of dew in the hot season. Hindus frequently use the broad leaves as plates for their rice; indeed, Brahmans prefer these to dishes of metal or earthenware. The flower of the plantain is the emblem of fruitfulness. It is this which we see on so many Indian shawls, and which is called incorrectly the "pine" in shawl-patterns. There is hardly a plant in the world which, for its size, absorbs so much moisture. The rock-plantain is not edible. It is called "*kal-vâḷei*," but the deer of Indian forests are partial to its tender shoots. The plantain is unquestionably indigenous to India. None has doubted this, though some have refused to believe that such is the case with the palm itself. R. C. CALDWELL.

Valence' [anc. *Valentia*], town of France, capital of the department of Drôme, on the left bank of the Rhone, 57 miles S. of Lyons, is surrounded with walls, which, however, have no military value. It is an old town, with narrow, crooked streets, but not decaying or unattractive. Its manufactures of silks, cotton goods, glassware, leather, gloves, etc., are flourishing, and its trade in wine, timber, and its own manufactures is brisk. Its cathedral, founded in 212, contains the monument, by Canova, of Pius VI., who d. here, and it has a school of artillery and engineering. P. 20,668.

Valen'cia, a small island on the south-western coast of Ireland, belonging to the county of Kerry, is noted as the station of the two American cables. It is 5 miles long, 2 miles broad, and has a pop. of 2500.

Valencia, one of the old provinces of Spain, bordering on the Mediterranean and situated between Catalonia in the N. and Murcia in the S., is now divided into the three provinces of Valencia, Alicante, and Castellon de la Plana. From the eighth to the thirteenth century it was possessed by the Moors, and from the eleventh century to 1238 it formed an independent Moorish kingdom. It was at that time, as it still is, the best cultivated and most productive part of Spain. Nowhere in Europe are manuring and irrigation carried to such perfection as on the terraces of Valencia, where in many places the soil yields from three to five harvests annually. Besides the common Spanish products, rice is grown here in sufficient quantity to supply all Spain; also sugar is cultivated.

Valencia, town of Spain, capital of the province of Valencia, on the Turia, near its mouth in the Mediterranean, is surrounded by old picturesque walls, within which its narrow, tortuous streets wind along in endless confusion. But the houses are neat and substantially built; the squares, though small, are elegant; the streets, though crooked and narrow, are clean, well paved, and well lighted, and the whole city is a pleasant and enterprising place, the centre of an exceedingly fertile district and the seat of extensive trade and manufactures. Its cathedral is a vast edifice containing many excellent pictures. Its university is a well-endowed and well-attended institution, and has a good library. Its manufactures of silk, tobacco, sackcloth, and tiles are celebrated, and its export trade in corn, rice, oil, wine, almonds, figs, and oranges is very considerable. The town proper has 87,073 inhabitants; with the suburbs and huerta, 115,512.

Valencia, town of South America, in Venezuela, is at an elevation of 1475 feet above the sea, and enjoys a healthy and agreeable climate. It is well built, and carries on a considerable trade between Puerto Cabello and the interior. P. about 15,000.

Valencia, county of Central New Mexico, separated into two parts by the southerly projection of San Miguel co., the E. part bordering upon Texas, and intersected by the Rio Pecos, the W. part bordering upon Arizona, crossed by several mountain-chains, intersected by the Rio Grande, and drained by streams, some of which finally find their way into the Gulf of California, others into the Gulf of Mexico. Sheep are very numerous, forming the principal part of the live-stock, though there are considerable numbers of cattle. Staples, wool, Indian corn, and a little tobacco. Cap. Belen. Area, about 10,500 sq. m. P. 9093.

Valencia, DUKE OF. See NARVAEZ (RAMON MARIA).

Valenciennes', town of France, department of Nord, on the Scheldt, is fortified and defended by a citadel situated on an island in the river, and contains an arsenal, barracks, hospitals, and magazines. It carries on a brisk trade in timber, coal, agricultural produce, and its own manufactures, which are varied and extensive. Sugar-refineries, saltworks, dye-houses, bleaching establishments, and spinning and weaving factories are in operation. Its laces and fine woven fabrics are celebrated. P. 24,344.

Valenciennes (ACHILLE), b. at Paris Aug. 9, 1794; studied natural science; became professor of anatomy at the normal school in 1830; was the collaborator of Cuvier in his ichthyological studies; succeeded Geoffroy Saint-Hilaire in the Academy of Sciences. D. at Paris Apr. 14, 1865. Besides a number of monographs and minor essays in various scientific journals, he wrote *Histoire naturelle des Poissons* (11 vols., 1829–49) and *Histoire naturelle des Mollusques, des Annélides et des Zoophytes* (1833).

Va'lens, Roman emperor of the East (364–378), b. in 328, brother to Valentinian I., who shortly after his election as emperor by the officers of the army of Jovian at Nicæa, Feb. 26, 364, declared his brother Augustus or emperor of the East, in the Hebdomon, near Constantinople, Mar. 28. In 367, Valens received baptism from Eudoxus, patriarch of Constantinople and the chief leader of the Arian party; and intrigues and persecutions between the Catholics and the Arians form one of the most prominent features of his reign. Of still more importance, however, was his relation to the Goths settled in Dacia to the N. of the Danube. In 365, while Valens was at Cæsarea, a rebellion broke out in Constantinople, and Procopius was declared emperor; 3000 Goths were taken into the service of Procopius, and when he died and the insurrection was suppressed, this body of men was captured, scattered over the empire, and settled at various points under military surveillance. Athanaric, king of the Goths, demanded the surrender of these men; Valens refused, and war began. But the Romans crossed the Danube several times, and defeated Athanaric, who sued for peace. During the protracted and desultory war with Persia which now ensued the Huns appeared in Europe on the northern shores of the Black Sea. They fell upon the Goths, and drove them before them to the S. In 377 large swarms of Goths gathered on the banks of the Danube and asked permission to enter the Roman territory. They were received, and

spread over the whole of Thrace and Macedonia. But the mismanagement, frauds, and superstition of the imperial officials soon occasioned collisions between the Romans and the Goths, and the collisions rapidly developed into open war. The Romans were defeated, and large tracts of the country were devastated by the Goths. In this emergency Valens returned from Antioch, and at the head of a large army met the Goths outside of Adrianople. A severe contest took place Aug. 9, 378, and the Romans sustained a defeat unparalleled in the annals of the Empire since the battle of Cannæ. Valens was never seen or heard of afterward.

Valentin' (GABRIEL GUSTAV), b. at Breslau, Prussian Silesia, July 8, 1810, of Jewish parentage; studied medicine at the university of his native city, and practised for some time there as a physician, but received in 1836 a chair as professor of physiology at the University of Berne. His principal works are—*Handbuch der Entwickelungsgeschichte* (1835), *Lehrbuch der Physiologie des Menschen* (2 vols., 1845), *Grundriss der Physiologie des Menschen* (1846), often reprinted, besides a number of monographs and minor essays—*Die Einflüsse der Vaguslähmung auf die Lungen- und Hautausdünstung* (1857), *Versuch einer physiologischen Pathologie der Nerven* (1864), *Versuch einer physiologischen Pathologie des Blutes und der übrigen Körpersäfte* (1866), *Die physikalische Untersuchung der Gewebe* (1867), etc.

Val'entine (DAVID THOMAS), b. at East Chester, N. Y., Sept. 15, 1801; received an academical education, and in 1821 became clerk of the marine court in New York. In 1837 he was appointed clerk of the common council of New York, a position to which he was reappointed by every successive administration until his death. For a quarter of a century he prepared annually a *Manual of the Common Council*, the successive volumes of which embody a vast amount of curious and valuable information. He also published a *History of New York* (2 vols., 1853–56). D. in New York Feb. 25, 1869.

Valentine (MILTON), D. D., b. near Uniontown, Md., Jan. 1, 1825; graduated at Pennsylvania College, Gettysburg, 1850, and at the theological seminary at Gettysburg 1852; was ordained to the ministry of the Lutheran Church Oct. 4, 1852; preached at Winchester, Va., 1853–54, and at Greensburg and Adamsburg, Pa., 1854–55; was principal of Emmaus Institute, Middletown, Pa., 1855–59; pastor of St. Matthew's church, Reading, Pa., 1859–66; became professor of ecclesiastical history and church polity at Gettysburg Seminary 1866, and has been president of Pennsylvania College, Gettysburg, since May 15, 1868. Author of *The Relation of the Family to the Church* (1859), *Justification by Faith, The Dynamics of Success, Knowledge by Service, Truth's Testimony to its Servants*, and various other published discourses; has been a frequent contributor to the *Quarterly Review* of the Evangelical Lutheran Church, and was one of its editors 1871–76.

Valentine, Saint. See VALENTINE'S DAY, SAINT.

Valentine's Day, Saint, the 14th day of February, observed in commemoration of St. Valentinus, a bishop or presbyter who was decapitated in 270 A. D., during the Claudian persecution at Rome. The custom of sending valentines (sentimental or comic love-messages, often in rhyme, and adorned with ornamental or grotesque devices) is a very ancient one. Some tell us that on this day the birds select their mates; others trace the custom to the Roman Lupercalia (Feb. 15), when similar practices were observed. Traces of the custom have been detected among the observances of the Northern pagans of ancient Europe. Hence it is probable the tradition that ascribes its origin to a commemoration of the loving and charitable disposition of St. Valentine is a comparatively late invention.

Valentin'ian, the name of three Roman emperors. VALENTINIAN I. (364–375), b. in 321 at Cibalis in Pannonia, a son of Count Gratian, and educated in the army; under Julian was a tribune of the guard, but was dismissed and exiled because, being a Christian, he refused to sacrifice to the heathen deities; reinstated by Jovian, he was raised to the throne on the sudden death of the emperor by the officers of the army, at Nicæa Feb. 16, 364, and on Mar. 28 made his brother, Valens, emperor of the East, and proceeded himself to Italy. He was a man of military talent and a laborious and prudent administrator. He had natural eloquence, but no literary accomplishments. In his personal habits he was chaste and frugal, but had a violent temper, and was often cruel; one of his secretaries, who had defrauded a widow, he ordered seized in the circus and burnt alive in the arena. In spite of his passionate and impulsive temper, he was, nevertheless, tolerant, and even forbearing. He placed the cross and the name of Jesus Christ on the Roman standards, and forbade all judicial proceedings on Sundays, but he persecuted neither the Arians nor the pagans, and promulgated several constitutions to check the greediness of the Catholic clergy. During his reign Theodosius once more extended the Roman dominion in Britannia to the wall of the Antonines in 367, and put down the rebellion of Firmus in Africa in 370, while the emperor himself fought successfully against the Germanic tribes along the Rhine and the Danube. Treves was his favorite residence, but he died at Bregetio, near Presburg, Nov. 17, 375, while addressing with great vehemence an embassy from the Quadi. He was succeeded by his oldest son, Gratian, who, however, was compelled by the army at Bregetio to take his younger half-brother, VALENTINIAN II., as co-emperor (375–392). Valentinian, who at that time was only four years old, remained at Milan under the tutelage of his mother, Justina, while Gratian carried on the government. After the death of Gratian in 383, Justina attempted to grasp the reins, but Maximus usurped the throne of Gratian in Gaul, Spain, and Britain, and in 387 he even crossed the Alps and marched against Milan. Valentinian and his mother fled to Thessalonica, but by the aid of the Byzantine emperor, Theodosius I., Maximus was finally overthrown and Valentinian reinstated. It was now Theodosius who actually ruled both in the Western and Eastern empires, and the first attempt the young emperor made to vindicate himself cost him his life. He was at Vienna in Gaul, and here he tried to dismiss Arbogast, a Frank, a captain in the Roman army, a rude and violent man, who held Valentinian in a sort of subjection; but Arbogast simply laughed at the emperor, and had him strangled the next day, May 15, 392.—VALENTINIAN III. (425–455), a son of Constantius and Placidia, the sister of Honorius, was only six years old when his uncle, Theodosius II., emperor of the East, established him as emperor of the West. His mother, who governed in his name, was entirely under the control of the clergy, and the empire suffered severely from the rivalry between Bonifacius and Aëtius. In spite of the great military ability of the latter, who defeated Attila at Châlons-sur-Marne in 451, the West Roman empire now began to crumble. Most of Africa fell into the hands of the Vandals; Britain was entirely given up; Merida in Spain was taken by the Suevi, and along the Rhine and the Danube one strong outpost after the other was lost. In 450, Placidia died, and in 454 the emperor killed Aëtius with his own hand, jealous of his merits and afraid of his power. In the following year, however, Valentinian himself was murdered by Petronius Maximus on the field of Mars, in the midst of a great crowd which looked on with indifference.

Valentin'ians, a Gnostic sect founded by Valentinus, who descended from Egypt, lived in Alexandria and Cyprus, and taught in Rome from 140 to 160. Of all the Gnostic systems, that of Valentinus was the most elaborate and the most interesting, and it was still further developed by his pupils, among whom were Ptolemæus, Secundus, Heracleon, Axionicus, and others. In this system the great mythological apparatus which the Gnostics employed is spiritualized, and transformed into speculative elements, personifications of ideas, etc.; and with this character of the system it was natural that the Valentinians should enter into a much closer connection with the pagan religions than any of the other Gnostic sects, as they considered paganism not as an aberration of the human mind, but as a divinely-ordained preparative to Christianity. The principal source of knowledge of this sect is Irenæus, *Adversus Hæreses*.

Valentinois, DUCHESS OF. See DIANE DE POITIERS.

Va'lenza [*Forum Fulvii Valentinum*], town of Northern Italy, province of Alessandria, pleasantly situated on an elevated plain on the right bank of the Po, N. of the city of Alessandria, was formerly a place of great strength, but its walls and fortifications were destroyed in 1805 by order of Bonaparte. It now contains 10 churches and other noticeable public and private buildings. The inhabitants are not deficient in agricultural and manufacturing industry, and popular education receives considerable attention. Valenza was a town of some importance under the Romans, and the sieges and other vicissitudes sustained by it during the Middle Ages form an interesting chapter in Italian history. P. 9630.

Vale'ria Gens, one of the oldest and most prominent patrician families of ancient Rome, was of Sabine extraction, and is said to have settled at Rome with Titus Tatius. It afterward spread into many branches—the Maximi, Volusi, Poplicolæ Potiti, Corvi or Corvini, Flacci, Messallæ, etc.; also into the *plebs*. It was still powerful and flourishing in the last days of the Empire. All through the history of Rome it occupied a conspicuous position, and its members, although belonging to the highest aristocracy, generally pursued a democratic policy. Several of the em-

perors bore its name—Maximinus, Maximianus, Maxentius, Diocletian, Constantius, and Constantine the Great. But it produced only one man who attained a truly national fame—MARCUS VALERIUS CORVUS, and his exploits have a somewhat mythical aspect. He received his surname, *Corvus*, a "raven," from his success in a combat with a giant Gaul, whom he slew by the aid of a raven which alighted on his helmet at the beginning of the fight, and flew in his adversary's face. He was afterward twice dictator and six times consul, and distinguished himself greatly in the wars with the Samnites, Marsi, and Etruscans in the fourth century B. C. The so-called *Lex Valeria de Provocatione*, which gave every citizen a right to appeal in all non-military cases from the verdict of the magistrates to the assembly of the people, was established in the first year of the Republic by Publius Valerius, who therefrom received the surname *Poplicola*, and it was renewed in 449 B. C. by Lucius Valerius Poplicola Potitus.

Vale'rian, a genus of plants of the natural order Valerianaceæ. The most important species is *V. officinalis*, the root of which is used in medicine. This plant, called also the "great wild valerian," is a native of Europe, but is cultivated also in this country, in Vermont, New Hampshire, and New York. It is an herbaceous perennial plant, the stem being erect and round, rising from two to four feet, and bearing small white flowers in terminal panicles. The fruit is a capsule containing a single oblong seed. The root consists of an upright root-stock about as thick as the little finger, from which spring numerous slender cylindrical rootlets about three or four inches in length. This root, though nearly odorless when fresh, develops a strong and peculiar smell upon drying. The taste is somewhat bitter, acrid, and disagreeable. The important ingredient of the drug is a pale greenish volatile oil (oil of valerian), which is present in the proportion of from 1½ to 2 per cent. This oil, when fresh, has but little smell, but on exposure it slowly acidifies, becomes yellow and thick, and acquires a strong valerian smell. There is thus developed a peculiar acid (valerianic acid), which when isolated is a colorless limpid fluid of strong smell and acrid taste. With salifiable bases this acid forms soluble salts, retaining to a certain degree the odor of the acid. The active principle of valerian root is the volatile oil. This, in experiments upon animals, is found to greatly deaden the reflex excitability of the spinal cord, thus antagonizing the operation of strychnine. Upon man, preparations of valerian sometimes reduce undue nervous irritability, and are therefore resorted to in affections characterized by this condition, such as hysteria, chorea, and milder forms of so-called "nervousness." The most elegant preparation is the ammoniated tincture, but the oil itself may also be used. The valerianates of ammonium, quinine, and zinc are officinal medicines, but their effect is inferior to that of the oil or preparations of the root. A curious property of valerian is the attraction of its smell for cats. These animals seem to snuff the plant from a long distance, and are said to be excited to a kind of frenzy by it, during which they display strong sexual excitement. EDWARD CURTIS.

Vale'rian, Roman emperor (253–260), descended from a noble Roman family; enjoyed great reputation both for ability and integrity; held the highest offices under Decius, and by the general consent of the army, the senate, and the people was elected emperor after the assassination of Æmilianus. The empire was in a dangerous state. The Franks had invaded Gaul and Spain. The Alemanni had crossed the Danube, and descended even into Italy. The Goths devastated Mœsia, and penetrated into Thrace and Macedonia, and in the East the Persians under King Sapor had conquered Mesopotamia and Syria. Valerian, who was over sixty years old, took his eldest son, Gallienus, as co-emperor, and sent him to Gaul, while he himself hastened to Syria. In the beginning he was successful, but at Edessa (in 260) he was completely defeated by Sapor, and taken prisoner. Gallienus did nothing to effect the liberation of his father, and the emperor died several years afterward in Persian captivity. After his death, his body was flayed and his skin stuffed, and this trophy was always exhibited when a Roman ambassador visited the Persian court.

Valerianos (APOSTOLOS). See FUCA, DE (JUAN).

Vale'ric (or **Valerianic**) **Acid** [*Delphinic Acid, Phocenic Acid, Butylcarbonic Acid*; Ger. *Baldriansäure*], ($C_5H_{10}O_2$), was first obtained in 1817 by Chevreul from the fat of a dolphin, *Delphinum phocæna*, and by Grote in 1830 from the essential oil of VALERIAN (which see). In the vegetable kingdom it occurs in the berries of *Viburnum opulus*, in the angelica-root, in the root of *Athamanta oreoselinum*, and in the bark of the elder tree; in the animal kingdom it is found in numerous animal oils and in the products of the oxidation of oleic acid and other fats. It is likewise contained in decayed cheese. The acid can be obtained by passing the vapor of fusel oil through a tube filled with a mixture of lime and soda, and heated to 400° F., and decomposing the sodic valerate produced by distillation with sulphuric acid; but the best method for its preparation consists in the oxidation of fusel oil, which is accomplished by gradually adding a mixture of the alcohol and concentrated sulphuric acid to a solution of potassic dichromate, and heating the liquid in a flask provided with an inverted condenser, after which the liquid is distilled, and the distillate neutralized with sodic carbonate. The amylic valerate contained in the distillate is next removed by distillation, and the residue of sodic valerate is dissolved in water and distilled with sulphuric acid, when a fluid passes over consisting of an aqueous solution of valeric acid mixed with a hydrated acid containing 1 equivalent of water, from which it can be separated by redistillation. Valeric acid forms a limpid, colorless oil, possessing a sour, burning taste and a powerful odor, resembling that of valerian-root, also like that of rancid cheese and butyric acid. It has a sp. gr. of 0.955 at 32° F. (*Kopp*), remains liquid at 6° F., and boils at 317° F., the density of its vapor being 3.66. If the active modification of amylic alcohol is used for its preparation, the resulting acid exerts a rotatory power on polarized light. Valeric acid is sparingly soluble in water, but dissolves in all proportions in alcohol and in ether; also in concentrated acetic acid. It unites with water, forming a definite hydrate, $C_5H_{10}O_2.H_2O$, which is also produced upon decomposing a valerate with strong sulphuric acid. This hydrate is also oily, but it possesses a lower boiling point than the anhydrous acid. *Valeric anhydride* ($(C_5H_9O)_2O$) is obtained by treating dry potassic valerate with oxychloride of phosphorus ($POCl_3$). It forms a mobile oil, is not miscible with water, and possesses a pleasant odor of apples. When a mixture of calcic formate and valerate is submitted to dry distillation, *valeral* or *valeraldehyde* (C_5H_8O) is formed, this compound being also produced by the partial oxidation of amylic alcohol. Valeric acid is related to amylic alcohol in the same way as acetic acid is to ethylic or common alcohol, valeral being the compound corresponding to ordinary aldehyde. It is a monobasic acid, and forms neutral (also a few acid and basic) salts, which are obtained by direct saturation. The valerates are odorless when dry, but if moistened or treated with dilute sulphuric acid, they emit the characteristic and unpleasant odor of valeric acid; with the exception of argentic and mercuric valerates, they are soluble in water.

Valeric acid is separated from butyric acid by *fractional saturation—i. e.* half saturating the mixture of the two acids with soda, and distilling, only sodic valerate being at first formed. Besides the form of valeric acid just described, two other modifications have been obtained—one by the oxidation of normal amylic alcohol, the other from tertiary butylic alcohol. The zincic valerate has received some application in medicine as a remedy in nervous affections. J. P. BATTERSHALL.

Valerius Flaccus (CAIUS). See FLACCUS (CAIUS VALERIUS).

Vale'rius Max'imus, the name of a compiler of a large collection of historical anecdotes, *De Factis Dictisque Memorabilibus Libri IX.*, which is still extant. During the Middle Ages the book, which is not without value to the student of history and antiquities, was much read and highly esteemed; there were fourteen distinct editions of it before 1490. Critical editions have been given by Hase (Paris, 1822), Kempf (Berlin, 1854), and Halm (Leipsic, 1865). There is an English translation by W. Speed (London, 1678).

Valet'ta, capital of the island of Malta, on a rocky promontory of the north-eastern coast which forms two large, deep, and safe harbors. These harbors, as the whole city, are strongly fortified by lines of works, mostly hewn into the rock, and defended by forts, of which St. Elmo, on the extremity of the promontory, is the most important and deemed impregnable. On account of its harbors and fortifications, Valetta has been made the station of the English fleet in the Mediterranean, and it is regularly visited by all steamers crossing this sea. Thus, it became a point of great military and commercial importance, and although it has no manufactures and no natural resources, it is still increasing. It was founded in 1566 by the grand-master Valette, and contains in the cathedral and palace many interesting monuments from the times of the Knights of St. John. Together with its four suburbs, it has about 90,000 inhabitants.

Valette', de la (JEAN PARISOT), b. in 1494 at Toulouse, France; entered very early the order of St. John, and distinguished himself so much that in 1557 he was chosen grand-master of the order. In this position he fought the Turks with great effect, and finally roused the

wrath of the sultan Solyman to such a pitch that he determined to annihilate the order. Accordingly, a magnificent Turkish armament, consisting of 180 vessels of war and 30,000 select troops, Janizaries and Spahis, appeared off the coast of Malta before the fortifications of Valetta on May 18, 1565, and a most memorable siege began. La Vallette had between 8000 and 9000 men, but of these only 700 were knights; the rest were militia, the inhabitants of the island. With this force he resisted the furious attacks of the Turks for several months. On Sept. 8 the number of his men had dwindled down to 600, but on this day the viceroy of Naples arrived with reinforcements. The Turks embarked; once more, however, they returned, but were completely routed and driven off in wild disorder. The result of this event was a most severe check to the Turkish progress. La Valette died three years afterward in Valetta, Aug. 21, 1568.

Valguarne'ra Carope'pe, town of Sicily, province of Caltanisetta, delightfully situated in the Val di Noti, about 8 miles from Piazza Armerina. Behind it rise, amphitheatre-like, some of the loftiest peaks of the island, and the outlook upon the sea, between two promontories, is very lovely. The whole neighborhood offers views of rare grandeur and beauty. The principal products are grain and vines. P. 9524.

Valhalla, or **Walhalla.** See SCANDINAVIAN MYTHOLOGY and WALHALLA.

Valhermo'sa, p.-v. and tp., Morgan co., Ala. P. 1037.

Va'li, in Scandinavian mythology, a son of Odin and brother to Vidar, was destined in the popular faith to reappear in the new heavens which the All-Father should create after the fall of Walhalla, but remained in other respects a vague name, and received no distinct form in the popular imagination.

Val'la (LAURENTIUS), b. at Rome about 1410; was ordained priest in 1431; taught rhetoric and philosophy at Pavia and Milan, but had bitter controversies with the scholastic philosophers of the Aristotelian school; went to Naples, where he was treated with great kindness by King Alfonso V.; returned to Rome in 1443, but provoked the wrath of Pope Eugenius IV. by his *De Falso Credita et Ementita Constantini Donatione Declamatio;* fled to Naples, where he established a school, but fell out with the priests; was accused of heresy, and saved from death in the dungeons of the Inquisition only by the exertions of the king, who, however, could not prevent his being publicly whipped by the monks; was reconciled to Pope Nicholas V., who restored him as canon of St. John Lateran, and d. in Rome about 1460. He was one of the earliest and most ardent revivers of classical studies. His translations into Latin of Herodotus and Thucydides were eagerly read, and his *Elegantiæ Sermonis Latini* was for centuries the norm and rule for writing the Latin language. His collected works were published at Bâle in 1543. Erasmus published an edition of his *Annotationes* to the New Testament, which were considered heretical, and Ulrich von Hutten published his above-mentioned work on the donation of Constantine, and dedicated it to the pope. (See Vahlen, *Lorenzo Valla*, 1864.)

Valladolid, the former name of COMAYAGUA (which see), Honduras.

Valladolid', town of Spain, capital of the province of the same name, on the Pisuerga, communicates by the Duero and a vast system of canals with the Atlantic and the interior. It was formerly the capital of the Spanish empire, and adorned by Charles V. and Philip II. with many magnificent buildings. But after the removal of the royal residence to Madrid at the close of the sixteenth century, it fell into decay, and many of its buildings were much damaged by the French soldiery under the occupation in 1810. Of late, however, it has given signs of revival. Its manufactures of silk, yarn, perfumery, earthenware, paper, and leather have been enlarged and its trade has increased. Its university was founded in 1346, and was in 1841 attended by 1300 students. It is celebrated as a school of jurisprudence. P. about 50,000.

Valladolid, the former name of MORELIA (which see), Mexico.

Valladolid, town of the Mexican confederation, state of Yucatan, is in a healthy and fertile district, very rich in cotton, and is laid out and built in a grand style, though now it looks a little decayed. In the vicinity are many interesting remains of Indian edifices, and even ruins of whole cities. P. 10,000.

Vallancey' (CHARLES), LL.D., originally VALLENCE, b. in England in 1721; entered the army, in which he ultimately became a general of engineers; was quartered several years at Gibraltar, where he aided in strengthening the celebrated fortifications; resided for most of his life on engineer duty in Ireland, of which country he made an elaborate survey, and devoted himself to Irish antiquities and the Irish language. D. at Dublin in Aug., 1812. Author of two treatises on military engineering, *Collectanea de Rebus Hibernicis* (6 vols., 1770–1804), *An Essay on the Antiquity of the Irish Language, etc.* (1772), *A Grammar of the Iberno-Celtic or Irish Language, with an Essay on the Celtic Language* (1773), *An Essay towards illustrating the Ancient History of the Britannic Isles* (1786), *The Ancient History of Ireland proved from the Sanscrit Books of the Bramins of India* (1797), and issued a *Prospectus of a Dictionary of the Language of the Aire Coti, or Ancient Irish, compared with the Language of the Cuti or Ancient Persians, with the Hindostance, the Arabic, and Chaldean Languages* (1802), a work which was never completed. Gen. Vallancey was one of the most obstinate of the numerous school of etymological antiquarians who founded theories of vast scope upon the resemblances of words.

Vallan'digham (CLEMENT L.), b. at New Lisbon, O., in 1822; studied law, and was admitted to the bar in 1842, was member of the Ohio legislature 1845–46; edited the Dayton *Empire* 1847–49, after which he devoted himself especially to politics. He was elected a representative in Congress in 1857, and re-elected for two subsequent terms. He was especially active in opposing the measures of the national government in carrying on the civil war. Failing of re-election in 1863, he returned to Ohio, where at public gatherings he assailed the government with great vehemence; was arrested by order of Gen. Burnside, who commanded in the department of the Ohio; tried by court-martial and sentenced to close confinement during the war —a sentence which President Lincoln commuted to banishment beyond the lines. Dissatisfied with his reception by the Confederates, he made his way to Canada, and while there was nominated by the Democratic party as governor of Ohio, but was defeated by more than 100,000 votes. He soon returned to Ohio, was not molested, and in 1864 was an active member of the national Democratic convention at Chicago. D. at Lebanon, O., by the accidental discharge of a pistol in his own hands, June 17, 1871.

Vallan'ri (TOMMASO), b. at Chiusa of Cuneo about 1805; took his degree in the University of Turin, and after the death of Carlo Boucheron was called to succeed him in the chair of Latin rhetoric, which he occupied with distinction till 1843; he wrote and spoke the Latin language with remarkable elegance. Among his works the following deserve to be mentioned: *Storia della Poesia in Piemonte* (1841), *Storia delle Università in Piemonte* (1846), *Historia Critica Literarum Latinarum*, besides his many inaugural orations. He was elected deputy to the Subalpine Parliament by the extreme Right or clerical party.

Valle, tp., Jefferson co., Mo. P. 2816.

Valledol'mo, town of Sicily, province of Palermo, pleasantly situated in a fertile valley of the Nettunei chain, but not in a thriving condition, from lack of roads. P. 7000.

Valle'jo, city and seaport of Solano co., Cal., on California Pacific R. R. and on an arm of San Pablo Bay, in lat. 38° 6′, lon. 122° 15′, has a spacious harbor, 6 churches, excellent schools, water and gas works, 2 daily and 1 weekly newspaper, 2 banks, an orphan asylum, 1 street railway, several flouring-mills, shipyards, iron-foundries and machine-shops, and broom manufactories. Large quantities of grain are shipped from this point. P. 6391.

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Vallejo, tp., Sonoma co., Cal. P. 1114.

Vallelun'ga Pratamen'to, town of Sicily, province of Caltanisetta, on the central high-road of the island, about 30 miles N. W. of the town of Caltanisetta. The pasturage of the district is good, and wine and oil are exported. P. 5200.

Valley. See EARTH, by PROF. GUYOT, PH. D., LL.D.

Val'ley, county of Central Nebraska, intersected by Loup Fork; surface rolling, soil fertile, consisting mainly of prairie-land. Newly formed and not organized. Cap. Ord. Area, 576 sq. m.

Valley, tp., Madison co., Ark. P. 743.

Valley, tp., Van Buren co., Ark. P. 224.

Valley, tp., Stark co., Ill. P. 1061.

Valley, tp., Page co., In. P. 636.

Valley, tp., Polk co., In. P. 715.

Valley, tp., Linn co., Kan. P. 1096.

Valley, tp., Nemaha co., Kan. P. 777.

Valley, tp., Guernsey co., O. P. 834.

Valley, tp., Scioto co., O. P. 724.

Valley, tp., Armstrong co., Pa. P. 1821.

Valley, tp., Chester co., Pa. P. 1165.

Valley, tp., Montour co., Pa. P. 1061.

Valley, tp., Preston co., West Va. P. 1131.

Valley Brook, p.-v. and tp., Osage co., Kan. P. 1539.

Valley Falls, p.-v., Pittstown tp., Rensselaer co., N. Y. P. 600.

Valley Falls, p.-v., Providence co., R. I.

Val'leyfield, p. v., Beauharnois co., Quebec, Canada, on the S. shore of the St. Lawrence, 42 miles above Montreal, near the Beauharnois Canal, has a splendid water-power, large paper-mills, and manufactories of woollens, pumps, lumber, etc., and a good trade. P. about 2000.

Valley Forge, tp., Montgomery co., Pa. P. 119.

Valley Town, p.-v. and tp., Cherokee co., N. C. P. 1030.

Vallière, La. See LA VALLIÈRE.

Vallisne'ri, or **Vallisnie'ri** (ANTONIO), b. at Tresilico, near Modena, Italy, May 3, 1661; studied medicine at Bologna, and began in 1688 to practise as a physician at Reggio, but was in 1700 appointed professor of medicine at Padua, where he d. Jan. 18, 1730. He was a zealous defender of the principle *omne vivum ex ovo*, and his complete works, published in 1733 in 3 vols. fol. at Venice, contain several original investigations and experiments relating to the subject.

Vallisne'ria [named in honor of *Antonio Vallisneri*, an Italian botanist (1661–1730)], a genus of plants of the order Hydrocharidaceæ. *V. spiralis*, a plant common in slow waters in the U. S. and in the S. of Europe, is remarkable for its curious process of fecundation. The fertile or pistillate plants put up long, spirally-twisted flower-stalks, which allow the flowers to float upon the surface. But the male flowers are held to the bottom by their short stems. Accordingly, when the proper time for fertilization comes, the sterile or staminate flowers break their stems, rise, float upon the surface, and shed their pollen around the fertile flowers. The spiral stems of the latter (which are from one to four feet long) now contract and draw the fertilized germ under water, where it is perfected. Upon its roots the canvas-back duck feeds. Other species are found in Australia, etc.

Val'lo della Lucu'nia, town of Southern Italy, province of Salerno, pleasantly situated on a hill 56 miles from the city of Salerno, is, in general, a well-built town, and the municipal palace and the Dominican convent, now public property, are worthy of notice. It is also a place of some industry and traffic. Vallo della Lucania occupies the site of an old Samnite city. P. 5050.

Vallombro'sa ("shady valley"), a former Benedictine monastery in a valley of the Apennines, 18 miles from Florence. It was founded by St. John Gualbert in 1039. The present noble buildings were erected in 1638. This ancient and celebrated establishment acquired great wealth, but in 1869 it was suppressed by the Italian government, which converted the buildings into a royal school of forestry (*instituto forestale*).

Vallo'nia, b., Crawford co., Pa. P. 462.

Valls, town of Spain, province of Tarragona, on the Francoli, manufactures soap, leather, paper, brandy, and yarn. P. 12,655.

Valmore' (MARCELINE FELICITÉ JOSÉPHE DESBORDES), b. at Douai, department of Nord, France, in 1787; was educated in Guadaloupe; made her début on the stage as a singer after her return to France; married the tragedian Valmore in 1817; left the stage subsequently, and devoted herself to literature. D. at Paris July 7, 1859. She published several volumes of poems—*Elegies et Romances* (1818), *Elegies* (1824), *Pleurs* (1833), *Pauvres Fleurs* (1839); also several novels—*L'Atelier d'un Peintre* (2 vols., 1833), *Le Salon de Lady Betty* (2 vols., 1836). (See Sainte-Beuve, *Madame Desbordes-Valmore* (1870; translated into English by Harriet W. Preston, Boston, 1872).)

Valmy', village of France, department of Marne, is famous as the place where in 1792 the republican armies of France, under Kellerman, won the first skirmish against the allied armies under the duke of Brunswick.

Valmy, DUKE OF. See KELLERMANN.

Valognes', town of France, department of Manche, on the Morderet, manufactures lace and trades in butter, honey, wax, poultry, and eggs. P. 5812.

Valois', a part of the former province of France, Ile de France, corresponding nearly to the present department of Oise, formed under the Capet dynasty a countship in the possession of the house of Vermandois, but was incorporated with the French crown by Philip II. Augustus on the extinction of this family in 1215. In 1285, Philip III. gave the county of Valois to his younger son, Charles (b. 1270, d. 1325), and when the direct line of the Capet dynasty died out in 1328 with Charles IV., the eldest son of this Charles of Valois ascended the French throne under the name of Philip VI., and founded the dynasty of Valois, which ruled France to 1589. In direct succession from father to son the crown was borne by John the Good (1350–64), Charles V. (1364–80), Charles VI. (1380–1422), Charles VII. (1422–61), Louis XI. (1461–83), and Charles VIII. (1483–98). Charles VIII. having no male heirs, the crown fell to Louis XII. (1498–1515), the representative of the nearest collateral line, a grandson of Duke Louis of Orleans, the younger brother of Charles VI. As Louis XII. also died without male issue, the succession devolved once more upon a collateral line, and Francis I., a great grandson of Duke Louis of Orleans, through his younger son, Charles of Angoulême, ascended the throne (1515–47). He was succeeded by his son, Henry II. (1547–59), who was married to Catharine de' Medici, and he again by his three sons—Francis II. (1559–60), Charles IX. (1560–74), and Henry III. (1574–89), with whom all the male lines of the house of Valois died out, and the French crown fell to the house of Bourbon, descending from Robert, the younger brother of Philip III., and represented by Henry IV., king of Navarre. The most prominent events during the reign of the house of Valois were the succession wars with England, the wars of conquest in Italy, and finally the civil or religious wars. Philip VI. ascended the throne, according to Salic law, as the nearest male heir of the Capet family, but his right was disputed by the English king, Edward III., who claimed the French throne for himself as a son of Isabel, daughter of Philip IV., arguing that the Salic law, although it excluded females from the succession, did not prevent them from transmitting a legitimate claim to their male heirs. The wars lasted a whole century. Charles VII. finally succeeded in driving the English out of the country, but the English kings continued to bear the title of kings of France up to George III. The Italian wars began under Charles VIII. with his conquest of Naples in 1495. Charles of Valois, the founder of the family, was first married to Margaret of Anjou-Sicily, by whom he obtained the counties of Anjou and Maine, and some very slender claims on the kingdom of the Two Sicilies. As his second wife he married Catharine of Courtenay, by whom he obtained some still thinner claims on the Byzantine empire, and he actually assumed the title of emperor of Constantinople. On the basis of these claims, Charles VIII., two centuries later, invaded Naples, and meditated an attack upon the Turks from thence. It was the idea of a world-empire, the ghost of the Roman empire, which haunted him. The three last kings of the house of Valois, the sons of Catharine de' Medici, were ruined, bodily and mentally, by their mother, who hoped thus to secure the supreme power to herself. Henry III. was the greatest fool of whom there exists any record. But the civil and religious wars were not the work of the Valois; they originated in Rome and the Escurial. The Holy League, which under the leadership of the family of Guise began open war in 1588, was formed and fed by Philip II. (For further details see the biographical articles on the various kings.)

Valois, de (CHARLES). See ANGOULÊME, D', DUKE.

Valo'nia [It. *vallonia*], the acorn-cups of *Quercus Ægilops*, a large oak tree of the Levant. Valonia is of a light drab color, and is exceedingly rich in tannic acid. It is imported from Trieste, Greece, and Smyrna, and largely employed by tanners and dyers.

Valparai'so, town of Chili, South America, capital of a province of the same name, is in lat. 33° 1′ S., on a large bay of the Pacific, sheltered on all sides except the N. Although it has suffered several times severely from earthquakes, and still more from the bombardment of the Spaniards (in 1866), when property to the value of about $15,000,000 was wantonly destroyed, and although it is situated on a small strip of lowland surrounded by steep, barren mountains, where no tree, hardly any grass, will grow, still it is steadily increasing. It had 52,413 inhabitants in 1854, and at present it has about 110,000, of whom about 75,000 are natives, 15,000 Germans, 6500 British, 3750 French, 1500 Italians, etc. But its position as a commercial place is very favorable, being the only good harbor along the American coast of the South Pacific, and forming the only outlet from a vast territory of rich and productive land. It is connected with Santiago by a railway, and communicates with Hamburg by a German line of steamers—with Panama by an English and a Chilian. Gold, copper, lead, hides, and tallow are the principal articles of export. In 1873–74 its port was entered by 1585 vessels, of 973,090 tons burden, of which

611 were British, 276 Chilian, 161 Nicaraguan, 103 German, 101 French, 99 Guatemalan, 87 American, 46 Italian, etc. The educational and benevolent institutions of the city have increased with its commercial prosperity. There is an English, French, and U. S. hospital, attended by resident physicians. The most prominent public buildings are the government palace, the government warehouses, the custom-house, etc. Since 1866 a chain of forts has been constructed to protect the harbor.

Valparaiso, p.-v., cap. of Porter co., Ind., at the junction of Pittsburg Fort Wayne and Chicago and Chicago and Lake Huron R. Rs., 44 miles E. of Chicago, contains 8 churches, the Northern Indiana Normal School, 2 banks and a broker's office, 2 weekly newspapers, 1 large paper-mill, a pin manufactory, iron-foundry and machine-shops, and 3 hotels. Principal business, manufacturing and farming. P. 2765.

E. ZIMMERMAN, ED. "MESSENGER."

Val'py (ABRAHAM JOHN), son of Dr. Richard, b. at Reading, England, about 1787; educated under his father and at Pembroke College, Oxford; commenced business in London as a publisher and bookseller about 1808; was the publisher of several of the works of his uncle Edward and of his brother Frederick; originated the *Classical Journal* (1810), and the *Museum* (1822–25); brought out Barker's edition of Stephens's *Thesaurus* (8 vols., 1815–25); edited the Delphin and Variorum classics (141 vols., 1819–30), the *Family Classical Library, a Series of English Translations*, etc. (52 vols., 1830–34), a magnificently illustrated *Shakspeare* (15 vols., 1832–34), and successfully conducted many other literary enterprises of considerable magnitude. D. at London Nov. 19, 1854.

Valpy (EDWARD), D. D., brother of Dr. Richard, b. in the island of Jersey in 1764; educated at Trinity College, Cambridge: took orders in the Church of England; was for many years assistant to his brother in the classical department of Reading School; became head-master of the grammar school at Norwich 1810; held the rectory of Thwaite and the vicarage of St. Mary's, Walsham, Norfolk. Under his management Norwich School attained a high degree of prosperity. D. at Yarmouth Apr. 15, 1832. He published *Elegantiæ Latinæ* (1803) and editions of the Greek Testament (3 vols., 1816), the Septuagint (1819), and Homer's *Iliad* (1819).

Valpy (RICHARD), D. D., F. R. S., b. in the island of Jersey Dec. 7, 1754; educated at the college of Valognes, Normandy, 1764–69, and at the Southampton grammar school; obtained one of the scholarships founded at Pembroke College, Oxford, for natives of Jersey and Guernsey; graduated there about 1776; took orders in the Church of England; held for several years a living at Bury St. Edmund's; became rector of Stradishall, Suffolk, 1787; and from 1781 to 1830 was the highly-successful head-master of the celebrated school founded at Reading by Henry VII., and composed for that institution Latin and Greek grammars and a series of classical textbooks which enjoyed a wide reputation. D. at Kensington, Mar. 28, 1836.—He was succeeded in the head-mastership by his youngest son, REV. FREDERICK E. J. VALPY, b. about 1805, a graduate of Trinity College, Cambridge, and author of numerous classical textbooks, among which are an *Etymological Dictionary of the Latin Language* (1828), and *Etymology of Words of the Greek Language in Alphabetical Order* (1860).

Val'ue [Fr. *valeur*; Sp. *valor*, from Lat. *valere*, to "be strong," to "have influence," to "be worth"]. In ordinary usage, the word expresses that quality of a thing which makes it desirable. But the term is here introduced as a technical term of modern political economy, and so to be considered. It holds so important a place in that science that political economy has been called the "*science of values*." Ambiguity in the use of this term leads to much confusion of ideas on economical problems; hence the necessity of a strict definition, to be closely adhered to. Value is *purchasing power—i. e.* as applied to any object, *that which gives it power to command other objects in exchange*. It supposes always a comparison of two objects in view of an exchange actual or contemplated. Hence it is not, like weight, an absolute inherent quality of a substance. It cannot be discovered by examining an article by itself. Value is always a relative term, and the measure of it pertaining to anything can be expressed only by naming some other thing for which it can be exchanged—the *quid pro quo*. Thus, the value of a hat may be set down at four bushels of wheat or a quarter of an ounce of gold, because it will command so much of one or the other in exchange.

Value should be distinguished from *price*. Price is value with reference to a single article—viz. money. Value is the power to command commodities generally. Money is made the general standard of value, and so value may be indicated by a comparison of prices; but it is important to observe the distinction between the two terms. The value of a specific commodity may rise or fall. Thus, the hat, which brought four bushels of wheat last year, may bring but three this year. To discover which of the two has changed in value, the causes affecting one or the other must be inquired into. It may be that a failure of crops has enhanced the value of the wheat, or that some new invention, cheapening the process of manufacturing, has lessened the value of the hat. But there can be no general rise or fall of all values. There may be, however, a general rise or fall of prices in consequence of some cause, like an expansion or contraction of currency, which affects money, the one object with which all things are compared. (See MONEY.)

Value should also be distinguished from *utility*. Utility is simply adaptedness to satisfy a want or gratify a desire. Things that have value have always utility in the sense of capacity to gratify desire, without reference to the quality of the desire as right or wrong, wise or foolish. The power of a commodity in exchange is measured by its desirableness. But some things of the very highest utility have no value: as, for instance, air, sunlight, water. We cannot live without them, yet they have no value, no purchasing power, simply because the supply is so large and so free that whosoever will may take to his satisfaction without labor. They cost nothing, and they cannot ordinarily be appropriated in exclusive possession.

With these distinctions in mind it is plain that value may be resolved into two elements: (1) Utility—*i. e.* desirableness for gratification; (2) cost—*i. e.* difficulty of attainment, measured by the amount of labor necessary to secure the object. Recognizing the presence of these two elements, we have the limits of value defined. The *maximum limit* of value in any commodity is its utility; that is, its purchasing power is determined by the intensity of desire for its possession by the parties to the exchange. This will depend on a variety of circumstances, such as the taste of individuals, the fashion of the day, the emergency of the hour, and the like. The value may, and often does, fall short of this limit, but can never go beyond it. We seldom give for a loaf of bread an equivalent which expresses the measure of its utility to support life; and when a man is willing to give 10,000 bushels of wheat for a choice diamond, he expresses only the intensity of his desire for the glittering gem.

The minimum limit of value in any article, for any long time, is the cost—*i. e.* the exponent of the labor either actually expended in its production or which must be expended for its reproduction. When the market value of a commodity falls permanently below its cost, its production will be suspended. If, however, there is reason to believe that its value will rise again, it may be good economy to tide over the temporary depression by exchanging at a rate less than cost. In the last analysis, the comparison is of labor with labor, and it is true, as has been said, that "service for service, rather than commodity for commodity, is the rule of value and the law of exchange." Between these two limits there is room for a considerable variation, which is determined by the *law of supply and demand*. Concisely stated, the rule is, That value increases directly as the demand, and inversely as the supply. Monopolies artificially limit supply for the purpose of increasing value. Thus, it is said that the Dutch, who had a monopoly of the trade in pepper, once actually destroyed a part of an extraordinary crop rather than permit the market-price to be lowered. Reduced value extends demand, and enhanced value restricts demand, quite beyond the mere ratio of the change. A thousand people will use cotton cloth at 10 cents a yard, where a hundred would use it at 50 cents. When left free from artificial interference, demand and supply rush toward an equilibrium; and the condition of stable equilibrium is that things exchange for each other according to the cost of production, or, as some express it, according to their *natural value*. Formerly, a distinction was made between *exchangeable* value and *intrinsic* value. Strict adherence to our definition does away with that distinction, for it resolves real value always into power in exchange, and what was meant by intrinsic value is best expressed by the word *utility*.

The term *value* is applicable to services as well as to commodities; indeed, as we have seen, it always carries with it an idea of service or labor. But most commonly a contract for service is made with reference to some material objects to be produced which fitly represent the service. We must, however, recognize an exception in the case of certain immaterial products. An hour's service of song by a Nilsson or a Jenny Lind will command $1000—equal to more than a year's salary of many a hard-worked man—yet we have no tangible product to carry away from the

entertainment. Here the gratification is instantaneous, coincident with the service rendered, yet an object of intense desire with those who have a taste for music. Still, the standard of value is the cost, estimated not by the effort of the singer for the hour, but by the long labor of training which has perfected her wonderful capacity, and by the difficulty of finding another with equal power, natural and acquired, to impart the gratification. A. L. CHAPIN.

Valve [Lat. *valva*, "folding doors"], a cover to an aperture, so formed as to open communication in one direction and to close it in the other, by lifting, sliding, or turning. Among the varieties of valves employed in mechanics are the *slide* or *sluice valve*, where the orifice is opened by drawing up a plate; the *flap valve*, which opens and shuts like a door; the *pot-lid valve*, where the orifice is closed by shutting down upon it a disk of metal; the *ball valve*, where the orifice is closed by a ball; and the *throttle valve*, where a disk of metal turning on a spindle passing through its edge may be made to stand across a pipe, and so close the opening. (For descriptions of some valves see PUMP, PUMPING ENGINE, and STEAM-HAMMER. For safety-valve see STEAM-ENGINE. For the valves of the circulation, see HEART, HUMAN, and VEINS, ANATOMY OF.)

Valver'de del Cami'no, town of Spain, province of Huelva, situated among the spurs of the Sierra Moreon, is the centre of a rich mining district. P. 5460.

Vam'bery (ARMINIUS (HERMAN)), b. at Szerdahély in the Danubian island of Schütt, near Presburg, Hungary, in 1832, of Jewish parentage; studied languages at Presburg, Vienna, and Pesth; went to Constantinople, where he supported himself by teaching French; published in 1858 a Turkish-German pocket dictionary; undertook in 1862, with the support of the Academy of Pesth, an extensive journey of exploration through Persia into Turkestan; visited Khiva, Bokhara, and Samarcand, and was appointed professor of Oriental languages at the University of Pesth in 1865. He wrote *Cagataische Sprachstudien* (1867), *Uiguirische Sprachmonumente und das Kudatku-Bilik* (1870), *Magyartörök szohasonlatok* (1870), a comparison of Hungarian and Turkish words, besides a number of travelling sketches published simultaneously in German and English—*Travels in Central Asia* (1865), *Wanderings and Adventures in Persia* (1867), *Sketches of Central Asia* (1868), *History of Bokhara or Transoxiana* (1873), *Central Asia and the Anglo-Russian Frontier Question* (1874), and *The Islam in the Nineteenth Century* (1875).

Vam'pire [Fr.], according to a superstition still existing among the lower classes in Hungary, Servia, Romania, and the Christian population of the Balkan peninsula, a kind of ghost which during the night leaves the grave and maintains a semblance of life by sucking the warm blood of living men and women. It is probable that this superstition originated from the ancient myth of the *lamiæ*, beautiful women who enticed young men into their embrace, and then sucked their life-blood; but it was much strengthened by the belief, common in the Middle Ages all through the Greek Church, that the bodies of those who died under the ban of the Church were kept alive by the devil, and by him sent out to ruin their friends and relatives. In the first part of the eighteenth century a vampire panic fell over Servia and Hungary, and spread thence into Germany. Books were written *pro et contra*, and thousands of graves were opened, and corpses which looked suspicious were fastened with nails and bolts to the ground, that they should not wander any more. Among the Wallachs it is still customary to drive a nail through the head of the corpse into the bottom of the coffin.

Vampire Bat. See BAT.

Van, town of Asiatic Turkey, in Armenia, in lat. 38° 30′ N., lon. 43° 40′ E., on the shore of Lake Van, a large salt-water lake covering an area of about 1500 sq. m., and receiving several minor streams, though it has no outlet itself. The town is ill built and surrounded with dilapidated walls. Its bazaars, however, are well stocked with the products of the surrounding fertile plain, and it has some manufactures of coarse cotton fabrics. It also contains some interesting ruins with cuneiform inscriptions. P. estimated at from 12,000 to 35,000.

Vana'dium, one of the elements of matter, a very interesting metal, named after the Scandinavian myth *Vanadis*. It was first discovered in 1801 by the chemist Del Rio in a Mexican lead ore, now called *vanadinite*, and named by him *erythronium*; but erythronium was for twenty-nine years a doubtful element, being imagined by many chemists, *including its discoverer*, to be identical with *chromium*. In 1830, Sefström, however, found it again in some commercial metallic iron, and called it *vanadium*—a name which still stands, the original name having been, somewhat unaccountably, altogether abandoned. Wöhler first pointed out that Sefström's supposed new element was the erythronium of Del Rio. Just as happened in the case of URANIUM (which *see*), for a long time the lowest oxide of vanadium was mistaken for the metal itself, and it is only within a few years that the English chemist Roscoe discovered that this supposed metal was the protoxide V_2O_2—a discovery which changed the whole aspect of this element and of its chemical relations, developing the fact that vanadium is one of the relatives (chemically speaking) of phosphorus and arsenic, and, like these, is a *pentad* in its chemical equivalency with oxygen.

Vanadium occurs as an essential constituent of several mineral species, *descloizite* and *descloizite* being vanadates of lead, *vanadinite* being chloro vanadate of lead, similar in constitution to *pyromorphite* and *apatite*, *volborthite* being a hydric vanadate of copper, *chileite* a vanadate of lead and copper, and others. An ochreous mineral has been found associated with the native copper of Lake Superior, which has been pronounced to be vanadic acid, V_2O_5, but this requires confirmation. Two new American localities of vanadium minerals have, within the year 1876, been announced by our eminent American chemist and mineralogist, Genth of Philadelphia. One is at Granite Creek, El Dorado co., Cal., in a gold-mine. Here Dr. James Blake of San Francisco found a dark-green *mica*, which he supposed to contain chromium largely, but Dr. Genth at once recognized the chromium as vanadium, and this new and interesting vanadic mica has hence been named *roscoelite*, by Dr. Blake its discoverer, after the chemist Roscoe. Dr. Genth found in it 20 to 23 per cent. of an oxide of vanadium, approaching to the composition V_6O_{11}, conjectured by Dr. Genth to be possibly $2V_2O_3.V_2O_5$. The other locality of Dr. Genth is at the Iron Rod Mine, Silver Star district, Mont., where a new hydric vanadate of lead and copper was recognized and analyzed by him, which he names *psittacinite*. Other Montana gold-mines furnish the same mineral. Recently, two other American chemists have announced important discoveries regarding vanadium and its distribution on this continent. Dr. A. A. Hayes of Boston claims to have detected this metal in waters and some common soils, and considers that its distribution may be found to be as wide and general as that of the related element phosphorus. Dr. Isidor Walz also announced very recently that he has discovered the presence of vanadium in almost all the magnetic iron ores of this country, and suggests that, like phosphorus, it may have an effect upon the qualities of the iron made therefrom. Dr. Walz announces that titanic acid and vanadic acid are generally concomitant in iron ores, and that Dr. König of the University of Pennsylvania has also observed this same fact.

Metallic vanadium was obtained by Roscoe by long-continued ignition of the dichloride VCl_2, in hydrogen gas, as a metallic powder of a grayish-white color. Its equivalent weight is cited by some as 51.2, by others 51.3. Roscoe's density for the metal at 15° C. is 5.5. The writer's new geometric law of condensation, with the molecular diameter 21 for vanadium, computes for the zero-density, with equivalent, 51. = 5.507, with equiv. 51.2 = 5.528, with equiv. 51.3 = 5.539, with equiv. 51.5 = 5.561. (See VOLUMES, MOLECULAR.) Though insoluble in muriatic acid, it decomposes boiling water. It burns splendidly in oxygen to vanadic pentoxide, V_2O_5. Nitric acid dissolves it readily to a blue solution.

Compounds of Vanadium.—It forms five oxides, in exact parallelism with those of nitrogen—V_2O, V_2O_2, V_2O_3, V_2O_4, V_2O_5. V_2O is brown, formed by oxidation of the metal in air at dull redness. V_2O_2 is the compound which Berzelius, and all before Roscoe, thought to be the metal itself. It may be obtained by the reduction of higher oxides with potassium. It is a lustrous gray metalloidal powder, density at 20° = 3.61, according to Schafarik. V_2O_3 may be formed by igniting V_2O_5 in hydrogen; black and infusible; conducts electricity; pyrophoric when warmed, burning to pentoxide; insoluble in acids; density by Schafarik at 16° = 4.72. V_2O_4 may be formed, by slow spontaneous oxidation of the previous compound, in shining blue crystals. Density undetermined; soluble in acids with blue color, forming a corresponding series of salts called *vanadious* salts.

V_2O_5, *Vanadic Oxide, Divanadium Pentoxide.*—The native lead vanadates may be used for the preparation of this compound by solution in nitric acid, precipitation of lead and arsenic by sulphuretted hydrogen, filtering and evaporating the blue liquid (containing vanadious nitrate, produced by the reducing action of the H_2S) to dryness, during which V_2O_5 is reproduced, and may be dissolved out from the residue with ammonia. Solid sal-ammoniac added to this solution causes *ammonia-vanadate* to deposit as a white powder, insoluble in the sal-ammoniac. This on ignition leaves pure vanadic oxide. It has a reddish-yellow color, and is

slightly soluble in water—1000 times its weight—to a yellowish solution. Acids dissolve it, and some form with it crystalline compounds. It combines also with bases, forming vanadates. Its density, according to Schafarik, at $21° = 3.51$. The new geometric law (equiv. $V = 51.5$) requires 3.525 at 0°. Vanadates exist, corresponding to the phosphates, of three or more different degrees of basicity (see under the head PHOSPHORIC ACIDS, by HENRY WURTZ), although the only hydrogen-salt or vanadic acid known is dibasic, or corresponds to metaphosphoric acid, being $O_6V_2H_2.H_2O$.

Chlorides of Vanadium.—VCl_2, VCl_3, and VCl_4 are known. The last is formed by the action of chlorine on the metal as a dark yellowish-brown liquid. Roscoe's density at $0° = 1.8584$. The others are obtained from the tetrachloride, and are solid and crystalline, of much higher densities, that of VCl_2 being 3.23 at 18°, indicating entirely different molecular structure. (See VOLUMES, MOLECULAR.) There are several interesting oxychlorides and an oxybromide known, as in the case of phosphorus. Two sulphides of vanadium, V_2S_4 and V_2S_5, are known. Roscoe proposed to regard the vanadium compounds as containing a compound radical, VO, *vanadyl*, similar to the assumed *phosphoryl*, PO, of the hydroxyl school of chemical theorists. (See SALT-RADICALS.) This hypothesis remains to be fully tested by the only possible mode, investigation of relations of molecular-volumic condensation.

HENRY WURTZ.

Vanbrugh' (Sir JOHN), b. probably in Chester, England, in 1666, was of Flemish descent; received a liberal education, partly in France; entered the French army as ensign, and rose to the rank of captain; became in 1695 secretary to the commission for completing Greenwich Hospital; devoted himself to literature and to the profession of an architect; brought out with great success the comedies *The Relapse* (1697) and the *Provoked Wife* (1698), which exposed him to the charge of indecency and profanity strongly pressed by Jeremy Collier; wrote, in consequence, his highly moral comedy *Esop* (1699), afterward recast by Garrick; produced an adaptation of Fletcher's *Pilgrim* (1700); made in 1702 the architectural designs for Castle Howard, Yorkshire, the seat of the earl of Carlisle; became Clarencieux king-at-arms 1703; undertook, in connection with Congreve and the actor Betterton, the construction of a large theatre in the Haymarket (1705), which proved a failure from defective acoustic properties; was for a short time manager of the Haymarket; produced there, with indifferent success, his *Confederacy* (1705), a witty but highly immoral comedy, and three adaptations from Molière; was the architect of the palace of Blenheim, built by order of Parliament for the duke of Marlborough—a task which occupied him for several years (1706–15) and involved him in a quarrel with the duchess; built several edifices of minor importance; was knighted and made comptroller of the royal works 1714, and surveyor of the works at Greenwich Hospital 1716. D. at London Mar. 26, 1726. His last play, left unfinished, *The Journey to London*, was completed by Colley Cibber under the title *The Provoked Husband*. His plays are admitted to be well written and to contain life-like pictures of the times, but are ill adapted to modern ideas of decency. They were edited with a biographical notice by Leigh Hunt, in connection with the plays of Congreve, Wycherley, and Farquhar (London, 1840), a volume which gave occasion to Macaulay's characteristic essay on *The Comic Dramatists of the Restoration*.

Van Bu'ren, county of Central Arkansas, intersected by Little Red River; surface undulating and well timbered, soil fertile. Swine, cattle, and sheep are the chief live-stock. Staples, lumber, Indian corn, wool, and tobacco. Cap. Clinton. Area, 1260 sq. m. P. 5107.

Van Buren, county of S. W. Iowa, bordering on Missouri, intersected by Fox and Des Moines rivers, the latter being navigable by steamboats during the greater part of the year, and traversed by Des Moines Valley R. R.; surface level, timber-land and prairies alternating; soil very productive. Bituminous coal is abundant. There are woollen-mills and flour-mills, and manufactories of carriages, agricultural implements, stone and earthen ware, and paper. Sheep, cattle, horses, and swine are numerous. Staples, Indian corn, wheat, oats, wool, and dairy products. Cap. Keosauqua. Area, 468 sq. m. P. 17,672.

Van Buren, county of S. W. Michigan, bordering on Lake Michigan, drained by several rivers and traversed by Central Michigan and Chicago and Michigan Lake Shore R. Rs.; surface level, soil fertile and well timbered. There are saw-mills, flour-mills, wood-turning and carving establishments, tanneries and currying establishments, manufactories of carriages, pig iron, and iron castings. Live-stock of all kinds, especially sheep, is numerous. Staples, Indian corn, wheat, oats, potatoes, wool, lumber, and dairy products. Cap. Paw Paw. Area, 633 sq. m. P. 28,829.

Van Buren, county of Central Tennessee, drained by the Caney fork of Cumberland River; surface mountainous, soil moderately productive, abounding in bituminous coal. Swine are the principal live-stock. Staples, Indian corn, wool, tobacco. Cap. Spencer. Area, 350 sq. m. P. 2725.

Van Buren, p.-v. and tp., cap. of Crawford co., Ark., on Arkansas River and Little Rock and Fort Smith R. R., has a newspaper. P. of v. 985; of tp. 3296.

Van Buren, tp., Newton co., Ark. P. 319.

Van Buren, tp., Union co., Ark. P. 2032.

Van Buren, tp., Brown co., Ind. P. 2048.

Van Buren, tp., Clay co., Ind. P. 3323.

Van Buren, tp., Daviess co., Ind. P. 1172.

Van Buren, tp., Fountain co., Ind. P. 522.

Van Buren, p.-v. and tp., Grant co., Ind. P. 1110.

Van Buren, tp., Kosciusko co., Ind. P. 1467.

Van Buren, tp., La Grange co., Ind. P. 1347.

Van Buren, tp., Madison co., Ind. P. 874.

Van Buren, tp., Monroe co., Ind. P. 972.

Van Buren, tp., Pulaski co., Ind. P. 972.

Van Buren, tp., Shelby co., Ind. P. 1194.

Van Buren, p.-v. and tp., Jackson co., Ia. P. 1155.

Van Buren, tp., Keokuk co., Ia. P. 1031.

Van Buren, tp., Lee co., Ia. P. 956.

Van Buren, tp., Van Buren co., Ia. P. 2455.

Van Buren, tp., Wayne co., Mich. P. 1970.

Van Buren, p.-v., cap. of Carter co., Mo.

Van Buren, tp., Jackson co., Mo. P. 2036.

Van Buren, tp., Newton co., Mo. P. 1288.

Van Buren, p.-v. and tp., Onondaga co., N. Y. P. 3038.

Van Buren, tp., Darke co., O. P. 1212.

Van Buren, p.-v. and tp., Hancock co., O. P. 780.

Van Buren, tp., Montgomery co., O. P. 2690.

Van Buren, tp., Putnam co., O. P. 1350.

Van Buren, tp., Shelby co., O. P. 1381.

Van Buren, tp., Hardeman co., Tenn. P. 661.

Van Buren (JOHN), second son of Pres. Martin Van Buren, b. at Hudson, N. Y., Feb. 18, 1810; graduated at Yale College in 1828; studied law, and was admitted to the bar in 1830. In 1832 he attended his father, who had been appointed minister to England; was attorney-general of New York 1845–47, and in 1848 took an active part in the Presidential canvass, his father being an unsuccessful candidate for the Presidency. After this he devoted himself wholly to his profession. In May, 1866, he left New York for a European tour, travelling in Sweden, Norway, Russia, and Scotland. D. at sea, while on his way home, Oct. 13, 1866.

Van Buren (MARTIN), the eighth President of the U. S., b. at Kinderhook, N. Y., Dec. 5, 1782. He began the study of law at the age of fourteen, and took an active part in politics before he had reached the age of twenty; in 1812 was elected to the State senate; was attorney-general 1815–19, and in 1816 a State senator for a second time. In 1818 he became a member of a small clique of politicians known as the "Albany regency," which held control of the State for a score of years; the other most prominent members being Benjamin F. Butler, Edwin Croswell, and William L. Marcy. In 1821 he was chosen a member of the convention for revising the State constitution, in which he advocated an extension of the franchise, but opposed universal suffrage, and also favored the proposal that colored persons in order to vote should have freehold property to the amount of $250. In this year he was also elected U. S. Senator, and at the conclusion of his term, in 1827, was re-elected, but resigned in the following year, having been chosen governor of the State. In Mar., 1829, he was appointed by Pres. Jackson secretary of state, but resigned in Apr., 1831, and during the recess of Congress was appointed minister to England, whither he proceeded in September. The Senate, when convened in December, refused to ratify the appointment, mainly on the ground that Mr. Van Buren, while secretary of state, had foisted our domestic party questions into his foreign diplomacy. In May, 1832, he was nominated as the Democratic candidate for Vice-President, and elected in the following November. In 1836 he was elected President, receiving 170 electoral votes out of 283, Gen. W. H. Harrison receiving 73, Hugh L. White 26, and Daniel Webster 14. The opening of his administration was at a time of

severe financial difficulty, which resulted in the suspension of specie payments by the banks, and the President urged the adoption of the independent treasury system, which was twice passed in the Senate and defeated in the House, but finally became a law near the close of his administration. Another important measure was the passage of a pre-emption law, giving actual settlers the preference in the purchase of public lands. The question of slavery now began to assume great prominence in national politics, and after an elaborate anti-slavery speech by Mr. Slade of Vermont in the House of Representatives, the Southern members withdrew for a separate consultation, at which Mr. Rhett of South Carolina proposed to declare it expedient that the Union should be dissolved; but the matter was tided over by the passage of a resolution that no petitions or papers relating to slavery should be in any way considered or acted upon. In the Presidential election of 1840, Mr. Van Buren was nominated without opposition as the Democratic candidate, William H. Harrison being the candidate of the Whig party. The Democrats carried only seven States, and out of 294 electoral votes only 60 were for Mr. Van Buren, the remaining 234 being for his opponent. The Whig popular majority, however, was not large, the elections in many of the States being very close. In 1844, Mr. Van Buren was proposed as the Democratic candidate for the Presidency, and a majority of the delegates to the nominating convention were in his favor, but owing to his opposition to the proposed annexation of Texas he could not secure the requisite vote of two-thirds; his name was at length withdrawn by his friends, and Mr. Polk received the nomination, and was elected. In 1848, Mr. Cass was the regular Democratic candidate; a schism, however, sprang up in the party upon the question of the permission of slavery in the newly-acquired territory, and a portion of the party, taking the name of "Free-Soilers," nominated Mr. Van Buren; they drew away sufficient votes to secure the election of Gen. Taylor, the Whig candidate. After this, Mr. Van Buren retired to his estate at Kinderhook, where the remainder of his life was passed, with the exception of a European tour in 1853–55. D. at Kinderhook July 24, 1862. He left a MS., which was edited and published by his sons, entitled *An Inquiry into the Origin and Course of Political Parties in the United States* (1867). A. H. GUERNSEY.

Van Buren Plantation, tp., Aroostook co., Me. P. 922.

Vance, tp., Vermilion co., Ill. P. 1542.

Vance (JOSEPH), b. in Washington co., Pa., Mar. 21, 1786; went at an early age, with his father, to Kentucky, and afterward to Urbana, O.; was successfully engaged in mercantile pursuits, and subsequently became a farmer and stock-raiser upon a large scale; was a member of the State legislature 1812–16; Representative in Congress 1821–35, and again 1843–47, serving as chairman of the committee on claims; and governor of Ohio 1836–38; was also major-general of militia. D. near Urbana, O., Aug. 24, 1852.

Vance (ZEBULON B.), b. in Buncombe co., N. C., May 13, 1830; received mainly a common-school education, although he spent a single year at the University of North Carolina; studied law, and was admitted to the bar in 1853; and in 1854 was elected to the State legislature; in 1858 was elected a Representative in Congress, to fill a vacancy occasioned by the resignation of Mr. T. L. Clingman, and was re-elected in 1859. He was governor of North Carolina at the time of its secession, to which he was originally opposed, although he afterward took an active part in it; in 1870 was elected to the U. S. Senate, and re-elected governor in Nov., 1876. In 1879 was elected U. S. Senator.

Vance'boro Plantation, tp., Washington co., Me. P. 329.

Vance'burg, p.-v., cap. of Lewis co., Ky., on Ohio River, 20 miles S. W. of Portsmouth (O.), has 3 churches, 2 seminaries, a fine court-house, 1 weekly newspaper, 3 manufactories of hubs, spokes, and staves, 1 flouring and feed mill, and an extensive tannery. It is an important shipping-point, and good timber abounds. P. 513.
SAMUEL J. PUGH, ED. "KENTUCKIAN."

Vance's, tp., Orangeburg co., S. C. P. 822.

Van Cleve (HORATIO PHILLIPS), b. at Princeton, N. J., Nov. 23, 1809; graduated at West Point in 1831; was appointed second lieutenant, but resigned in 1836, and became a farmer and civil engineer in Michigan, and afterward in Minnesota; in July, 1861, was made colonel of volunteers, led his regiment at the battle of Mill Spring, and was made brigadier-general Mar. 21, 1862; commanded a brigade at Corinth, and subsequently a division. He bore a distinguished part in the battle of Stone River, where he was wounded; was engaged in several other battles, notably at Chickamauga; was in command at Murfreesboro' 1863–65, and in 1866 was appointed adjutant-general of Minnesota.

Van Cort'landt (PHILIP), b. in New York Sept. 1, 1749; became a land-surveyor, and at the opening of the Revolutionary war was made lieutenant-colonel, and subsequently colonel. He served at the battle of Stillwater, and against the Indians on the frontier in 1778; commanded a regiment under La Fayette, and was made brigadier-general for gallant conduct at the siege of Yorktown. He was a member of the New York house of representatives 1788–90, of the State convention of 1788 by which the Constitution of the U. S. was adopted, State senator 1791–94, and Representative in Congress 1793–1809. The latter part of his life was spent at his manor in Westchester co., N. Y. He was appointed to accompany La Fayette in his tour through the U. S. in 1824. D. at Croton, Westchester co., N. Y., Nov. 5, 1831.

Van Cortlandt (PHILIP), brother of Philip, b. in 1720; was a member of the first provincial congress, and of the committee which framed the constitution of the State; president of the senate and the first lieutenant-governor of the State of New York 1777–1805. D. at Cortland, N. Y., May 1, 1814.

Vancouver, p.-v., cap. of Clarke co., Wash. Ter.

Vancou'ver (GEORGE), b. about 1758; entered the British navy as midshipman in 1771; was with Cook in his first and second voyages (1772–75 and 1776–80); was made first lieutenant in 1780, and served in the West Indies until 1789. In 1790 he was put in command of a small squadron sent to take possession of Nootka, being also charged to ascertain if there was between the parallels of 30° and 60° N. lat. any water-communication between the Pacific and Atlantic oceans. He sailed in the Discovery Apr. 1, 1791, and after touching at the Sandwich Islands, crossed in Mar., 1792, to the American coast; received from the Spanish commandant the formal surrender of Nootka, and passed the three summers of 1792–94 in surveying the coast as far N. as Cook's Inlet, lat. 58°–61°, wintering at the Sandwich Islands, and convinced himself that no N. W. passage existed. On his return voyage he surveyed most of the W. coast of South America, visiting the principal Spanish settlements, and reached England in 1795, greatly broken down in health. The rest of his life was spent in preparing for publication a narrative of his long voyage, which was nearly finished at the time of his death. The work was completed by his brother, and published at the expense of government (3 vols. 4to, 1798). He was made a post-captain in 1794, and Vancouver's Island was named after him. D. near London May 10, 1798.

Vancouver's Island [named from Capt. George Vancouver (1758–98), a British sailor], an island which forms a part of British Columbia and of the Dominion of Canada, lies between lat. 48° 20′ and 50° 55′ N., and between lon. 123° 10′ and 128° 20′ W. It is bounded W. by the Pacific Ocean, and occupies the greater part of the Gulf of Georgia, which it converts into a narrow sound, the northward continuation of Puget Sound. The Strait of San Juan de Fuca on the S. and Queen Charlotte's Sound on the N. afford communication between this sound and the open sea. The island is 300 miles long and from 30 to 70 miles wide. Area, 18,750 sq. m. It is mostly a mountain-region, and is in part a waste of rocks, with large tracts of heavily-timbered land and open grassy glades. The highest mountain, Mount Arrowsmith, is 5900 feet high. The western coast is precipitous and forbidding, and is deeply cut up by high-walled fiords called *canals*. The climate is much like that of Scotland, but is perhaps more rainy. Only one-fifth of the surface is fit for cultivation, but the arable soil is of the most productive character, well adapted for all ordinary crops except Indian corn. Wheat, apples, root-crops, oats, and barley are extensively produced. Gold and other metals are abundant. Coal of Tertiary origin, partly anthracite of good quality, is very abundant. The timber-trade and the fisheries are the most important industries.

Population, etc.—The Indians constitute the most numerous portion of the people, and number some 18,000. They are mostly tribes or bands which belong to the confederation known as the Ahts. The Roman Catholics maintain missions among them. Vancouver's Island constitutes a Roman Catholic diocese, with its see-town at Victoria. There are reported 3 convents, 1 seminary (St. Louis College), 3 academies, and a Roman Catholic population. (This diocese includes Alaska, but not the vicariate apostolic of British Columbia.) The Anglican churches of the island are under the bishop of British Columbia. The census of 1871 gives no separate returns for the island as distinct from the province. The chief town is Victoria, which is the capital of British Columbia.

History.—The island was named Quadra, and Vancouver's Island by Vancouver, who in 1792 negotiated with Quadra,

the Spanish commandant of the coast, for the surrender of the Nootka region to the British. In 1846 it was secured to the latter by the U. S. by the Oregon treaty. In 1846 and 1849 it was leased to the Hudson's Bay Co. It was (1863–65) a distinct British colony, but in the latter year was united to British Columbia.

Vanda'lia, p.-v. and tp., cap. of Fayette co., Ill., on Illinois Central and St. Louis Vandalia and Terre Haute R. Rs., 67 miles E. of St. Louis (Mo.). Vandalia was the former capital of the State (1820–40). It contains 6 churches, excellent graded schools, 2 weekly newspapers, 2 banks, waterworks, a woollen-factory, 1 foundry, 1 extensive plough-factory, several wagon and carriage manufactories, a tannery, 3 public halls, and 2 hotels. Excellent hardwood timber abounds. P. of v. 1771; of tp. 2431.

CHARLES G. SMITH, ED. "FAYETTE DEMOCRAT."

Vandalia, p.-v., Cass co., Mich.

Vandalia, p.-v., Butler tp., Montgomery co., O. P. 313.

Van'dals, The, a barbaric tribe, probably of Germanic, though by some believed to be of Slavic or mixed, origin, were settled in the second century of our era on the eastern slopes of the Riesengebirge, which after them were called *Montes Vandalici*, and appeared in the wars of Marcus Aurelius as the allies of the Marcomanni and Quadi. In the third century they removed into the Roman province of Dacia, where they lived among the Goths and the Gepidæ, and in the fourth century were found in Pannonia as quiet and peaceable inhabitants. But in the beginning of the fifth century they suddenly arose, together with the Suevi, Alani, and other Germanic tribes, overran the southern part of Gaul, thronged through the passes of the Pyrenees into Spain, and formed here, in the southern part of the country, an independent empire, *Vandalitia*, the modern Andalusia. In 429, Bonifacius, governor of the Roman province of Africa, invited them to Africa in order to avenge himself on Valentinian III., and a horde of from 50,000 to 80,000 crossed the Strait of Gibraltar under the leadership of Genseric. The Vandals were Arians; in Africa they were immediately joined by the Donatists, and the most horrible cruelties were perpetrated against the orthodox Christians. Meanwhile, Bonifacius had become reconciled to the emperor, and now turned against the Vandals, but was completely defeated and shut up in Hippo. In 435 a peace was concluded between Valentinian III. and Genseric, and the largest part of the province of Africa was ceded to the Vandals; but in 439, Genseric broke the peace and conquered Sardinia and Sicily. In 455 he invaded Italy, captured and sacked Rome, which he plundered and devastated with wild wantonness, and spread horror into all countries along the Mediterranean shores. But the power of the Vandals was only of short duration. Genseric died in 477, and none of his successors—Guntamund (477–496), Thrasamund (496–523), Hilderic (523–530), and Gelimir (530–534)—were prominent men. Hilderic had been educated in Constantinople, and leaned toward the orthodox conception of Christianity. This caused a revolt, in which he was overthrown by Gelimir. But the Byzantine emperor now sent an army to Africa under Belisarius. Gelimir was captured and sent to Constantinople, and most of the Vandals were drafted into the Byzantine army to serve in the wars against Persia; the rest soon disappeared among the natives. (See Papencordt, *Geschichte der vandalischen Herrschaft in Afrika*, Berlin, 1837.)

Vandamme' (DOMINIQUE JOSEPH), COUNT, b. at Cassel, department of Nord, France, Nov. 5, 1770; entered the French army in 1788, and served in a regiment in Martinique, but returned in 1790, and organized in 1792 a volunteer regiment, the so-called *chasseurs de Vandamme*, at the head of which he distinguished himself so greatly that in 1793 he was made a brigadier-general. In 1799 he was made a general of division, fought with great distinction at Austerlitz and Eckmühl, and was made a count, but took no part in the Russian campaign of 1812 on account of a conflict with Jerome. In 1813 he commanded the corps which from Lower Saxony was destined to penetrate into Bohemia in pursuit of the allied army, which had been defeated at Dresden, Aug. 27, but at Kulm he was surrounded, defeated, and compelled to surrender with 10,000 men and 81 guns, Aug. 30. He was brought as a prisoner to Russia, but restored to liberty in 1814. During the Hundred Days he joined Napoleon, fought at Ligny and Wavre, and led the army back to the walls of Paris. During the second Restoration he was banished from France, lived in the U. S., returned to France in 1819, was reinstated in the army in 1820, retired into private life in 1825, and d. at Cassel July 15, 1830. (See P. E. Albert du Casse, *Le Général Vandamme et sa Correspondance*, 2 vols., Paris, 1870.)

Vandemere, p.-v., cap. of Pamlico co., N. C.

Van den Eeckhout. See EECKHOUT, VAN DEN.

Van'denhoff (GEORGE), b. in England about 1820; made his début upon the stage at Covent Garden Theatre in Oct., 1839; came to New York in 1842; continued to act until 1856; studied law and was admitted to the bar in 1858. He has given public readings and lessons in elocution in America and England, and has published *The Art of Elocution* (1846), *Dramatic Reminiscences* (1859), *Leaves from an Actor's Note-Book* (1860), *Clerical Assistant, an Elocutionary Guide* (1862), etc.

Van'derbilt, p.-v., cap. of Unicoi co., Tenn.

Van'derbilt (CORNELIUS), b. at Staten Island, N. Y., May 27, 1794. His parents emigrated from Holland, and were among the early settlers of New York. He had a very meagre education, and at an early age devoted himself to sailing boats in New York Bay. At the age of sixteen he purchased a boat of his own, and ran it as a ferry between New York and Staten Island. During the war of 1812 he carried some officers from Fort Richmond during a perilous storm, being the only boatman in the harbor who would undertake the task—carrying them, as he said, "part of the way under water." In 1814 he carried government supplies to various posts about New York, and that year he built a small schooner for his increased business; in the year following he built a larger schooner for the coast-trade. In 1817, having accumulated $9000 from his harbor-trade, he entered the employ of Thomas Gibbons, and became captain of a small steamboat running between New York and New Brunswick, N. J., on the road to Philadelphia. He also took charge of a hotel at New Brunswick, where the passengers remained over night. He remained with Mr. Gibbons for twelve years, during which time the line of steamboats had grown to be one of great importance; at the end of that time he resigned his position and started out for himself; he built several small steamboats, and ran them to points on the Hudson River and other places near New York. In 1851 he established the route of steamships between New York and California by way of Nicaragua, which he managed for two years, when he sold out and acted as agent for a short time; subsequently, he was chosen president of the company. In May, 1853, having amassed immense wealth, he built the steamship North Star, and, taking his family on board, made a tour of Europe in it at his private expense. In Apr., 1855, he established an independent line of steamships between New York and Havre. In the spring of 1862 he presented the government with his finest steamship, the Vanderbilt, for which Congress passed a resolution of thanks to him. Subsequently, he withdrew his money from vessels and invested it in railroads. He was president of the New York Central and Hudson River R. R., the Harlem R. R., and the Lake Shore and Michigan Southern R. R., and was a director in the Western Union Telegraph Co. In 1870 he purchased the building known as the Mercer street Presbyterian church in New York City, and presented it to the Rev. Charles Force Deems, pastor of a free and independent church of Jesus Christ, organized in 1868 under the name of the Church of the Strangers, to be used by that society as a place of public worship. On Mar. 27, 1873, Mr. Vanderbilt presented the Methodist Episcopal Church, South, with $500,000, afterward increasing the amount to about $1,000,000, to be used in founding a university at Nashville, Tenn., for the education of the youth of the Church. The board of trust of the proposed institution voted to call it VANDERBILT UNIVERSITY (which see), after its chief founder, and it was opened Oct. 4, 1875. Mr. Vanderbilt had been twice married, and had thirteen children. D. at New York Jan. 4, 1877.—His son, WILLIAM HENRY, b. in New Brunswick, N. J., May 8, 1821. He received a common-school education, and in 1873 was elected vice-president of the Hudson River R. R. Co. J. B. BISHOP.

Vanderbilt University, an institution of learning at Nashville, Tenn., founded in 1872 under the name of Central University of the Methodist Episcopal Church, South, and received its present name in 1873 in consequence of a donation of $500,000 by Cornelius Vanderbilt of New York, subsequently increased to $1,000,000, of which $600,000 is to remain as a permanent invested endowment. By one of the conditions of the gift, Bishop Holland N. McTyeire was named as president of the board of trust, and the labor of organization chiefly devolved upon him. L. C. Garland, LL.D., was chosen chancellor, and Rev. Dr. Thomas O. Summers, dean of the theological faculty, is *ex-officio* vice-chancellor. The corner-stone was laid Apr. 28, 1874, in the western suburbs of Nashville in a plot of 75 acres of land purchased for the university, and the institution was opened for students Oct. 4, 1875. During the first academic year the total number of students was about 300. There are four departments, devoted respectively to theology, law, medicine, and phi-

losophy, science, and literature, the two latter having 11 professors each. The library, scientific apparatus, and cabinets are already valuable. The courses of study are elective, and tuition is free to theological students.

Van'derburg, county of S. W. Indiana, bordering upon Ohio River, and traversed by Wabash and Erie Canal and by several railroads centring at the county-seat; surface generally undulating, soil fertile. Bituminous coal is abundant. There are nearly 300 manufacturing establishments, including those of cotton and woollen goods, clothing, furniture, agricultural implements, saddlery, iron, machinery, and tobacco; saw-mills, planing-mills, tanneries, currying establishments, and breweries. Live-stock is not very numerous. Staples, manufactured articles, Indian corn, wheat, tobacco, lumber, and dairy products. Cap. Evansville. Area, 216 sq. m. P. 33,145.

Van der Goes (Hugo), a disciple of Van Eyck; flourished in the latter part of the fifteenth century; painted mostly religious subjects, and is said to have ended his life as a monk in the monastery of Rodendale, near Brussels. His most celebrated pictures are a *Birth of Christ*, in the church of Santa Maria Nuova in Florence, a *Crucifixion*, in the church of St. James in Bruges, and a *St. John*, in the Pinakothek of Munich, bearing his name and the date of 1472.

Van der Hey'den (Jan), b. at Gorkum, Holland, in 1637; lived mostly in Amsterdam; acquired great fame as a painter of landscapes and city prospects, and received a pension from the government for his improvements of street-lamps and fire-engines. D. at Amsterdam Sept. 28, 1712. His principal pictures are—*The Exchange of London, The Exchange of Amsterdam, The Village on the River-bank*, etc. The figures in his landscapes were often painted by Adrian Vandervelde.

Van der Hoeven. See Hoeven, Van den.

Van'derlyn (John), b. at Kingston, Ulster co., N. Y., Oct., 1776; at sixteen was employed as a blacksmith's assistant, when by accident one of his sketches of a horse's head made in charcoal upon a barn-door attracted the attention of Aaron Burr, who invited him to New York, and received him into his house. He received instruction from Stuart, and in 1796 went to Europe through the assistance of Burr, where he remained five years. He returned to Europe in 1803, remaining until 1815; made many admirable copies from the old masters; painted the picture of *Marius seated amid the Ruins of Carthage*, which gained the Louvre gold medal in 1808, *The Murder of Jane McCrea by the Indians*, and other original works, which gave him a high reputation. Returning to America, he painted the portraits of Calhoun, Clinton, Madison, Monroe, Jackson, and other distinguished men, and endeavored to introduce large panoramas into this country—an enterprise which was pecuniarily unsuccessful. In 1832 he was commissioned to paint a full-length portrait of Washington for the hall of the House of Representatives, and in 1839 was commissioned to paint the *Landing of Columbus* for the Rotunda of the Capitol. Among his best works is the *Ariadne*, which he sold to Durand to engrave for $600, who many years after sold it for $5000. The later years of Vanderlyn's life were passed in great poverty. D. at Kingston, N. Y., Sept. 23, 1852. He had some time before dictated to a friend a sort of *Autobiography*, but the MS. was, after his death, destroyed by a fire in the publishing-house to which it had been sent for publication. (See Tuckerman's *Book of the Artists*.)

Van der Meer (Jan), the Elder, b. at Haarlem about 1625; painted landscapes with animals and sea-pieces, and held various positions in the civil service. D. in Haarlem about 1685.—His son, Jan van der Meer, the Younger, b. at Haarlem about 1660; received instruction first from his father, afterward from Berghem, and acquired a great reputation as a painter of landscapes and marine battles, but is said to have led a very dissolute life. His best picture is a *View of the Rhine*. D. at Haarlem about 1704. Both his and his father's paintings are very rare outside of the Netherlands.

Van der Meulen (Antoine François), b. at Brussels 1634; received his first instruction in painting from Peter Snayers; was invited to France by Colbert through the influence of Lebrun, and appointed designer at the Gobelins manufactures; attracted attention by his talent for battle-pieces, and accompanied Louis XIV. in several campaigns; was elected a member of the Academy in 1673. D. at Paris Oct. 15, 1690. Among his most celebrated pictures are the *Entrance of Louis XIV. into Arras*, the *Siege of Maastricht*, etc.; he also painted hunting and genre scenes.

Van der Neer. See Neer, Van der.

Van'derveer (Ferdinand), b. in Butler co., O., Feb. 27, 1823; was educated at Farmers' College, O.; enlisted as a private in an Ohio regiment during the Mexican war; rose to be captain, and headed one of the assaulting columns at the capture of Monterey. He subsequently practised law, and became sheriff of Butler co.; at the beginning of the civil war was made colonel of an Ohio regiment; succeeded to the command of McCook's brigade; led it until the autumn of 1861, when he was made brigadier general; was in the battle of Mill Spring, and distinguished himself at Chickamauga and Chattanooga.

Vandervel'de (Adrian), b. in Amsterdam in 1639; was celebrated as a figure-painter, and was often employed by other artists—Ruysdael, Hobbema, Van der Heyden—to paint figures as staffage in their landscapes. D. at Amsterdam in 1672.

Vandervelde (Willem), the Elder, b. at Leyden in 1610; was educated as a sailor, but early attracted great attention by his drawings of sea-views; was sent by the Dutch government to accompany Admiral de Ruyter, and acquired great reputation by his sketches of manœuvres, engagements, etc.; was invited to England in 1675 by Charles II., who made him court-painter of sea-fights, and gave him a pension of £100 a year. D. in London in 1693. Most of his productions were drawings, many of which were colored by his son, Willem Vandervelde, the Younger, b. at Amsterdam in 1633, who succeeded his father as marine-painter to the king of England, and attained great fame. Most of his pictures are in England, especially in the gallery at Bridgewater House. D. London Apr. 6, 1707.

Van der Weyde (P. H.). See Appendix.

Vandi, or **Bandy.** Constantly, when treating of Indian topics, we come across such words as "bandy," which simply means a common country vehicle, much used by Hindus. Had there been no *Calicut* in India, the term *calico* would never have arisen. To take the commonest instance of all, *mulligatawny* is simply the Europeanized pronunciation of *milagu-tanni*—*i. e.*, literally translated, "pepper-water." This *milagu-tanni* is a pure Tamil word. It is wholly and solely from Tamil-land that we have derived those hot-flavored soups which, under various forms, go by the name of "mulligatawny soups," and are generally best liked when their pungency is partially subdued by a little well-boiled rice—"Patna rice," as it is foolishly called in England, as if the best Indian rice was from Patna. When also, as all over India, our white kinsmen speak of "bandymen" and "bandies," the word thus anglicized is simply the old Tamilian one. We all know how readily *b* and *v* change places in other languages. F in Latin becomes *h* in Spanish with no greater facility. The framework of "bandies" is made of light wood, but of wood as strong as possible. Above it is spread a semicircular awning of bamboos supporting mats or cloth or canvas. The bandy is a cross-country vehicle, and, as a rule, possesses no springs of any kind. The conveyance is dragged by oxen. Some bandies of rajahs are drawn by huge oxen, standing as tall as "galloways," with silver bells round their necks, jewels plaited on their foreheads, their feet shod with brass, and their horns encased with massive gold. Several of the late gaikwar of Baroda's bandy-oxen used to have diamonds and pearls worth $1,000,000 or so dangling round their necks on festive occasions, when they bore his wives on important pilgrimages to famous temples. The wheel of the common Indian bandy has been so rudely constructed from time immemorial that numbers of pattern-wheels for bandies have not long since been despatched to India from America. The writer has seen several, and two in his possession, five years ago, were immediately copied, to the best of their ability, by native carpenters, who were astounded at being informed that the original wheels came over the "great wild black water," not only of the Indian Ocean, but of the stormy Atlantic itself. R. C. Caldwell.

Van Diemen's Land. See Tasmania.

Van Dorn (Earl), b. in Mississippi in 1821; graduated at West Point in 1842; served with distinction in the Mexican war, and was brevetted as captain and major for gallant conduct at Cerro Gordo, Contreras, and Chapultepec, and was wounded in the final assault upon the City of Mexico; was secretary of the military asylum at Pascagoula, Miss., 1853–55, was subsequently employed in scouting in Texas, led an expedition against the Comanches in 1858, and severely wounded at Washita Village, Ind. Ter., Oct. 1, 1858. In Jan., 1861, he threw up his commission of major 2d Cavalry, and entered the Confederate army as colonel, taking command of a regiment of Texan volunteers; early in 1861 he captured the steamer Star of the West at Indianola, and soon after received the surrender of Major Sibley and of Col. Reeve, with thirteen companies of U. S. infantry. He rose to the rank of major-general, and in Jan., 1862, was placed in command of the Trans-Mississippi district; was defeated at Pea Ridge; superseded by

Gen. Holmes, and transferred to the Army of the Mississippi; commanded at the battle of Corinth, where he was defeated and superseded by Gen. Pemberton. D. in Maury co., Tenn., May 8, 1863, having been shot by a Dr. Peters on account of a private grievance.

Vandyke', or **Van Dyck** (Anthon), b. at Antwerp Mar. 22, 1599; received his first instruction in painting from Van Balen (1610–15), then from Rubens (1615–20), whose most illustrious pupil he became; travelled in Italy 1620–25, visiting Venice, Genoa, Florence, Rome, Palermo, and other cities; resided after his return partly in Antwerp, partly at the Hague; went in 1632 to England on the invitation of Charles I., was knighted, received a pension of £200 a year, and lived in great style in London, where he d. Dec. 9, 1641, and was buried in St. Paul's church. During the first period of his career the influence of Rubens is very apparent; but after his Italian journey, especially after a thorough study of the Venetian school, his own style became fully developed. A deep, pensive, sometimes almost melancholy, sentiment, and a subdued, refined, and elegant harmony of colors, took the place of the active, often violent passion, with its burst into brilliant colors, which characterizes Rubens. In this manner he has painted numerous *Holy Families*, *Crucifixions*, etc., now found principally in the galleries of Antwerp, the Louvre, Madrid, and Munich; the most celebrated is the altarpiece in the cathedral of Mechlin. But it was principally as a portrait-painter that Vandyke achieved his great fame, and there exist about 300 portraits by him. The most remarkable are those of Thomas Carignan in the gallery of Turin, of Gen. Moncada and Charles I. in the Louvre, of Marchese Brignoli in the Palace Brignoli at Genoa, of the children of Charles I. in the gallery of Windsor, and the series of 100 small portraits of contemporaneous artists, of which etchings have been made. Many of the portraits which he painted during his residence in England are excellent with respect to conception, but somewhat hasty, and even careless, in execution.

Vane. See Londonderry, Marquis of.

Vane (Sir Henry), b. at Hadlow, Kent, England, in 1612, son of Sir Henry (1589–1654), who was secretary of state to Charles I.; educated at Westminster School, and entered as gentleman commoner Magdalen College, Oxford, about 1628, but before matriculation renounced the Church of England and refused to take the oath of allegiance; travelled in France and Holland, and completed his education at Geneva, where he became a Puritan and a republican; determined to cast in his lot with the Massachusetts Colony, he arrived at Boston 1635; was received with great satisfaction on account of his high reputation and social position; was chosen governor for the year 1636, but having taken the part of Mrs. Hutchinson in a bitter religious controversy then existing, lost much of his popularity, and was not re-elected; was chosen a member of the general court, and published a pamphlet in reply to one by Winthrop; returned to England Aug., 1637; was knighted, elected to Parliament, and made joint-treasurer of the navy 1640; took part in the impeachment of Strafford; became sole treasurer of the navy 1642; was a zealous supporter of Parliament in the civil war; gave up to that body the fees of his office, at that time very lucrative; went in June, 1643, to Scotland as one of the joint commissioners to negotiate an alliance, and was influential in securing the adoption of the "Solemn League and Covenant;" enabled Roger Williams to obtain the Rhode Island charter 1643; was a promoter of the "Self-denying Ordinance" 1644; served during the war on important parliamentary commissions, especially those empowered to treat with the king or to accompany the army in an advisory capacity; opposed the terms of settlement offered by Charles in 1648; was a member of the Westminster Assembly and a leader of the Independents in Parliament, but disapproved of the interference of that body in military affairs; condemned the execution of Charles and the "purge" of Parliament effected by Cromwell; became in Feb., 1649, a member of the council of state, in which capacity he had the direction of the navy and ample powers in regard to the foreign wars then carrying on; enjoyed at this time the friendship of Milton, who addressed him one of the most notable of his sonnets; reported, as chairman of a committee, a bill for parliamentary reform; came into conflict with Cromwell in consequence of the forcible dissolution of the Long Parliament Apr., 1653; retired to his estate of Raby Castle, where he wrote religious treatises and political pamphlets, one of which led to an imprisonment of four months in Carisbrooke Castle by order of Cromwell Mar., 1656; remained in opposition until the death of the Protector, when he was chosen to Parliament; became the leader of the republican party, and endeavored without success to mould the Commonwealth to his ideas of government; was a member of the committee of safety and president of the council of state during the brief renewed existence of the Long Parliament 1659; was one of the twenty persons excepted from the act of general pardon and oblivion passed at the Restoration; was sent to the Tower, and afterward to other prisons, remaining two years in a castle in the Scilly Islands, occupied in theological studies and writing; was tried for high treason before the court of king's bench June 2, 1662; was unjustly convicted and sentenced to be hanged, and in violation of a promise made by Charles was beheaded on Tower Hill June 14, 1662. His theological writings are pitched in so high a strain of mysticism as to be almost unintelligible to ordinary readers, but are said by Sir James Mackintosh to "display astonishing powers;" and the same writer ranks Vane as "one of the most profound minds that ever existed—not inferior, perhaps, to Bacon." His religious views were millenarian, and gave rise to a small circle of disciples who were known as Vanists. His *Life* was written by Charles W. Upham in Sparks's series of biographies (1st series, vol. iv.). Porter C. Bliss.

Van Effen. See Effen.

Van Et'ten, tp., Chemung co., N. Y. P. 1533.

Van Eyck. See Eyck, Van.

Van Helmont. See Helmont, Van.

Van Hornes'ville, p.-v., Stark tp., Herkimer co., N. Y. P. 169.

Van Huysum. See Huysum, Van.

Vanil'la [Fr. and Ger. *vanille*], the fruit of the *Vanilla planifolia* and of the *Vanilla aromatica*, which are climbing plants native in Mexico and Brazil and cultivated in the West Indies. The pods of the plant are from 6 to 8 inches in length, possess a very pleasant odor, and are often encrusted with needle-shaped crystals of *vanilline*, their aromatic constituent. They also contain an iron-greening tannin, a fatty oil, and a resin. *Vanilline* ($C_8H_8O_3$), the odorous principle of vanilla, was formerly considered identical with benzoic and cinnamic acids. Its individuality was first recognized by Bley in 1858, afterward by Stokkebye in 1864, who assigned to it the incorrect name *vanillic acid* and the composition $C_{17}H_{22}O_5$. It is obtained by mixing the alcoholic extract of vanilla with water until a fluid of a syrupy consistence is formed, agitating with ether, evaporating the ether, treating the residual mass with boiling water, again evaporating, and purifying the crystals formed by solution and filtration through animal charcoal. It forms long colorless prisms, which are nearly insoluble in cold water, but dissolve in hot water, in alcohol, and in ether, the alcoholic solution possessing a feeble acid reaction. Vanilline fuses at about 176° F., sublimes at above 300° F., and can be distilled with the vapor of water. Its synthetical preparation has recently been accomplished by submitting the glucoside of the cambium of the Coniferæ (*coniferine*) to the action of emulsine, whereby it is converted into glucose and a crystalline body fusing at about 160° F. Upon oxidizing this crystalline compound by treatment with sulphuric acid and potassic dichromate, ethylic aldehyde is at first produced, then an acid substance, which, upon separation by agitation with ether, and evaporation, possesses the odor of vanilline, and is indeed identical with that compound. The product of the fermentation of coniferine appears to be the ethylic ether of vanilline. When fused with caustic soda, vanilline is converted into protocatechuic (oxysalicylic) acid, with formation of carbonic acid and water; if treated with hydrochloric acid, methylic chloride and protocatechuic aldehyde are formed. These and other transformations of vanilline indicate that it is a compound of methylic aldehyde and protocatechuic acid. When treated with nascent hydrogen, vanilline is converted into *vanillyl alcohol*. *Vanillic acid* ($C_8H_8O_3$) has been obtained from coniferine by oxidation with potassic permanganate, also by removing one methyl group from dimethyl-protocatechuic acid; it appears, therefore, to be monomethyl-protocatechuic acid. By heating a mixture of calcic vanillate and formate, vanilline—which is really the *aldehyde of vanillic acid*—is formed. When vanilline is treated with nitric acid, oxalic acid is produced. A good method for estimating quantitatively the amount of vanilline contained in vanilla consists in dissolving the latter in ether, and agitating the liquid with an aqueous solution of sodic hydrosulphite, when a solution of a compound consisting of vanilline and sodic hydrosulphite is obtained, from which the pure vanilline can be separated by decomposition with dilute sulphuric acid and extraction with ether. Vanilla is chiefly used for flavoring ice-cream, chocolate, etc., and, to a slight extent, in medicine. J. P. Battershall.

Vani'ni (Lucilio, or, as he afterward called himself in his writings, Julius Cæsar), b. at Taurisano, near Naples, about 1585; studied philosophy, theology, and natural sci-

ence at Rome and Padua; took holy orders; taught at Geneva, Paris, and Lyons; visited England; published in 1615 at Lyons his *Amphitheatrum Æternæ Providentiæ*, which, although an argument against atheism, made him suspected of being a free-thinker; published next year at Paris his dialogues, *De Admirandis Naturæ, Reginæ Deaque Mortalium, Arcanis*, which was burnt by order of the Sorbonne; removed to Toulouse, and began to teach, but was accused of atheism, sentenced to death by the Parliament, and burnt at the stake the same day the sentence was given, Feb. 19, 1619. (See David Durand, *La Vie et les Sentiments de L. Vanini* (Rotterdam, 1717), and *Œuvres philosophiques de Vanini*, by Rousselot (Paris, 1841).)

Van'ishing Frac'tion [Lat. *vanescere*, to "vanish"], a fraction that reduces to $\frac{0}{0}$ for a particular value of the variable which enters it. The fraction reduces to the anomalous form $\frac{0}{0}$ in consequence of the existence of a factor in both terms, which factor reduces to 0 in consequence of the particular hypothesis. In some cases this factor can be found and struck out, and then the true value of the fraction can be found by making the particular substitution. A more general method of treating such cases depends on a principle of the differential calculus. The rule is as follows: Differentiate the numerator of the fraction for a new numerator, and the denominator for a new denominator; then in the resulting fraction substitute the special value of the variable. If the result is $\frac{0}{0}$, repeat the operation, and continue the repetition till a result is found which does not reduce to $\frac{0}{0}$; the final result is the required value. This rule fails when the factor which reduces to 0 in both terms of the given fraction has fractional exponents, both of which are included between two consecutive whole numbers.

There is a species of vanishing fraction which reduces to the form $\frac{\infty}{\infty}$ for a particular value of the variable. The cause of this anomalous result is the existence of a factor in both terms which reduces to ∞ for the value in question. Fractions of this kind are freed of their anomalous forms by the process just considered. W. G. Peck.

Vanishing Point. See Perspective, by Prof. W. G. Peck, LL.D.

Van Lennep. See Lennep, Van.

Vanloo', the name of a family of painters of Flemish descent, but settled in France. The two most celebrated members of this family were the brothers Jean Baptiste and Charles André. The former, b. at Aix, Provence, Jan. 14, 1684; studied at Rome, supported by the prince of Carignano; settled in 1719 in Paris; enjoyed the patronage of the regent; became teacher at the Academy; visited England 1738–40, and d. in Paris Dec. 19, 1745. He painted mostly portraits. The latter, generally known under the name of Carle Vanloo, b. at Nice in 1705, and educated by his brother; became director of the Academy of Fine Arts in Paris in 1760, painter to the king in 1762, and d. in Paris 1765. He painted mostly historical pieces. Pictures by both of them are frequent in French and English galleries. Younger members of the family lived as court-painters in Madrid and Berlin.

Van Meter, p.-v. and tp., Dallas co., O. P. 1433.

Van Mil'dert (William), D. D., b. in London, in 1765, descended from a family of Dutch merchants; educated at Merchant Taylors' School and at Queen's College, Oxford; took orders in the Church of England; became curate of Sherbourne and Lewknor, Oxfordshire, 1788, rector of Bradden, Northamptonshire, 1795, and of St. Mary-le-Bow, London, 1796; gained a high reputation for pulpit eloquence by the Boyle lectures of 1802 and 1805; was chosen preacher of Lincoln's Inn 1812, and regius professor of divinity at Oxford 1813; was Bampton lecturer 1814; became bishop of Llandaff Mar., 1819, dean of St. Paul's, London, 1820, and bishop of Durham Mar., 1826. D. at the episcopal palace of Bishop-Auckland Feb. 21, 1836. Author of *An Historical View of the Rise and Progress of Infidelity* (2 vols., 1802–05; 5th ed. 1838), with copious and learned notes, being the Boyle lectures for the year of publication; *An Inquiry into the General Principles of Scripture Interpretation* (Oxford, 1815), being the Bampton lectures for the preceding year; *Fifty Sermons before the Honorable Society of Lincoln's Inn* (2 vols., 1812–19) and *Sermons on Several Occasions* (1838), preceded by a *Memoir* by Cornelius Ives. Bishop Van Mildert had edited the complete *Works of Daniel Waterland, D. D.* (10 vols., 1823), which were then first collected and arranged, and prefixed an elaborate *Review of the Author's Life and Writings* (1823).

Vannes, town of France, department of Morbihan, at the mouth of the Vannes, carries on a lively and varied manufacturing industry and an active trade in salt, butter, wax, honey, and cider. P. 14,690.

Van Ness (Cornelius Peter), LL.D., b. in Vermont Jan. 26, 1782; studied law; practised successfully in Burlington; was U. S. district attorney 1809–13; representative in the legislature 1818–21; commissioner for the settlement of the boundaries between the U. S. and Great Britain 1818–21; collector of the port of Burlington 1815–[illegible]; chief justice of Vermont 1821–23; governor of the State 1823–26; minister to Spain 1829–39, and collector of the port of New York 1841–45. D. in Philadelphia Dec. 15, 1852.

Vannucci. See Perugino.

Vannucci (Aito), b. Dec. 1, 1808. Besides school editions of the classics, his principal works are: *Studi storici e morali intorno alla Letteratura Latina* (Turin, 1843), *I primi Tempi della Libertà Fiorentina* (Florence, 1853–61), *I Martiri della Libertà Italiana* (last edition Milan, 1875), *Storia dell Italia antica* (his most important work, many editions), *Ricordi della Vita e delle Opere di N. B. Nicolini* (2 vols., Florence, 1866). Vannucci was for some years professor of Latin literature at Florence, and is now senator of the kingdom.

Vannuchi (Andrea). See Sarto, del.

Van Oos'terzee (Jan Jacob), b. in Rotterdam in 1807; studied theology at the University of Utrecht; was appointed minister of the principal Reformed church of Rotterdam in 1844, and professor of systematic and practical theology at the University of Utrecht in 1862. He is a celebrated preacher and a reputable author. He wrote for Lange's *Bibelwerk* commentaries on the Gospel of St. Luke, the Pastoral Epistles, and the Epistles to Philemon and of St. James, which have been translated into English, as well as his *Theology of the New Testament* (1870) and *Christian Dogmatics* (1874).

Van Ostade. See Ostade, Van.

Van Ren'sselaer (Cortland), D. D., son of Stephen Van Rensselaer, "the patroon," b. in Albany May 25, 1808; graduated at Yale College in 1827; studied law, and was admitted to the bar in 1830; afterward studied divinity at Princeton Theological Seminary; was ordained in 1835; preached for a short time in Virginia, and in 1837 became pastor of a Presbyterian church in Burlington, N. J. For a time he acted as agent for Princeton College, and succeeded in raising $100,000 for its endowment. He was the founder of the *Presbyterian Magazine*, to which he contributed largely. D. at Burlington, N. J., July 25, 1860. A volume of his *Essays and Discourses*, edited by his son, was published in 1861.

Van Rensselaer (Henry Killian), b. near Albany in 1744; commanded a New York regiment during the war of the Revolution; in July, 1777, was attacked near Fort Anne by a large body of the enemy, whom he repelled, but learning that the strong position of Ticonderoga had been abandoned by Gen. St. Clair, he withdrew. He was present at the engagements which in the following October led to the surrender of Burgoyne, in which he was severely wounded. Toward the close of the war serious disputes occurred between the authorities of New York and New Hampshire in respect to the jurisdiction of what were known as the "New Hampshire grants," and a mutiny broke out in Van Rensselaer's regiment, which was quelled only by the intervention of Washington. He afterward rose to the rank of general of militia. D. at Greenbush, N. Y., Sept. 9, 1816.

Van Rensselaer (Solomon), son of Henry Killian, b. in Rensselaer co., N. Y., Aug. 6, 1774; entered the army in 1792 as cornet of cavalry; was captain under Wayne at the battle of Miami, Aug. 20, 1794, where he was shot through the lungs. In 1801–10, and again in 1813, he acted as adjutant-general of the New York militia, and in the brilliant but unsuccessful assault upon Queenstown Heights, Oct. 13, 1812, being then lieutenant-colonel of volunteers, he bore a conspicuous part and received four wounds; was a Representative in Congress 1819–22, and postmaster at Albany 1822–39. In 1836 he published a *Narrative of the Affair at Queenstown*. D. in Albany Apr. 23, 1852.

Van Rensselaer (Stephen), LL.D., known as "the patroon," b. in New York Nov. 1, 1764, was the fifth in descent from Killian Van Rensselaer, the original patroon or proprietor of a tract of land granted by the States-General of Holland, 48 miles long by 24 miles broad, and comprising the greater part of Albany, Columbia, and Rensselaer cos.; graduated at Harvard College in 1782; was member of the assembly in 1789, of the State senate 1793–95; lieutenant-governor 1795–1801; member of the constitutional convention 1801; in 1810 was appointed one of the commissioners to explore the proposed line for a canal from Lake Erie to the Hudson, and to report upon the feasibility of its construction, and from 1816 to his death one of the canal commissioners. He was in command of the State militia at the commencement of the war

of 1812, and directed the unsuccessful assault upon Queenstown Heights. In 1819 he was chosen one of the regents of the New York University, of which he was subsequently chancellor; in 1821–23 instituted the geological surveys of New York, which were executed wholly at his cost by Prof. Eaton, and in 1824 established at Troy a scientific school for the instruction of teachers, which was two years afterward incorporated as the Rensselaer Institute, one-half the current expenses being for a long time defrayed by him. He was a Representative in Congress 1823–29, and it was by his casting vote in the New York delegation that John Quincy Adams was made President of the U. S. D. in Albany Jan. 26, 1839. He published *A Geological and Agricultural Survey of the District adjoining the Erie Canal* (1824).

Van Sant'voord (George), b. at Belleville, N. J., Dec. 8, 1819; graduated at Union College in 1841; studied law, and practised first in Indiana, then at Kinderhook, N. Y., and subsequently at Troy; was elected to the State assembly in 1852 and 1856, and in 1859 became district attorney for Rensselaer co. He contributed several historical papers to the *Democratic Review*, and published—*The Indiana Justice* (1845), *Life of Algernon Sidney* (1851), *Lives of the Chief-Justices of the United States* (1854), *Principles of Pleading in Civil Actions* (1852 and 1855), *Precedents of Pleading* (1858), and *Practice in the Supreme Court of New York in Equity Actions* (1860–62). D. at East Albany, N. Y., Mar. 6, 1863, being run over by a railway train.

Van Schaack (Peter), LL.D., b. at Kinderhook, N. Y., in Mar., 1747; graduated at Columbia College in 1768, was admitted to practise at the bar in 1769, and in 1773 was appointed to revise the statutes of New York. Being opposed to the principles of the Revolution, he went to England at the close of 1776, but returned to New York in 1785; resumed the practice of his profession, and also was a teacher of the science of law. He published—*Laws of the Colony of New York 1691–1773* (1773), and *Conductor Generalis, or the Duty and Authority of Justices, Sheriffs, Coroners, etc.* (1788). D. in New York Sept. 27, 1832. His *Diary, Journals, and Letters*, edited by Henry C. Van Schaack, were published in 1842.

Van Schaick (Gozen), b. at Albany in 1737; was appointed in 1756 a lieutenant in the expedition against Crown Point, and took part in the subsequent French and Indian war. Early in the Revolutionary war he was sent to Cherry Valley, in the interior of the State, to protect the settlers against the British and Indians; was present at the battle of Monmouth, and in 1779 was sent to destroy the settlements of the Onondaga Indians, for which and other services he received the thanks of Congress; was made brevet major-general in 1783. D. July 4, 1789.

Vans'ville, tp., Prince George's co., Md. P. 2273.

Van Swieten. See Swieten, Van.

Vantal'lar, tp., Licking co., O. P. 70.

Van Tromp. See Tromp, Van.

Vanux'em (Lardner), M. D., an eminent geologist of New York, of whose career no information is found in works of reference, is accredited by Dr. H. Charlton Bastian in his *Beginnings of Life* (2 vols., 1872) with the discovery and announcement of the doctrine of the correlation of forces, which was afterward independently discovered and demonstrated by Mayer and Joule.

Van Veen (Otho, also called Ottovenius), b. at Leyden about 1556; studied painting at Liege, then for eight years at Rome; settled at Brussels as painter to Alexander Farnese; removed afterward to Antwerp, where he established a school in which Rubens received his first instruction; returned finally to Brussels, where he d. as master of the mint about 1630. The most remarkable of his paintings are the portrait of Alexander Farnese and some religious pictures in Brussels and Antwerp.

Vanvitel'li (Luigi), b. at Naples in 1700, the son of a Dutch painter, Caspar van Witel, who had settled in Italy; studied first painting, afterward architecture; formed his style principally after Palladio and Vignola; executed many works in Rome and Naples, and d. in the latter place Mar. 1, 1773. His principal buildings are the Augustinian convent in Rome and the palace of Caserta near Naples. (See *Vita di Luigi Vanvitelli*, by L. Vanvitelli, Naples, 1823.)

Van Wert, county of N. W. Ohio, bordering on Indiana, drained by St. Mary's and other rivers, is touched on its E. border by Miami Canal, and traversed by Pittsburg Fort Wayne and Chicago R. R.; surface level and well timbered, soil a rich loam resting upon blue marl. There are saw-mills, flour-mills, tanneries, and some manufactories of iron and woollen goods. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, wool, lumber, and dairy products. Cap. Van Wert. Area, 390 sq. m. P. 15,823.

Van Wert, p.-v., Pleasant tp., cap. of Van Wert co., O., on Pittsburg Fort Wayne and Chicago R. R., has a national bank, a State bank, 2 private banks, and 2 newspapers. P. 2625.

Van Zandt, county of N. E. Texas, bounded N. E. by Sabine River, and drained by affluents of the Sabine, Neches, and Trinity; surface undulating, a large portion being well timbered. Cattle and swine are very numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Canton. Area, 875 sq. m. P. 6494.

Vapereau' (Louis Gustave), b. at Orleans, France, Apr. 4, 1819; was educated at the normal school of Paris; taught philosophy and German at the College of Tours 1843–52; settled in the latter year in Paris, and became in 1854 chief editor of the *Dictionnaire Universel des Contemporains*, of which editions appeared in 1858, 1861, 1865, and 1870. He also contributed occasionally to various periodicals.

Va'pors and Vaporization. Under Liquids, Chemical and Physical Nature of, the passage from the liquid to the gaseous or vaporous state is discussed, and the law of *latent heat of vaporization*, or gasefaction, stated. Regarding the nature of the change called vaporization, it may be further pointed out that it is legitimate for us to compare the phenomenon of the disappearance of *temperature* or *thermometric* heat in this case to the similar phenomena that occur during fusion, solution, and other chemical transformations accompanied by absorption of heat. Heat being always *motion*, as universally believed in recent times, the writer seeks here again to apply his views (see Temperature, Nature of) regarding the differences in nature and effects between *atomic* and *molecular* motion. He deems latent heat of gasefaction, like heat of liquefaction or fusion, to be *atomic* motion only, *intramolecular*, or inside the molecule, and that it is latent for the reason that it is expended in amplifying the atomic excursions or orbits. It follows that the molecules of a compound in gaseous form, besides being separated further, are *larger*; or it may be, more probably, that *there are more of them*, from the splitting up of more compound chemical molecules into simpler ones. Thus, we may suppose that *liquid* muriatic acid (liquefied by pressure) is H_2Cl_2 or H_4Cl_4, or generally $nHCl$, and that when it is gasefied it becomes simply HCl. Water in liquid form may be $H_{10}O_5$ or nH_2O, and in steam simple H_2O. By this hypothesis it will not be necessary to believe that the *intermolecular distances* in steam are twelve times those in water, the enormity of this latter deduction being very greatly mitigated. This view makes the relation between the liquid and gaseous conditions simply one of *polymerism* (see the sub-head *Polymeres* under Isomerism), the gaseous state being that in which chemical molecules have their simplest possible atomic form, or are reduced to their smallest possible number of constituent atoms.

The total space occupied in a gas, therefore, by the molecules themselves—apart from the intermolecular space—is greater than in a liquid, this increase representing the latent heat of gasefaction, which only appears again on reconversion into liquid. And the intermolecular distances and spaces, on the new polymeric hypothesis above stated, may have received no greater increase than is due to the mere increase of *temperature*, or motion of the molecule as a whole; the multiplied number of molecules accounting largely for the increase of volume. A still further increase of temperature leads, in the case of chemical compounds, to a further decomposition of the molecule into gaseous molecules of the elements themselves, composed each of a certain number as yet unknown—possibly unknowable—of elementary atoms; this being Dissociation. (See this article, by Prof. Joy.) Henry Wurtz.

Vapors, Determination of the Density of. Owing to the near relations which the atomic weight of the elements and the composition of compounds bear to the specific gravity of their vapors, the accurate determination of the latter at a known temperature and pressure, in comparison with that of an equal volume of air at the same temperature and pressure, possesses very great importance. Of the numerous methods proposed for this determination, those suggested by Gay-Lussac and by Dumas are most often employed; other processes proposed by Deville and Troost, Regnault and Hofmann, are also used for special purposes. In the determination of vapor-densities it is necessary that the substance be completely volatile without decomposition, that it be entirely free from bodies possessing lower or higher boiling-points, and that it be perfectly dry.

Gay-Lussac's method is employed in cases where the density of a liquid which boils at about 212° F. is to be

determined. In it a known weight of the substance is converted into vapor at a definite temperature, and its volume accurately measured. The density is then calculated by dividing the weight of the substance by the weight of an equal volume of air at the same temperature and pressure. The apparatus used consists of an iron bath containing mercury, on which a wide glass cylinder (open at both ends) rests; this is filled with water or melted spermaceti, the temperature of which is indicated by a thermometer dipping into the liquid, and encloses a smaller graduated cylinder, which is filled with dry mercury. A small bulb of thin glass is completely filled with the liquid whose vapor-density is to be determined, and sealed by fusing its orifice. Its weight when empty and when full is determined, the difference being, of course, the weight of the liquid used. The bulb is next introduced into the small graduated cylinder containing mercury, and this is immersed in the large cylinder filled with water or spermaceti, which is then heated to a temperature of about 60° F. above that of the boiling-point of the liquid in the bulb. Owing to the dilatation of the liquid, the bulb bursts, and the liquid becomes converted into vapor, causing a depression of the mercury. The volume of the vapor as indicated by the graduated tube is read off, the temperature being shown by the thermometer, and the barometric pressure by the difference between the height of the barometer at the time of the observation and the height of the mercurial column in the glass cylinder. It is, however, also necessary to determine the height of the column of water or spermaceti in the larger cylinder, and reduce it to the corresponding volume in millimètres of mercury, which is then added to the height of the barometer. It then remains to calculate the weight of a volume of air equal to that of the vapor under the same pressure and temperature, and to divide the weight of the vapor by that of the air. Thus, let p be the weight of the vapor in grains, v its volume in cubic inches, and t its temperature; if H be the height of the barometer (to which has been added that of the column of water or spermaceti reduced to its equivalent volume of mercury), and h that of the mercury in the graduated cylinder, $H - h$ will be the pressure on the vapor. The weight p' of a volume of air v, at the temperature t and the pressure $H - h$, is ascertained as follows: At zero, under the normal pressure of 760 millimètres, a cubic inch of air weighs 0.31 grains; therefore, under the same conditions, v cubic inches will weigh $0.31\,v$ grains, and the weight of v cubic inches of air at $t°$ and the pressure of 760 millimètres will be $\frac{0.31\,v}{1 + a\,t}$ grains, where a = the coefficient of cubical expansion of air for 1 degree (= .00366); and, as the weight of a volume of air is proportional to the pressure, the above weight can be reduced to the pressure $H - h$ by multiplying by $\frac{H - h}{760}$, which gives $\frac{0.31\,v(H - h)}{(1 + a\,t)\,760}$ for the weight p' of the volume of air v at the pressure $H - h$ at $t°$; therefore $\frac{p}{p'} = \frac{p(1 + a\,t)\,760}{0.31\,v(H - h)}$ = D, or the desired density of the vapor.

The method just described cannot be employed for vapor-density determinations of liquids which boil much above 300° F., as the mercury vapors evolved at a greater temperature would be dangerous to the operator, and would also vitiate the result by increasing the tension of the vapor of the liquid.

Dumas's method can be employed up to the temperature of 750° F. (about the heat at which glass softens), but it involves the necessity of a considerable supply of substance. It is executed as follows: A thin glass globe, having a neck consisting of a fine capillary tube, is first carefully dried, internally and externally, and weighed, the temperature t and the barometric pressure h being noted; the weight W is that of the glass G added to that of the air contained, p. The globe is next slightly warmed, and its neck inserted in the liquid the vapor-density of which is to be determined. On cooling, a small quantity of the liquid rises into the globe. It is then immersed in a bath consisting of oil or fusible metal, according to the temperature desired, the temperature of which is indicated by a thermometer. The bath is now heated a little above the boiling-point of the liquid contained in the globe, the vapor of which expels the air, and finally fills the globe. As soon as the vapor ceases to escape from the capillary tube, the point of the latter is hermetically sealed, the temperature of the bath t' and the barometric pressure h' being observed. When cold, the globe is carefully cleaned, and again weighed. This second weight W′ represents that of the glass G and that of the vapor p' which filled the globe at the temperature t' and pressure h', or $W' = G + p'$. In order to ascertain the weight of the glass when empty, the weight p of air is found by dipping the capillary tube beneath mercury and breaking off its extremity; if the operation has been properly performed, a vacuum is formed by the condensation of the vapor, and the mercury enters the globe, entirely filling it. The metal is then measured by pouring it out into a graduated tube, from the result of which the volume of the globe at the temperature t', and therefore the volume of the vapor, can be readily calculated. The weight p of the air at t and h is also then easily obtained, which, if deducted from W, gives the weight of the glass G. The weight of the vapor p' is W′ − G; and, as we have now ascertained the weight p' of a given volume of vapor at the temperature t' and pressure h', it only remains to calculate the weight p'' of an equal volume of air under the same conditions; which is easily done, when the quotient of $\frac{p'}{p''}$ will give the required vapor-density of the substance.

Deville and Troost have extended Dumas's method to the determination of vapor-densities of substances having a very high boiling-point, by employing a light porcelain vessel in place of the glass globe, and sealing the exit-tube by means of the oxyhydrogen blowpipe. The bath used is contained in an iron vessel, and consists of vapors of known and constant temperature; thus, boiling mercury furnishes a vapor-bath having a temperature of 662° F., sulphur one of 824° F., cadmium one of 1580° F., and zinc one of 1904° F. The temperature of the bath is best determined by means of a thermometer filled with iodine vapor, as it has about the same coefficient of dilatation as air, and possesses a heavy density.

Of the several methods proposed by Regnault, the following, which possesses great simplicity, and can be employed in the vapor-density determinations of substances which have a high boiling-point and are not affected by exposure to the air, merits mention: The vessels used are two cast-iron flasks of the same capacity and thickness, having their orifices partially closed by means of two metallic bullets. The volume of the flasks is first accurately determined by weighing the quantity of water necessary to fill them. Some mercury is then introduced into one flask, the substance experimented upon being placed in the other, and both are placed in a muffle and heated to a temperature above that at which the substance boils; whereby the mercury and substance are converted into vapor, which expels the air from the flasks. They are subsequently removed from the fire and allowed to cool, when the quantities of mercury and substance remaining in the flasks are determined by analysis. If P be the weight of the residual mercury, P′ that of the substance, and δ the density of mercury compared with that of the air under the same conditions of temperature and pressure that existed in the muffle when the flasks were removed, the density of the vapor x will be $x = \delta\,\frac{P'}{P}$; but as the capacities of the flasks are never precisely the same, the following equation is more correct: $x = \delta\,\frac{P''}{P} \cdot \frac{v}{v'}$, where v is the volume of the flask in which the mercury is placed, and v' that of the flask containing the substance.

Hofmann's method, which is based upon that of Gay-Lussac, is as follows: A graduated glass tube is first completely filled with mercury, and then dipped in a mercury bath, when a barometric vacuum of several millimètres will be formed in the top; this portion of the tube is then enclosed within another tube which is drawn out at its upper extremity to a conducting tube having a moderate width and bent at a right angle. This tube connects with a copper or glass vessel in which water or other liquids can be boiled. The outer tube is closed at the bottom with a cork having two openings, in one of which the barometric tube is inserted, in the other an escape-tube. In this way a current of vapor of water or other volatile liquid (such as *aniline*) can be made to traverse the space between the two tubes, thus maintaining the upper part of the barometric tube at the temperature desired in the determination. The substance under examination is introduced into the barometric vacuum in a small glass tube provided with a ground-glass stopper, which is afterward forced out by the expansion of the vapor. In other respects the determination is made as in Gay-Lussac's method. The above method is very advantageous in that, under the very slight pressure to which the enclosed vapor is exposed, the determination may be made at a comparatively low temperature. The vapor-densities of liquids, for instance, which boil as high as 300° F., can be ascertained at the boiling-point of water. J. P. BATTERSHALL.

Vapors, Latent Heat of. See VAPORS AND VAPORIZATION, by HENRY WURTZ; also LIQUIDS, CHEMICAL AND PHYSICAL NATURE OF, by the same.

Var, department of France, bordering S. and S. E. on the Mediterranean, comprises an area of 2384 sq. m., with

293,757 inhabitants. It is mountainous, covered with spurs of the Alps, and rich in forests and useful minerals, especially coal and iron. In the valleys wheat, wine, olive oil, and all kinds of fruit are produced in abundance, and a considerable manufacturing industry is carried on, comprising iron goods, perfumery, earthenware, and articles of marble. Of 35,380 children of school age, 9911 received no school education at all in 1857. Cap. Draguignan.

Varal'lo, small town of Italy, province of Novara, in the centre of the Val Sesia. In its immediate neighborhood is the Sacro Monte di Varallo, one of the most celebrated sanctuaries in the kingdom of Italy, and annually visited by many thousands of pilgrims. Here are more than 40 chapels, all adorned with plastic or pictorial groups representing scenes from the life of Christ. The modelled figures, which generally possess decided merit, are of baked clay, painted to resemble life; they are the work of some of the best artists of Northern Italy, among them the celebrated Gaudenzio Ferrari, whose house is still shown in the town. P. 3200.

Varangian Guards and **Varangians.** See NORMANS, by E. MUNROE SMITH.

Varan'idæ [from *Varanus*—the Latinized form of a native name—the typical genus], a family of reptiles of the order Sauria and sub-order Pleurodonta, confined to the Old World. The body has the typical lizard form; the scales are small, roundish, and disposed in transverse lines; the head is covered above with small scales or shields, and bony superorbital plates are developed; the mouth is well cleft; the teeth adnate to the inner side of the jaws; the tongue is elongate, slender, and bifid, and its base receivable in a membranous sheath; the legs are well developed, as are also the toes, which are five in number; the femora are destitute of pores. The skull offers a number of additional characters signalized by Cope: "the temporal bone superior plate developed beyond arched body; frontal underarching olfactory lobes; arches not complete; fossa not covered by dermo-ossification; articular and angular separate: dentary short, not developed posteriorly; Meckel's cartilage exposed in its groove; premaxillary single, suspensoria two;" the clavicle at its proximal end is simple; the sternum has an anchor-shaped mesosternum. The family includes some of the largest of known lizards; they are swift in their motions, and progress mostly in a somewhat serpentine manner; they feed chiefly on insects and the eggs of birds, reptiles, etc. The most noteworthy species is the monitor of Egypt (*Monitor niloticus*), so called because it was anciently supposed to give a warning or monitorial hissing or whistling noise on the approach of a crocodile. Modern Egyptians, it is said, believe that the species is a neglected young crocodile hatched on dry land. It is represented on ancient Egyptian monuments, and probably owed this commemoration to the fact that it devoured the eggs of the crocodile. It lives near the water, and attains a length of five or six feet.

THEODORE GILL.

Varaz'ze [Lat. *Vicus Virginis*], town of Italy, province of Genoa, on a bay near the mouth of the Teiro, about 7½ miles E. of Savona, is a walled and well-built town, and several towers of the old fortifications are still standing, but a large portion of the inhabitants now live in the suburbs outside the walls. In the church of S. Ambrosio, built in the twelfth century, restored in the sixteenth, and again in the seventeenth, there are some very fine marbles and good pictures, as also in some of the other churches. There is a very extensive dock here, and the chief occupation of the inhabitants is shipbuilding and the manufacture of all articles required for the outfit of vessels. Between 700 and 1000 men are employed in the construction of vessels, mostly for the Genoese mercantile service. Large paper-mills, one or two cotton-factories, etc., are also in operation. P. 9179.

Var'döe, island of Norway, in the Arctic Ocean, in lat. 70° 20′ N., lon. 31° 10′ E., and contains a town and fort, Vardöehuus, which is the northernmost inhabited place in Europe.

Varec (see KELP, by HENRY WURTZ), a French name for barilla or kelp, sea-weed ashes.

Varennes', a beautiful p.-v. of Verchères co., Quebec, on the S. shore of the river St. Lawrence, 15 miles below Montreal. It has in the vicinity saline and inflammable gas springs, a college, convent, and hospital. P. 561.

Varennes, tp., Anderson co., S. C. P. 1892.

Varc'se, town of Italy, province of Como, on one of the extreme spurs of the Rhætian Alps, about 35 miles N. of Milan. Its vicinity to Lago Maggiore and Switzerland has made it a place of considerable trade, as well as of much general activity, and the fine climate and scenery render it a very favorite summer residence for the Lombard nobility. The sanctuary known as S. Maria del Monte, on a lofty hill about 5 miles N. W. of the town, is an object of special attraction to the devout Roman Catholic on account of an image of the Virgin consecrated by St. Ambrose which is still preserved here, and to the lover of nature for the magnificent views to be obtained from this summit. Varese was a Roman town of some importance, and recent discoveries in the lakelets near it prove that it was inhabited in pre-historic times. P. 12,600.

Vare'se Ligu're, town of Italy, province of Genoa, once fortified, but the ancient castle, with its lofty tower built by the Fieschi, is all that remains of that period. The very scattered population of this commune numbers about 7000.

Var'gas (José), b. in Venezuela in 1786; was educated at the University of Caracas, and subsequently studied medicine in Edinburgh; after travelling in England, France, and Spain, entered upon practice in the island of Porto Rico, becoming the foremost surgeon in the West Indies. Returning to Venezuela, he became professor of anatomy, surgery, and chemistry in the University of Caracas, of which he was subsequently rector. His lectures, which were published, were the textbooks in the university, and he gathered the largest collection of plants and minerals, and the finest private library, in Venezuela. He also took an active part in public affairs; was a member of the first congress of the republic in 1821, president in 1834, and subsequently senator and councillor of state. D. in New York July 14, 1854.

Vargas, de (LUIS), b. at Seville, Spain, in 1502; studied painting in Italy, residing chiefly in Rome for nearly thirty years, after which he established himself in his native city, where he executed for the churches numerous large oil paintings and frescoes; was regarded as the chief of the Seville school, and hastened his end by his rigorous austerities, being accustomed, among other ascetic practices, to sleep in a coffin. D. at Seville in 1568. Among most admired paintings are *Adam and Eve, Jesus bearing his Cross*, and *La Generacion*, representing the parents and ancestry of Christ, all of which are preserved in Seville, and a portrait of the duchess of Alcalá, esteemed as equal to the similar works of Raphael.

Va'riable [Lat. *variare*, to "vary"]. Variables are quantities which admit of an infinite number of sets of values in the same equation. Thus, in the equation $y^2 = 2px$, x and y are variables, because there is an infinite number of sets of values of these quantities that satisfy the equation. If there are two or more variables in an equation, all but one may be regarded as *independent*: that is, we may assign values to them at pleasure, but the value of that one must be such as to satisfy the given equation. Because one variable always depends on the form of the equation, as well as on the values assigned to the others, it is called the *dependent* variable or the *function*. In the rectangular equation of lines, x, or the abscissa, is called the independent variable, and y, or the ordinate, is the function; in the rectangular equation of surfaces x and y, or the abscissas, are taken as independent variables, and z, or the ordinate, is the function. In the polar equation of a line the radius vector is regarded as the function, and the corresponding angles are regarded as independent. This is the conventional rule, but any variable may be regarded as the function, the other varying elements being regarded as independent.

The difference between the variables and the arbitrary constants that enter an equation is this: the variables admit of an infinite number of sets of values in the same expression, whilst the arbitrary constants admit of but one out of an infinite number of sets of values. Thus, in the equation of a parabola, which is $y^2 = 2px$, $2p$ may have any arbitrary value, whilst x and y must have an infinite number of values for any assumed value of $2p$. W. G. PECK.

Varia'tions [It. *variazioni*], in music, certain ornamental changes or embellishments in the treatment of a theme during several successive repetitions. The simplest kind of variation is by the breaking of chords into triplets or quadruplets, etc., or by throwing them into some of the numerous forms of arpeggio, or by inserting passing notes into the melody, together with scale movements, and many similar devices. In simple variation the fundamental harmony usually remains unchanged, whatever may be the form of the structure built upon it. But in the more elaborate styles of variation new harmonies, rhythms, and melodic developments gradually appear, and are often so richly worked out as to display with brilliance the fertility of the writer's fancy. Variations of *chorals* consist chiefly of changes in the harmony, suspensions, syncopations, and passing notes, while the flow of the original melody is preserved intact. A strain of mere melody may be so varied as to convey the idea of three or four parts in harmony, as

when on a violin or flute each note is broken into an arpeggio movement on a supposed series of chords.

WILLIAM STAUNTON.

Variations, Calculus of. John Bernouilli proposed (1696) to the mathematicians of his day the following problem: "Datis in plano verticali duobus punctis A et B, assignare mobili, M viam A M B per quam gravitate sua descendens, et moveri incipiens a puncto A, brevissimo tempore perveniat ad alterum punctum B." (Given, two points, A and B, in a vertical plane, to find the path or curve by which a body under action of gravity will descend from A to B in the least possible time.) In this problem (since known as that of the *brachystocrone*—βραχύς, "short," and κρόνος, "time") was the germ of the subsequently-developed *calculus of variations*. The peculiarity of the problem lies in this, that a curve is to be found no element of which is given; no condition establishing *directly* a condition between its elements (or parameters); nor any relation governing the *relative* increments of its co-ordinates (*i. e.* determining *its law of growth*; see CALCULUS). It was thus removed out of the sphere of pure geometry, and was beyond the methods of the differential calculus; for the first needs data involving the integral elements; the second (besides perhaps these), data governing the law of growth (*i. e.* involving some one or more of the differential coefficients). Such were not the data of this new problem, but (regarding the required curve as to be expressed by a relation between Cartesian co-ordinates y and x) to find that relation or *function* which should *fulfil a certain condition*—*i. e.* that it should be the minimum-*time* path of descent, by action of gravity, of a body falling from one of its *given* points to the other and lower *given* point. Solutions were given by the proposer and his brother, James Bernouilli, and by the Marquis de l'Hôpital, but they were special, and involved assumptions which are not always admissible. Subsequently, Euler took up the subject, and to him the modern calculus is greatly indebted. He developed what (in his predecessors) had been mere solutions of a particular problem into an almost complete science. But it remained for the illustrious Lagrange to separate the principles of the calculus of variations from the geometrical considerations from which his predecessors had derived them: to establish a pure analytic basis; to invent a simple and definite notation; and thus to open a new and extensive field for its future applications. To Lagrange, therefore, is usually attributed the calculus of variations as it is now presented.

It is not in place here to attempt to set forth its methods. Its problems all involve the condition of maximum or minimum, absolute or relative—*e. g.* in that of the brachystocrone the condition is *absolute*, inasmuch as no *other* condition is imposed; in that of a line of *given* length which shall be the perimeter of a *maximum area*, is that of *relative* maximum. The methods are analogous to those by which maxima and minima are derived by the differential calculus. If in the expression $y = f(x)$ (y being any function depending for its value on that of x) there be a value, x_m, for which the corresponding value y_m is greater (or less) than all others (*i. e.* a maximum or minimum), then (in general) an indefinitely small increment of x_m will produce no change in y_m. In the language of the differential calculus, the differential of y taken with respect to x becomes *zero* for that value of x which renders y a maximum (or minimum). But if, *instead of varying* x in the particular function, we slightly vary *the function f itself* (this may be done by slightly varying its parameters or slightly varying its analytic form), we should have, for every value of x, a slightly-varied value of y. The differences thus created may be called *variations*. Now, analogously to the above law of maxima in the differential calculus, if for some particular form $f(x)$ *some other quantity or derived function depending upon this particular form* (*e. g.* the *time of descent* by gravity from one point to another) be a *minimum*, then an infinitesimal variation (under restrictions which cannot here be explained) of the *function* will produce *no* change in that minimum. By this condition (subject to certain restrictions) the *calculus of variations* determines the form of $f(x)$—somewhat as in the differential calculus the particular value of x which makes y a maximum is determined. The simplest of its problems is that of the shortest path between two given points, by which it is shown to be a *straight line*. The *History of the Calculus of Variations* has been written by Todhunter, as also *Researches in the Calculus of Variations*. Strauch, a German author, is an authority; but the most exhaustive English treatise is that of Jellett (Dublin, 1850).

J. G. BARNARD.

Var'ick, p.-v. and tp., Seneca co., N. Y. P. 1741.

Varick (RICHARD), b. at Hackensack, N. J., Mar. 25, 1753; at the opening of the war of the Revolution was a lawyer in New York; entered the army as a captain, was secretary to Gen. Schuyler in the northern department, and after the discovery of Arnold's treason was inspector at West Point, and subsequently, with the rank of colonel, a member of the military family of Washington. In 1783 he became recorder of the city of New York, and was subsequently mayor for several years, ending in 1801. In 1786 he and Samuel Jones were appointed to revise the State laws, and the result of their labors, bearing their joint names, was published in 1789. He was one of the founders of the American Bible Society, and succeeded John Jay as its president. D. at Jersey City July 30, 1831.

Var'icose Veins, relaxation of the coats of the superficial veins, with increased calibre, occurring most frequently in the lower extremities. Gravitation, the weight of the venous blood-column above, and the difficulty of the ascent of blood from the feet to the body, determine the greater frequency of the disease in the veins of the legs. Varicose veins are common in aged men, the result of senile degeneration of the various tissues, including attenuation of the coats of vessels; less often it occurs in mid-life to robust men of the gouty habit, and who by vocation are constantly standing; walking does not favor the condition, since the movements of the superficial muscles and tension of the integument help to lift the blood upward. Even in youth violent exercise, as in the gymnasium, by unduly taxing the tension of the vascular system, causes a breaking down of the valves in the veins and venous dilatation or varicosity. In women the chief and not unfrequent cause is pregnancy. Women who have borne several children will often have marked varicose veins, the result of the pressure of the gravid uterus upon the veins in the pelvic cavity, and consequent detention of the venous blood in the lower extremities. Varicose veins occur exceptionally in other parts of the body—upon the scalp and side of the neck, and upon the abdomen in the region of the groin. Varicocele in the male is a local varicosity of the spermatic veins. Haemorrhoids or piles are due to repeated passive congestions of the haemorrhoidal veins at the verge of the anus; obstruction to the portal circulation is the primary cause, but if of frequent recurrence and long standing, the veins become varicose. Varicose veins, as seen in the lower extremities, are increased in diameter with inequalities of calibre, and present nodular enlargements or pouches at intervals; there are greater relaxations at the site of former valves or at the points of division of veins. The veins are also tortuous, since the longitudinal fibres of the coat are relaxed no less than the circular; the tortuosity accommodates the increased length of the vessel and favors the ascent of the blood. Varicose veins when appearing do not necessarily indicate debility or degeneration, but should warn the patient at once to abandon vocations involving violent exertion, to habitually regulate the diet and bowels, and neutralize and remove any rheumatic or gouty vice. The varicose limb may be benefited by daily friction, cold effusion, and salt bathing. But the extension of the disease is best checked, and the best prospect of cure ensured, by constant external support. This is secured by uniform bandaging, or by wearing an elastic stocking or laced leg-corset. The elastic stocking, made of rubber webbing, is of the greatest value to those who can afford the silk and rubber webbing, and keep them constantly renewed when stretched by wear. The inferior stocking by stretching at points leaves bands of circular constriction which aggravate the disease rather than give the intended benefit. The cheapest and most efficient appliance is a case or corset of strong jean fitted to the shape of the limb and lacing up in front. Varicose veins are radically cured by ligation and by hypodermic injection of a drop of liquor ferri pernitratis within the vein. Either process may result in local ulceration and failure. The latter method carefully performed may afford permanent relief, with the precaution to tightly bandage the part for several hours to prevent blood-clots from reaching the heart and vessels of the trunk. Arsenical preparations are thought to act well on varicose veins.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Vari'na, tp., Henrico co., Va. P. 3210.

Varinas, or **Barinas.** See BARINOS.

Varioloid. See SMALL-POX and VACCINATION.

Var'na, in Bulgaria, on an inlet of the Black Sea, 180 miles N. W. of Constantinople, with which it is connected by a line of steamers (about 15 hours). It makes a good appearance as seen from the water, and has some importance on account of its fortifications; and although its harbor is safe only in summer, it carries on a considerable trade. A railway, owned in England, connects it with Roustchouk (140 miles N. W.) on the Danube. P. about 20,000.

Varn'hagen von En'se (KARL AUGUST), b. at Düsseldorf Feb. 21, 1785; was educated at Hamburg; studied

first medicine, then philosophy and literature at Berlin, Halle, and Tübingen, and published in 1804 a *Musenalmanach*, together with Chamisso. In 1809 he entered the Austrian army, fought in the battles of Aspern and Wagram, and accompanied, after the conclusion of peace, Gen. Prince Bentheim as adjutant on his diplomatic journeys to Prague and Paris. In 1812 he received a position in the Prussian civil service, but in 1813 entered the Russian army as a captain; served in Tettenborn's corps during its campaign from Hamburg to Paris, and wrote *Geschichte der Kriegszüge Tettenborns* (1814). After the fall of Paris, he accompanied Prince Hardenberg to the Congress of Vienna, and went in 1815 as Prussian minister to Carlsruhe; but removed in 1810 to Berlin, where he subsequently resided till his death, Oct. 10, 1858, devoting himself to literature. In 1814 he married Rahel Levin, a rich Jewess (b. in 1771), much noted for the chivalric homage which the late Prince Louis Ferdinand of Prussia (d. in 1807) had borne to her, and most remarkable for the power and brilliancy of her intellect and for the energy and nobleness of her character. In Berlin she formed the centre of a large circle encompassing all the greatest talents in art, literature, science, and politics, and after her death (in 1833) her husband published *Rahel, ein Buch des Andenkens für ihre Freunde* (3 vols., 1834), containing selections from her posthumous papers, and *Galerie von Bildnissen aus Rahel's Umgang* (2 vols., 1836), a series of literary sketches. This last kind of production, the biography, the literary portrait, was the true talent of Varnhagen von Ense, and his *Goethe in den Zeugnissen der Mitlebenden* (1823) and *Biographische Denkmale* (5 vols., 1824–30) are very interesting. After his death were published his *Tagebücher* (14 vols., 1861–72), *Blätter aus der preussischen Geschichte* (1868), *Biographische Porträts* (1871), *Briefe von Alexander von Humboldt 1827–58* (1860), etc., which works gave many surprising revelations with respect to characters and events of his time.

Var'nish [Lat. *vernix*; Ger. *Firniss*; Fr. *vernis*], a resinous solution which is employed for coating various objects in order to produce a thin, transparent, and hard surface, forming a protection against moisture and air. The principal resins employed are the gums copal, shellac, animé, mastic, and sandarac; the solvents being spirit of wine, wood-spirit, oil of turpentine, linseed and other drying oils. From the nature of the solvent used varnishes may be conveniently divided into four classes—viz. fixed oil, spirit, volatile oil, and ether varnishes.

Fixed oil varnishes, which possess great durability and lustre, are usually prepared from linseed oil, which, on being oxidized by the action of the air, is converted into a tough elastic substance termed *linoxine*, the change taking place more rapidly in a boiled oil, which possesses greater siccative power. In the preparation of the oil for the manufacture of varnish, it is boiled in a copper vessel in the presence of litharge, oxide of zinc, or peroxide of manganese, by the action of which the *linoleine* of the oil is partially converted into linoxine. The resin is then fused in a caldron, and the boiled oil, which is heated to about 300° F., gradually added, with constant stirring. As soon as a complete admixture between the resin and oil has been effected, the caldron is removed from the fire and allowed to partially cool, when heated oil of turpentine is added in a thin stream until the mixture acquires a proper consistence. The proper amount of linseed oil to be added to the resin can be determined by taking out a drop of the fluid every few moments and allowing it to cool on a glass plate, when, if the proportions of oil and resin are correct, it will remain limpid and wax-like; in case it becomes hard and brittle, more oil is required. It was formerly considered necessary to boil the mixture of linseed oil and resin before adding the oil of turpentine, but the only heat really requisite is that needful to melt the resin and cause it to become thoroughly miscible with the oil. The manufacture of varnish should be carried on in dry weather, as otherwise its transparency and drying qualities are liable to be impaired by the absorption of moisture; and, owing to the inflammability of the oil of turpentine, great caution is necessary to avoid danger of fire. When practicable, all heating should be done by means of a sand-bath. The quality of the linseed oil used is of importance; a pale limpid oil, which is prepared from full-grown and ripe seeds, and does not change the color of the varnish to any great extent, should be employed. The proportions by weight of the ingredients composing an ordinary oil-varnish are as follows: resin (copal, amber, etc.), 10; boiled linseed oil, 20 to 30; oil of turpentine, 15 to 18. As a rule, varnishes of this composition improve with age. An amber varnish, which possesses great durability, but dries slowly, has the following composition: resin (*amber colophonium*), 1 pound; boiled linseed oil, 10 ounces; oil of turpentine, 1 pint. A good carriage varnish is made from gum-animé, 8 pounds; boiled linseed oil, 3 gallons; camphor, ¼ pound; litharge, ¼ pound; oil of turpentine, 5½ gallons. A black asphaltic varnish, suitable for iron-work, can be made from asphalt, 3 parts by weight; boiled linseed oil, 4; oil of turpentine, 15 to 18; or from foreign asphalt, 45 pounds; linseed oil, 6 gallons; litharge, 6 pounds; boil, then add dark fused gum-amber, 8 pounds; hot linseed oil, 2 gallons; boil again, remove from the fire, and thin down with oil of turpentine, 25 gallons. A good wainscot or mahogany varnish is obtained from sorted gum-animé, 8 pounds; clarified linseed oil, 3 gallons; litharge, ¼ pound; dried sugar of lead, ¼ pound; oil of turpentine, 5½ gallons. The addition of India-rubber or gutta-percha to oil varnishes imparts further flexibility to the product.

Spirit varnishes (*lac varnishes*) differ from the preceding in being true solutions of resins. The solvents most employed are spirit of wine and wood-spirit. Acetone, benzole, etc., are also occasionally used. The gums chiefly employed are sandarac, mastic, shellac, and animé. Sandarac confers hardness on varnishes; mastic imparts a gloss. Shellac is rendered more soluble by being powdered and exposed to the air for a long time. The spirit used as the solvent should not be less than 95 per cent. in strength. In the preparation of spirit varnishes the resins, before being added to the solvent, should be well pulverized and mixed with sand or broken glass, in order to prevent the gum from agglutinating into lumps. The solution is accomplished in a still heated in a steam-bath, the varnish being filtered, first through silk, then through filter-paper. The tendency of the varnish to "chill" or give a rough surface is obviated by the addition of a little concentrated ammonia or gum-sandarac; excessive brittleness being remedied by the addition of Venice turpentine. Sandarac varnish is prepared by dissolving 10 parts of the gum and 1 part of Venice turpentine in 30 parts of spirit. Ordinary copal varnish is made by first melting the resin at a gentle heat, then pulverizing and mixing it with sand, dissolving in strong alcohol, and filtering. Elemi resin, or solution of turpentine, is sometimes added to give greater softness. A colorless copal varnish is prepared by dissolving 6 parts of pulverized and fused copal in 6 parts of strong alcohol in a closed vessel, and adding 4 parts of oil of turpentine and 1 part of ether. Colored spirit varnishes, or *lacquers*, are commonly used to impart a gold color to instruments made of brass and other base metals. As the coloring ingredients, tinctures of gummi-gutta, dragon's blood, gamboge, coralline, picric acid, turmeric, Martius yellow, annotto, etc., are separately prepared and added in the proportions necessary to give the required color to a varnish consisting of seed-lac, 2 parts; sandarac, 4 parts; elemi, 4 parts; alcohol, 40 parts. The following mixture furnishes a good gold lacquer for brass-work: seed-lac, 3 ounces; turmeric, 1 ounce; dragon's blood, ¼ ounce; alcohol, 1 pint. Recently, aniline colors have been employed to impart various tints to spirit varnishes, which are especially adapted to the coloring of glass, the "bronzing" of leather, etc.

Volatile oil varnishes are prepared in the same manner as the preceding, the solvent being oil of turpentine. They are more durable than spirit varnishes, and are less brittle, but require more time in drying; they also differ from the latter in improving by age, whereas spirit varnishes usually deteriorate in quality. The resins employed (gum-copal, gum-damar, Canada balsam, etc.) are commonly directly dissolved in the oil of turpentine, with or without previous fusion, the usual proportions being about 5 pounds of the resin to 7 pounds of the solvent.

Ether varnishes consist simply of an ethereal solution of a resin. They have a very limited application. The following is sometimes used for the repairing of jewelry: copal, 5 parts; ether, 2 parts. A varnish for photographers' use is prepared by dissolving 3 or 4 grains of amber in 1 ounce of chloroform.

Besides the varieties of varnish already mentioned, numerous other preparations are used for specific purposes which cannot well be classified under any of the above heads. A varnish consisting of 1 part gutta-percha dissolved in 5 parts oil of turpentine, to which 8 parts of hot linseed oil are added, does not scale, and is sometimes used for maps. Wax varnish, or milk of wax, is prepared by melting 1 pound of white wax at a low heat, adding 1 pint of warm spirit of wine (90 per cent.), mixing, and pouring the liquid out on a cold porphyry slab, on which it is ground with a muller to a smooth paste. An emulsion with water is then made and strained through muslin. This preparation is extensively employed as a protective coating for old paintings, upon which it is first allowed to dry, and then equally fused by passing a warm iron over it. A varnish for covering zinc is obtained by dissolving equal parts of chlorate of potassa and sulphate of copper in hot water, and immersing the zinc in the solution for a few seconds; a coating of oxide of copper is formed on the

metal, which when dry is washed and polished, when it acquires an indigo-blue color. The preparations used for varnishing guns, engravings, leather, etc., differ little from those described above, and do not require special mention. A process closely resembling varnishing is practised by the Japanese, and is for this reason termed *japanning*, in which the object coated is heated in an oven after every application of the varnish. The Japanese varnish appears to consist of the resin of the *Rhus vernix*. In China the sap of the *Augia sinensis* is frequently employed as a varnish, either in the crude state or after being mixed with various coloring-matters. J. P. BATTERSHALL.

Var'nish-Tree, a name given to *Rhus vernicifera* of Japan, *Melanorrhœa usitata* of India, *Stagmaria verniciflua* of the Malay Islands, *Semecarpus anacardium* of Sylhet, and other varnish-producing trees of the order Anacardiaceæ.

Var'num (JAMES MITCHELL), b. at Dracut, Mass., in 1749; graduated at Rhode Island College in 1769; studied law, and practised at East Greenwich, R. I.; in 1774 headed a company called the Kentish Guards which gave to the army more than thirty commissioned officers, among whom was Gen. Greene; rose to the rank of brigadier-general, and commanded the American troops on the Delaware when the British took possession of Philadelphia; was with the army during the winter at Valley Forge; took part in the battle of Monmouth, and afterward served under La Fayette in Rhode Island, leaving the army in 1779. He was twice elected to the old Congress, and in 1788 was appointed a judge of the supreme court of the North-west Territory. D. at Marietta, O., Jan. 10, 1789.

Varnum (JOSEPH BRADLEY), brother to James M., b. at Dracut, Mass., in 1750; after serving in the Revolutionary army was successively a member of both houses of the Massachusetts legislature, Representative in Congress 1795–1811, Speaker of the House 1807–11, and Senator 1811–17. D. Sept. 11, 1821.

Varo'li (COSTANZO), b. at Bologna about 1543; studied medicine at the university of his native city, and taught anatomy there for some time, but was invited to Rome by Pope Gregory XIII., and made his first physician. D. at Rome in 1575. He made comprehensive investigations concerning the human brain, of which one part still bears his name, *pons Varolii*, and wrote *De Nervis Opticis, nonnullisque aliis, prater communem Opinionem in Humano Capite observatis* (1573), and *De Resolutione Corporis humani*, not published until after his death (1591).

Var'ro (MARCUS TERENTIUS), b. B. C. 116 in the Sabine town of Reate, of ancient family of senatorial rank. He early devoted himself to antiquarian lore and to literature, but did not neglect his duties toward the state, and was often employed by Pompey on grave political occasions. When the civil war arose, he espoused the republican cause, but was reconciled to the victorious Cæsar, who made him librarian of his contemplated collection. He was an exceedingly prolific writer, and versatile as well in matter as in form. Though a devoted patriot, he availed himself of Greek culture, but in style he always remained uncouth and harsh. He was older than Cicero, who with sentiments of admiration and fear dedicated his *Academica* to him. He was styled by Cicero *homo πολυγραφώτατος* (*Ad Att.*, xiii. 18), and by Quintilian, *vir Romanorum eruditissimus* (x. 1); he was a great favorite with the Christian Fathers, and especially with St. Augustine, who says of him: "Tam multa legit, ut aliquid ei scribere vacasse miremur; tam multa scripsit quam multa vix quemquam legere potuisse credamus." (*De Civ. Dei*, vi. 2.) His writings amounted to 620 books on 74 different works, of which 170 books were in metrical form. His prose works embraced almost all branches of knowledge—grammar, rhetoric, geography, history, philosophy, jurisprudence, husbandry—but in his universal study he kept Rome and Roman interests always in view, and thus exerted an immense influence on his own and on subsequent times. D. B. C. 27. Of all his works, only two have come down to us: *De Lingua Latina* and *Rerum Rusticarum Libri III.* Of the original 25 books on the Latin language, only books 5–10 are extant, and these imperfect. His three books on husbandry we have complete, with the exception of a gap at the beginning of the second; this treatise is given in the form of a dialogue, like Cicero's philosophical writings, but with far more spirit and vigor. The other works of Varro do not appear to have been in existence beyond 600 A. D. CHARLES SHORT.

Varu'na. In the present day, when it is the fashion amongst certain scholars to doubt everything, it is doubted by some whether this word is at root identical with the Greek *Ouranos*. It certainly is. It is derived from the Sanskrit root *vri*, to "surround." *Varuna* is therefore "that which surrounds." Varuna is adored as a deity by Hindus. He is the greatest offspring of the Lord of Space, *Aditi*. More than most gods of the Hindu pantheon, Varuna is shrouded in mystery. He is worshipped, in a dim sort of way, together with Indra, Mitra, and Agni. Varuna is especially praised in Vedic hymns; yet even there he is a mysterious power, just as space is mysterious. He first takes his place in Oriental mythology as something indefinable. It is only in later times that he assumes a substantial personality. At first, Varuna was the hidden sun. He had set, but he would rise. Whilst hidden underneath the earth in the bosom of night, Sûrya, the sun, was "Varuna." No one knew aught of him; he was of all powers that power who did his deeds in secret, lived in darkness, and withdrew at the first flush of dawn. Mitra was the rising sun, Agni was the god of fire, but Varuna was the heavenly mystery. The golden light of the beautiful Mitra (dawn) precedes Varuna, who loves the dark shades of night, which are especially sacred to him. He gives coolness to the people who are faint with the ardent beams of Agni. Yet, though a night god and a lover of cool winds and dews, Varuna is luminous as the moonbeams themselves. He is described as the guardian of immortality, the lover of truth, having in his hand a rope with many nooses, with which he seizes evil-doers by flinging the slip-knot round their necks; all-powerful and all merciful. It is written: "No one rules for the twinkling of an eye without his permission and favor." He governs the great waters. He is the "lord of punishment." His grand Vedic emblem is the setting sun. He resides on *Pushpagiri*, the fabulous mountain clad with sweet-scented flowers. R. C. CALDWELL.

Va'rus (PUBLIUS QUINTILIUS), consul in 13 B. C., and afterward governor of Syria; was sent in 7 A. D. to Germany as governor. Augustus considered the moment favorable to introduce the regular administration of a Roman province in the regions between the Rhine and the Weser, which Drusus had conquered; and although Varus carried out the abolition of the old German law and the introduction of the Roman law, he experienced no open resistance; he did not even suspect any disaffection. A formidable conspiracy had nevertheless been formed under the lead of Hermann between the chieftains of the Cherusci, Marsi, Catti, and Bructeri. By the information of the insurrection of a distant German tribe, Varus was allured out of his fortified camp. His way to the place of the insurrection led through the *Saltus Teutoburgiensis*. He had hardly entered the pass, however, before he was attacked on all sides by the Germans lying in ambuscade. After three days' hard fighting, he finally succeeded in making his way through the passes, and emerged, much reduced in numbers and utterly exhausted, into the open country; but here he was met by the main force of the German tribes, and his army was completely annihilated. In despair, he killed himself. The impression which this defeat made in Rome was enormous, and the old emperor himself was almost driven to distraction by the loss of his legions.

Va'sa, p.-v. and tp., Goodhue co., Minn. P. 1218.

Vasa, House of, one of the most celebrated royal families of Europe, was founded by Gustav Ericsson Vasa in 1523, and ruled over Sweden till 1818. Thrice the succession passed into collateral female branches, the direct male having become extinct—namely, with (1) Charles X. (1654–60), son of John Casimir, prince-palatine of Deux Ponts, and Catharine, daughter of Charles IX. and sister of Gustavus Adolphus; (2) Ulrike Eleonore (1718), daughter of Charles XI., sister of Charles XII., and married to Frederick of Hesse-Cassel; (3) Adolphus Frederick (1751–71), grandson of Eleonore Sophia, the elder sister of Charles XII., and married to Frederick III. of Holstein-Gottorp. On the death of Charles XIII. (1818) the house of Vasa ceased to reign, and was succeeded by Marshal Bernadotte, though there was an heir, Prince Gustav of Vasa (b. in 1799), the son of Gustavus IV. Adolphus, who abdicated in 1809. He lives in Vienna, and his only child, Princess Caroline of Vasa, is married to Prince Albert of Saxony. The most celebrated members of the family were Gustavus Adolphus and Charles XII. Queen Christina and Gustavus III. were also interesting characters, if not great, and Charles IX., X., and XI., as well as the founder, were very energetic and able rulers. Eric XIV., who was mad; the Polish branch of the family, which was controlled by the Jesuits; and the two last rulers, Gustavus IV. Adolphus and Charles XIII., were weak-minded. (For further information see the biographies under the separate headings.)

Vas'arhely, or **Hold-Mezö-Vasarhely,** market-town of Hungary, on Lake Hold, has 49,153 inhabitants, mostly engaged in the rearing of cattle and cultivation of wine and tobacco. Its annual markets are well frequented.

Vasa'ri (GIORGIO), b. at Arezzo in Tuscany in 1512, belonged to a family of painters; studied art, architecture, and painting practically; became a pupil and friend of

Michael Angelo; was much employed by Pope Clement VII. in Rome, and by Alessandro and Cosmo de' Medici in Florence: built the church of Abbadia in Arezzo and the Palazzo degli Uffizi in Florence; painted several noted pictures in the Palazzo Vecchio in Florence and in the Scala Regia in the Vatican: became one of the founders of the Academy of Fine Arts in Florence, and d. there June 27, 1574. His fame, however, rests less on his artistic productions than on his writings on art. His celebrated work, *Vite de' più eccellenti Pittori, Scultori ed Architetti*, appeared first in 1550; in 1568 he published an enlarged and revised edition, ornamented with the portraits of the artists; a recent edition appeared in Florence in 13 vols. (1846–57). As a work of history it contains invaluable information; as a work of criticism it rests on broad and sound views; its style is simple and unaffected, sometimes eloquent. It has been translated into English by Mrs. J. Forster (5 vols., London, 1850–52).

Vasco da Gama. See GAMA, DA.

Vas'cular Tis'sue, in plants, is in general made up of elongated cells, which usually have closed extremities, so that fluids passing from cell to cell have to be passed by osmosis, or other physical or vital forces, through the intervening walls. In many plants there is no distinction into separate vascular and woody tissues, the two being commingled, and many hollow tubular cells contain coiled or spiral rolls of fibre. Some distinguish laticiferous vessels also for containing the milky, gummy, or other peculiar principles of the species. These, in some instances, seem to be not cells, but cavities between bundles of cells.

Vasisht'ha. This was a celebrated Brahman sage and rishi. He comes before us chiefly as a champion of Brahmanic claims to supremacy. He is accredited with many of the Vedic hymns. In the epic period of Sanskrit poetry he is extolled in the *Mahâbhârata*. In Puranic times every poetical history, or nearly so, records some legend of the sage. The reader should consult the article on VISWÂMITRA. Vasishtha represented the true principle of exclusive Brahmanism. He was the greatest champion they ever had. Though not in fact, yet virtually, he conquered *Viswâmitra* even, at the end of a struggle lasting over many thousand years; for *Viswâmitra* could only become his equal, after prodigious ascetic exertions, by becoming born again as a Brahmanic rishi. Viswâmitra was of the royal or military class, the Kshattriya caste. For it he primarily contended, and opposed himself against Vasishtha, who at every point overcame him. It was only after the attainment to Brahmanic power and honor that Vasishtha endured his splendid defeat. But he was still the champion of Brahmanism, for had he not demonstrated that it was only a man who was born, or who had made himself, a Brahman, who could contest equal honors with him? Thus this legend of the struggles of Vasishtha and Viswâmitra is a very one-sided one, intensely interesting, but a myth concocted wholly by Brahmans for their own glorification. There is little doubt but that in early Aryan times there was constantly going on a struggle between the priestly and royal castes of Hindus. It appears that at one period the Brahmanic element rose to an undoubted ascendency. The legend records that the struggle lasted over cycles of time. This is of course simply the splendid exaggeration of the Eastern poet who first invented the nucleus of the myth. But all accounts agree in this, that at length the Kshattriya champion became the equal at least of his Brahman-born competitor. Though this was only effected after terrible exertions, yet we see in it a foreshadowing, as it were, of a custom now prevalent amongst the royal race of Travancore, that most exclusive of Brahman states under British protection in the present day. The Travancore kings are of the Sudra, or one of the lower castes. But each of these mahârâjahs, as he ascends the throne, has a cow made of his own weight in gold, through which, literally, he passes, after great display and ceremonial. The cow of gold is then broken up, and the pieces of the costly metal are distributed amongst the temple Brahmans. The râjah then is "twice-born." He is no longer a mere Sudra. He may actually enjoy the sacred felicity of *seeing* a Brahman eat. Here we have, it may be well believed, a reflection of the effects which the Vasishtha-Viswâmitra myth was primarily intended to produce. Even kings can only buy the efficacies of holy birth by gold, and ancient sages could only buy it by superhuman austerities. The true moral of the Vasishtha-Viswâmitra legend is the greater glory of birth to that of anything else, royalty included. Vasishtha is said to have been the emanation of the intellect of Urvasî; he is also called the offspring of Mitra and Varuna. He was endowed with wonderful knowledge of efficacious sacrifices, and possessed a cow of plenty, which not only gave him everything he desired, but also protected him from all machinations and assaults. (See article on VISWÂMITRA.) He could tell that which passed in the minds of the gods, and was possessed of divine power. Manu says that he was a son of Brahma, and the *Purânas* here and there echo this statement, which is a little contradictory to others made in them. He is said to have edited the *Vêdas* in the Dwapara age. He is said to have had two wives—*Urjâ* ("strength") and *Arundhati*, a star in the constellation of the Pleiades. He was one who, through the wonderful merits of his cow of plenty, could make barren women bear children. He aided King Dilipa in this way. He also was a profound lawyer. But his chief characteristic was arrogance. Like the Turk, he would have no brother near his throne. *Aut Cæsar, aut nullus*, was in effect the motto of his life, which was one long struggle with Viswâmitra, and one long assertion of self and the unapproachable excellence of the Brahmanic caste. Fiery-tempered, strong in intellect as well as in the physical aids he could summon, he was, after all, strange to say, just the last man one would have imagined that subtle, luxurious, and effeminate Brahmandom would have chosen as its representative champion. But the fact remains, and we must suppose that ancient Brahmanic Aryans were different from the wily, sleek, and flaccid Hindu priests of the present day. The following are a few of the stanzas of the hymns ascribed to the Vasishtha in the Rig Veda [Mandala vii., Anuvaka i., Sûkta i. (see Prof. H. H. Wilson's translation of the *Rig Veda Sanhitâ;* edited by Prof. Cowell, 1866). The lines quoted are only a few of many hundreds]: "Men generate the excellent far-gleaming master of the mansion, the accessible Agni, present in the two sticks, by attrition with their fingers. The dwellers have placed in the mansion, for its constant protection, that visible Agni who has been from ever, who is to be honored in every house. Well-kindled, youthful Agni! shine before us with undecaying radiance. To thee abundant sacrificial viands proceed. . . . Consume, Agni, all thine enemies. . . . Eminent, holy, radiating, purifier, Agni, be present at the sacrifice of him who lights up thy blaze, and at ours who address thee with these praises. Let us not sit down, Agni, in an empty dwelling; let us not be without successors. . . . Shine with bright lustre, Agni, son of strength, thou who art earnestly invoked and art of a benignant aspect." It is needless to give further illustrations of Vasishtha's Vedic verses. They run smoothly enough. To this day they are popular amongst Brahmans. R. C. CALDWELL.

Vasquez' de Corona'do (FRANCISCO), b. at Salamanca, Spain, about 1505; was an early settler in Mexico, where he served in several campaigns against the Indians; was given command of an expedition which left Culiacan, Sinaloa, Apr., 1540, with which he passed through Sonora northward, crossed the Gila, reached the Little Colorado River, and visited the famous "seven cities of Cibola," which he found to consist of vast communal houses, sometimes five stories high, but did not find the wealth of precious metals announced by the explorer of the previous year, Fray Marcos de Niza; drew up and sent to Spain a report of his observations, with drawings of the edifices; reached the city of Quivira, 170 miles N. E. of the present town of El Paso, and was the first European to give an account of the great Western prairies and of the buffalo. Returning in Mar., 1542, Vasquez fell from his horse at Tiguex, from the effect of which fall he lost his reason and soon died.

Vas'salborough, p.-v. and tp., Kennebec co., Me. P. 2219.

Vas'sar, p.-tp., cap. of Tuscola co., Mich., on Detroit and Bay City R. R. and on Cass River, 20 miles S. E. of the latter city, has 3 churches, a union school-house, 1 newspaper, 2 foundries and machine-shops, 1 woollen and 1 pump factory, several flouring and lumber mills, furniture and basket warehouses, and 3 hotels. P. 775.

ALEX. TROTTER, ED. "TUSCOLA CO. PIONEER."

Vassar (MATTHEW), b. at East Dereham, Norfolk, England, Apr. 29, 1792; was brought to the U. S. in 1796 by his father, who settled on a farm near Poughkeepsie and carried on an extensive brewery, and acquired a considerable fortune in the same business. D. at Poughkeepsie June 23, 1868. In 1861 he delivered to trustees the sum of $408,000 for the foundation of VASSAR COLLEGE at Poughkeepsie (which see), and by his will increased the amount to $800,000.

Vassar College, an institution of learning at Poughkeepsie, N. Y., founded by Matthew Vassar in 1861 for the advanced education of young ladies. A sum of $408,000 was delivered in February of that year to an incorporated board of trustees, and he also gave 200 acres of land, beautifully situated 2 miles E. of Poughkeepsie, where in accordance with his wishes, about $200,000 was expended in the erection of a fine brick edifice with blue freestone

trimmings, five stories in height, 500 feet in length, 200 feet in breadth at the centre, and 164 feet at the transverse wings. This building contains several independent residences for officers, a chapel, library, reading-room, recitation and lecture rooms, laboratories, and apartments for 400 students. There are besides, apart from the main building, an astronomical observatory and an extensive museum containing an art-gallery, cabinets of mineralogy and natural history, a hall for calisthenics, etc. The college was opened in Sept., 1865, with 8 professors and 20 other instructors, and 300 students, which number was augmented to 350 during the academic year. The organization of the institution was chiefly effected by Prof. Milo P. Jewett, who was chosen first president, and visited Europe for the promotion of its interests. Resigning in 1861, he was succeeded by John H. Raymond, LL.D., who died Aug. 14, 1878. Prof. Samuel L. Caldwell was next president. Admission must be preceded by examination. The course of studies is equivalent to that of other first class colleges, and good facilities are given for literary, scientific, and artistic training outside the regular course, the studies of Junior and Senior year being elective within certain limits. The baccalaureate degree is given in regular course, and the degree of M. A. is conferred after examination upon studies equivalent to a post-graduate course of two years. The regular expenses are for board and tuition $400 for the academic year of 40 weeks, and provision is made for the remission of half that amount when necessary. The college has a library of 9000 volumes, is well equipped with scientific apparatus, and has a particularly fine collection of objects of natural history from South America. In 1876 there were 9 professors (3 women) and 22 female teachers, besides the president and lady principal, 202 collegiate and 168 preparatory students, and the alumni numbered 323.

Vassilkov', town of European Russia, government of Kiev, on the Stugna near its influx in the Dnieper, has large tobacco manufactures. P. 8972.

Vas'to [*Histonium*], town of Italy, province of Chieti, in the charming plain known as the Piano d'Aragona, connected by rail with Brindisi and Bologna. The aspect of the town itself is very agreeable, and the neighborhood is unusually rich in olives, but unfortunately brigandage is very common. After the fall of the Roman empire, Vasto suffered many disasters, was almost totally destroyed by an earthquake in 1456, and in 1816, after a season of extraordinary rain, a land-slide more than a mile in length, occasioned by the subterranean flow of water, carried a considerable part of the town into the sea. It is a curious fact that similar slides took place in ancient times, and Augustus endeavored to guard against their recurrence by an extensive underground canal of the most solid construction. This great aqueduct and the reservoirs connected with it have been partially cleared during the present century of the accumulated obstructions of ages, and the completion of this work would be in every way a great advantage to the town. P. 13,797.

Va'ter (JOHANN SEVERIN), b. at Altenburg in the duchy of Saxe-Altenburg, Germany, May 27, 1771; studied theology and languages at Jena and Halle; was appointed professor of theology and Oriental languages at Jena in 1796, at Halle in 1800, at Königsberg in 1809, and returned in 1820 to Halle, where he d. Mar. 16, 1826. He gave a condensation and continuation of Henke's *Allgemeine Geschichte der christlichen Kirche* (1818–23) and *Synchronistische Tafeln der Kirchengeschichte*, which latter work was reprinted several times. But he is most widely known as a linguist by his grammars of the Hebrew (1797), Polish (1807), and Russian languages (1809); his *Handbuch der hebräischen, syrischen, chaldäischen und arabischen Grammatik* (1801), his continuation of Adelung's *Mithridates* (1806–17), and his *Literatur der Grammatiken, Lexika und Wörtersammlungen aller Sprachen der Erde* (1815).

Vatican Codex. See CODEX VATICANUS, by PROF. THOMAS CHASE, A. M.

Vat'ican Council, the nineteenth and the last œcumenical council of the Roman Catholic Church, has its name from the Vatican Palace in Rome, where it was held. It marks the greatest event in the history of the Roman Catholic Church since the Council of Trent, and completes the doctrine of the papacy. It was called by Pope Pius IX. in the twenty-third year of his pontificate by an encyclical (*Æterni Patris unigenitus Filius*) June 29, 1868, and solemnly opened amid the sounding of innumerable bells and the cannon of St. Angelo, but under frowning skies and a pouring rain, on the festival of the Immaculate Conception of the Blessed Virgin, Dec. 8, 1869, in the basilica of the Vatican. It was adjourned and indefinitely postponed Oct. 20, 1870, in consequence of the Franco-German war, which broke out immediately after the passage of the Infallibility decree, and ended in the prostration of France and the destruction of the temporal power of the papacy. Whether it will ever be reconvened (like the twice interrupted Council of Trent) to finish its work remains to be seen. But since the Vatican Council decreed the infallibility of the pope there is no serious work left for a future œcumenical council. The confirmation and solemn proclamation of infallible decrees of the pope would be a mere formality and expensive luxury. The attendance was larger than on any previous council, and presented an array of hierarchical dignity and power such as even the Eternal City never saw before, nor is likely ever to see again. It seems as if the Roman Church on this occasion summoned all its vast resources for an overwhelming assault upon its enemies. At the opening there were present 719 prelates from all parts of the globe, including 49 cardinals, 9 patriarchs, 1 primates, 121 archbishops, 479 bishops, 57 abbots and generals of monastic orders. This number gradually increased to 764, but after the outbreak of the war it dwindled down to less than 200. The occupation of Rome by the Italian troops and the disturbed state of Europe made the continuance impossible. The whole number of prelates who are entitled to a seat in an œcumenical council and were invited is 1057. Among the many nations represented, the Italians had a vast majority of 276, of whom 113 belonged to the former Papal States alone. The French and German bishops were least in number, but strongest in learning and intelligence and the extent and importance of the dioceses which they represented. The deliberations of the council were conducted in strict secrecy, but four public sessions were held for the solemn proclamation of the results. The stenographic reports of the proceedings are still locked up in the papal archives, but every fact of importance has been made known by reports and letters of outside observers from familiar intercourse with their friends in the council.

The subject-matter of the council was divided into four parts: faith, discipline, religious orders, and rites (including missions), and each part was assigned to a special commission (*congregatio* or *deputatio*) consisting of 26 prelates, with a presiding cardinal appointed by the pope. The decrees were prepared on the basis of *schemata* previously drawn up by learned divines and canonists, discussed, revised, adopted in secret sessions by the general congregations, and then solemnly proclaimed in public sessions in the presence and by the authority of the pope. The management was entirely in the hands of the pope and his cardinals and jesuitical advisers. The proceedings were, of course, entirely conducted in Latin, the official language of the Roman Church.

The chief object of the council was to protest against modern infidelity and to settle the vexed question of papal infallibility. Both objects were fully obtained. The Vatican Council rung the death-bell to Gallicanism and liberal Catholicism, and put the topstone to the pyramid of papal absolutism. But it also gave rise to the Old Catholic secession and to a serious conflict with the sovereignty of secular governments, especially in Germany. The results are embodied in two sets of decrees, the first against outside infidelity, the second against inside liberalism.

(1) "The decrees on the dogmatic constitution of the Catholic faith" were unanimously adopted in the third public session, Apr. 24, 1870. They are directed against modern rationalism, pantheism, materialism, and atheism, and set forth the orthodox doctrine of God, the creation, and the relation of faith to reason. The Roman *Civiltà Cattolica* praises these decrees as "a reflex of the wisdom of God," the Paris *Univers* as "a masterpiece of clearness and force," Cardinal Manning as "the broadest and boldest affirmation of the supernatural and spiritual order ever yet made in the face of the world." But during the discussion a Swiss prelate declared the *schema de fide* a work of supererogation, and said, "What boots it to condemn errors which have been long condemned and tempt no Catholic? The false beliefs of mankind are beyond the reach of your decrees. The best defence of Catholicism is religious science. Encourage sound learning, and prove by deeds as well as words that it is the mission of the Church to promote among the nations liberty, light, and true prosperity." Bishop Strossmayer from the Turkish frontier, the boldest and most liberal member of the council, attacked the preamble to the scheme which made Protestantism responsible for modern infidelity, and said, "Protestants abhor these errors as much as Catholics. The germ of rationalism existed in the Catholic Church before the Reformation, and bore its worst fruits in the midst of a Catholic nation at the time of Voltaire and the Encyclopedists. Catholics produced no better refutation of the errors to be condemned than Leibnitz and Guizot."

(2) Far more important are the "decrees on the dogmatic constitution of the Church of Christ," or the decrees of papal absolutism and papal infallibility, which agitated

the council for several months, and after a vigorous opposition and the departure of the anti-Infallibilist bishops, passed, with two dissenting votes, in the fourth public session, July 18, 1870. This is undoubtedly the crowning act of the council on which its historical significance rests. The question of vital moment to every Catholic, the question of jurisdiction and authority which had been left open by the Council of Trent, and kept up for 300 years an agitation between Gallicans and Ultramontanes, Jansenists and Jesuits, constitutional monarchists and absolute monarchists, was brought to final rest within that Church. Ultramontanism and Jesuitism achieved a complete triumph over a powerful minority of liberal bishops, who at last gave up in despair, left Rome before the final vote, and then gradually submitted to the decision of the council for the sake of unity and peace, which they esteemed higher than their personal conviction and the facts of history. Even Bishops Hefele, Kendrick, and Strossmayer submitted. The council decided that the Roman pontiff has an *ordinary* episcopal authority and *immediate* jurisdiction over all the Catholic churches and dioceses, that he is the bishop of bishops, and that all bishops are simply his vicars, as he is the vicar of Christ; moreover, that the Roman pontiff, whenever he speaks in his official capacity to the Catholic world on any question of faith or morals, is infallible, and that his decisions are irreformable—that is, absolutely final and irreversible in and of themselves, even without the consent of an œcumenical council. (On the history and literature of this dogma during and after the council see INFALLIBILITY.)

The literature on the Vatican Council is very extensive. Not to mention innumerable controversial pamphlets and reports which appeared on both sides (the Infallibilists and anti-Infallibilists) before and during the council, the reader is referred to the following works: (1) By Roman Catholics: *Acta et Decreta sacrosancti et œcumenici Concilii Vaticani* (Friburgi, 1872, in 2 parts); *Actes et Histoire du Concile œcuménique de Rome, premier du Vatican* (Paris, 1869 *seq.*, 6 vols.); Eugen Cecconi (canon at Florence), *Geschichte des vaticanischen Concils*, translated from the Italian by Dr. W. Molitor (Regensburg, 1873 *seq.*, several vols.); Cardinal Manning, *Petri Privilegium* (London, 1871); Bishop Fessler (secretary of the council), *Das vaticanische Concil, dessen äussere Bedeutung und innerer Verlauf* (Wien, 1871). (2) By Old Catholics: Joh. Friederich, *Documenta ad illustrandum Concilium Vaticanum* (Nördlingen, 1871); by the same, *Tagebuch während des vaticanischen Concils geführt* (Nördlingen, 1871); Janus (pseudonymous), *Der Papst und das Concil* (Leipsic, 1869, before the council); Quirinus, *Letters from Rome on the Council*, first in German (London, 1870); sundry pamphlets of Döllinger, Schulte, Reinkens, and Huber. (3) By Protestants: Emil Friedberg, *Sammlung der Actenstücke zum ersten vaticanischen Concil* (Tübingen, 1872); Th. Frommann, *Geschichte und Kritik des vaticanischen Concils* (Gotha, 1872); E. de Pressensé, *Le Concil du Vatican* (Paris, 1872); L. W. Bacon, *An Inside View of the Vatican Council* (New York, 1872); Gladstone's two pamphlets—*The Vatican Decrees* (London and New York, 1874) and *Vaticanism*, in reply to Newman and Manning (London and New York, 1875).

PHILIP SCHAFF.

Vatican Decrees. See VATICAN COUNCIL and INFALLIBILITY.

Vatican Palace, the principal residence of the pope, is in Rome, on the right bank of the Tiber, in the Leonine City, so called, and on the Vatican Hill. It is the largest palace in the world. It is reported to have been founded by Pope Symmachus about 300 A. D., and to have been at one time the residence of Charlemagne. It has several times fallen into decay and been restored. In 1450, Nicholas V. commenced the great work of making it what it now is, the noblest palace of Christendom. A long line of popes have added to its size and magnificence. At present the lowest estimate gives the number of rooms at 4422; some place it as high as 16,000 (Bädeker says 11,000 halls, saloons, chapels, and apartments, and 20 courts). It contains the finest existing collection of marbles, bronzes, frescoes, paintings, gems, and statues. It contains the Sistine Chapel (built by Sixtus IV., 1473, and adorned by the genius of Michael Angelo); the Pauline Chapel (by Paul III., 1540); the Loggia and Stanze of Raphael; the court of the Belvedere; the noble library, containing 24,000 MSS. and 50,000 printed volumes; and several rich museums of ancient and modern articles of vertu. Since the return of the popes from Avignon, the Vatican has been their principal residence, and since the conversion of Rome into the capital of Italy in 1870 it is their *only* residence. Before the residence at Avignon, the Lateran was their chief abode.

Vattel', de (EMMERIC), b. Aug. 25, 1714, at Couvet, Neufchâtel, Switzerland; studied theology and philosophy at Bâle and Geneva; published in 1741 his *Défense du Système Leibnitien*, which attracted considerable attention; went in the same year to Berlin to solicit a position in the Prussian diplomacy, Neufchâtel being at that time a Prussian possession; received in 1743 an office in the civil service of Saxony; went in 1746 as Saxon minister to Berne; returned in 1758 to Dresden, and d. on a journey at Neufchâtel Dec. 20, 1767. While residing at Berne he wrote, besides several minor works, *Mélanges de Littérature, de Morale, et de Politique, Loisirs philosophiques*, etc., his celebrated book, *Droit des Gens, ou Principes de la Loi naturelle appliqués à la Conduite et aux Affaires des Nations et des Souverains* (2 vols., 1758), which was translated into several foreign languages and often reprinted. A recent edition appeared at Paris in 3 vols. (1863); translated into English in 1797 by Joseph Chitty, *Law of Nations, or Principles of the Law of Nature applied to the Conduct and Affairs of Nations and Sovereigns*, which translation has been reprinted several times, both in England and America. Vattel's last work was *Questions de Droit naturel, et Observations sur le Traité du Droit de la Nature par M. le Baron de Wolf* (Berne, 1762).

Vauban' (SEBASTIAN LE PRESTRE), b. near Saulieu, Burgundy, France, May 15, 1633, one of the most celebrated of the military engineers of that country. To his inventive genius is due the creation or perfection of the bastioned system of fortification, or that modification of mediæval forms which the invention of gunpowder and the perfecting of artillery imposed. Errard of Bois-le-Duc, the Chevalier Antoine de Ville, and the Comte de Pagan were his predecessors in this; Vauban following up principles suggested by Pagan, and putting them extensively into practice. He constructed 33 new fortresses and repaired and improved about 100. He conducted 53 sieges, and shared in 140 battles and skirmishes; acquiring the fullest confidence of his sovereign, he attained, as marshal of France, the highest honor in the French army. Notwithstanding his eminence as an author and creator, almost, of the subsequent art of fortification, his success as engineer of sieges was even more marked. Engaged in the service of one of the most ambitious of monarchs, Louis XIV., it was on the *offensive* rather than the defensive that his services were called for. The inventor of "parallels" in sieges and of the "ricochet" fire, he developed that irresistible system of attack which has ever since been so successfully followed.*

This is not the place to discuss the principles and forms of fortification, nor to allude to the distinctions between the so-called *three* "Vauban" systems, or developments of Vauban's method, as they were successively practised by himself. Reference must be made to technical treatises and to his great work, *De l'Attaque et de la Défense des Places* (1736). He was eminent also as a civil engineer, and indeed the impress of his genius is still borne in the history of his country. The question of such vital interest to France in modern days, the *fortification of Paris*, was elaborately treated by him, and in the subsequent discussions which preceded and accompanied the execution under Louis Philippe of the actual system, he has been by all parties deferentially appealed to. (See works of Choumara and others.) Among other subjects not military to which he devoted himself, political economy may be mentioned. "Vauban," says Gen. Bardin (*Dict. de l'Armée*, etc.), "has enjoyed an unparalleled fame; for a century and a half himself and his works have been the theme and study of Europe. Never before had engineer been able to obtain such consideration or to acquire so much experience." Allent (*Histoire du Corps du Génie*) affirms he *wrote* nothing on the tracé of fortifications; hence works thus attributed must be regarded rather as commentaries or exhibits by others of his methods. His principal military writings (*Œuvres militaire de Vauban*) have been edited by Gen. Latour Foissac (1796), and De Chambray has published (1834) *Notice historique sur Vauban* (inserted in the "Plutarque français"), new ed. 1745. Vauban also left a voluminous work entitled *Mes Oisivetés*. He was made governor of Lisle 1663, commissary-general of the fortifications of France 1678, governor of the maritime ports of Flanders 1689, marshal of France 1703. D. at Paris Mar. 30, 1707.

J. G. BARNARD.

Vaucanson', de (JACQUES), b. at Grenoble, department of Isère, France, Feb. 24, 1709; d. in Paris Nov. 21, 1782; became noted as a mechanician, especially as an inventor of automata. His most famous works were his brass duck, which could fly, quack, eat, digest, and evacuate its bowels; his flute-player, etc. Cardinal Fleury

* It remains to be seen whether, with the more recent systems of fortification, and with recent inventions in firearms, by which their range and accuracy have been so much increased, the march of the attack shall be hereafter so absolutely "irresistible."

made him superintendent of silk manufactures, but his improvements of the machinery caused a riot among the workmen of Lyons; in order to avenge himself, he made an automaton ass which could weave flowered silks. His collection of automatons he bequeathed to the queen, but it subsequently became scattered. Several pieces fell into the hands of a certain Dumoulin, who exhibited them in Germany, and three of them were found in the possession of the noted charlatan Prof. Boireis, body physician to the duke of Brunswick.

Vaucluse', department of South-eastern France, bordering W. on the Rhone and S. on the Durance, comprises an area of 1328 sq. m., with 263,151 inhabitants. The eastern part is covered with spurs of the Alps; the western, along the Rhone, consists of low plains. The soil is not very fertile, and produces insufficient grain for home consumption. Wine and fruits succeed well; bees and silkworms are extensively reared; some manufactures of silk, perfumery, and confectionery are carried on. Of 33,277 children of school age, 8206 received no school education at all in 1857. Cap. Avignon.

Vaud, or **Pays-de-Vaud** [Ger. *Waadt*], canton of Switzerland, bordering S. on Lake Geneva and bounded W. by France, comprises an area of 1185 sq. m., with 231,700 inhabitants, most of whom are Protestants and speak French. The surface is an elevated plateau between the Jura and the Bernese Alps, sloping S. toward Lake Geneva, N. toward Lake Neufchâtel. Near the mountains are regions of pasture-land where cattle-rearing and dairy-husbandry form the principal occupations. But the larger part of the plateau is under tillage, and very carefully cultivated. Wheat and wine are extensively cultivated, and the white wines of the canton are of superior quality. The manufacturing industry is insignificant. Salt, marble, coal, and sulphur are produced. Cap. Lausanne.

Vaude'ville [believed to be from *Les Vaux de Vire*, two valleys in the Bocage of Normandy, where dwelt Olivier Basselin in the fifteenth century], a name at first applied to satirical songs relating to current events, for the composition of which Olivier Basselin was famous. The name is now applied to light dramatic compositions interspersed with music, and having pleasant or satirical allusions to current topics of the day. They are mostly in French.

Vaudois. See WALDENSES.

Vaudreuil', county of Quebec, Canada, bounded N. E. by Ottawa River. Grand Trunk Railway traverses the S. E. part of the county. Area, 330 sq. m. Cap. Vaudreuil. P. 11,003.

Vaudreuil, p.-v., cap. of Vaudreuil co., Quebec, Canada, on the river Ottawa and near the Grand Trunk Railway, 24 miles W. of Montreal. In the vicinity are fine beds of ochre, sandstone, blue earthy phosphate of iron, a good pigment, and bog-iron ore of good quality and in unlimited quantity. P. 494.

Vaudreuil, the title of a French family, several members of which are notable in Canadian history.—PHILIP DE RIGAUD, MARQUIS DE, b. in France about 1641; entered the military service; rose to be a brigadier-general; came to Canada in 1687; served in various expeditions against the Seneca, Onondaga, and Oneida Indians; was made governor of Montreal in 1698, and governor-general of Canada in 1703. His administration was vigorous and successful; he put a check to the influence of the English in the W., and, although unable to prevent the loss of Acadia, succeeded in thwarting a formidable naval expedition sent against Quebec. D. in Quebec, Oct. 10, 1725.—PIERRE DE RIGAUD, MARQUIS DE, fifth son of Philip, b. in Quebec Nov. 22, 1698; entered the French military service; was made governor of the Trois Rivières in 1733, of Louisiana in 1742, and having in 1748 succeeded by the death of his brothers to his father's title, became in 1755 governor-general of Canada. He made strenuous but unavailing efforts to avert the capture of Quebec by Wolfe, and afterward endeavored to recapture it; was successful in one engagement, but receiving no support from the mother-country, was obliged to capitulate. He returned to France, where an investigation was instituted, and his administration was fully justified. D. in Paris in 1564.—LOUIS PHILIPPE DE RIGAUD, MARQUIS DE, nephew of Pierre, b. at Rochefort, France, Oct. 28, 1724; entered the French navy, and commanded vessels in several important actions, notably in that between D'Estaing and Byron off Granada in 1779, and that between De Grasse and Graves off the capes of Chesapeake; in the action with Rodney, Apr. 12, 1782, he saved his own squadron of the French fleet, with which he succeeded in reaching the harbor of Boston. Returning to France, he became a member of the States General in 1789, and in October defended the royal family against the populace; made his escape to England during the Reign of Terror, returning after its close. D. in Paris Dec. 11, 1802.

Vaughan (BENJAMIN), LL.D., b. in Jamaica Apr. 19, 1751; educated at the University of Cambridge; studied law at the Temple, London, and medicine at the University of Edinburgh; was a Whig member of Parliament 1792–96; settled in the latter year at Hallowell, Me., where he cultivated a large farm, practised medicine gratuitously, and devoted himself to literary pursuits, aided by a fine library, part of which he gave to Bowdoin College. D. at Hallowell Dec. 8, 1835. Author of *The Rural Socrates* (1806), and translator of Poivre's *Travels of a Philosopher* (1797).—His brother CHARLES, b. in England June 30, 1759, came to the U. S. about 1785; became a distinguished merchant and scientific agriculturist. D. at Hallowell May 15, 1839.

Vaughan (CHARLES JOHN), D. D., b. at Leicester, England, in 1816; educated at Rugby School under Dr. Arnold; graduated at Trinity College, Cambridge, as senior classic and chancellor's medallist 1838; became a fellow of Trinity 1839; took orders in the Church of England; held the living of St. Martin's, Leicester (formerly his father's), 1841–44; was head-master of Harrow School 1844–59, raising that institution from a comparatively low ebb to great prosperity; refused the bishopric of Rochester 1860; was vicar of Doncaster 1861–69, since which he has been master of the Temple; is chancellor of York cathedral and chaplain in ordinary to the queen; is married to a sister of Dean A. P. Stanley, with whom he is popularly associated as one of the leaders of the "Broad Church," and enjoys a high reputation as a pulpit-orator and as a commentator, chiefly upon the Pauline Epistles. His published sermons and expository discourses exceed 40 vols.

Vaughan (HENRY), M. D., b. at Newton St. Bridget, Brecknockshire, South Wales, in 1621; studied, but did not graduate at Jesus College, Oxford; qualified himself for the practice of medicine at London; was imprisoned as a royalist during the civil war, after which he passed his remaining years at his native place, enjoying great repute as a physician. D. at Newton Apr. 23, 1693. He called himself "the Silurist," from the name of the ancient British tribe of South Wales. Author of *Poems, with the Tenth Satyre of Juvenal Englished* (1646), *Olor Iscanus, a Collection of some Select Poems and Translations* (1650), *Silex Scintillans, or Sacred Poems and Private Ejaculations* (2 parts, 1650–55), *The Mount of Olives, or Solitary Devotions* (1652), *Flores Solitudinis, or Certain Rare and Elegant Pieces* (1654), and *Thalia Rediviva, the Pastimes and Diversions of a Country Muse, in Divine Poems* (1678). A *Memoir* by Rev. H. F. Lyte appeared in 1847.—His twin-brother, THOMAS, was educated at and became a fellow of Jesus College, Oxford; was for some years rector at his native village, whence he was expelled as a royalist; afterward resided at Oxford; was also a "tolerable" poet; studied Oriental languages; became familiar as an alchemist and Rosicrucian, and wrote several works on occult sciences under the name of "Eugenius Philalethes." D. Feb. 27, 1665, in consequence of a rash experiment on the properties of mercury.

Vaughan (Sir JOHN), b. in England in 1738, was a son of the earl of Lisburne; entered the army 1746; served in Germany and the West Indies; was colonel of the 40th regiment in the war of the American Revolution; became major-general Jan. 28, 1777; took part in the battle of Long Island and in the storming of Fort Montgomery, which was renamed from him Fort Vaughan; destroyed Esopus Oct., 1777; captured Stony Point and Verplanck's-on-the-Hudson May, 1779; became commander-in-chief of the Leeward Islands Dec., 1779; was subsequently lieutenant-general and governor of Berwick. D. at Martinique June 30, 1795.

Vaughan (ROBERT), D. D., b. in Wales in 1795; educated for the Independent ministry at Bristol College; was pastor of churches at Worcester and Kensington; professor of ancient and modern history in London University 1830–42; president of, and professor of theology in, the Lancashire Independent college, Manchester, 1842–57; was for a time pastor of a church at Uxbridge; projected the *British Quarterly Review* as an organ of the Independents, and edited it from 1845 to 1865; visited the U. S. 1865, and spent his later years in London. D. at Torquay June 15, 1868. Author of *John de Wycliffe, D. D., a Monograph, with some Account of the Wycliffe MSS.* (1853), which was a revised edition of an earlier *Life* (2 vols., 1828), *Memorials of the Stuart Dynasty* (2 vols., 1831), *The Protectorate of Oliver Cromwell* (2 vols., 1838), *History of England under the House of Stuart* (2 vols., 1840), *Essays on History, Philosophy, and Theology* (2 vols., 1849), *Revolutions in English History* (3 vols., 1859–63), treating of changes of race, religion, and government, and a bi-centenary memorial

volume on *English Nonconformity* (1862), besides several works of theological controversy or exposition.

Vaughan (Robert Alfred), son of Dr. Robert, b. at Worcester, England, Mar. 18, 1823; graduated at London University 1842, and at the Lancashire Independent college 1846; studied theology at Halle 1846; visited Italy 1847; became an Independent minister; was colleague with Rev. William Jay as pastor of Argyle Chapel, Bath, 1848–50, and pastor of a church at Birmingham 1850–55. D. in London Oct. 26, 1857. Though but thirty-two years of age at his death, he had been considered for some years as one of the ablest divines of his denomination. Author of *The Witch of Endor, and other Poems* (1844), and of a remarkable work, *Hours with the Mystics, a Contribution to the History of Religious Opinions* (2 vols., 1856; revised ed. 1860). His *Essays and Remains* (2 vols., 1858) were edited, with an interesting *Memoir*, by his father. The *Memoir* was also issued separately in 1864.

Vaughan (Sir William), M. D., LL.D., b. at Golden Grove, Caermarthenshire, Wales, in 1577, brother of the first earl of Carbery, the patron of Jeremy Taylor; educated at Jesus College, Oxford, where he graduated in law; became a physician about 1625; was the founder of a settlement called Cambriol in Newfoundland, and wrote the praises of that colony in a quaint tract in prose and verse called *The Golden Fleece, divided into Three Parts, etc., by Orpheus Junior* (1626), written apparently to attract emigrants, and notable as the first volume of original poetry written in the British North American colonies. Vaughan returned to England, and d. about 1640. Author, among other works, of *Varia Poemata* (1589), *The Golden Grove* (1600), *The Newlander's Cure* (1630), in the introduction to which he gives an account of his American experience, and *The Church Militant* (1640), a labored production in verse.

Vaughan (William), b. at Portsmouth, N. H., Sept. 12, 1703, son of George (1676–1724), who was lieutenant-governor of New Hampshire 1715–17; graduated at Harvard 1722; settled at Damariscotta, Me.; became largely engaged in the Newfoundland fisheries; was the originator of the expedition against Louisburg under Pepperell, and as lieutenant-colonel of New Hampshire troops had command of the military operations leading to the capture of that fortress, June 16, 1745, but being overlooked in the distribution of ministerial rewards, he went to England to assert his claims, and d. at London Dec. 11, 1746.

Vaughay, the native name of a South Indian tree, probably a *Rhizophora*, the bark of which is much valued by fishermen for tanning their nets.

Vaughn, tp., Jefferson co., Ark. P. 4735.

Vaulabelle', de (Achille Tenaille), b. at Châtel-Censoir, department of Yonne, France, in 1799; published in 1835 his *Histoire de l'Égypte moderne, de 1801 à 1833*; became editor of the *National* in 1835; published in 1844 *seq.* his *Histoire des Deux Restaurations* (8 vols.); was elected a member of the Constituent Assembly in 1848, and appointed minister of public education from July to Oct., 1849, in the government of Cavaignac, but retired from all participation in politics after Dec., 1851, and devoted himself to historical studies, preparing a *Histoire de la Monarchie de Juillet, de la deuxième Republic et du Second Empire*. D. Mar., 1879.

Vault [O. Fr. *vaulte*]. When an arch moves around its keystone, it produces a dome; when it moves along in a straight line on its springers, it produces a vault; whence it follows that there are as many kinds of domes and vaults as there are arches. (See Arch.) Wherever the arch was known, the vault was also known, and the only new element which it introduced into the history of architecture occurred when two vaults intersected each other, and consequently had to be groined.

Vauquelin' (Louis Nicolas), b. at St. André d'Hébertot, department of Calvados, France, May 16, 1763; was employed in a drug-store in Rouen; went in 1781 to Paris; studied pharmacy; gained the patronage of Fourcroy; was appointed chief pharmaceutist in the military hospital at Melun in 1793, professor of docimacy in the mining school of Paris in 1794, and subsequently professor of chemistry at the École Polytechnique, Jardin des Plantes, and Collége de France. D. at Paris Nov. 14, 1829. Besides a great number of *Mémoires* in scientific periodicals, he published a *Manuel de l'Essayeur* (1812). He undertook a great number of analyses, and was the discoverer of chromium, glucina, etc.

Vautier' (Benjamin), b. at Geneva in 1830; studied painting at Düsseldorf 1850–51, and acquired great celebrity as a genre painter. Among his most remarkable pictures are—*Devout Singers in a Church* (1858), the *Spinning-Woman* and the *Surprise* (1863), *A Sunday Afternoon in Suabia* and *Cats in a Criminal Case* (1864), the *Wake in the Bernese Highlands* (1866), the *First Dancing-Lesson* (1868), a *Village Funeral* (1871).

Vaux (Richard), son of Roberts, b. at Philadelphia, Pa., in 1817; became a lawyer in that city; was recorder 1842–47, mayor 1856–58; was a director of Girard College, member of the committee of correspondence of the Grand Lodge of Freemasons of Pennsylvania, and for more than thirty years from 1842 was an inspector of the State penitentiary. Author of some 30 *Annual Reports* of inspectors of the penitentiary, of *Reports of Criminal Cases* (1846) tried by him as recorder, and of addresses, lectures, papers on social science, critical and humorous essays.

Vaux (Roberts), b. in Philadelphia, Pa., Jan. 21, 1786; was a member of the Society of Friends; devoted himself at an early age to philanthropic pursuits, promoting general education, the maintenance and instruction of the blind, deaf, and dumb, the care of the insane, prison discipline, the relief and employment of the poor, and the reformation of the vicious; corresponded with De Witt Clinton on internal improvements, and with Edward Livingston on penal codification; took an interest in scientific agriculture; and served for a short time as an associate justice of the court of common pleas. D. at Philadelphia Jan. 7, 1836. Author of *Memoirs* of Benjamin Lay and Ralph Sandiford (1815) and of Anthony Benezet (1817), and of addresses, letters, and pamphlets on philanthropic subjects.

Vaux (Thomas), Baron Vaux, b. at Harrowden, England, about 1510; educated at Cambridge; attended Cardinal Wolsey in his embassy to Charles V., 1527; succeeded to the title, and took his seat in the House of 1530; accompanied Henry VIII. to Calais and Boulogne 1532; became a knight of the Bath and governor of the island of Jersey 1533. D. in Oct., 1556. Author of a number of admired poems in the collection called *The Paradise of Dayntye Devises* (1576), of which the best are entitled *The Assault of Cupid* and *The Aged Lover renounceth Love*.

Vaux (William Sandys W.), F. R. S., b. in England in 1818; educated at Westminster School; graduated at Baliol College, Oxford, 1840; became an assistant in the department of antiquities at the British Museum 1841; was keeper of coins and medals 1861–70; is secretary of the Royal Society of Literature, president of the Numismatic Society, and co-editor of the *Numismatic Chronicle*; deciphered and edited for the trustees of the British Museum in 1863 a collection of 90 Phœnician inscriptions found at Carthage; is a high authority upon Oriental subjects; has contributed largely to the *Transactions* of the Royal Society of Literature and those of other learned associations, and to Dr. Smith's *Dictionary of Geography*; has published *Nineveh and Persepolis* (1850; 4th ed. 1855), *A Handbook to the Antiquities in the British Museum, being a Description of Greek, Assyrian, Egyptian, and Etruscan Art preserved there* (1851); edited for the Hakluyt Society, from the unpublished MS. of Chaplain Francis Fletcher, *The World encompassed by Sir Francis Drake, etc.* (1854); prepared for the Society of Biblical Archæology a manual of the *History of Persia from the Monuments* (1875), and drew up for the University of Oxford a *Catalogue of the Coins in the Bodleian Library*.

Vâyu. Vâyu is the Vedic god of wind, often confounded with Indra, god of heaven. Vâyu is sometimes classed, together with Indra, in Vedic mythologies, with *Agni*, fire, and *Sûrya*, the sun. The tradition is that Anjanâ was the wife of Vâyu, and that by her he had the monkey-god Hanumân. Vâyu is not much respected as a deity in India now; his glory is swallowed up by that of Indra. Whenever native painters represent Vâyu, they make him ride on a long-horned antelope, with a drawn sword in his right hand. In his left hand he generally is represented as holding his monkey-faced son and heir. The root-meaning of the name of this god is simply a "breath." The word is immediately derived from the Sanskrit *vâ*, to "blow." The god is therefore simply a spirit, or rather a ghost. He is an airy mystery, impalpable, indefinable, unascertainable, and even the sole specimen of his progeny, as in the case of Hanumân, is a *lusus naturæ*, for mythology declares this one monkey-faced boy to have been his only son. The father is spiritually abnormal, and his son is materially so. As the name of the god implies, so seems everything connected with him—dim, indistinct, ghostly. R. C. Caldwell.

Veale, tp., Daviess co., Ind. P. 893.

Vea'sey, tp., Drew co., Ark. P. 657.

Vea'zie, p.-v. and tp., Penobscot co., Me. P. 810.

Veda. See Sanskrit Language and Literature, by Porter C. Bliss, A. M.

Vedanta. See Hindu Philosophy, by Prof. John Dowson.

Veddas. See WEDDARS.

Ved'der (ELIHU), b. in New York City in Feb., 1836; studied art with Matteson, and also in Europe; had for some years a studio in New York; took high rank among American *genre* painters, and subsequently became a resident of Italy.

Vee'dersburg, p.-v., Fountain co., Ind., on Indianapolis Bloomfield and Western and Indiana North and South R. Rs., 65 miles W. of Indianapolis, contains 1 church, high-school building, 1 bank, 1 mill and woollen-factory, 2 hotels, 2 bakeries, a large hall, 2 warehouses, 1 newspaper, and rich deposits of bituminous coal. P. about 500. GEORGE ROWLAND, ED. "REVIEW."

Ve'gn, tp., Jackson co., O. P. 65.

Vega (GARCILASO DE LA). See GARCILASO DE LA VEGA.

Vega Carpio, de la (LOPE FELIX), usually called **Lope de Vega,** b. at Madrid, Spain, Nov. 25, 1562; lost his father in early childhood; was placed at the Royal College of Madrid by his uncle, the inquisitor Miguel de Carpio, by whom he was destined for the Church; displayed at school extraordinary precocity and aptness for versification; served in a campaign against the Portuguese at the island of Terceira 1577, during an escapade from college, which lost him the patronage of his uncle; was taken under the protection of Geronimo Manrique, bishop of Avila, by whom he was sent to complete his studies at the University of Alcalá de Henares; entered the service of the younger duke of Alva as his secretary about 1583; composed for his new patron his first notable literary effort, a pastoral entitled *Arcadia;* married Isabel de Urbino, daughter of a king-at-arms at the court; was imprisoned and exiled to Valencia for having wounded a courtier in a duel; returned to Madrid about 1587; lost his wife soon after; served as a volunteer in the Invincible Armada sent against England 1588, during which expedition he composed a long poem, *La Hermosura de Angelica,* intended as a continuation of Ariosto's *Orlando Furioso;* became secretary to the marquis of Malpica about 1590, and subsequently to the marquis of Sarria, afterward celebrated as viceroy of Naples and as the patron of Calderon, under the title of count of Lemos; contracted a second marriage with Juana de Guardio about 1597; passed thereafter at Madrid several years of happiness, prosperity, and almost incredible literary activity, pouring forth innumerable plays, *autos sacramentales,* madrigals, and sonnets, often writing a whole drama in a day; was liberally patronized by the Church, the nobility, and the court; acquired a literary popularity unexampled in Spain; was deeply affected by the loss in quick succession of his son Carlos at the age of seven and of his wife, who died in childbirth, after which he concentrated his affections upon a natural daughter, Marcela, who ultimately became a nun; became in 1609 a priest of the Franciscan order; continued his literary activity without intermission, though his later productions were tinged with fanaticism and religious melancholy; obtained several ecclesiastical preferments, becoming in 1628 chief chaplain to his congregation at Madrid; underwent the severest self-imposed penances, and is supposed to have hastened his end by a terrible scourging which he inflicted upon himself, dying at Madrid Aug. 26, 1635. He bequeathed his manuscripts to the duke of Sessa, by whom he was given a sumptuous funeral, lasting nine days. In productiveness Lope de Vega appears to have surpassed every other writer, ancient or modern. The number of his plays is variously calculated at from 1500 to 1800; his *autos* numbered several hundreds, and his miscellaneous pieces of prose and verse baffle all attempts at exact statement. About 300 of his plays were printed in his *Works* during his life or shortly afterward (28 vols., 1604–17), besides many others not gathered into volumes. Of these, 112 have been deemed worthy of reproduction by J. E. Hartzenbusch in his *Biblioteca de Autores Españoles.* He was a complete master of versification, which in all his works is uniformly facile, correct, and brilliant. As may be inferred from his fecundity, his invention was marvellous, but he usually contented himself with very slight though always ingenious and usually pleasing plots. For the dramatic proprieties and "unities" he had little regard, and never hesitated to set chronology and moral verisimilitude at defiance. The very number of his plays has contributed to their oblivion *en masse,* since there are few that can be pronounced notably superior to the general average. Among these few may be mentioned *El Padre engañado,* probably the only one which has appeared on the English stage (*The Father Outwitted,* adapted by Thomas Holcroft), *La discreta Enamorada, La Fuerza lastimosa,* and *Los tres Diamantes,* the very titles of which give a sufficient idea of the melodious cadence of his verse. PORTER C. BLISS.

Ve'ga, von (GEORG), BARON, b. at Sagoritza, Carniola, in humble circumstances in 1756; studied at the lyceum of Laibach; taught mathematics in the school of navigation, then in the school of artillery; became professor of mathematics at the military academy; was made commander of a regiment of artillery, and fought with distinction in the wars against the Turks and the French; was ennobled in 1800, and murdered Sept. 26, 1802. His *Vorlesungen über die Mathematik* (4 vols.) have often been reprinted, and are still used as textbooks in mathematical instruction in many Austrian institutions. His *Logarithmentafeln* (2 vols., 1783) reached their 57th ed. in 1876. He also published *Logarithmisch-trigonometrisches Handbuch* (1793, often reprinted), *Thesaurus Logarithmorum Completus* (1794), *Anleitung zur Zeitkunde* (1801), and *Natürliches Maass, Münz und Gewichtssystem* (published after his death, in 1803).

Vegetable Alkali. See POTASH, by H. WURTZ, A. M.

Vegetable Chemistry. See ORGANIC CHEMISTRY, by H. WURTZ, A. M.

Veg'etable Flan'nel is woven in Germany from "fir-wool," called also *wald-wolle,* a fibre prepared from the leaves of *Pinus sylvestris* after the turpentine has been distilled off. The fabric is reputed to have useful medicinal properties, and is worn by rheumatic and other patients.

Vegetable Histol'ogy treats of the minute structure of plants. By mechanical and chemical appliances the vegetable fabric can be separated into pieces suitable for examination by the microscope. Such an examination reveals the fact that even those parts of plants which appear to the naked eye to consist of compact material are in reality honeycombed with cavities. But it is further shown that these cavities are not mere hollow places in a homogeneous substance; they are contiguous and conjoined structures known as *cells.* Plants are composed of such cells variously developed, modified, and arranged.

In one of its simple forms the vegetable cell is a minute globular body, consisting of a closed membrane investing certain contents. The cell-wall consists of *cellulose,* a firm, elastic substance which remains when the contents of the cells have disappeared, and which constitutes the permanent bulk of the vegetable fabric. Cellulose has the same chemical composition as starch ($C_{12}H_{20}O_{10}$). It is insoluble in water, dilute acids, or alkalies, and generally possesses a slight admixture of incombustible matter. A living vegetable cell contains within the wall of cellulose a soft, inelastic mass known as *protoplasm.* The vital properties of this substance will be considered under VEGETABLE PHYSIOLOGY; it is necessary now merely to describe its appearance under the microscope. Protoplasm is usually transparent or translucent, often finely granular, and sometimes opaque from the presence of other matter, and easily recognizable by the yellow-brown color which it takes with solution of iodine. Cells differ greatly in size. In the pith of elder they are about $\frac{1}{120}$th of an inch in diameter; in *Chara* they are often an inch or more in length. The spores or reproductive cells of some plants are only $\frac{1}{5000}$th of an inch in diameter. Cells differ in size in different parts of the same plant. They differ also very widely in shape. The more common forms are the sphere and its polyhedral modifications, caused by the pressure of contiguous cells; spheroids of different kinds; elongated and tubular varieties; flattened cells, and branched cells. Many of the forms are irregular, but most shapes can be referred to one of three types: (1) *parenchyma,* in which the diameters are nearly equal; (2) *prosenchyma,* or long cells; and (3) *tubular,* or flattened and short cells. By the obliteration of the partitions between contiguous cells they may be thrown into one, and many other forms are produced. The cells thus constitute, by their confluence, slender tubes and the like, known as *ducts* and *vessels.* The cell-wall varies greatly in thickness in different cells, and in different parts of the same cell. Long, slender cells, especially if their walls are thick and the size of the cavity is very much reduced, are called *fibres.*

Inequalities in the cell-wall give rise to different markings. Some of the more common sorts are *dots* or *pits,* which are thin places, either round or linear, often surrounded on the inner surface of the cell by an elevated border (bordered pits and discoid markings, the latter characteristic of the wood-cells of Coniferæ); spiral, annular, netted, and cross-line deposits on the interior of the cell-wall. In many cases of internal deposit the proper cell-wall gives way and the ring or spiral becomes free. This is often seen when the cells are ruptured during dissection. Deposits on the external surface of a cell are seen in the case of some pollen-grains, where they exist as slight protuberances or sculpturings of regular or irregular shape.

Coherent cells constitute *tissues.* In most cases the contiguous cells are joined together from the period of earliest

growth, and they possess a common wall. Between cells which are near each other, but not united at all parts, there are cellular interspaces. It is convenient to classify tissues under three heads—namely, fundamental tissue, fibro-vascular bundles, and epidermal tissue. *Fibro-vascular bundles* arise in fundamental tissue, and are composed of two classes of modified cells—namely, flexible fibres, termed *bast*, and *woody ducts*, distinguished chiefly by their position. The wood is made up of ducts or cells, which have regular or irregular deposits by which they become denser and lignified. These structural elements, *bast* and *wood*, are variously arranged in a fibro-vascular bundle. Cells less modified, generally parenchyma, are interposed between them. Sometimes these intermediate cells are capable of growth by division, and are then called *meristem*. Fundamental tissue, in the substance of which fibro-vascular bundles arise, is generally made up of polyhedral cells. It constitutes a packing tissue, which fills the spaces between the bundles. *Epidermal* or cortical tissue surrounds the whole. It is composed largely of tabular cells in close contact with each other, and is not always easily distinguishable from the fundamental tissue which lies within; all these tissues grade off into each other. Epidermal tissue clothes all the organs of the plant. In the root it is modified to form the protective *root-cap* and the *root-hairs*: that of the stem frequently produces *cork*; that of the leaves possesses peculiar organs termed *stomata*, by which the intercellular cavities are placed in communication with the outer air. The epidermal tissue may at any part give rise to *hairs*, which are simple cells or rows of cells, or branched cells. The exposed wall of epidermal cells, except at certain parts of the stomata, is covered with cuticle, a film capable of resisting the chemical agents which destroy the cell-wall. Modifications of the cuticle give rise to waxy, granular, or gritty glazings of the outer cells.

The cells and tissues are variously arranged in different plants. The simplest plants consist of single cells, either simple or branched; and although nearly all such plants are of minute size, a few attain a length of an inch or more. Cells are arranged in rows, as in some fresh-water Algæ, or in planes, as in many seaweeds, or in solid forms, as in ordinary stems, etc. In the higher plants the structure is more complex, and the three systems of tissues are disposed differently in the different organs.

Arrangement of Tissues in the Stem.—In the stem of monocotyledonous plants the fibro-vascular bundles are closed—that is, they have no provision for further growth of the bundles in thickness. New bundles may arise between the old ones, but the old ones no longer increase in size. The bundles in solid monocotyledonous stems run in curves, and they cross each other, forming a complicated network. The bast-elements and wood-elements in different bundles differ in their relative amount, in their character, and their distance apart. A cross-section of a solid stem of a monocotyledonous plant shows that the bundles are nearer together at the outside than toward the interior. The bundles start from the leaves, curve inward, and pass downward, and, coming out to the surface of the stem, lose wood-tissue, and consist chiefly of bast. Between all the bundles there is fundamental tissue. In the stems of dicotyledonous plants the bundles are generally wedge-shaped, the broader part of the wedge being outside, and the bundles are arranged radially, so that by their contiguity they form rings. The wood is toward the centre; then comes a layer of *meristem* called *cambium*, and then bast. The fundamental tissue in the middle, where the bundles do not reach the centre, is *pith*; on each side of the bundles it constitutes the medullary rays; outside the bast it comprises the cells in which leaf-green is held. Annual layers of new wood are added by the cambium, and form by their juxtaposition the rings of wood marking the growth of the year. The tissues outside the cambium are called collectively the *bark*. Slight increments of bast and other parts of the bark are made each year. The year's growth in a tree is indicated by a ring of new wood, or sap-wood, laid down on the outside of the older wood, or heart-wood, and therefore such stems have been called *exogenous*—that is, "growing on the outside." Stems of monocotyledonous plants by contradistinction are often termed *endogenous*, "growing on the inside."

Arrangement of Tissues in Roots.—The roots of monocotyledonous plants are slender and simple, and do not materially increase in size. Those of perennial dicotyledons are much like the stem in structure, but have rarely any pith. The epidermis of the older parts is rough and almost corky; that of the newer portions in most plants is clothed with root-hairs of extreme delicacy. The point of the root is covered by a cap of modified epidermis, which exfoliates at its surface, but is constantly renewed by meristem behind it. This meristem constitutes the *growing-point* by which new tissue is added to the root at its protected tip.

Arrangement of Tissues in the Leaves.—The framework consists of fibro-vascular bundles variously disposed. In monocotyledons they proceed without branching from base to apex, or else from the midrib to the edge of the leaf. In dicotyledons they branch very variously, and form a network. The fundamental tissue of leaves surrounds the bundles, usually being more compact above than below, and consequently possessing larger or smaller intercellular spaces on the under side. The epidermal tissue of the leaf possesses *stomata*, which consist of a group of cells so arranged as to form a sort of valve. The lateral cells are known as *guard-cells*, and form with the contiguous cells a mechanism which will be described when the function of the leaf is spoken of. It is sufficient to say at this point that the leaf is a structure fitted to expose a large amount of surface to the air. The intercellular spaces taken in the aggregate present a vast exposure of transpiring surface. This framework, and the cells upon it, are all connected directly or indirectly with the stem from which supplies are received.

Besides the three systems of tissues now described, there is a peculiar modification of cells which must be noticed separately. When the leaf of lettuce is wounded, there exudes a milky juice called *latex*. The cells which contain latex form the laticiferous tissue. Sometimes they are distinct, and course irregularly through interspaces, but often they appear to be mere modifications of some one of the three systems of tissues.

In addition to the protoplasm previously referred to, there are other cell-contents of interest in histology—namely, (1) *chlorophyl*, or leaf-green; (2) *starch*, easily detected by the blue color imparted by a solution of iodine; (3) *inuline*, which forms spheres having a radiate structure; (4) *crystalloids*, nitrogenous substances imitating crystalline shapes; (5) *crystals*, chiefly calcium oxalate in needles, prisms, or clusters. All of these are described under their respective heads, and with regard to their origin and office, see VEGETABLE PHYSIOLOGY. G. L. GOODALE.

Vegetable Ivory, a substance considerably resembling ivory, is the hardened kernel of the carrozo-nut, the fruit of *Phytelephas macrocarpa*, a South American tree assigned by some to the palms, which it closely resembles, and by others considered a palm-like member of the order Pandanaceæ or screw-pines. Vegetable ivory is extensively employed as a substitute for real ivory, which it sometimes, but not always, closely resembles. Some specimens have a translucency entirely wanting in ivory.

Vegetable Physiology treats of the phenomena of plant-life. It investigates the development, growth, and functions of vegetable organisms, and the relations of plants to their surroundings. It is obvious that this science must depend largely for its means of research upon chemistry and physics. Anterior to the application of the microscope to the examination of vegetable structure, and even in the first century of its use, most of the explanations which were offered to account for the vital phenomena of plants were extremely unphilosophical. Methods of investigation by experiment do not appear to have been much employed in vegetable physiology until the beginning of the last century. At that period many of the relations of plants to water were clearly made out, and some of the relations of plants to the air and light were set forth as plainly as the imperfect physics and chemistry of that day would allow. Without tracing the history of vegetable physiology further, it will suffice to say that the science is of comparatively recent development. In the present treatment of the subject it is proposed to speak first of the nutrition of plants; secondly, of their growth; thirdly, of their reproduction; fourthly, of their movements. These phenomena, considered generally, may be investigated in the simplest plant, a one-celled alga, and the more striking characteristics of nutrition, growth, reproduction, and motion examined. But it will be better for the present purpose to direct attention to these phenomena as they are exhibited in the higher plants, such as the herbs and shrubs and trees with which all are familiar; a consideration of these will prepare the way for a comparison of the life-processes throughout the vegetable kingdom.

The Nutrition of Plants.—Plants do not undergo so extensive metamorphoses of tissues as do animals. Although a part of the oxidizable substance must be consumed in various kinds of work, the material of the vegetable fabric, once organized, remains essentially unchanged. It is obvious, therefore, that the word "nutrition," here retained for convenience, has in the vegetable kingdom a restricted signification. Certain inorganic substances, taken in from the soil and air, furnish all requisite materials for the sustenance of plants. These substances we shall call the food

of the plant. We may discover in two ways what the essential materials of plant food are—first, by determining, through chemical analysis, what is the chemical composition of the plant itself; second, by direct experiments upon living plants, to which are given, or from which are withheld, certain substances. The chemical analysis, for the purpose of answering the question above submitted, may be ultimate or proximate. Ultimate analysis breaks the plant into its elements; proximate analysis stops just short of this, and separates from each other the complex substances found in the plant, such as water, various salts, etc. When a fresh green plant is exposed to a temperature of 212° F. a part of the water which it contains is expelled. At a temperature slightly above this it soon ceases to lose weight. The amount of water driven off varies very greatly in different plants and in different parts of the same plant. Some Fungi and Algæ contain 95 per cent. of water; red clover contains 80 per cent.; the grains of the cereals about 14 per cent. The amount of water varies widely in the same plant at different periods of its life and in different seasons of the year. When the dry mass, from which all the water has been expelled, is burned in the open air, it disappears in the form of gaseous compounds, chiefly carbon dioxide and water, leaving behind only a small residue of ash. The percentage of unconsumed matter left after combustion varies in different plants, in different parts of the same plant, and at different seasons. Dry pine-wood yields about 0.2 per cent., dry oak-wood 0.5 per cent., dry pine-bark 2.8 per cent. The combustible part of plants consists chiefly of the chemical elements carbon, oxygen, hydrogen, and nitrogen, variously combined. The ash invariably contains potassium, calcium, magnesium, sulphur, phosphorus, and iron. Besides the above, other elements are frequently found in plants—namely, sodium, silicon, chlorine, iodine, bromine, and more rarely zinc and lithium. A few other elements have been detected in exceptional cases. Some of these elements, combined, enter directly into the structure of the vegetable fabric; others appear to be accessory, although indispensable, and assist in various processes in the economy of the plant.

We are now to inquire as to the sources from which plants obtain the elements necessary for their growth and work. These elements may be said in a broad sense to constitute the food of plants. *Carbon*, which makes up about 45 per cent. of cellulose, is ultimately derived from the slight admixture of carbon dioxide—or, as it is better known, carbonic acid—in the atmosphere ($\frac{4}{10}$ths of 1 per cent.). *Oxygen*, a constituent of cellulose and many other organic compounds in the plant, comes in either combined as in carbon dioxide and water or in the free state from the atmosphere. *Hydrogen* is obtained from water taken in through the roots. *Nitrogen*, which is found in the albuminoids, is derived from compounds of nitrogen, chiefly the nitrates; these compounds may be ultimately referred back to the air, in which they may be produced in minute quantities and under peculiar conditions. *Sulphur*, a constituent of the albuminoids, is obtained, perhaps exclusively, from calcium sulphate, a sparingly soluble salt. Plants obtain the remaining elements, such as iron and potassium, from aqueous solutions of their salts. The relative values of the different elements of plant-food, and of their different modes of combination, have been carefully investigated, and are being still further examined by means of water-culture. Plants soon after germination are cultivated under special conditions, by which certain substances are furnished or withheld. The general results obtained by such a method of research may be summed up as follows: An ordinary green plant, when growing in the open air and supplied with a sufficient quantity of water, requires for its healthy growth the following substances: combined nitrogen, preferably a nitrate; an available phosphate; compounds from which the plant can obtain the elements calcium, potassium, sulphur, magnesium, iron, and possibly chlorine. A few other elements appear to be required by certain plants, but they need not be considered in this place. A fertile soil not only contains the elements mentioned above, but it possesses them in such a form and such proportions as to be readily used by the plant. The physical as well as the chemical properties of soil have a very important bearing upon the healthy growth of plants, but a detailed consideration of these lies too far from the present path.

How does a plant obtain its food? Part of the food, consisting of ash-constituents dissolved in water and the combined nitrogen, is absorbed through the roots; the remainder, by far the largest part, is taken in in the gaseous form through the leaves.

Root-Absorption.—In many of the lower plants absorption of dissolved mineral matter takes place through all the surface, but in the higher plants this work is performed wholly by the roots. The amount of root surface possessed by plants varies greatly in different species. It is difficult to estimate accurately the quantity of roots in a plant, but the following figures from German observers may be received with confidence: The length of roots of a strong barley-plant is about 125 feet; a vigorous oat-plant has not far from 150 feet; and all this spread of roots can be packed away in less than 4 inches cube. In some interesting observations made at the Massachusetts Agricultural College in 1874 by Pres. Clarke a surprising development of roots of a squash-plant was noted: "The entire system of roots was cleaned and spread out upon the floor of a large room, where they were carefully measured. The main branches extended from 12 to 15 feet, and their total length, including branches, was more than 2000 feet. At every node or joint of the vine was also produced a root. One of these nodal roots was washed out, and found to be 4 feet long, and to have 480 branches, averaging, with their branchlets, a length of 30 inches, making a total of more than 1200 feet. As there were 70 nodal roots, there must have been more than 15 miles in length on the entire vine." (P. 10, *Report of College for 1874.*) The plant is said to have grown in a propagating-pit, 4 feet wide by 50 long, in soil 6 inches deep. Notwithstanding the vast extent of roots possessed by plants, only a comparatively small part of each has the power of absorption.

A short distance behind the growing and protected tips of ordinary roots the fibrils are clothed with slender hairs. These root-hairs are very short-lived. As the root tip advances, new hairs are formed on the newer parts of the slender roots, while the hairs on the older parts die off. A few plants with soil-roots are said not to have any root-hairs—*Abies excelsa*, for instance. (*Schacht.*) They are absent in aërial roots, as in the case of many orchids and other plants, chiefly endogenous. The root-hairs are the efficient agents in absorption of crude liquids from the soil. It was formerly held that this work was performed by the very tip of the root, the so-called spongiole. This erroneous view is still perpetuated in some treatises on vegetable physiology. It was shown experimentally by Ohlerts in 1837 that after the very tip of the root has been cut off and the wound closed by varnish, absorption takes place as before; but if the root-hairs are kept out of contact with water or moist earth, absorption ceases. It may be said confidently that only the new surface, consisting of the root-hairs and the delicate epidermis, of which they are a part, just behind the tip of the root, constitute the apparatus by which dissolved inorganic matter is absorbed from the soil. The question to be asked is, In what way do the root-hairs absorb? They are living cells which have grown to their full size in the interstices of the soil, and they are in most intimate contact with the minute particles of earth. When a root is taken carefully from loose earth, the smaller rootlets are covered with a thick envelope of soil which clings to them. The apparatus of absorption, when reduced to its lowest terms, is merely a living cell in close contact with particles of soil, and constituting a part of the external tissues of the rootlet. The cell-wall is made up of cellulose, a substance shown by Hofmeister to possess extraordinary power of imbibing water and dilute solutions. When the young cell-wall is completely dried, its imbibing power is greatly impaired. To account for this and some analogous phenomena, Nägeli proposes an hypothesis which has met with much favor. He assumes that organized substances—of which we may now take cellulose of the root-hair as an example—are composed of arranged *structural molecules*, each of which, under ordinary conditions, is surrounded by a film of adherent water. Each molecule has its own film of water adherent to it, and this film may, within certain limits, be increased in thickness or diminished. When, however, the diminution is too great, the relations of the molecules are so much disturbed that they cannot again resume their former position. The hypothesis of Nägeli carries back one step—namely, to the structural molecule—the attraction known as *attraction of adhesion*. This is not the place to discuss the subjects of adhesion and capillarity, but attention must be here called to the fact that many organized substances imbibe water and dilute solutions with great force, and that imbibition appears to be a phase of the attractions just mentioned. The root-hair is lined with active protoplasm, itself a substance which possesses an enormous power of imbibition. When it is remembered that the contiguous living cells in the root, stem, and leaves have cellulose walls, and that these walls are lined with protoplasm, it is not difficult to believe that the removal of a portion of the liquid already held imbibed by a leaf-cell, or a cell in the stem, would produce an immediate effect upon the cells next adjacent, and thus indirectly upon those most remote. The ultimate effect upon the root-hair would be to cause imbibition of water to replace the loss. This must come from the soil.

The root-hairs are closely appressed to the particles of the soil. Water holding salts in solution may adhere to the particles, but in a form which cannot be detected by the touch. The soil may appear to be dry, and yet contain enough water, held by adhesion, for the immediate use of the root-hairs. The root-hairs absorb the water in part by imbibition. It is, however, well known that when two liquids of different densities, and miscible with each other, are separated by a film of membrane, there is a transfer through the membrane, called membrane-diffusion, or osmosis. Experiments upon this subject by Graham in 1862 showed that the nature of the membrane largely influences rapidity of diffusion through it. The substances, other than gases which are now left out of account, with which we meet in the plant or its food, may be divided into two classes—those which diffuse rapidly, and those which diffuse very slowly, if at all. The saline solutions in the soil may be placed in the first class, the protoplasm which lines the cells in the second. It has been shown that substances of the second class, although they do not themselves diffuse, assist in diffusion. The root-hair with its surroundings is an apparatus for osmosis: the protoplasmic lining of the cell-wall is a non-diffusible substance; the dilute saline solution in the soil furnishes the diffusible materials. Under the term "imbibition," which is used somewhat vaguely to indicate the active and forcible absorption of water by a membrane, and the term "osmose," which is used to signify diffusion through a membrane, may be brought the general phenomena of root-absorption of liquids. The roots of aquatic plants are surrounded with water or with a saturated soil, but they do not appear to differ in structure from the roots of plants which thrive in a moist but not wet soil. If Indian corn is transferred after germination upon moist tan or a damp sponge, to a vessel containing water or an aqueous solution, the roots alone coming in contact with the liquid, the plant will continue to grow, and if suitable food is given to it, it will flourish vigorously. This method of cultivating plants with their roots in aqueous solutions of various substances is termed water-culture. When a plant has thus developed its roots in water, earth can be carefully sifted around the delicate fibrils until the whole mass of roots is secured in a wet soil, after which the excess of water can be easily drained off and the soil left dry. Under such conditions the plant will continue to grow as before, but its new roots will specifically adapt themselves to the interstices of the soil, and minute particles will adhere closely to the new root-hairs.

The roots of many plants are aërial. They strike off above ground, and may or may not come in contact with soil. Large numbers of the tropical orchids have such roots. In what way true aërial roots absorb is not yet clear. Duchartre, who examined this subject with care, concludes that water in the state of vapor is not absorbed by such roots, but that the liquid water which moistens them is. He furthermore suggests that such roots make use of the soluble substances which alight on them as dust from the air, and which are dissolved in the water on their surface.

The roots of some plants are parasitic. These roots plunge more or less deeply into the tissues of living plants near them, and absorb the juices which their hosts had elaborated for themselves. The mechanism of such absorption can be understood when the transfer of elaborated matters in the stem is hereafter considered. It may here be noted that some of the roots of a few plants appear to be parasitic, while the remaining roots are ordinary roots, with hairs for absorption of crude matters. Such plants are termed partial parasites. Again, the roots of some plants thrive only in decaying vegetable or animal matter; such plants are called saprophytes.

It must now be asked, In what way are the crude matters absorbed by ordinary roots conveyed to and through the stem? and what are the phenomena which accompany the transfer? It is held that the liquids are carried in part from cell to cell by osmosis; in part, by the walls themselves, either in their very substance or as an extremely thin film covering the cellulose. This view, which of course is hypothetical, is now generally adopted. That the crude liquids are transferred, for the most part, through the wood there can be no doubt, but whether through the substance of the cellulose or by means of the capillary tubes and the cells is not clearly made out. It was stated in the article on vegetable histology that the stem of woody plants consists of fibro-vascular bundles variously arranged. The essential constituents of such bundles are wood and bast, with cells of roundish shape between these elements. The roots of woody plants have substantially the same structure. The transfer of crude liquids is now believed to be through the woody part of the bundle, chiefly through its newer portion, and in the manner previously detailed. The cavities of the woody vessels may contain the overflow, and those of smaller calibre may assist in the transfer by their capillarity. The larger ducts, however, generally contain air more or less modified. Crude liquids are transferred, under certain conditions, with great force. The pressure of sap has long been a favorite subject with experimenters in vegetable physiology. Some of the earliest observations were made by Rev. Stephen Hales in England in 1724. The more recent investigators have been Hofmeister, Sachs, and De Vries. Their results accord very closely with some made in this country at a later date. In 1873 a protracted series of experiments was carried out at the Massachusetts Agricultural College under favorable conditions as regards ingenuity in contriving and patience in employing apparatus. The experiments did not materially differ in their scope, or generally in their results, from Hofmeister's, just referred to, but they are more extensive in their range than any other published observations upon the subject. "Observations were made on one or more gauges several times daily, and occasionally every hour of the day and night from the 1st of April to the 20th of July. A gauge was attached to a sugar-maple Mar. 31, which was three days after the maximum flow of sap for this species, so that further observations are required earlier in the season to complete the record and determine with certainty the maximum pressure which it exhibits in the spring. Of the record made, the following facts are specially interesting: first, the mercury was subject to constant and singular oscillations, standing usually in the morning below zero, so that there was indicated a powerful suction into the tree, and rising rapidly with the sun until the outward pressure was sufficient to sustain a column of water many feet in height. Thus at 7 A. M., Apr. 21, there was a suction into the tree sufficient to raise a column of water 25.90 feet. As soon as the morning sun began to shine on the tree the mercury suddenly began to rise, so that at 9.15 A. M. the pressure outward was enough to sustain a column of water 18.47 feet high, a change represented by more than 44 feet of water. On the morning of Apr. 22 the change was still greater, requiring for its representation 47.42 feet of water. These extraordinary fluctuations were not attended by any peculiar state of the weather, and happened twelve days before there were any indications of growth to be detected in the buds." . . . "The maximum pressure of the sap for the season was observed at 10 A. M., Apr. 11, and was equal to sustaining a column of water 31.73 feet high. This was an excellent sap-day, considering the lateness of the season. There was noticed a general correspondence between the flow of sap in other maples and the pressure on the gauge. After Apr. 29 the mercury remained constantly below zero, day and night. During the month of May there was a uniform suction equal to about 8 feet of water, and the unaccountable feature of this fact is that, though apparently produced by exhalation from the expanding leaves, it remained the same, day and night, for several weeks. In June the suction gradually lessened, and finally disappeared, the mercury standing steadily at zero. On the 20th of April two gauges were attached to a large black birch, one at the ground, and the other 30 feet higher. The next morning at six o'clock the lower gauge indicated the astonishing pressure of 56.65 feet of water, and the upper one of 26.74 feet. The difference between the indications of the two gauges was thus 29.92 feet, while the actual distance between them was 30.20 feet, so that it corresponded almost exactly as if they were connected by a tube. In order to learn whether the same principle would prevail if the upper gauge was moved, it was raised 12 feet higher. The same correspondence continued through nearly all the observations of the season, notwithstanding the gauges were separated by 42.20 feet of close-grained birch-wood. At 12.30 P. M., Apr. 21, a hole was bored into the tree on the side opposite to the lower gauge, and at the same level. Both gauges at once began to show diminished pressure, while sap issued freely from the orifice. In fifteen minutes, 1 pound of sap having escaped, it was found that both gauges had fallen equal to 19.27 feet of water. Upon closing the hole the gauges rose in ten minutes to their previous level, showing that the rootlets had reabsorbed in that brief period the sap which had escaped from the tree, notwithstanding the enormous pressure already existing. A stopcock having been inserted in the hole opposite the lower gauge, it was found that the communication between it and the two gauges was almost instantaneous, which appears to prove that the tree was entirely filled with sap, exerting its pressure in all directions as freely as if standing in a cylindrical vessel more than 60 feet in height, as indicated by the lower gauge. The sap-pressure continued to increase until, on the 11th day of May, it represented a column of water 84.77 feet in height, which is believed to be the highest pressure of vegetable sap ever before recorded. The buds of the birch now began to expand, the pressure of the sap to diminish, and

the oscillations of the mercury to become more decided and regular than before. The upper gauge ceased to vary May 14, remaining stationary at zero. The lower one declined slowly and varied greatly, but did not fall below zero until May 18. On May 27 it also became stationary at zero. The suction manifested by the birch was very little, never exceeding 9 feet of water, and continued only for a few days."

One of the best modern authorities on this subject says, that "although the movements of water in plants have been copiously investigated and discussed for nearly 200 years, it is nevertheless still impossible to give a satisfactory and deductive account of the mode of operation of these movements in detail." (Sachs's *Lehrbuch*, Eng. trans., p. 601.)

The crude sap which makes its way from the roots consists, before admixture with the elaborated juices of the plant, of a dilute saline solution containing ash-constituents and some form of combined nitrogen. The combined nitrogen is believed to be absorbed generally in the form of a nitrate. Inasmuch as starch is generally found in the root-cap, where it could not have been originally produced, but must have been formed there from products of assimilation elsewhere, it is difficult to believe that crude sap exists in any part of the plant free from admixture with elaborated matter. What is called crude sap is a mixture of saline solutions and elaborated substances in varying amount. The transfer of crude liquids through woody tissue is hindered, or absolutely prevented, by allowing the tissue to dry. This is strikingly shown by a well-known experiment by De Vries (quoted in Sachs's *Lehrbuch*, Eng. trans., p. 606): "If rapidly-growing shoots of large-leaved plants are cut off at their lower part, which has become completely lignified, and are placed with the cut surface in water, they remain for some time perfectly fresh. But if the cut surface is exposed even for a short time to the air, the leaves will speedily droop." The crude sap is ultimately carried to green tissue composed of cells containing granules of chlorophyll. The green tissue occurs on young shoots and in leaves. The crude sap, brought into this tissue by the same process which carries it from the root into and through the stem, undergoes certain changes which require to be now examined in detail. It may be noticed, in passing, that the tissues of the leaves are continuous with those of the stem. Upon the framework of fibres and vessels the chlorophyll-bearing cells arranged, packed in general more closely on the upper than on the lower part of the leaf. Between many of the cells are interspaces which communicate with the external atmosphere through stomata or valve-like pores. Over the whole upper and under surface, except at certain points in the stomata themselves, there is a cuticular layer differing in thickness in different plants. The cuticle and the cellulose walls of the outer or epidermal cells are both so thin as to be transparent, and reveal through their substance the color of the chlorophyll-granules in the cells below. Into this apparatus the crude sap is conveyed, and is there concentrated by evaporation, or more properly *transpiration*. The dilute solution parts with a large portion of the water in the form of vapor, which escapes chiefly through the stomata. The rate of transpiration varies with the nature of the tissue and with certain external conditions. If the cortical tissue is thick, as in the bark of older stems, transpiration ceases. From structures which are highly cuticularized, as are many kinds of Cactaceæ, *Euphorbias*, and ice-plants, transpiration takes place very slowly. Plants having such structure are natives of dry climates. The number and size of the stomata vary greatly, and must directly affect the rate of transpiration. The number and size of the intercellular spaces influence the rate of evaporation. If they are abundant and large, transpiration from the tissue will be rapid. The intercellular spaces in the leaves of some Araceæ are exceedingly numerous and of great size; in some leaves, like the common pine, they are small. The flexure of stems and leaves by wind must mechanically influence the rate of transpiration. It may be added that the character of the crude sap has been thought to affect the rate of transpiration: and if the process was simply one of evaporation, this would be the case, for it is well known that solutions of salts evaporate more slowly than pure water, and under similar conditions the more slowly the more concentrated they are. But it is to be remembered that the solution in the present case must first give up the water by imbibition to the cell-walls surrounding the intercellular spaces, and it is from these surfaces that the water evaporates. The problem is therefore, so far as the plant itself is concerned, very difficult and complicated.

The external conditions which affect the rate of transpiration are the relative dryness and the temperature of the surrounding atmosphere. The rate increases with the dryness and with elevation of the temperature. It is still an unsettled question whether light (independently of the rise in temperature) affects the rate of transpiration, but there is reason to believe that increase in the amount of light increases transpiration by causing the stomata to open more widely and allow the aqueous vapor to escape more freely. The disputed point is, whether the effect produced upon some, if not most stomata, causing them to open widely with access of light, is itself caused by the light, or by the heat, or by the chemical transformations which take place under its influence. The amount of water transpired by plants is therefore dependent upon many and diverse conditions. The earliest methodical experiments were made by Rev. Stephen Hales in 1731. He found that a sunflower which exposed 39 square feet of foliage transpired on an average 1 pound 4 ounce of water in twelve hours of the day, the maximum amount being 1 pound 11 ounces.

Transpiration is doubtless one of the most efficient agents in causing the ascent of crude sap. The escape of water in the form of vapor from the tissues of the leaf and young shoots causes a deficiency there, which is to be supplied, sooner or later, from below. If the loss is not made good by absorption through the roots, the lower leaves droop and the fading proceeds steadily upward. If the loss of water is not too great, the freshness can be restored by furnishing water to the roots, but if the leaves have become dry, they will not regain their former condition. In droughts the leaves which fade during the day partially or wholly recover during the cooler nights, when there is dew, leading to the belief that the leaves absorb water, and thus become fresh. But experiments have shown that the partial or complete restoration is to be attributed not to absorption of water by the leaves, but to the fact that transpiration is hindered on account of the coolness of the night and the greater humidity of the atmosphere. It is now generally held that, except in a few cases yet doubtful, leaves in the air do not absorb water, either in the form of liquid or vapor. The experiments upon this subject have disclosed a curious fact which should be mentioned here—namely, that transpiration can actually take place in an atmosphere saturated with moisture. Transpiration is an active and not a passive process. Water frequently exudes in drops from the tips of tender leaves, and from their under side. This takes place very frequently in germinating grasses and in many endogens. The exudation is obviously caused by internal pressure at some point, which forces the water into the intercellular spaces and out through the stomata.

By transpiration the crude sap is concentrated. The green tissue in which the concentration takes place is permeable to gases by what is known as gaseous diffusion. By means of the diffusion of gases through the cell walls of green tissue carbon dioxide—or, as it is better known, carbonic acid—is taken up from the air into the leaves. This gaseous substance is termed an impurity in the atmosphere, but it exists in nearly the same amount everywhere in the free air of the globe, averaging $\frac{1}{2500}$th of 1 per cent. by bulk, and $\frac{1}{1500}$th of 1 per cent. by weight. Under the influence of light this gas, taken in by diffusion from the air, and the elements of water taken up by absorption from the soil, are assimilated by the plant.

Assimilation—or, as it has been called, vegetable digestion—consists in the conversion of this mineral matter into vegetable matter. Assimilation takes place only in the cells which contain chlorophyll (or its physiological equivalent), and under certain conditions of illumination and temperature it is accompanied by evolution of oxygen. Hales in 1730 said: "We may therefore reasonably conclude that one great use of leaves is what has been long suspected by many—viz. to perform in some measure the same office for the support of the vegetable life that the lungs do for the support of the animal life, plants very probably drawing through their leaves some part of their nourishment from the air." (Hales's *Veg. Statics*, vol. i. p. 326.) Shortly after this, Bonnet of Geneva observed that on leaves of grapevine, placed in spring water and kept in the sun, bubbles of gas appeared, and more abundantly on the under side. He further noticed that this phenomenon ceased at night, and did not take place at all in water which had been boiled and cooled. He thought, therefore, that the bubbles of gas came from the water, and not from the leaves. Shortly after this, Priestley discovered that green leaves in sunlight purify air which has been vitiated by the breathing of animals, and appears to have shown that the gas which is seen on green leaves immersed in spring water and exposed to sunlight is oxygen ("dephlogisticated air," as it was then called). Ingenhousz showed a little later that under solar influence leaves evolved a gas which we now call oxygen, but at night emitted a pernicious gas (carbonic acid). Senebier proved

that the oxygen evolved by the leaves in sunlight came from the decomposition of carbonic acid. De Saussure determined the quantitative relations existing between the carbonic acid taken up by plants and the oxygen given off by their green foliage in the sunlight. Daubeny in 1836 showed that intense light is more active in causing the evolution of oxygen, and he experimented upon the relations of plants to different kinds of light and to varying amounts of carbonic acid in the air. In 1844, Dr. John C. Draper of New York demonstrated that the decomposition of carbonic acid by green leaves is due to the action of the rays which belong to the middle part of the solar spectrum; he further proved that the violet rays do not produce this effect. The subject has been further investigated by Sachs, Pfeffer, and others, and with confirmatory results, the most recent statement of which is as follows (transcribed from the English translation of Sachs's *Lehrbuch der Botanik*): "Only those rays of the spectrum which are visible to our eye have the power of decomposing carbon dioxide; and indeed, those which appear brightest to the eye, the yellow rays, are alone as efficacious in this process as all the others put together. The most refrangible rays of the visible spectrum, and those which act most energetically on silver chloride, etc., play a very subordinate part in assimilation."

Assimilation, as indicated by the evolution of oxygen, can take place at low temperatures—in the leaves of the European larch at 0.5°–2.5° C. (Boussingault); in the leaves of some grasses at 1.5°–3.5° C. In a water-weed (Vallisneria) the decomposition of carbon dioxide can begin at or near 6° C.; in Potamogeton, between 10° and 15° C. The organic substance formed from carbon dioxide and water by chlorophyll in sunlight is a carbhydrate, and in most cases is starch ($C_{12}H_{20}O_{10}$), in a few cases it is oil, having probably nearly the same chemical composition. It is unnecessary to assume, as is generally stated, that this carbhydrate is first formed in the chlorophyll grain as solid starch, and then made soluble for transport elsewhere. In active chlorophyll grains it is generally possible to demonstrate the presence of starch, and under some conditions the grain becomes full of starch. Assimilation is understood to comprise the formation of a carbhydrate by chlorophyll in the sunlight from carbonic acid and water, with evolution of oxygen. It is believed by some authorities that the albuminoids (protoplasm, etc.) in the plant are also produced by assimilation in green tissue, but of this there does not appear to be any clear proof. Others hold that the albuminoids are products of further elaboration, and are formed in active meristem-cells. Such elaboration and similar changes are now termed *metastasis*. Other products of elaboration are the sugars, glucosides, etc., etc. The dissolved or modified starch enters into the composition of elaborated sap, of which mention has previously been made, and is either at once consumed in work or growth, or it is stored up in some form for future use. The liquid form of stored material is characterized by the presence of sugar or of some soluble carbhydrate. It is found in all tissues, even in those which convey chiefly crude sap. The solid form is generally starch. This is lodged in the parenchyma of the plant, but may occur in any tissue. In plants of the order Compositæ it is replaced by inuline. In many seeds—for instance, Ricinus—oil is the form in which the stored material chiefly occurs. These kinds of stored material are believed to be physiological equivalents, since the plant can turn them equally well to account in work and growth.

When green organs are kept from the light for a long time the color becomes blanched, and returns only when the light is restored. It is now known that by exclusion of light the chlorophyll is first changed in form, then is absorbed, and finally disappears with the protoplasm from the parenchyma. On the access of light, especially diffused sunlight, the chlorophyll shortly reappears. It should here be noticed that while most seedlings grown in the dark are blanched, the cotyledons of pines are green even when the darkness has been complete.

Toward the close of summer the leaf becomes loaded with solid inorganic matter, and changes take place in the organic contents. The protoplasm is withdrawn into the branches and stem, the coloring-matter of the chlorophyll becomes modified, leaving only yellow granules in the parenchyma cells, and, finally, the leaf becomes detached at the point of articulation with the stem. The so-called evergreen leaves of coniferous plants are more slowly charged with mineral matter, and do not fall for two, three, or even many more years.

Work and Growth.—These subjects can be now considered together. Work in the plant demands the oxidation of an oxidizable substance, and this process is accompanied, therefore, by absorption of oxygen, the evolution of carbon dioxide, and an increase of temperature. Water must of course also be produced as a product of oxidation. The absorption of oxygen by plants, and the corresponding evolution of carbon dioxide, properly answer to respiration in animals, and may be called *vegetable respiration*. The evolution of carbon dioxide during growth can be easily and well shown by Sachs's experiment, in which seeds are made to germinate in a mass of moist cotton or sawdust upon a polished marble slab. The roots grow over the surface of the calcic carbonate, and by the evolution of carbon dioxide from them during growth, and the consequent localized action of an aqueous solution of carbon dioxide upon the marble, the marble is corroded wherever the roots go. The increase of temperature during oxidation can be easily demonstrated in the germination of barley in the manufacture of malt. In the space enclosed by the spathe or envelope of the so-called calla-lily the elevation of temperature during flowering is very considerable, and varies in general with the time of day, but has fluctuations dependent upon causes not as yet well understood.

Growth consists essentially in the production of new cells and in the increase of cells in size.

Formation of New Cells.—New cells are formed in various ways; but they have this in common—namely, a rearrangement of the protoplasm around one or more new points, which for convenience may be called centres, and the enveloping of this new mass, sooner or later, by a new cell-wall. The modes of formation are referred conveniently to three types, and this classification will be adopted here from Sachs's *Lehrbuch* (ed. 4, p. 8):

A. *Formation of Reproductive Cells.*—(1) Cell-formation by renewal, a new cell being produced from the whole of the protoplasm already existing. In this the whole contents of a cell contract, force out a part of the water of the cell-sap, the protoplasm changes its form, and, escaping from the old cell-wall, becomes after a while clothed with a new cell-wall. Here the material for the production of the cell-wall is doubtless held dissolved in the protoplasm. (2) Conjugation. In this the protoplasmic contents of two or even more cells coalesce to form a new common protoplasmic body, which, escaping from the old cell-walls, sooner or later becomes covered with cellulose. This is common among Algæ. (3) Free cell-formation is characterized by having new centres, around each of which a part of the protoplasm collects and forms a cell. But after the new cells have thus been formed within the old cell, there is still some protoplasm left, which survives for a time as the living contents of the old cell. (4) Formation of reproductive cells by division of the mother-cell. In this case, as in the last, new centres arise, but around each the protoplasm gathers, and the whole is thus used up in the production of new cells, instead of having some remain over. The new cell-wall may be produced only when the new cells are fully isolated from each other, or it may arise during the separation of the new cells. Another mode of cell-formation is characterized by a continuous chain-like succession of new cells, as in the case of the reproductive organs of certain Fungi. This may be regarded as a sort of gemmation or budding.

B. *Vegetative Cell-Formation.*—(1) In growing parts, while the protoplasm is dividing from without inward, a partition-wall is formed, thus intruding as a ring between the separating protoplasmic bodies. This is interesting as being the first of all processes of cell-formation that was accurately examined, having been described by Von Mohl in an alga (*Conferva glomerata*) in 1835. (2) The partition-wall arises simultaneously at all points of the boundary-surface as a thin cell-membrane. This is the commonest form of cell-formation in the growth of the higher plants. The relations of the nucleus to cell-formation are not fully made out. The most recent investigations upon the subject are by Strasburger.

Growth of Cells in Size.—When a new cell has been formed, it may increase in size and in thickness of the wall. The increase in size and in thickness results from the interstitial deposition of new cellulose—that is, new matter is placed between the molecules already existing. At first superficial increase is much more rapid relatively than growth in thickness, and it takes place in various directions, so that different forms are assumed by the new cells, depending upon their specific character or upon their surroundings. The growth is not uniform either in surface or in thickness, and hence arises the infinite variety of cell-forms and cell-markings already referred to under VEGETABLE HISTOLOGY. The new cells may be in rows, and give rise to filamentous forms, or on the same plane, producing flat sheets of tissue, or they may constitute masses of tissue, as in the higher plants.

The place of formation of new cells, and the conditions under which they arise, can be now specially considered. The root increases in length by the multiplication of cells, which lie just behind the protective root-cap. Roots and stems of exogens increase in thickness by the formation of

new cells of the cambium or meristem layer under the bast, the inner layer of the bark. Roots of endogens do not, as a general thing, increase in diameter after they are once formed. The stems of endogens increase in diameter by the formation of new fibro-vascular bundles among the older ones. Stems grow in length by the extension of the internodes. The growth of an internode ceases after the first year or sooner, and all further increase of stem or branches in length must be from the elongation of new internodes. The nodes and internodes of a branch are recognizable in the bud, where they exist in a rudimentary state. Leaves arise as minute papillæ upon the shortened stem within the bud, and always at a point some distance below the apex. The stipules and petioles are often formed at an early stage, and in the bud are generally larger than the rudimentary blade. The expansion of the blade after unfolding from the bud is extremely rapid.

The conditions under which growth of cells, tissues, and organs takes place have been examined by many investigators, of late chiefly with respect to what may be termed the physics of growth. Leaving out of sight the recognized fact that the parts of each plant have inherited tendencies to assume certain forms, the question is asked whether these forms may be modified by changes in the surroundings. *Light* appears to affect growth very slightly, if at all, when there is enough assimilated material present for the formation and enlargement of new cells. In simple structures, where assimilation takes place in light, cell-division occurs only, or mostly, at night or in darkness. From what has been previously said, it will be remembered that in the higher plants the points where new cells are formed, and where new cells increase in size, are for the most part protected from the light. It is not yet clear from experiments whether cell-division is favored or retarded by exposure to light. When seeds germinate in darkness, and the seedling plants are kept in the dark, the internodes become much elongated, the leaves of monocotyledonous plants becoming extremely long and slender, those of dicotyledonous plants remaining small and generally taking an abnormal shape. Flowers are not generally changed in shape or in color when they develop in darkness. It is well known that when growing stems and other organs are differently illuminated on different sides, they bend or curve toward the side where the light is most intense. It is stated by Sachs that this *heliotropic* curvature is caused by the slower growth in length of the illuminated side. This may be illustrated by a simple experiment: "If plants which show heliotropic properties are grown in a box which receives light from one side that has passed in one case through a solution of potassium bichromate (yellow), in another case through one of ammoniacal copper oxide (blue), the internodes of the first remain quite straight and lengthen considerably, as if they were in the dark, while those exposed to the mixed blue light grow less, and at the same time bend strongly toward the light. It follows from this that only rays of high refrangibility, the blue, violet, and ultra-violet, cause the curvature by retarding growth." (*Sachs.*) The stems and other parts of a few plants bend in the opposite direction—that is, away from the light. Such are known as *negatively heliotropic*.

Heat has a very decided influence on growth. The results of the observations of Sachs and others may be summed up as follows: The growth of a plant takes place with certain limits of temperature, and these upper and lower limits are different for different plants. The rapidity of growth generally increases with elevation of temperature above the lower limit until a certain maximum is reached; above this, which is called the *optimum*, the rapidity diminishes. Some of the results of the experiments by De Vries and Köppen are here given:

Temp.	Root of *Lupinus albus.*	*Pinum.*	*Tea.*
14.1 C.	9.1 m. m.	5. m. m.	
18.	11.6	8.3	1.1 m. m.
23.5	31.0	30.0	10.8
26.6	54.1	53.9	29.6
28.5	50.1	40.4	26.5
30.2	43.8	38.5	64.6
33.5	14.2	23.0	69.5
36.	12.6	8.7	20.7

Temp.	*Cucumis melo.*	*Sinapis.*	*Lepidium.*	*Linum.*
15.1 C.	.....	3.8 m. m.	5.9 m. m.	1.1 m. m.
21.6	.....	24.9	38.9	20.5
27.4	18.2 m. m	52.0	71.9	44.8
30.6	27.1	44.1	44.6	39.9
33.9	38.6	30.2	26.9	28.1
37.2	70.3	10.	0.0	9.2

In these experiments it was found that growth was most rapid when there were no sudden oscillations of temperature. All oscillations appeared to retard growth.

Gravitation was long since suspected by Knight of England to have a marked influence upon the direction of growth. Some organs can be proved by experiment to be dependent, as regards the direction of their growth, upon the action of gravitation. When an organ is thus influenced, it is said to be *geotropic*. Geotropism may be positive, as in roots, or negative, as in many stems. It was formerly explained by the presence of tension in the latter and the absence of it in the former; but this hypothesis has been abandoned, and no satisfactory suggestion has taken its place.

Tension of tissues is that condition produced by unequal growth in the different tissues, which gives rise to mutual pressure of the inner masses and the epidermis. When a thrifty internode which measures 100 units in length is separated with care into bark, wood, and pith, there are at once seen great differences in length of the isolated parts. The bark shrinks, the wood shortens or remains stationary, or in some cases lengthens, while the pith becomes considerably longer than before. It is plain that if the parts were again put together, it would bring about a condition of longitudinal tension. Measurements show also that there is a slight transverse tension as well. The following table, from Sachs, will exhibit these remarkable changes of length:

Plant.	Number of internode counting from the youngest.	Change in length of the isolated tissue, in percentage of the entire internode.		
		Bark.	Wood.	Pith.
Nicotiana tabacum.	I.—IV.	—5.9	—1.5	+2.9
	V.—VII.	—3.1	—1.1	+3.5
	VIII.—IX.	—3.5	—1.5	+0.9
	X.—XI.	—0.5	—0.5	+2.4

In some other plants the differences are as striking as those above given. It will be at once seen that a young shoot whose internodes are in such a state of tension is in a condition of unstable equilibrium, which may be disturbed by slight causes, such as changes of temperature, illumination, shock, etc. This tension of tissues is observable in all young organs, even leaves, and may be easily demonstrated by severing the different tissues from each other. While this tension is brought about by growth, it in turn affects growth. This can be shown by the effect produced by incisions in the bark of rapidly-growing plants; the growth becomes at once more active upon the side where the tension has been relieved. This subject has been studied chiefly by De Vries and Hofmeister. The tension may exist in a cell, a group of cells, or an organ, and disturbances of this tension will give rise to changes of form which can be recognized by change of position of the mass or the movements of parts.

The force exerted by growing cells is in many cases very great. Some of the most interesting facts respecting this subject have been brought out by Pres. Clark of the Massachusetts Agricultural College at Amherst, and a brief account is here given: A squash-vine was grown in rich earth in a plant-house under very favorable conditions for rapid development. A single fruit was selected for experiment. "On the 15th of August it measured 22 inches in circumference; on the 16th, 24 inches, and on the 17th, 27. Though the rind of the young fruit was very soft, it was now determined to confine it in such a way as to test its expansive power. In doing this, great care was taken to preserve the health and soundness of every part of the squash, and to expose at least one-half of its surface to the air and the light. The apparatus for testing its growing force consisted of a frame or bed of 7-inch boards, 1 foot long. These were arranged in a radial manner, like the spokes of the lower half of a wheel, their inner edges being turned toward the central axis. These pieces were held firmly in place by two end-boards 12 inches square, to the lower half of which they were secured by nails and iron rods. A hemi-ellipsoidal cavity, about 5 inches deep in the centre and 8 inches long, was cut from the inner edges of the seven boards, and in this the squash was carefully deposited, the stem and vine being carefully protected by blocks of wood from injury by compression. Over the squash was placed a semi-cylindrical harness or basket of strap iron firmly riveted together. The meshes between the bands, which crossed each other at right angles, were about 1½ inches square. The harness was 12 inches long and the same in width, so that when placed over the squash it just filled the space between the end-boards. Upon the top of the harness, and parallel with the axis of the cylinder and the squash, was fastened a bar of iron with a knife-edge to serve as the fulcrum of a lever to support the weights by which the expansive force was to be measured. At first, an iron bar, 1 inch square, was used for a lever, then a larger bar of steel, then a lever of chestnut plank, then one of seasoned white-oak plank, and, finally, one of chestnut, 5 by 6 inches square, and 9 feet long; but even this required to be strengthened by a plate of iron 4 inches wide by ½ an inch thick and 5 feet in length. The fulcrum for the lever was also renewed from time to time as the

weight was increased. The following table shows the weight of iron lifted by the squash in the course of its development:

Aug.	21	60 pounds.	Sept.	14	1300 pounds.
"	22	69 "	"	15	1400 "
"	23	91 "	"	27	1700 "
"	24	162 "	"	30	2015 "
"	25	225 "	Oct.	3	2115 "
"	26	277 "	"	12	2500 "
"	27	356 "	"	18	3120 "
"	31	500 "	"	24	4120 "
Sept.	11	1100 "	"	31	5000 "
"	13	1200 "			

The last weight was not clearly raised, though it was carried ten days, on account of the failure of the harness-irons, which bent at the corners under the enormous pressure of 2½ tons, and consequently broke through the rind of the squash. It was not feasible to remove the harness and substitute for it a stouter one, on account of its being imbedded in the substance of the squash, which grew up through the meshes of the harness, forming protuberances 1½ inches high and overlying the iron bands. When, on the 7th of November, the harness was removed in order to take a plaster cast of the squash, it was necessary to cut the straps with a cold chisel, sometimes into several pieces, and draw them out endways. The growing squash adapted itself to whatever space it could find as readily as if it had been a mass of caoutchouc; nor did it ever show the slightest tendency to crack, except in the epidermis. This would often open in minute seams, from which a turbid mucilaginous fluid exuded. In the morning drops of this would frequently bedew the protuberances like drops of perspiration. In the sunshine these dried up and fell off as minute globules, resembling gum-arabic. The lifting power was greatest after midnight, when the growth of the vine and the exhalation from the foliage was least." Recent experiments have shown that the form of certain organs in very low plants may be considerably influenced by changes in the surroundings, but these observations, and those which relate to changes produced by pressure, are too technical for consideration here. They may be found described in *Arbeiten des botan. Inst. in Würzburg.*

Parasitic Plants, etc.—There are some plants which do not contain chlorophyl, and which require that their food should be prepared by other organisms. Fungi and some higher plants of very different families are parasitic. Growth and reproduction in such plants are identical with corresponding processes in the plants which contain chlorophyll. When they take food from living organisms, they are known as true *parasites*—when from dead organic matter, *saprophytes*. They differ from green plants chiefly in their total inability to assimilate inorganic matter. Some plants are partial parasites, deriving a portion but not all of their food from the soil and air. A few of the higher plants are suspected of being carnivorous, or at least under certain circumstances capable of absorbing animal matter. These have been fully described under INSECTIVOROUS PLANTS.

REPRODUCTION in plants may be conveniently divided into *vegetative* and *sexual*. The former is seen in the production of a new cell or new cells from a single old cell, without the intervention of a second cell. In some of the lower plants this is exhibited in a simple division of an old cell—in such cases an individual—to form two or more new ones, which become new individuals separate from that which produced them and from each other. In the higher plants the phyton (see BOTANY), or a group of them in a bud, may be separated spontaneously or artificially from the mother-plant and give rise to new individuals. Many of the processes of horticulture, such as propagating by cuttings, etc., are based upon the facility with which parts of plants can be made to live and reproduce the wanting parts when severed from the parent. These modes of reproduction by buds and the like are termed vegetative. In the life of the plant there comes a time when the contents of two cells combine to form a new cell or new cells. This is known as sexual reproduction. It is seen in its simplest form in the lower plants, when the contents of two cells, which are not distinguishable by any means in our power, blend by the process known as *conjugation*. The new mass formed of the contents of the two old cells escapes, becomes clothed sooner or later with cellulose, and leads an independent existence. When, however, any considerable difference exists between two cells which thus interact, it is observed that one is active, and loses its identity by blending with the second, which is inactive and generally larger. The first is known as the sperm-cell, or male element—the second the germ-cell, or female element. The union of the two is termed fertilization. The male cell varies greatly in form and in its activity during fertilization, sometimes moving free toward the germ-cell, in other cases becoming attached to the latter during its growth. The different modes of reproduction in the groups of lower plants have been sufficiently described under the separate heads, and it is necessary here to refer briefly only to the higher plants known as phænogamous. These are sexually reproduced by the action of pollen (the *germ*-cell) upon the ovule (containing the *sperm*-cell). When the ovule is unenclosed in any pistil, it is naked, and receives the pollen directly at the apex of the nucleus (as in the pines and allied plants). If, however, the ovule is enclosed in a pistil, the pollen falls first upon a portion of the envelope known as the stigma, and thus can act on the ovule only mediately. It sends down a slender tube or tubes, consisting of prolongations of the inner coat through the style, and this tube at last penetrates the cavity of the ovary, where the ovules are lodged. The tip of the tube advances to the ovule, and comes in contact with the enlarged cell at the upper part of the nucleus. This cell has been termed the embryonal sac, and it contains the embryonal vesicle, a mass of protoplasm which does not generally fill the entire cavity of the sac. After contact of the tip of the pollen tube with the embryonal sac, the contents of the latter become covered with a cellulose film, and begin the formation of new cells, usually arranged in a vertical row. This row is known as the suspensor, or pro-embryo, and its terminal cell is the commencement of the formation of the embryo. The subsequent production of new cells gives rise to the embryo, which may remain very rudimentary, or may attain a large size and assume the form of a small plant. The other parts of the ovule undergo concomitant changes, by which the coats increase in size, or may become changed in form, and by which the food for the embryo is stored away either in its substance or immediately around it. The ripened ovule is a seed. The ovary, which may contain one or many thousand ovules, ripens into a fruit. Usually, other contiguous parts are more or less affected during maturation, and may constitute part of what is popularly known as the fruit. In the strawberry the end of the flower-stalk, the receptacle, becomes pulpy and large, and carries on its surface the minute ripened ovaries or seed-like fruits. In the apple, part of the receptacle and the calyx ripen off with the fruit. Other similar cases are more fully described under their respective heads.

Cross-Fertilization.—It is now well known that the pollen which is most efficient to produce the changes above noticed comes not from the same flower in which the ovule to be fertilized is found, but from some other flower of the same or a different plant of the same species. This cross-fertilization is effected by the wind, which carries pollen from one flower to another, as in the case of many imperfect or separated flowers, or by the agency of insects. The study of the mechanism by which this is brought about through the intervention of insects forms one of the most interesting chapters in vegetable physiology, but it is a subject which needs to be treated at greater length than can here be allowed. It can be found explained in Darwin's *Fertilization of Orchids*, and in a popular manner by Prof. Gray in *How Plants Behave.*

Hybridization.—The pollen of one plant has generally no effect upon the ovules of another species. In a few cases, however, the ovules are fertilized, and *hybrids* are the result. These are usually infertile, the sterility being closely connected with proximity of relationship between the plants producing the hybrid. Plants raised from seeds do not always perpetuate the minor characteristics or peculiarities of the parent. This is well known in our cultivated pears, apples, and the like, the varieties of which are propagated only by budding or grafting. This tendency to vary, and the tendency to closely resemble the parent, may be said to be conflicting tendencies in every case. The variation which arises in one generation is generally slight, and may be usually kept down in any case by cross-fertilization. Hence the production of varieties is greatly hindered by the various means by which cross-fertilization through insect-agency or wind is secured. Varieties are sometimes fixed, so that they are perpetuable by seed. Such varieties are termed *races*. They are well illustrated in many of the choicer annuals and garden vegetables. Varieties desirable to florists and horticulturists are generally propagated by cuttings and the like. By care in the selection of seed from desirable varieties the variation may often be led farther and farther away from the ancestral form. To what extent this variation and the fixation of varieties take place in nature forms one of the most interesting fields of modern speculation.

During flowering, and probably during the maturation of the fruit, there is a constant consumption of oxygen by the ripening parts, and an evolution of carbon dioxide. This is accompanied by a marked elevation of temperature in the case of the flower. The temperature varies considerably during the day, and presents oscillations which are not yet understood.

The seed, or, in the case of indehiscent fruits, the fruit itself, is often provided with means for dissemination. These are hooks, wings, hairs, and the like, by which, through the agency of the wind or of animals, the seeds or fruits may be carried for some distance from the parent plant. Many fruits, like the violet, witch hazel, etc., by a peculiar mechanism project the seeds; others are furnished with appliances by which they can become fastened in suitable soil.

Germination.—The conditions of germination of seeds are sufficient moisture, access of oxygen, and a proper temperature. Different seeds require different degrees of temperature, some, like water cress, germinating in ice-cold water, others requiring 100° F. or even more. These conditions must coexist in order to ensure germination; but as soon as the seed has once fairly sprouted, oxygen can be withheld without injury. Van Tieghem has shown that the embryo of a seed may be mutilated even to complete separation of its parts, and yet possess the power of partial repair. The albumen of a seed like the four-o'clock can by replaced by a wholly different starch without impairing the power of speedy germination. It is still a disputed point how long seeds can retain their vitality. The widely-published accounts of the germination of wheat found with Egyptian mummies are all discredited by botanists, but that there are cases of greatly prolonged viability there can be no doubt. (See SEEDS. For VEGETABLE METAMORPHOSIS and VEGETABLE MORPHOLOGY see METAMORPHOSIS, BOTANY, LEAF, and MORPHOLOGY (in botany), by PROF. ASA GRAY, M. D., LL.D.) G. L. GOODALE.

Vegetable Tissue. See BOTANY, by PROF. ASA GRAY, LL.D., and VEGETABLE HISTOLOGY, by PROF. G. L. GOODALE, A. M.

Vegetable Wax, the wax-like product of various plants, used to a considerable extent as a substitute for beeswax. (1) Myrtle wax, produced from the bayberry or wax-myrtle, *Myrica cerifera* of the U. S. It is of a greenish hue, and is sparingly used in pharmacy as an ingredient of cerates. Its candles emit a pleasant odor, but do not give a good light. (2) The wax of the Carnahuba palm, *Copernicia cerifera* of Brazil. It is used in Europe in candle-making and waxing floors and furniture. (3) That of *Ceroxylon andicola*, a fine palm tree of the Andes. It is abundant, but rather resinous, and for candles is mixed with tallow. (4) The Japan wax, produced by boiling the seeds of *Rhus succedanea*, a sumach tree. It is nearly equal to beeswax, and is used in candle-making. It should not be confounded with China wax, which is an insect product.

Vegeta'rianism, a view according to which vegetable substances ought to form the sole food of man, while the use of all animal substances, or at least of meat proper, ought to be avoided in the diet as something wrong, both physiologically and morally. Many of the ancient philosophers—as, for instance, Plato—encouraged a vegetable diet as the most suitable for the well-being of man, physically and morally; and some of them—as, for instance, Pythagoras—absolutely forbade the use of animal food. In modern times the view found eloquent advocates in Rousseau, Shelley, and others, and in 1847 a society was formed for the propagation of vegetarianism at Manchester, England, which published the *Vegetarian Messenger*, a monthly paper, up to 1861. A similar society was formed in the U. S. in 1850.

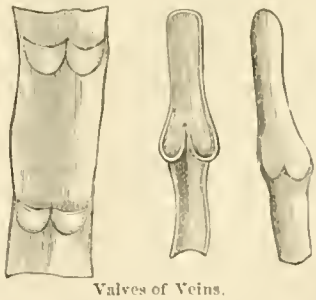
Veg'etative Process, Chemistry of. In the article BOTANY, by PROF. ASA GRAY, it has already been explained that the functions in nature of vegetation are to transform lifeless and stable bodies and compounds, such as make up the air, water, and soil, into organic matter, unstable, changeable, decomposable, oxidable, and full of chemical energy, which it evolves when decomposing or oxidating—matter fitted thus for the food of animals, whose life and movement it supports by supplying the energy necessary for animal heat and muscular motion. The methods and processes by which the plant accomplishes this fundamental vital function upon the earth constitute the subjects of a special branch of chemistry, which may be called *vegetable chemistry*. It is as yet but little cultivated, and but few things are known, even *superficially*, regarding the changes that occur in the conversion of mineral into organized matter. It is known that carbon, the binding element of organized bodies, is derived from the carbonic acid gas of the atmosphere. Hence this extremely minute constituent of the air, equal to only .0001 of its volume or .00061 of its weight, is the sole dependence of plant-life, and through this of animal life, upon the earth. Within the leaf of the plant resides the inscrutable vital influence which is able, with the assistance of the heat of the solar ray, to set up the most mysterious of chemical laboratories, where such substances as cellulose and starch (and through these sugars), with still more complex proteid bodies, are elaborated from the simple compounds carbonic acid and water. Generations may pass away at the present rate of progress of chemical investigation before any real insight will be gained into the chemistry of the plant leaf. The writer is enabled to state, from his own new researches in volume chemistry, a fact which has not been known in reference to this problem, and which is most impressive in its character. The fact is, that in the bodies formed in the plant leaf *hydrogen* exists in a greater state of condensation than in any other class of compounds yet known. While in liquid water, according to his computations, liquid hydrogen exists with a density of .1561 only (water being 1), in cellulose, starch, and gum it has about twice this density, or .309, and in cane sugar one higher still, .368. That this enormously condensed condition of the hydrogen in these food-constituents is intimately connected with their nature as reservoirs of animal energy may be asserted without doubt, but the nature of this connection is yet to be elucidated by laborious chemical investigation. (See VEGETABLE PHYSIOLOGY and VEGETABLE HISTOLOGY.) HENRY WURTZ.

Ve'glia, an island of Austria, belonging to the government of Triest, in the Gulf of Quarnero, an inlet of the Adriatic, and separated from the mainland by the channel of Morlacca. It is 23 miles long, 12 miles broad, mountainous, and produces timber, wine, silk, marble, and salt. P. 15,000.

Vehmic Court. See FEHMIC COURT.

Veh'se (KARL EDUARD), b. at Freiberg, Saxony, Dec. 18, 1802; studied jurisprudence at Leipsic and Göttingen; was appointed assistant keeper of the royal archives of Dresden in 1825; published his *Geschichte Kaiser Otto's des Grossen* in 1828, and became chief of the archives in 1833. In 1838 he resigned his office and emigrated to America, but returned in 1839; lectured in Dresden and various other German cities; settled in 1853 in Berlin, but was arraigned for some passages in his *Geschichte der deutschen Höfe* (48 vols., 1851–58), condemned to six months' imprisonment, and banished from Prussia. In 1856 he went to Switzerland; settled at Sisach, near Bâle; was naturalized as a Swiss citizen; visited Italy twice, and d. at Dresden in 1870. The first 6 vols. of his *Geschichte der deutschen Höfe* treat of Prussia, the next 11 Austria, etc. He also wrote *Shakspeare als Politiker, Psycholog und Dichter* (2 vols., 1851).

Veins, Anatomy of [Lat. *vena*], the companion vessels to the arteries, distributed throughout the body for the purpose of returning the venous or impure blue blood from the extremities, surfaces, and viscera to the heart and lungs. The veins are membranous canals, essentially devoid of elasticity and without pulsation. They arise from venous capillaries which collect from the tissues the blood recently brought to them by the arterial capillaries, richly freighted with oxygen and nutritive matter. These venous capillaries unite to form ultimate veins, which still again unite, forming successively larger branches and trunks as they approach the centre of the circulation. The motion of venous blood is secured in part by the *vis a tergo*, or power of the capillary chemico-vital nutritive processes, in part by the pressure of the moving muscles and viscera between which the veins are imbedded, the veins being provided with valves which permit of blood-currents toward the heart, but not the reverse. Veins have three coats—internal, middle, and external. The veins are not uniform, symmetrical cylinders, like the arteries, but have pouches or sinuses adjacent to the valves, so that a vein distended resembles a bamboo stick with bulbous or knotted joints. The veins, like the arteries, have nutrient vessels, or *vasa vasorum*, in their walls. The veins of bones are termed sinuses, their outer coat being replaced by the endosteum or fibrous lining of the bone, as in the great sinuses of the skull. The venous blood returned by the veins from above the region of the heart is united in one great vein, the *vena cava superior*, all from below entering by the *vena cava inferior*. The *vena azygos* connects the two *venæ cavæ*, and receives a few veins from the region between them. The portal vein receives the venous blood from the intestines, and conveys it through the liver to the inferior vena cava. The pulmonary vein and branches go from the right side of the heart to the lungs, carrying the



Valves of Veins.

blood to the air-sacs to be revivified by the oxygen of inspired air.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Veins, Metallic and Mineral. See ORE DEPOSITS, by PROF. R. PUMPELLY.

Veit (PHILIPP), b. at Berlin Feb. 13, 1793; was educated by Friedrich Schlegel, who became his stepfather, and exercised a decisive influence on the peculiar cast of his mind; made his first art-studies in Dresden; joined afterward Cornelius and Overbeck in Rome, and became one of the most vehement champions of the romantic school in painting. In 1830 he was appointed director of the Städel institute of art in Frankfort, but resigned this position in 1843 because the institute bought Lessing's picture of *Huss before the Council of Constance*, and removed his studio to Sachsenhausen, opposite Frankfort. He has painted both *al fresco* and in oil, mostly allegorical and biblical subjects. Among his most remarkable pictures are—the *Seven Years of Plenty*, in the Villa Bartholdy at Rome, *Christianity bringing the Fine Arts into Germany*, in the Städel institute of Frankfort, the *Assumption of the Virgin*, in the cathedral of Frankfort, and the *Egyptian Darkness*, for the king of Prussia. D. Dec., 1877.

Veitch (JOHN), b. at Peebles, Scotland, Oct. 24, 1829; educated at the grammar school of that place and at the University of Edinburgh, where he graduated 1851 with honors in logic and moral philosophy; was assistant to Sir William Hamilton and to his successor, Prof. Fraser, in the chair of logic and metaphysics of that university 1855–60; became professor of logic, metaphysics, and rhetoric in the University of St. Andrew's 1860, and professor of logic and rhetoric in the University of Glasgow 1864. He translated Descartes' *Discourse on the Method of rightly conducting the Reason and Seeking Truth in the Sciences* (Edinburgh, 1850), and the same author's *Meditations and Selections from the Principles of Philosophy* (1853); prepared a *Memoir of Dugald Stewart* for the revised edition of the *Complete Works* of that philosopher (vol. x., 1858); was joint editor with the late Dean H. L. Mansell of Sir William Hamilton's *Lectures on Metaphysics and Logic* (Edinburgh and Boston, 4 vols., 1859–60), and has written a *Memoir of Sir William Hamilton, Bart.* (Edinburgh, 1869).

Vejer' de la Fronte'ra, town of Spain, province of Cadiz, on the declivity of a steep rock, is gloomy and dirty, but looks down on an exceedingly fertile plain along the river Barbate. P. 7662.

Ve'la (VINCENZO), b. in 1822 at Ligurnetto, canton of Ticino, Switzerland; was trained as a stone-cutter in the quarries of Viggio; went to Milan in 1836, where he studied drawing; worked in the studio of Cucciatori, and made models for the jewellers; removed in 1847 to Rome; won a prize in 1848 at Venice by his bas-relief, *Christ raising the Daughter of Jairus*; volunteered in the Italian war against Austria in 1848; settled permanently at Turin, and attracted general attention by his statues, *A Prayer* and *Spartacus*. Among his later works are *Harmony in Tears* (1855) for the monument of Donizetti at Bergamo; *France and Italy*, a group (1863), presented by the ladies of Milan to the empress Eugénie; *Columbus and America* and *Napoleon in St. Helena*, in the Metropolitan Museum of New York.

Velas'quez (DIEGO), b. in Spain about 1470; accompanied Columbus on his second voyage to America 1493; took a prominent part in the subjugation of St. Domingo, where he held several offices; was commissioned to conquer and colonize the island of Cuba, of which he became governor; founded Havana (1511) and other cities, and despatched to Mexico the expeditions of Grijalva, Cortez, and Narvaez. His last years were occupied by a controversy with the conquerors of Mexico about jurisdiction. D. 1523.

Velasquez (DIEGO **Rodriguez de Silva**), b. at Seville, Spain, in June, 1599, of Portuguese descent on the father's side; displayed in childhood such a fondness for drawing that he was placed in the school of Francisco de Herrera, the elder, and afterward in that of Francisco Pacheco, whose daughter he married; but was indebted for his style less to either of his masters than to his own resolute and untiring study of nature, by the aid of which he developed an intense realism, "adhering strictly to color, form, and outline of whatever he represented," and executing studies of the same model, a ragged peasant lad, in every possible attitude. He thus acquired wonderful skill in taking likenesses, as well as in his representation of still life. To this earliest period belong his celebrated *Water-Carrier*, at Apsley House, London, the *Adoration of the Shepherds* and *Beggar Boy*, at the Louvre, Paris, and a *Laughing Peasant*, in Vienna. In 1622 he made a short visit to Madrid to see the royal galleries, painted a portrait of Gongora the poet, and secured the friendship of powerful patrons; was invited to Madrid the following year (1623) to paint the portrait of Olivares, the primo minister of Philip IV.; was next employed by that monarch, and produced a portrait which at once established his reputation as the first artist of Spain; was appointed court-painter, with a regular salary in addition to handsome compensation for his separate works; made a portrait of Prince Charles of England during his secret visit to Madrid in 1623; gained great applause by his *Expulsion of the Moriscoes from Spain* (1627); became intimate with Rubens on the arrival of the latter at Madrid on a diplomatic mission (1628), but was not sensibly affected by his florid style; visited Italy 1629; was received with great honor by Pope Urban VIII., and assigned apartments in the Vatican; employed himself chiefly in copying the frescoes of Michael Angelo and Raphael, but considered Titian greater than either; returned to Madrid 1631; was given a painting-room in the palace, and became more than ever a royal favorite; went a second time to Italy to buy pictures and statuary for the royal gallery 1648–51, and was on his return appointed chief chamberlain of the court. D. at Madrid Aug. 7, 1660. He is generally regarded as the greatest of Spanish painters. An appreciative account of *Velasquez and his Works* (1855) has been written by Sir W. M. Stirling. PORTER C. BLISS.

Velde. See VANDERVELDE.

Ve'lez, town of New Granada, in lat. 6° 10′ N., lon. 73° 50′ W., on the Suarez, has cotton manufactures. P. 7546.

Ve'lez Mala'ga, town of Spain, province of Malaga, on the river Velez, near its mouth in the Mediterranean, in a plain of the highest fertility, producing sugar, cotton, and rice, besides wine and fruits of superior quality. The town itself is old and somewhat decayed, but it is rich and carries on an important trade. It contains the ruins of a Moorish castle and two fine old churches. P. 15,000.

Ve'lez Ru'bio, town of Spain, province of Almeria, on a plain 2558 feet above the level of the sea, has some very efficacious chalybeate springs in the vicinity. P. 5148.

Velia, or **Elea,** a Greek city. See ELEA.

Veli'ki Ustjug', town of European Russia, at the confluence of the Jug and the Suchona, manufactures leather, tallow, soap, and vinegar. P. 7763.

Velish', town of Russian Poland, government of Witebsk, on the Dwina, exports large quantities of corn, flax, and hemp to Riga. P. 9562.

Velle'ia, town of ancient Liguria, the present province of Parma, Italy, near the Nura, was founded under Tiberius, and was buried by a land-slide in the fourth century. It lay hidden and forgotten till 1760, when by chance it was discovered, and its forum, amphitheatre, baths, etc., were excavated. Singularly enough, Roman history does not contain the least hint of any such incident having taken place, but a comparison between the soil covering the city and that of the neighboring mountains makes the hypothesis of a land-slide very probable.

Velleius Paterculus. See PATERCULUS.

Velle'tri [anc. *Velitræ*], town of Italy, province of Rome, situated on a spur of Monte Artemisio, about 26 miles S. E. of the city of Rome. The walls, now very ruinous, are of the time of the Lower Empire; the cathedral and other churches contain ancient marbles, pictures, and other mediæval objects worthy of notice; but the Egyptian, Etruscan, and Roman antiquities formerly preserved here in the Museo Borgiano have been dispersed, as has also the important collection, likewise made by the Borgia family, of stone implements belonging to the age of the lake-dwellers. Velletri was one of the most conspicuous of the Volscian cities, and one of the most restless and rebellious under the Roman yoke. The Octavian family is said to have transferred itself from Velletri to Rome during the reign of Tarquinius Priscus, and to have been immediately admitted, as one of the chief heads of the Volsci, to the full rights of Roman citizenship. Velletri had to endure its share of suffering from the arms of the barbarians, and its mediæval life was no less turbulent than that of its neighbors. The modern town, notwithstanding its nearness to the Pontine Marshes, is said to be perfectly healthy. It is supplied with water by a subterranean aqueduct about 8 miles in length, constructed by Fontana. P. 16,500.

Vellore', a British fortress in the Arcot district of Southern India, is situated on the banks of the Pâlâr, or "river of milk," as the name of this picturesque stream signifies. The fort is surrounded by a deep moat excavated out of the solid rock. The European quarters of the town are airy and pleasant, but the town itself is overcrowded. Latterly, there have been severe floods in Vellore because of the sudden rise of the Pâlâr, and numbers of persons have perished. The town contains a fine temple to Vishnu, who is represented in his incarnation of Krishna, as divinely dallying

with and ravishing the thousand shepherdesses whom he so honored. Tippoo Sultan used to live a great part of each year (when he was not out on fighting expeditions) at this salubrious station. The railway now runs near the city, and it is likely to increase in size. As a fortress it is of considerable strategic importance even at this time. P. 51,500. R. C. CALDWELL.

Vellum. See PARCHMENT.

Velocim'eter [Lat. *velox*, "swift," and *μέτρον*, "measure"], an instrument for measuring with extreme accuracy the velocity of projectiles by means of electricity, was invented by Wheatstone in 1840, and has received ingenious improvements from Col. J. G. Benton of the U. S. ordnance department. A simpler form has recently been devised by Capt. Le Boulengé of Belgium.

Veloc'ipede [Lat. *velox*, "swift," and *pes*, "foot"], originally a vehicle invented in 1817 by M. Drais of Mannheim, consisting of a seat resting upon two wheels, one before the other. The rider sat astride the seat, and propelled the vehicle by striking the ground with his toes. More recently velocipedes are propelled by the action of the feet upon a crank attached to the axle of the forward wheel. Velocipedes are called bicycles, tricycles, or quadricycles, according to the number of wheels. Few things are more puzzling to the ordinary observer than the self-balancing or *self-sustenance* of the bicycle velocipede. If he makes the experiment, he finds his forebodings, founded upon the absence of *base* for *stable equilibrium* in the two wheels in the same fore-and-aft plane, but too well verified. The principle by which the skilled rider sustains himself is perhaps best illustrated by reference to the familiar experiment of balancing a long pole in a vertical position on the chin or end of the finger. The equilibrium of a pole thus balanced (supposing it to be perfectly so, which it never is) is *unstable*: but in its *almost* vertical (or balanced) position the motion of fall is extremely slow; the holder is easily able to detect it, and to move his finger (or chin) so as to counteract it. The process for the bicycle is not identical, but analogous; the experienced rider *feels* such incipient tendency of the vehicle to fall either way, and by an acquired habit, which becomes instinctive, checks it through the guiding-wheel, slightly varying his direction. The centrifugal force due to the *deflection* of his moving velocity thus brought into action counteracts each incipient falling tendency. Perhaps it would be more proper to say that what is, in statics (or *motionless*), a position of *unstable equilibrium* is made kinetically (*i. e. through motion*) stable. J. G. BARNARD.

Velocity. See MOTION, by PROF. W. P. TROWBRIDGE.

Velpeau' (ALFRED ARMAND LOUIS MARIE), b. at Brèche, department of Indre-et-Loire, France, May 18, 1795, the son of a common horse-leech; attracted attention by his passion for studies and his success in some cures he undertook in the neighborhood; went in 1816 to Tours, with some slender support from a friend, to study medicine; removed in 1821 to Paris, and became in 1830 surgeon in the Pitié Hospital in Paris, in 1835 professor of clinical surgery at the Academy of Medicine, and in 1842 at the Institute. D. at Paris Aug. 24, 1867. He wrote—*Traité de l'Anatomie chirurgicale* (2 vols., 1825), *Anatomie chirurgicale, générale et topographique* (2 vols., 1838), *Mémoire sur les Positions vicieuses du Fœtus* (1830), *Nouveaux Éléments de Médicine opératoire* (1832), *Embryologie ou Orologie humaine* (1833), *Des Convulsions pendant la Grossesse, durant le Travail, ou après l'Accouchement* (1834), *Traité des Maladies du Sein et de la Région mammaire* (1853). His disciples, Jeanselme and Pavillon, collected and published his *Leçons orales de Clinique chirurgicale* (3 vols., 1840–41).

Velvet. See APPENDIX.

Venan'go, county of N. W. Pennsylvania, drained by Alleghany, Venango, and other rivers, and traversed by Lake Shore and Michigan, Atlantic and Great Western, and several branch railroads. The county forms the centre of the great oil-basin of Pennsylvania, and a large part of it is traversed by spurs of the Alleghany Mountains. Petroleum, bituminous coal, and iron ore are very abundant, and lumber is largely exported. The soil along the streams is fertile. There are manufactories of refined petroleum, machinery, carriages, woollen goods, and boots and shoes; flour-mills and saw-mills. Live-stock of all kinds is numerous. Staples, petroleum, coal, lumber, wool, oats, Indian corn, wheat, potatoes, and dairy products. Cap. Franklin. Area, 850 sq. m. P. 47,925.

Venango, tp., Butler co., Pa. P. 902.

Venango, p.-b. and tp., Crawford co., Pa. P. of b. 318; of tp. 623.

Venango, tp., Erie co., Pa. P. 1370.

Venango, city and b., Venango co., Pa. P. 1550.

Venantius. See FORTUNATUS (VENANTIUS).

Venaria Reale, town of Italy, province of Turin, near the torrent Stura, about 5 miles N. of the city of Turin. The castle, which was the royal summer residence of the house of Savoy during the last century, was so damaged in the course of the French occupation that it has never been repaired. The royal chapel, however, is still in good condition, and is much admired for its architecture and internal decoration. Venaria Reale is an active little town, and its large *piazza d'armi* is used as a place for artillery-practice. P. 5900.

Venhâ Metre. Every one knows of the Sanskrit *slôka*. Next in importance to it in India we must consider the *venhâ*. Millions and millions of Hindûs not only read and write it, but *sing* it alike. It is a most intricate alliterative measure, consisting usually of four lines, but sometimes, as in the *Kural* of Tiruvalluvar, of two only. What the most involved and difficult versification of the Spenserian stanza, or the sonnet, is in English to the plain sober march of non-rhyming (called blank) verse, that is the venhâ to the slôka. The venhâ of four lines contains properly five alliterative rhymes and four or five alliterations simple. There is no need in this place further to dissect this strange Hindû metre, but the reader can easily consult Indian prosodies on the subject, where the venhâ, as it deserves, is treated of at great length. It is so extremely difficult a measure that it cannot be here treated of concisely. Probably, this is one reason why the word is to be found in no English cyclopædia. R. C. CALDWELL.

Ven'dace, the *Coregonus Willughbii*, a trout-like fish of the family Coregonidæ, found in Scottish and Swedish lakes, and probably in Pomerania also. Its introduction into Scotland is ascribed to Mary Queen of Scots. It is a fine prolific table-fish, and is caught in nets, since it never takes the hook.

Vendée, La, department of France, bordering W. on the Bay of Biscay, comprises an area of 2587 sq. m., with 401,446 inhabitants. The coast-land is either sandy or salt marshes, from which it has received the name of *Marais*. The northern part, the *Bocage*, is more elevated, but the ground is covered either with heath or with pine forest. The rest of the department, the *Plaine*, is fertile land, eminently well suited to agriculture. But in spite of all disadvantages, both the Marais and the Bocage are well peopled and carefully cultivated; flax, hemp, and vegetables are produced in the former, honey, fruit, and hops in the latter, and wine in both districts. In the Plaine large crops of wine, wheat, and fruits are raised, and many cattle fattened for the Paris market. Iron and coal are found. Of 54,003 children of school age, 18,234 received no school education in 1857. Cap. Napoléon-Vendée.

Vendémiaire' ("wine month"), in the French revolutionary calendar, lasted from Sept. 23 to Oct. 21. It was the first month in the revolutionary year.

Vendet'ta [It.]. Before the administration of justice becomes a social institution, with authority to redress all injuries and power to enforce its authority, the idea of justice manifests itself in social life by the formation of customs which make vengeance one of the most sacred duties of the individual. When a man is slain, his son, his brother, or his nearest kinsman must avenge the blood by slaying the murderer, or the whole family will stand disgraced. In its gravest and most sublime form this custom existed among the ancient Scandinavians, but, as it denotes a certain stage of social development, it is found under some form in the history of every nation. Traces of it still occur among the Montenegrins, Albanians, Druses, Circassians, etc., and it flourishes among the Bedouins and in Corsica. In this last place it has received a most rigid and cruel form, and plays a most important part in social life. The name *vendetta* originated here. In his novel *Colomba*, Prosper Merimée has given a very striking and minutely true picture of the custom.

Vendôme', town of France, department of Loir-et-Cher, on the Loir, has a college, cavalry barracks, and manufactures of cotton hosiery, gloves, needles, and paper. P. 9938.

Vendôme, an ancient countship of France, corresponding nearly to the present department of Loir-et-Cher, was erected into a duchy by Francis I., and given to Charles of Bourbon. It returned to the Crown with the accession of Henry IV. in 1589, but in 1598 he bestowed it on his eldest son by Gabrielle d'Estrées, CÉSAR (b. in 1594, d. Oct. 22, 1665), from whom descended the house of Vendôme. César played a very conspicuous part in the intrigues and conspiracies against Richelieu and in the entanglements of the Fronde, and left two sons—LOUIS, duke de Vendôme (b. in 1612, d. Aug. 6, 1669), and FRANÇOIS DE VENDÔME, Duke de Beaufort (see BEAUFORT). Louis married Laura Mancini, one of Cardinal Mazarin's famous nieces, but be-

came a priest after her death in 1657: was made a cardinal, and left two sons—LOUIS JOSEPH, duke de Vendôme (b. in Paris July 1, 1654, d. at Tinaroz, Catalonia, June 11, 1712), and Philip of Vendôme, grand prior of the Knights Templar in France (b. Aug. 23, 1655, d. Jan. 24, 1727), with whom the family became extinct. Of all the members of the family, however, Louis Joseph was the only one who exhibited really great talents. He entered the army in 1672, and fought with distinction under Turenne in Germany and Alsace, and under Crequi in Flanders, to the Peace of Nymwegen (1678). He earned still greater renown in the following war (1688), under Luxembourg in the Low Countries, at the sieges of Mons and Namur, and in the battles of Leuze and Steenkerk, and under Catinat in Italy, where he commanded the left wing in the battle of Marsaglia (Oct. 4, 1693). But in spite of the brilliant energy he often displayed at the moment, and the coolness and inexhaustibleness of resources he evinced in an emergency, Louis XIV. still hesitated to entrust him with an independent command; for he was as careless as he was audacious, and his fits of energy were often succeeded by periods of indolence, during which he gave himself up to the grossest sensualities. Nevertheless, in 1695 he was placed in command of the army of Spain, and the result was a singularly rapid campaign, in which one brilliant success followed another; the whole finally was wound up with the capture of Barcelona, which enabled the king to negotiate the Peace of Ryswick (1697). In the Spanish war of succession he was sent in 1702 to supersede Villeroi in Italy. He was received with enthusiasm by the beaten and demoralized army, defeated the Austrians at Ustiano and San Vittorio, and drove Prince Eugene beyond the Mincio. His attempt to penetrate into Germany through the Tyrol failed, as the duke of Savoy rose in his rear; but with great alertness he turned round, defeated the Piedmontese completely, and gained new victories over Eugene at Cassano (1705) and over Reventlow at Calcinato (1706). However brilliant, his Italian campaign was not without its narrow escapes, caused by his carelessness, such as the battle of Luzzara (1702), and having been removed to the army of the Rhine once more to make amends for the blunders of Villeroi, he was completely defeated by Marlborough and Eugene at Oudenarde (July 11, 1708). The fault was perhaps not his. He commanded under the duke of Burgundy, a grandson of Louis XIV., and the hands of Madame de Maintenon, who hated him, were busy in his affairs. He left the army and retired in disgust to his estates. But in 1710 the situation of the French party in Spain became so desperate that Philip IV. implored his grandfather to send him Vendôme. Accordingly, Vendôme was sent to Spain, created an army, defeated the English at Brihuega and the Austrians at Villa Vicioso, carried the king back to Madrid, and finished the war in Spain. But as soon as the work was done, he immediately relapsed into his old indulgences, and died suddenly from "extraordinary gluttony."

Vendôme, Column of. See PARIS.

Vend'or's Lien is an equitable lien for the unpaid purchase-money of land resulting to the vendor or grantor, although the purchaser has taken possession, and although the conveyance may acknowledge that the consideration has been paid. It attaches to the land in the hands of the vendee or grantee, and of all persons holding under him except purchasers for value without notice of its existence. It is in the nature of a mortgage, and is enforced by a foreclosure and sale of the land. If a higher security is taken for the price by the vendor, as a mortgage, and generally a collateral undertaking of a third person, the lien is waived, but no note, bond, or other personal security of the vendee will have this effect. Although this lien does not exist by the law of a few States, it is fully recognized in a large majority of the commonwealths. In several of the Western States it is of great practical importance, and seems to be very commonly relied upon as a security for the price of land. JOHN NORTON POMEROY.

Ve'nedey (JAKOB), b. at Cologne May 24, 1805; studied law at Bonn and Heidelberg, and began to practise as an advocate in his native city, but fled to France in 1832 on account of an injunction against his *Ueber Geschworenengerichte* and other conflicts with the Prussian police; settled in Paris, and began in 1835 to issue a monthly paper, *Der Geächtete*; was twice banished from Paris, but finally allowed to reside there by the intervention of Arago, Mignet, and others whose interest he had gained by his work, *Römerthum, Christenthum, Germanenthum* (1840); returned to Germany in 1848, and sat in the national assembly at Frankfort; was banished from Berlin and Breslau; went to Zurich in Switzerland, but settled finally in Oberweiler, Baden, where he d. Feb. 8, 1871. After a visit to England (1843–44), he wrote *Irland* (2 vols., 1844) and *England* (3 vols., 1845): he also wrote *Geschichte des deutschen Volks* (4 vols., 1854–62), besides a number of biographies and minor essays.

Venedy, p.-v., Washington co., Ill. P. 230.

Vencer'ing [Fr. *fournir*, to "furnish"], in cabinet-work, the art of laying thin leaves of some valuable wood or other material upon a foundation of inferior material. It was known to the Romans, and is referred to by Pliny as a novelty of his period. The plates were formerly sawn by hand, but in 1806, Brunel introduced a method of splitting them from straight-grained wood, and employed circular saws for carved and knotted wood. Veneers of ivory and bone are now largely used for some purposes. The finer processes are called MARQUETRY and BUHL-WORK (which see).

Venereal Ulcer. See APPENDIX.

Venesection. See BLEEDING.

Venetian Architecture. See RENAISSANCE, by CLEMENS PETERSEN.

Vene'tian Chalk, the same as French chalk, a soft white talc used by tailors instead of chalk; also used in making pastels and cosmetics.

Venezue'la, United States of, a republic of South America, extends between lat. 1° 8′ and 12° 16′ N., and between lon. 60° and 73° 17′ W., bounded W. by the United States of Colombia, N. by the Caribbean Sea, E. by the Atlantic and British Guiana, and S. by Brazil, and comprises an area of 403,000 sq. m., with 1,784,194 inhabitants, of whom about 17,000 are pure whites, about 52,000 pure Indians, and the rest a mixture of Spaniards, Indians, and negroes. The language is Spanish: the religion is Roman Catholic, but other religions are tolerated; the constitution is a close imitation of that of the U. S. of North America. The union comprises the following twenty states, with one federal district and one territory:

States.	Population in 1873.	Capitals.
Apure	18,635	San Fernando.
Barcelona	101,396	Barcelona.
Barquesimeto	143,818	Barquesimeto.
Bolivar	129,143	La Guayra.
Carabobo	117,605	Valencia.
Cojedes	85,678	San Carlos.
Cumaná	55,476	Cumaná.
Falcon or Coro	99,920	Coro.
Guárico	191,000	Calabozo.
Guayana	34,053	Ciudad Bolivar.
Guzman Blanco	94,151	Victoria.
Maturin	47,863	Maturin.
Mérida	67,849	Mérida.
Nueva Esparta (Margarita)	30,983	Asuncion.
Portuguesa	79,934	Guanare.
Táchira	68,619	San Cristobal.
Trujillo	108,672	Trujillo.
Yaracui	71,689	San Félipe.
Zamora	59,449	Barinas.
Zulia	59 235	Maracaybo.
Federal district	60,010	Caráeas.
Territory of Amazonas	23,948	Caráeas.

The capital, Caráeas, has 48,897 inhabitants; Valencia, 28,594; Barquesimeto, 25,664; Maracaybo, 21,954; Maturin, 12,944. The coast along the Atlantic is low, sandy, and mostly occupied by the delta of the Orinoco; along the Caribbean Sea, from the Gulf of Paria to that of Maracaybo, it is alternately low, swampy, and lined with lagoons, and bold and rocky, the cliffs rising wall-like against the sea, but forming many good harbors, such as those of La Guayra, Puerto Cabello, Cumaná, Barcelona, and Maracaybo. The interior comprises two different mountain-systems, N. and S. of the Orinoco. From Colombia the Andes enter this country, and at Pamplona, in lat. 7° 15′ N., lon. 73° W., they separate into two branches—the one running N., under the names of Sierra de Ocaña, Sierra de Perija, and the Oca Mountains, never rising above 5000 feet, and terminating in Cape Chichibacoa at the north-eastern extremity of the peninsula of Goajira; the other running first N. E., under the name of the Mérida Mountains, having an average altitude of 6000 feet, and rising in the two peaks of the Sierra Nevada to 15,000 feet, then more directly E., under the name of the Venezuela Coast Mountains, having a mean height of 4800 feet, and rising in the Silla de Caráeas to 8547 feet, and in the Picacho de Naiquata even to 9100 feet. S. of the Orinoco stretches the Sierra Parima, consisting of many ranges, among which is the Sierra de Pacaraima, which forms the boundary between Venezuela and Brazil, but is generally very little known. Between these two mountain-systems extend along the banks of the Orinoco the Llanos, grassy plains of various elevation and of various surface-formation, those of Apure being so perfectly level that the waters of the Rio Apure and Rio Meta, which traverse them and enter the Orinoco, are turned by the least E. wind or by a swelling of the Orinoco and flow up-stream, while those of Caráeas and Ca-

rabobo present low ranges of hills and groups of trees. The climate varies with the elevation. In the low regions, not rising beyond 2000 feet above the sea, it is very hot, the mean temperature being 80° and the thermometer often reaching 110°; these regions are by the natives called *tierras válidas* ("hot lands"). At an elevation of from 2000 to 7000 feet, in the *tierras templadas* ("temperate lands"), the climate is delightful and healthy, the mean annual temperature ranging from 65° to 75°. Where the country rises above 7000 feet, in the *tierras frias* ("cold lands"), it generally becomes uninhabitable, not so much, however, on account of any excessive coldness as because of the perpetual mists which hang over these regions, and the terrible hail and snow storms which visit them. There is a dry and rainy season, but in many parts of the country—as, for instance, in Guayana—rains are frequent also in the dry season. The mean annual rainfall at Caráccas is about 330 inches in eighty days. The country is everywhere well watered. Besides the Orinoco with its 400 navigable affluents, several hundred rivers, most of them navigable, enter the Caribbean Sea, and lakes and lagoons are numerous. The soil is generally exceedingly fertile, and the mineral wealth of the country seems to be very great, though its mining industry is as yet very little developed. Diamonds and precious stones are found in Nueva Esparta; gold, silver, and platinum in Bolivar and Guayana; copper, iron, tin, zinc, lead, and quicksilver in Falcon and Barcelona; alum, gypsum, saltpetre, asphaltum, petroleum, and sulphur abound; salt is produced in large quantities along the coast, and *urao* from the lagoon of Lagunilla in Mérida. Still richer is the vegetable kingdom. The primeval forests of Guayana contain excellent timber and fine cabinet woods, such as mahogany, satin-wood, ebony, etc. The cinchona occurs in large forests; also the caucho, or India-rubber tree, gum trees, dyewoods, among which the famous *dici-diri*, and medicinal plants. The cocoa, sago, wax, and royal palm abound in the low regions. The coffee tree, introduced in 1784, is extensively cultivated, and succeeds well at an elevation from 650 to 5500 feet. Cacao and cotton are also extensively cultivated. Sugar and indigo were formerly raised in larger quantities, but tobacco forms still a very important crop. The principal occupation, however, of the inhabitants is cattle-breeding. In 1873 the country possessed 1,389,802 head of horned cattle, 1,128,273 sheep and goats, 93,800 horses, 47,200 mules, 281,000 asses, and 362,597 swine. Excellent fish, beautiful birds, game, and barnyard fowls abound, but the lower regions are much infested by noxious insects, immense spiders, bats, and centipedes, venomous serpents and alligators; the boa constrictor reaches a length of 50 feet. The manufacturing industry is very little developed, but in spite of the lack of good roads and other proper means of communication, the commerce is considerable. In 1872–73 the total value of the exports amounted to $21,320,495; that of the imports to $11,264,976. The principal items of export were coffee, 23,998,585 pounds; cotton, 5,648,323; sugar, 5,017,469; cacao, 7,573,586; tobacco, 1,100,297; indigo, 182,976; hides, 130,000; skins, 150,000, etc. About 2200 vessels entered the ports of the country in 1874. In 1873–74 the revenue amounted to $5,570,401, the expenditure to $5,209,351; the home debt to $16,439,383, the foreign debt to $16,575,337.

The island of Margarita and the opposite coast of the mainland were discovered in 1498 by Columbus, and in the following year the whole northern coast of South America was traced by Ojeda and Vespucci as far as the Gulf of Maracaybo. At the entrance of the lake stood an Indian village built on piles in the water, and this aspect reminded the Spaniards so vividly of Venice that they called the place Venezuela ("Little Venice"), which name was afterward applied to the region around the lake, and finally to the whole country. The first permanent settlement was made in 1520 at Cumaná, and new colonies soon followed. Coro was founded in 1527, Tocuyo in 1545, Barquesimeto in 1552, Valencia in 1555, Caráccas in 1567, etc. Of great consequence for the development of the country were the discovery of gold in the coast range in 1540, and the organization in 1700 of the Guipúzcoa Company in Spain for the encouragement of the cacao cultivation. In 1810 the country revolted against King Joseph, and (July 5, 1811) declared itself independent. In 1812 it was brought once more under Spanish authority, but in 1813 it again revolted. The republic of Colombia, comprising Venezuela, New Granada, and Ecuador, was organized in 1819, and its independence was recognized by Spain in 1823. In 1829 the republic dissolved into three republics, and in 1830, Venezuela adopted a new constitution. The transition from a monarchical and absolutist to a free republican government caused a total change in the ideas and customs of the people, and brought on a series of civil wars, in which much that was good and pleasant became lost, while confusion, disturbances, and degeneration seemed to take its place. Nevertheless, real progress, foreshadowing a higher development, was accomplished in many points. At present the government is carried on by Antonio Guzman Blanco, who was elected president of the republic in 1873 for four years, and with an almost dictatorial authority.

Ve'nial Sin [Lat. *venia*, "pardon"], a term used in Roman Catholic theology, denoting, in contradistinction to *mortal sin*, those sins which, although as transgressions of the law of God they divert more or less the end of the law from that which God intended, nevertheless are too small and insignificant to wholly subvert the law, and therefore pardonable. This class of sins is thus subdivided into objective venial sin, where the matter of the sin is very small, and subjective venial sin, where the sinner commits the transgression without full advertence or consent; but the whole set of distinctions is puerile in spirit and coarse in form, and it is furthermore so far below the aspirations of modern morals that when applied in practice it must be considered dangerous.

Ven'ice [It. *Venezia*], a celebrated city of Italy, once the magnificent capital of a rich and powerful republic, now the chief town of the province which bears its name. It is situated on, or rather in, the Adriatic, in lat. 45° 25′ N., lon. 12° 19′ E., and occupies a large number of small islands and shoals which lie between the mouth of the Piave on the N. and the Adige on the S. These islets, created by the deposits of the Brenta and other affluents of the Adriatic at this point, are connected by bridges (more than 300 in number) sufficiently raised to allow boats to pass freely under them; most of the houses and other edifices rest on piles, and there is generally a strip of artificial terra firma either in front or at the rear of every building. When these margins are very narrow, they are called *rive*; when broader, *fondamenti*; while the name of *campo* is given to every open space. By means of these and of the bridges a slender land-communication is kept up throughout the city, but most of the business and amusement of the town is carried on through the canals, which form not only the main highways, but interpenetrate every lane and alley of the floating town. The boats or *gondolas* used in Venice are too well known to require description here. The water of the canals is constantly changed by the tides, which, fortunately for the health of the city, rise higher here than at any other point in the Mediterranean, averaging some two or three feet. The shallow waters which separate Venice from the mainland, as well as those which flow between the city and the low, narrow, outlying islands, or *littorali*, to the E., are called *lagoons*, though the latter are generally meant when the singular, *lagoon*, is used. Between the *littorali*, which together form a gigantic breakwater against the full force of the Adriatic on the E., there are several more or less navigable passages from the open sea into the lagoon, but only three of these are now much frequented. The Porto del Lido, N. of the Lido, or Littorale of Malamocco, was once the main entrance, the proper port of Venice, but it is now much sanded up, and available only for small steamers and trading vessels. The Malamocco Pass, now the most commodious of all, is between the S. extremity of the *littorale* of the same name and the N. point of that of Palestrina. This channel has been deepened during the present century, at the suggestion of the distinguished engineer Paleocapa, by erecting two extensive dikes running E. (one from the S. point of Malamocco, the other from the N. of Palestrina) into the Adriatic for a distance of nearly 7000 feet. These dikes, by narrowing the width of the passage, have increased the force of the current, and thus enabled it to sweep all deposits farther out into the sea. Similar means have been successfully employed for the same purpose at the mouths of the Danube and the Mississippi. The third principal entrance is the Pass of Chioggia, between the S. extremity of Palestrina and the little sandbank on which stands the town of Sotto Marina, separated from Chioggia by an arm of the lagoon. This passage once admitted vessels of heavier tonnage than did the Malamocco, but now threatens to become shoaled up. This unfortunate change, which has also proved very injurious to the health of the town of Chioggia (20 miles S. of Venice), has been brought about by diverting an arm of the Brenta, which was producing most disastrous effects elsewhere, into the lagoon near this town. A large number of dredging-machines are constantly employed in clearing these channels, but the strength of man seems almost powerless to resist the natural forces here combined against him. North of the Porto del Lido, and about 5 miles from the city of Venice, lies the island of Torcello, probably the earliest settlement in the lagoons, as the town of Torcello had already passed its meridian in the eleventh century. Murano, which lies much nearer Venice, once contained

30,000 inhabitants, and its glass manufactures were the most celebrated in Europe. (For San Lazzaro see Appendix.) The island of Malamocco is now generally known as the Lido, and is a favorite bathing place. Since 1845 the city of Venice has been connected with the peninsula by a railway bridge, and is thus brought within an easy hour of Padua. This bridge begins about 2 miles E. of Mestre, is built on piles (more than 80,000 of which were used in its construction), consists of 222 circular arches of nearly 33 feet span each, and is 2¼ miles in length. The water varies in depth from 3 to 13 feet, and about midway the length of the bridge there is an embankment 446 feet long and 98 feet wide, called the Ponte Maggiore, and intended for military purposes. For four and a half years, 1000 men, on an average, were employed on this gigantic work, at a cost of nearly $10,000,000. By an aqueduct just within the parapet fresh water is conducted into the city, though the supply is also in part furnished by artesian wells sunk below the bed of the sea, and in part brought in tanks from the main land. The approach to Venice by steam over this bridge may perhaps touch the fancy less than did the floating over the shallow lagoon in a gondola, but it cannot fail to impress the imagination most profoundly. The railway station is on the island of Santa Lucia, at the W. mouth of the Canal Grande, which runs through the heart of the city, nearly in the form of an inverted *s*, and divides it into two not very unequal parts. The famous bridge, the Rialto or Rivo Alto (1588), an eccentric-looking but very solid structure, crosses the Canal Grande at the most central point. It consists of a single arch over 90 feet in span, the crown of which is nearly 25 feet above the water, and it is divided longitudinally by two rows of shops into three passages, the middle and widest of which is about 22 feet. Only two other bridges, both of iron, cross this canal. There are naturally few squares or gardens in Venice; the Giardino Publico, at the E. extremity of the city, and the small grounds adjoining the royal palace are the only public gardens; the Piazza San Marco is the great square of Venice and the centre of its life. No adequate description, and indeed only a very imperfect catalogue, of the public edifices and private palaces of Venice, celebrated as they are throughout the world for the beauty of their architecture, can be given here, and the reader is referred for greater fulness to the works named at the end of this article. Some of the chief objects are in the immediate neighborhood of the Piazza San Marco, an open quadrilateral 576 feet in length and from 185 to 269 feet in width, on the Rivo Alto near the E. entrance of the Grand Canal. At the E. end of this piazza, where the Piazzetta joins it almost at a right angle, stands that wonderful monument of Oriental Greek architecture, the Basilica of San Marco, begun in 828 to receive the bones of St. Mark, which are believed to rest here. The façade of this church is composed of two tiers of round arches, five in each tier, the centre arch of both rows being larger than the others. These arches are supported by innumerable columns of great beauty; the spaces over the doorways, etc., are covered with rich mosaics and other most elaborate ornamentation; and above the central portal stand four copper horses, originally gilded, brought from Constantinople in 1204, and undoubtedly of Hellenic workmanship. The sides and rear of the basilica are also more or less highly adorned externally with curious works of art brought from the East, and the whole edifice is surmounted with pinnacles and domes so perfect in form and arrangement as to produce a finish of the most exquisite symmetry and fitness. Within, everything is worthy of the magnificent exterior. The vestibule is entered by five bronze doors of superb workmanship, is vaulted with mosaics from designs by Titian, and contains very interesting sepulchral monuments. Passing from the vestibule to the proper interior of the church, the effect of all the wealth of ornament gathered there is somewhat lessened by the want of sufficient light. By degrees, however, the eye becomes accustomed to the half twilight, and soon takes in with delight not only the general form of the Greek cross, with the great dome above the centre and a smaller one over each arm, but the splendid columns with their graceful capitals, the tessellated marble flooring with its rich patterns and quaint allegorical figures, the high altar, the pulpits, the screen, the candelabra, the reliefs, and all the countless objects of religious veneration and artistic value collected in the various chapels, in the sacristy, etc. The crypt (tenth century), long inaccessible, may now be seen, and the baptistery and the treasury are also of great interest. On the left, as you leave the church, stands the great campanile or bell-tower (begun 902), 42 feet square at the base and 323 feet in height, ornamented with arcades, statues, etc., and surmounted by a colossal angel. The view from the belfry is as magnificent as it is unique. On the right, but farther in the rear, rises the Torre dell' Orologio or *clock-tower* (1494), with its gorgeous dial-plate of blue and gold, above which stand the famous bronze Moors whose iron hammers have announced to Venice through ages of glory and of decay the flight of every passing hour. Directly in front of the church, and supported by highly-ornamented bronze pedestals, are the three masts from which once floated brilliant banners of silk and gold, emblematic of the republic and her proudest dependencies, Cyprus and the Morea. The following may be mentioned among the most noteworthy churches of different periods and different styles of architecture: The Chiesa de' Frari (1250) contains, besides exquisite pictures by G. Bellini, Titian, Pordenone, etc., several very remarkable sepulchral monuments, among them one of great artistic merit to the unfortunate doge F. Foscari, another to the doge N. Tron, and two modern erections, one in honor of Titian, ordered by the emperor of Austria (1853), a very grand work, the other in memory of Canova, less admirable. In the conventual buildings connected with this church are kept the archives of Venice, said to contain at least 14,000,000 documents of all dates from the ninth to the nineteenth century. The SS. Giovanni e Paolo, more commonly called San Zanipolo (1264), is very interesting architecturally, and contains many remarkable historical monuments of great excellence. The Santa Maria della Salute (1630) is very sumptuously decorated with pictures by Luca Giordano, Titian, Tintoretto, etc. San Giobbe is also very rich artistically; the Madonna dell' Orto is a fine Gothic church with admirable pictures; San Stefano Protomartire (1294) in charming Pointed style and abounding in curious monuments; San Giorgio de' Greci is for the Oriental ritual, and boasts of some very fine mosaics; San Giorgio Maggiore and San Giorgio dei Schiavoni both contain noteworthy pictures and statuary by eminent artists; San Giovanni in Bragola, San Giovanni Crisostomo, and San Giacomo on the site of the first church erected in Venice, all are rich in pictures by the great Venetian masters. Santa Maria Formosa, the church from which the brides of Venice are said to have been carried off by pirates, is now remarkable for the beautiful picture of Santa Barbara, perhaps the finest work of Palmavecchio; San Moïse, San Pantaleone, San Pietro di Castello, all contain pictures by Paul Veronese as well as by other great masters. The Redentore on the Giudecca, an island S. of the main city and separated from it by the Canal Giudecca, is regarded as Palladio's *chef-d'œuvre* in ecclesiastical architecture, and is splendidly adorned with pictures by some of the greatest names of the Venetian school. Adjoining the church of San Rocco is the famous Scuola di San Rocco, so rich in the works of Tintoretto. San Salvatore contains, among other celebrated monuments, that of Catharine Cornaro, queen of Cyprus. Santa Maria dei Scalzi abounds in the choicest marbles, and contains fine pictures by G. Bellini. San Sebastiano is the resting-place of Paul Veronese, and is magnificently adorned by his pencil. San Zaccaria (1456–1515) is of a mixed style of architecture, and is decorated with admirable pictures, carvings, etc. The Gesuiti is architecturally an extravagant and gaudy example of Jesuit bad taste, but contains some important historical memorials and some excellent pictures. The cathedral of Santa Maria at Murano (from the tenth to the twelfth century) is very noteworthy, and at Torcello the Duomo and the church of Santa Fosca (the former rebuilt in the beginning of the eleventh century, the latter little changed since the tenth) have very striking architectural features and are of great interest.

The secular edifices of Venice are not less remarkable than the ecclesiastical. The Palazzo Ducale or *doge's palace* (1354–55, 1420–71) stands almost adjoining the church of St. Mark. It extends to the Molo on the S., has the Piazzetta on the W., and the Bridge of Sighs, leading to the terrible prisons, on the E. The side next the Piazzetta and that on the Molo rest upon double tiers of pointed arches supported by columns of the greatest beauty, and above the upper tier runs a gallery with a screen of exquisite tracery. Over this is a flat wall composed of variously colored marbles disposed in regular patterns, and this wall is pierced by ungracefully broad Gothic windows, not all on the same line of elevation. The battlements are of stone, but by no means pleasing in form. Notwithstanding these undeniable architectural defects, the general design is so admirable, the decoration so rich and varied, and the historical associations connected with it are so thrilling, that few buildings in the world impress the imagination so powerfully. (For a description of the Porta della Carta, the Scala dei Giganti, the palace as seen from the court, and, indeed, of the whole wonderful interior with its untold wealth of pictures and other sumptuous adornment as well as historic memorials, the reader is again referred to the works at the end of this article.) E. of the ducal palace, and connected with it by the Bridge of Sighs, a covered footway over the canal, are the too famous *carceri* or pub-

lic prisons in a building rather handsome externally, and in themselves probably not worse than those in general use elsewhere at the time they were constructed. The buildings known as the Procuratie Vecchie, on the N. side of the Piazza San Marco, were originally intended for the use of the church-wardens, whose office was then one of great dignity and responsibility; they are now occupied as shops and for other business purposes, and the elegant Café Florian is here. The Procuratie Nuove, opposite the former, were built to furnish additional accommodation for the wardens; they now form a part, as does also the celebrated Libreria Vecchia (Sansovino, 1536), of the Palazzo Reale. This latter edifice, though very faulty in many respects, especially in the wing added in 1810 on the site of the church of San Geminiano (the masterpiece of Sansovino, and his sepulchre as well), which was destroyed to make room for it, is on the whole an extremely graceful structure. The Zecca or mint (Sansovino, 1536), immediately adjoining the library, is also a very admirable piece of architecture, and contains some superb pictures. The two granite columns (brought from the East in 1127) standing at the S. end of the Piazzetta, the one surmounted by a statue of St. Theodore, the other by the Lion of St. Mark, were considered as especially symbolic of the republic, and were copied in many of her dependent cities. The curious legend explaining why criminals were executed between these columns is well known. The number and beauty of the private palaces of Venice are such as to preclude any attempt to enumerate and describe them here. We may barely name the Palazzo Contarini Fasan (1360), the Ferso, the Fini, the Corner, the Giustiniani, the Foscari, the Rezzonico, the Balbi, the three Mocenigo palaces (in one of which Byron lived), the Trevisan or *Capello*, the Ca' d'Oro, the Giovanelli, etc.,—all of which are more or less remarkable for their architecture and their artistic treasures. The Palazzo Moro is interesting as the dwelling of Cristoforo Moro, the original of Shakspeare's Othello, and the Poli as that of the renowned traveller Marco Polo. The Accademia delle Belle Arti of Venice is one of the richest picture-galleries in the world. The first collection was placed here, by order of Napoleon I., in 1807. The picture-halls are on the first floor, are very conveniently arranged, and here the great masters of the gorgeous Venetian school are seen in all their splendor. The celebrated *Assumption of the Virgin* by Titian, the *Presentation of the Virgin in the Temple* by the same artist, the *St. Mark delivering the Slave* by Tintoretto, the *Tempest* by (probably) Giorgione, would alone make any gallery priceless, and yet these form but a small part of the wealth of this astonishing assemblage. There are several minor collections, but none of great importance. La Fenice is the principal theatre of Venice; the Malibran is used chiefly for *legerdemain* representations, and the Gallo is a second-class theatre.

History.—Though the principal islands now covered by the city of Venice were probably to some extent occupied by fishermen at an earlier date, yet the first regular settlements were no doubt made in the fifth century by fugitives from the violence of the Northern hordes, who repeatedly desolated the neighboring province during that period. Here they were secure from invasion, though of course subject to many privations, and the little colony thrové so well that about the middle of the sixth century it was able to maintain something like an independent government, its rulers being called "maritime tribunes." Rivalries between the different islands, however, compelled them to elect a chief magistrate, who had authority over all the islands with the title of *dux* or *doge*. This election took place in 697, and the first person who received this honor was Paluccio Anafesto, a man of ability, who fixed his seat on the island of Heraclia and maintained order and the public prosperity till his death in 717. In 737 the *arengo* or popular assembly declared itself weary of the doges, but in 712 returned permanently to that form of government, the ducal residence being then transferred to Malamocco. It was in 737 that Venice helped to reinstate the exarch of Ravenna, who had been driven out by the Lombards, and thus began the interesting relations which afterward existed between the two cities and the long career of Venetian enterprise which followed. The islanders, however, were divided in opinion as to the wisdom of siding generally with the Eastern empire or with the Lombards and Franks, and so violent were the factions that the most common fate of a doge was assassination or blinding or banishment. Early in the ninth century, the doge Obelerio having shown himself subservient to the Greeks, Pepin invaded the islands and overran several of them, while most of the inhabitants took refuge on the safest, the Rivo Alto, which Pepin vainly attempted to reach. The story of the great victory obtained over the Franks at the island of Albiola (809) is now given up as an exaggeration of later ages; but, at any rate, the Venetians gained such decided advantages that Pepin was glad to retire after concluding a peace very honorable to the little republic. The Rialto now became the fixed seat of the doge, the adjacent islands were united to it by wooden bridges, and the name *Venezia*, vaguely applied before, was formally given to the whole. The first doge elected after these changes was Agnello Partecipazio, under whom the new city advanced rapidly; but, like several of his successors, he was suspected, and probably justly, of the design of making the office of doge hereditary in his own family. In 828-829 the supposed body of St. Mark was surreptitiously taken from Alexandria in Egypt by two zealots and transported to Venice, where it was enthusiastically welcomed, and the apostle was at once raised to the dignity of patron saint of the republic; St. Theodore, who, it would seem, had hitherto performed the office, not without fidelity, being very unceremoniously set aside. It was to serve as a fitting monument for these relics that the first church of St. Mark was immediately designed and begun; this church was destroyed by fire in 976. In 991, Pietro Orseolo was placed in the ducal chair, and under his wise administration the internal disorders (which, however, had not prevented a rapid development of strength in the commonwealth) were quieted, piracy was repressed, the coasts of Istria and Dalmatia became a part of the Venetian territory (though the whole of these provinces was not ceded to the republic till 1085), and the doge received the additional title of duke of Dalmatia. It was also under this doge—according to many authorities, although others place it as late as 1177—that the ceremony known as the *sposalizio del mare* ("the espousals of the sea") was first instituted. In 1099, Venice sent out more than 200 vessels to aid the first crusade. But though in this and in the subsequent holy wars many brilliant deeds of arms were done by her sons, yet it must be confessed that they were rather inspired by policy than by piety, and the extension of her commerce was never made secondary to the liberation of the Sepulchre. In the early part of the twelfth century Venice obtained very important commercial concessions throughout almost every part of the Christian East, but the false and fickle policy of the Greek emperors soon threatened their loss, and these brave sons of the sea resolved to put forth all their naval strength to defend them, or at least to avenge themselves. They sent out a fleet, captured and overran Rhodes, Samos, and several other Greek islands, and even a considerable portion of the Morea. In 1177, Venice espoused the cause of the Church against F. Barbarossa, and won a brilliant victory over the Ghibellines, which was followed by the "Peace congress," during whose session Barbarossa made his famous submission to Pope Alexander III., allowing the latter, say some, to place his foot upon his neck, while others warmly deny that this humiliating ceremony (more disgraceful, if true, to the Vicar of Christ than to the emperor) ever took place. In 1204, Venice obtained fresh victories, possessions, and privileges in the East (see DANDOLO), and in 1260 was able to annul, in part at least, the immense influence acquired at Constantinople by her proud and powerful rival, Genoa, though the latter inflicted a severe blow in return at the terrible battle of Curzola (1298). Indeed, the "Queen of the Adriatic" was now at the height of her greatness abroad, but she had already lost much of her liberty at home. The election of the doge was less and less the act of the people, and at the end of the century Venice had really ceased to be a democracy, though the outward change in the form of the government was not great. The city, however, was a proverb for wealth and magnificence, for art and refinement. Churches and palaces rose on all sides as if by enchantment; her diplomacy was renowned throughout the world; and her enterprising and accomplished sons, such as Marco Polo, were bringing to light the mysteries of hitherto untrodden lands. But while so many liberalizing and progressive influences were at work, tyranny, temporal and spiritual, was not idle. The Inquisition, in a very mild form, it is true, had been established here as early as 1289, and in 1335, after the abortive attempt to return to more democratic usages known as the Quirini Tiepolo conspiracy, the famous Council of Ten declared itself permanent. This council, certainly at first, and perhaps always, more terrible to the nobility than to the commoners, has been the subject of the gravest historical discussion, and its true history is probably still unwritten; but it must be admitted on all hands that at least it preserved the external dignity and independence of the republic. Throughout nearly the whole of the fourteenth century Venice and Genoa were carrying on wars against each other, alternately disastrous to both. Andrea Dandolo, the accomplished statesman, scholar, and historian, was appointed doge in 1343. Not long after, a severe earthquake occurred, followed by extraordinary tides which threatened to submerge the whole city, and these terrible floods were succeeded by a still more awful pestilence

which swept away almost half the population. About the same time was discovered the conspiracy of Marino Faliero, the doge. Toward the close of the century, and only a few years after Genoa had boldly entered the Adriatic, defeated the Venetian fleet at Pola and seized Chioggia itself, the Ligurian republic placed herself under the protectorate of France, and Venice was once more at peace. Another short period of almost unparalleled prosperity followed. The argosies of the republic were upon every sea, her merchandise crowded every port, and was carried by caravans even far into Inner Asia. A successful war with Padua made her mistress not only of Padua itself, but of Verona, Vicenza, Bassano, Belluno, etc. Another war with Milan added Brescia, Bergamo, Crema, Cremona, Rovigo, and Treviso to the republic; but all this accession of territory by arms was at the cost of her commerce, which now began to decline. Unfortunately, in spite of the wise warnings of the doge, T. Mocenigo (1423), the same policy was pursued during the fifteenth and sixteenth centuries. Venice continued to take part in all the quarrels which divided the Peninsula, her government became more and more oligarchical, and every attempt on the part of the people to obtain a larger share in it failed. Though the most recent investigations seem to show that there has been great exaggeration in the pictures given of the despotism of the Council of Ten and of the dark and dreadful proceedings of the state inquisitors, yet it is certain that all power was in the hands of the aristocracy, and this aristocracy, though still capable of most brilliant achievements, was gradually wasting itself in idle and extravagant pleasures. The westward advance of the Turks, especially the fall of Constantinople (1453), was a cruel blow to the commerce of the republic, and the somewhat later exploits of the Portuguese navigators were not less damaging to it. Indeed, so well was Venice aware of her danger from these voyages that (as is proved by existing documents) she not only made every effort to induce Egypt to remove all restrictions upon commerce with the East through Cairo, but even projected, as early as 1504, that great work of the nineteenth century, the Suez Canal. The chivalric wars of the republic with the Porte, particularly that begun in 1645, in which Candia was most heroically defended by the Venetians during a siege of twenty-two years and at a cost in the single year 1668 of 4,392,000 ducats, are a sufficient evidence of the energy and the resources which still survived. Even in the eighteenth century the old maritime spirit was far from extinct, as was shown by the defence of Corfu (1716) and by the naval victories of Angelo Emo, who died in 1792. The final extinction of the republic of Venice by Napoleon Bonaparte (1797), and the means through which it was accomplished, are now familiarly known, but it is impossible to speak of this crime against humanity without characterizing it as one of the darkest of the many stains on a fame which has filled the world, but whose lustre is steadily waning before every new ray of light cast upon it by history. The story of Venice from the Treaty of Campo Formio (1797) to 1848 is a succession of secret conspiracies or open attempts at rebellion against Austrian domination. In 1848 a revolution broke out which was successful for a time, but in spite of the most heroic and masterly defence of the city by Manin and his brave companions-in-arms, Venice once more fell into the hands of her Northern lord. In 1866, however, as a consequence of the Austro-Prussian war, Venice and the so-called Venetian provinces became a part of the united kingdom of Italy, and in the autumn of that year the city welcomed her new sovereign with magnificent demonstrations of joy. Since then efforts have been made to revive the commerce and the manufacturing industry of Venice. Venetian glass and mosaics are once more found in all the markets of the world, the Venetian gold and silversmiths have a high reputation for certain styles of work, and the manufactures of silk and velvet are extensive. For a time, even the maritime trade of the city increased, but, owing to the physical difficulties already mentioned, it seems idle to hope that the merchant-fleets of Venice will ever again cover the seas as in the days when she was mistress of the commerce of the world. P. in 1875, 128,900.

(For the architecture of Venice see Ruskin's *Stones of Venice*, the works of Gwilt, Fergusson, etc.; for the Venetian school of painting, see also Ruskin, Kugler, Crowe, and Cavalcaselle; for modern life in Venice see George Sand's *Lettres d'un Voyageur*, Howell's *Venetian Life*. An adequate history of Venice still remains to be written, and it can therefore now be studied only fragmentarily, but the following are valuable sources of information on the subject: the *Chronicles* of Sagornino, Canale, Andrea Dandolo, Marin Sanuto; *Annals* of Malipiero; officially-appointed historians, R. Sabellico, Bembo, Paruta, Morosini, Contarini, Verdizzotti, Cappelletti. Romanin and Daru may also be named among the historians of Venice. Many interesting notices will be found in Sansovino, *Venezia*; in Filiasi, *Memorie Storiche*; in Muratori's Collection; also in Zannetti Girolomo, *Dell' Origine di alcune Arti*; Tafel and Thomas, *Urkunden*, etc. For the political relations of Venice see the *Correspondence of the Venetian Ambassadors*, published by Alberi (Florence).)

CAROLINE C. MARSH.

Venice, tp., Tulare co., Cal. P. 490.

Venice, tp., Shiawassee co., Mich. P. 986.

Venice, p.-v. and tp., Cayuga co., N. Y. P. 1880.

Venice, tp., Seneca co., O. P. 1781.

Venice Turpentine. See TURPENTINE, by J. P. BATTERSHALL.

Veni' Crea'tor Spir'itus, a hymn of the Roman Breviary, was probably composed by Pope Gregory I. (540–604), though it was once ascribed to Charlemagne. It is written in correct metre, according to the quantity of the syllables, and its Latinity is good. It is used in the ordinals of several of the Protestant churches. Dryden's translation of it is one of the best. This and the CREATOR SANCTI SPIRITUS (which see) are of the "seven great hymns of the mediæval Church." (See STABAT MATER.)

Veni're [Lat.]. At the common law the sheriff selected the jury from among the citizens of the county. The *venire*, or *venire facias* ("that you cause to come"), is a very ancient judicial writ directed to the sheriff, commanding him to select and summon from the body of the county before the court on a day named a specified number of qualified citizens to act as the jury at such court. The sheriff thereupon selects and summons the proper number, and returns their names with the writ. This mode and the writ are still retained in some of the U. S. In many of them, however, the whole common-law method has been abrogated. From lists of qualified persons made and kept by certain officials in each county the requisite number of jurymen for a court are drawn by lot; these names being certified to the sheriff, he summons them without a regular *venire* being issued to him. But even in these States a *venire* may be necessary when the sheriff is called upon to summon additional jurors in special cases, the original panel being exhausted. The term *venire de novo* is the old technical expression showing that a verdict has been set aside and a new trial ordered. J. N. POMEROY.

Ve'ni Sanc'te Spir'itus, a hymn of the Roman Missal, ascribed to King Robert II. of France (d. 1031 A. D.). It is in the mediæval Latin, is rhymed, and its metre is not according to quantity. It is a sequence in the mass for Whit-Sunday and its octave, and is one of the loveliest and most tender of the Latin hymns. (See VENI CREATOR SPIRITUS.)

Venloo', town of the Netherlands, province of Limburg, on the Meuse, is narrow and irregularly built, but surrounded by quite strong fortifications, and contains an arsenal, powder-mills, magazines, and hospitals. Its chief manufacture is cigars, and its principal trade is in swine. P. 7402.

Venn (HENRY), b. at Barnes, Surrey, England, in 1725; educated at Bristol and at Jesus College, Cambridge, where he graduated about 1745; took orders in the Church of England; became fellow of Queen's College, curate of Clapham, vicar of Huddersfield, Yorkshire, 1759, and rector of Yelling, Huntingdonshire, 1797. D. at Clapham in June, 1797. Author, among other works, of *The Compleat Duty of Man, or a System of Doctrinal and Practical Christianity* (1763), a Calvinistic work which obtained great popularity and was often republished. His *Life and Letters* were published in 1834; the *Memoirs* by his son John (1759–1813), edited by his grandson, Rev. Henry Venn.

Ven'om [Lat. *venenum*], the poisons elaborated by healthy animals as distinguished from *virus*, the virulent liquid product of disease in animals or man. Some insect stings are virulent, though as a rule they are mild and relieved by simple measures. Bees and wasps as a rule leave their sting in the wound they inflict; this should be extracted, the wound protected from the air or bathed in cooling and stimulating evaporating lotions; ammonia is a useful application. The scorpion is dangerously venomous in the tropical regions of the Indies and Africa, but in the milder climates it inhabits does little harm. Contrary to the fabulous accounts of the tarantula venom, it rarely causes death, and seldom causes alarming symptoms. In all countries there are venomous serpents, their number diminishing with increase of population and high cultivation of soil. Islands are comparatively free. Ireland is said to be quite free, and England has but one, the viper. The chief venomous serpents of the U. S. are the rattle-

snake, moccasin, and adder. The phoora of India and the cobra are exceedingly virulent. The venom of serpents is elaborated in special glandular apparatus adjacent to the mouth, stored in a sac or canal, and reserved for sudden voluntary ejection as a part of the reptile's means of self-defence. The effect of the poison upon man may be immediate, rapid, and speedily fatal, or slow and incomplete. The venom, which probably has definite living germs, a *contagium vivum*, is believed to rapidly multiply itself in the blood, and quickly pervades the entire body, vitiating the red corpuscles and the nutrition of the tissues. In some cases the nerve-centres are primarily attacked, various nervous phenomena being speedily followed by paralysis of the medulla oblongata, and death. More often a definite period, short or long, intervenes before death. A prickling, burning pain is felt in the wound, increases to intensity, and extends to adjacent parts. The limb or part swells and inflames; the veins often are inflamed (phlebitis), and as a result of obstructed circulation the part becomes speedily œdematous or dropsical, and assumes a variety of changed colors from disturbed circulation and the decomposed state of the blood—from dark red to livid white, to blue, purple, mottled, and leaden hue. The limb may become cold, and if life is not destroyed, in time slough away. These changes may extend over the entire body. The mind is anxious, depressed, often deranged. Breathing is embarrassed, there is profuse sweating, vomiting, and jaundice, and death occurs by paralysis of the nerve-centres or exhaustion.

Venomous wounds should at once be cleansed, encouraged to bleed freely by suction or excision, a ligature speedily placed on the limb, or the part sedulously rubbed *toward the wound* and *away from the centre of circulation*, to evacuate all contaminated blood. Bold and thorough cauterization is of value. Strength is to be kept up by the heroic use of alcohol, ammonia, and other stimulants. (See POISON OF SERPENTS.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Veno'sa [anc. *Venusium*], commune and city of the province of Basilicata in Southern Italy, celebrated as the birthplace of the poet Horace and as the scene of the defeat and death of the Roman consul Metellus in a battle with the Carthaginian troops under Hannibal. Venosa is mentioned by Diodorus and Dionysius as a town of great antiquity and importance, but we know nothing of the details of its early history, except that it belonged to the Samnites before its incorporation into the Roman state. It lies in a salubrious, fertile, and picturesque region, and now shares in the general material and moral improvement of renovated Italy. P. 7062.

Ve'nous Blood, the dark-colored fluid collected from every part of the system by the veins. It subsequently becomes mixed with the *chyle*, or nutritious portion of the blood, and is ultimately exposed to the modifying influences of the air as it passes through the lungs, whereby it is converted into bright-red arterial blood. (See BLOOD.) Besides the difference between venous and arterial blood in color, several distinctions in physical and chemical properties are presented. The specific gravity of venous blood is greater than that of arterial blood; it does not coagulate as rapidly, and contains more corpuscles, but less fibrine. Its serum contains less water and extractive matter, but more fat, than that of arterial blood. Corpuscles from venous blood contain 3.57 per cent. of fat; those from arterial blood contain but 1.81 per cent. The differences in color presented by the blood-corpuscles appear to be dependent, to a certain extent, upon their shape and upon the amount of *hæmatine* present. The florid color of arterial blood is probably due to oxidation of the hæmatine. Venous blood contains more carbonic acid, but less oxygen, than arterial. In 100 volumes there exist—nitrogen, 13; carbonic acid, 71.6; oxygen, 15.30; arterial blood containing nitrogen, 14.5; carbonic acid, 62.3; oxygen, 23.20. Venous blood does not evolve oxygen when placed in an atmosphere of nitrogen, as is the case with arterial blood.

J. P. BATTERSHALL.

Ventilation. See WARMING AND VENTILATION.

Ventimi'glia, commune in the province of Porto Maurizio in Ligurian Italy, comprising several contiguous hamlets, with a total pop. of 6809 souls. It is a town of great antiquity, but it has little present interest except from its strategical importance as a strong and often-contested position on the coast near the Italo-French frontier, and as a striking point in the scenery on the Corniche road.

Ventricles. See HEART, HUMAN, by PRES. A. CLARK, M. D.

Ventril'oquism, the art of so managing the voice as to cause the illusion that its origin is from some other source than the vocal organs of the speaker or from a distant point, was undoubtedly known to the ancients. The word "ventriloquism" (*venter*, the "belly," and *loquor*, to "speak") indicates by its etymology the idea formerly entertained in relation to the nature of the performance. It is now, however, well known that the sound does not come from the abdomen. Again, it was conceived that the ventriloquist spoke during inspiration instead of expiration, and that thus illusions in regard to locality and distance were produced. But though it is undoubtedly true that modulated voice may be formed by inspiring air through the vocal organs, it is equally certain that the sounds which result have little or no analogy with those of the ventriloquist, and are not calculated to cause the deceptions which the accomplished performer so readily produces. In reality, the words uttered by the ventriloquist are formed in precisely the same manner as in ordinary articulation, the difference consisting mainly in the mode of respiration. A very full inspiration is taken, and then the air is expired slowly through a narrowed glottis, the diaphragm being kept in its depressed condition and the thoracic muscles alone being used to empty the lungs. At the same time, the lips are scarcely moved, and the deception is still further facilitated by the attention of the auditors being directed to the object which the performer wishes to be regarded as the source of the voice. This latter is no hard task, for it is at all times difficult to determine the source of sounds by the hearing alone, and the only means by which the unassisted ear can form an idea of the distance of a sound is by estimating its intensity.

WILLIAM A. HAMMOND.

Ventu'ra, county of S. W. California, bordering on the Pacific Ocean, and drained by Buenaventura and Santa Clara rivers. The surface is generally mountainous, but the soil in the valleys is fertile, capable of producing grains and all kinds of semi-tropical fruits. There are large numbers of cattle and sheep. Cap. San Buenaventura. Area, about 2000 sq. m. P. not included in the census of 1870.

Ventu'ra de Ran'tica (GIOACCHINO), b. at Palermo Dec. 8, 1792; was educated by the Jesuits, but entered the order of the Theatines; became general of the order in 1824, and settled in Rome, where he enjoyed the confidence of Popes Leo XIII., Pius VIII., and Gregory XVI., and exercised considerable influence even on the diplomatic business of the papal government. He was a disciple of Lamennais. "The pope and the people" was his device; the establishment of free institutions under the tutelage of the Roman Catholic Church was his ideal. But in 1831 the disagreement between the pope and Lamennais became apparent, and in 1834, Lamennais burst into open rebellion against the Church. Ventura attempted to bring about a reconciliation, but failed, and was compelled by the intrigues of the Jesuits to retire from the papal court in 1836. For about ten years he lived almost in obscurity, devoting himself to studies, publishing 5 volumes of homilies, and preaching frequently in the church of S. Andrea della Valle. Here, however, his peculiar eloquence, characterized by a brilliant imagination and a strong flow of emotion, soon attracted great crowds, and the exertions of the Jesuits to disturb or annihilate the impression he made failed. With the accession of Pius IX. he returned to the court, and his influence, as well as his popularity, grew rapidly. In 1847 he made a funeral oration over O'Connell which astonished the whole world, and when, in 1848, the revolution against the Bourbons broke out in Sicily, he openly espoused the cause of his countrymen with great fervor, and wrote—*On the Independence of Sicily*, *On the Legitimacy of the Acts of the Sicilian Parliament*, and *Mensonges diplomatiques*. But with the revolution in Rome and the flight of Pius IX. to Gaeta his ideals disappeared in the air. On May 4, 1849, he fled from Rome; settled in Montpellier, and removed in 1851 to Paris, where he preached in French to large audiences in the imperial chapel in the Tuileries and in the Madeleine, and published many voluminous works—*Histoire de Virginie Bruni*, *Les Femmes de l'Évangile*, *La Raison philosophique et la Raison catholique*, *Sur l'Origine des Idées*, *La Femme catholique*, etc. As an author, however, he is not eloquent, and his knowledge is fragmentary as his reasoning is desultory. D. at Versailles Aug. 3, 1861.

Ven'ue [Lat. *visnetum* or *vicinetum*; Law Fr. *visne*, the "vicinity or neighborhood"] originally meant the place or neighborhood from which the jury were taken to try a cause. It finally came to designate the county in which a cause is to be tried, and this has for a long time been its signification. In England and in the U. S. all causes must be tried in some county, which must be indicated in the process or pleading. The place of trial is generally regulated by statute in the various States. In certain civil actions called "local" the venue must be the county where the cause of action arose or where the subject-matter—especially land—is situated. In others, called

"transitory," the venue, according to the prevailing rule, should be in a county where one of the parties resides. In criminal prosecutions it is a fundamental principle that the venue must be the county where the crime was committed, but in some instances of continuing offences there may be an election of counties. The venue may be changed in civil causes to prevent great inconvenience to witnesses, and in both civil and criminal causes to promote the ends of justice. The causes, occasions, and modes of change are regulated by statute in the various States.

JOHN NORTON POMEROY.

Ve'nus, the second planet in order of distance from the sun, and the next neighbor of the earth within her orbit. Venus travels at a mean distance from the sun of 66,134,000 miles, and the eccentricity of her orbit being only 0.00686, her greatest distance, 66,586,000 miles, exceeds her least distance, 65,682,000 miles, by only 904,000 miles. As the earth's mean distance from the sun varies by about 3 millions of miles—that is, 1½ millions on either side of its mean value, 91,430,000 miles—the distance of Venus when in inferior conjunction, or between the earth and the sun, depends more directly on the earth's position in her orbit than on that of Venus in hers. It varies from about 26½ to about 24 millions of miles. But Venus when nearest to the earth is invisible, being lost in the sun's rays, and she is most favorably placed for observation when near her elongations, when she appears like a half moon, or slightly gibbous or slightly horned. She lies then much farther from the sun's place in the heavens than Mercury when he is at his elongations, for the elongations of Venus range in extent from about 45° to about 47½°. Venus completes a sidereal revolution in 224.7008 days on a path inclined 3° 23½′ to the ecliptic, but her synodical revolution is much greater, amounting to 583.920 days, which is the mean interval between successive inferior conjunctions or between successive superior conjunctions. Half this period, or 291.960 days, is the interval between successive conjunctions, which are of course alternately inferior and superior. Between inferior conjunction and the next superior conjunction Venus is a morning star, while between superior conjunction and the next inferior conjunction she is an evening star. But for a considerable interval on either side of a conjunction of either sort she is invisible on account of her proximity to the sun's place in the heavens. It is also to be noticed that at equal intervals on either side of inferior conjunction she is much more conspicuous than at equal intervals on either side of superior conjunction. Venus has a diameter estimated at about 7500 miles; her volume is equal to about $\frac{17}{26}$ths of the earth. Her density is slightly greater than the earth's, insomuch that her mass is equal to about $\frac{17}{50}$ths of the earth. The telescopic study of this beautiful planet has not been attended by results so interesting as might have been expected from its proximity. Some astronomers, indeed, claim to have seen spots and markings upon the surface of Venus; but the best observers, using the most powerful telescopes, have uniformly failed to see what inferior observers have imagined they have discerned with relatively imperfect instruments. Sir John Herschel remarks that "the surface of Venus is not mottled over with permanent spots like the moon; we perceive in it neither mountains nor shadows, but a uniform brightness, in which we may indeed fancy obscurer portions, but can seldom or never rest fully satisfied of the fact. It is from some observations of this kind that both Venus and Mercury have been supposed to revolve on their axes in about the same time as the earth." Still, it is noteworthy that such observations have led to results tolerably accordant *inter se*. Thus, the elder Cassini deduced a period of 23 hours. Bianchini indeed inferred from his observations the monstrous rotation-period of 24 days 8 hours, but the younger Cassini showed that all Bianchini's observations could be reconciled with the elder Cassini's by taking for the rotation-period 23 hours 21 or 22 minutes; and as Bianchini's observations were not continued during several consecutive hours at each sitting, owing to the want of sky-room at his place of observation, this interpretation must be accepted as the more probable. Later, the industrious Schröter attacked the problem, and deduced the rotation-period 23 hours 21 minutes 19 seconds, while recently De Vico, by combining his own observations with those of Bianchini and Cassini, has deduced the rotation period 23*h*. 21*m*. 15*s*. All the observers agree in assigning to the axis of Venus a considerable inclination from a perpendicular to the planet's orbit, but while some assign an inclination of 70°, others make the inclination no greater than 50°. Sir John Herschel considers that "the most natural conclusion from the rare appearance and want of permanence of the spots is that we do not see, as in the moon, the real surface of the planet, but only its atmosphere, much loaded with clouds, serving to mitigate the otherwise intense glare of their sunshine." It may be questioned, however, whether any such arrangement would render the planet habitable according to our ideas, if the actual inclination of the planet's equator be so great as 50°; for in this case the sun's annual range in declination (that is, in distance N. and S. of the equator) amounts to 100°, and the variations of the seasons must therefore be far greater than those we experience with a sun ranging only 23½° on either side of the equator. Take, for example, lat. 40° (N. or S.) on Venus. At a place having such latitude the sun's midday altitude in spring or autumn is 50°, while some time before midsummer the sun attains a midday altitude of 90°—that is, shines vertically down from the zenith—and thence to midsummer, and for as long an interval after midsummer, the sun crosses the meridian on the N. side of the zenith, and remains nearly all the day above the horizon (at midsummer *all* the day). This, with the tremendous sun of Venus, twice as large in appearance, and therefore giving out twice as much heat, as the sun we see, must involve an overpowering degree of heat. On the other hand, at the time of midwinter the sun does not rise above the horizon at all, unless raised by refraction for a few minutes at midday, and the cold must be as intense then as in our arctic winters. Such contrasts (and changes as great must occur in all latitudes) taking place in the short year of Venus, with only 112 days from the intensest heat of summer to the intensest cold of winter, would be altogether unendurable by the strongest race of men upon our earth. It has been found by means of spectroscopic analysis that the atmosphere of Venus contains aqueous vapor, so that in the important point of possessing water the planet is well provided for. In fact, if it were not for the very great obliquity assigned by observers to the equator of Venus we might not unreasonably assume that the planet is fit to be the abode of life.

Venus, like Mercury, transits the face of the sun, but at longer intervals. Her transits are much more important than those of Mercury, because, being nearer to us when in transit, her position on the sun is measurably different for observers differently placed on the earth. It thus becomes possible to determine how great a displacement of Venus arises for so many miles of distance between the observers on earth; and this is equivalent to determining the distance of Venus, precisely as the determination of the displacement of a distant terrestrial object, when viewed from either end of a measured base, is equivalent to determining the distance of the object. And when the distance of Venus is thus ascertained, the scale of the solar system is also determined, seeing that the proportions of the solar system are known from Kepler's third law. Accordingly, the transit of Venus on Dec. 9, 1874, was observed with great care at many stations on different parts of both hemispheres, and it is hoped that the results then obtained will lead to a more accurate knowledge than we have hitherto had of the distance of the sun. Transits of Venus occur only when she is in inferior conjunction near one of her nodes. These lie in longitudes 75° 19′ and 255° 19′, and the earth passes these longitudes respectively on or about Dec. 7 and June 6; so that transits can only occur near these dates. If a conjunction has occurred near the place for December transits, another will occur there 243 years later under very nearly the same conditions; but usually a pair of transits will occur near this date, separated by eight years, so that, for instance, we have a December transit in 1631 and another in 1639, followed by a transit like the first of the pair in 1874 (1631 + 243), and a transit like the second of the pair in 1882 (1639 + 243). In the interval between two pairs of December transits a pair of June transits or a single June transit will occur, but not quite in the middle of the interval, because neither the earth nor Venus moves quite uniformly. Thus, from Dec., 1631, to the 1st of the next June pair, in 1761, there elapsed 129½ years, whereas from the latter transit to the 1st of the next December pair in 1874 there elapsed only 113½ years; and of course the same intervals of 129½ years and 113½ years separate the second of the three pairs of transits in the seventeenth, eighteenth, and nineteenth centuries. But it is to be noticed that from the first or second of a June pair to the first or second of the next June pair there elapses the same period of 243 years that we have recognized in the case of December transits. Thus, between June, 1761, to June, 2004 (the next June transit), there are 243 years, and the same between June, 1769, and June, 2012 (the second transit of the next June pair).

R. A. PROCTOR.

Venus, in Roman mythology, the goddess of spring, generation, sensual love, etc., seems to have played no very prominent part in the oldest epoch of Roman civilization, but became afterward completely identified with Aphrodite, the Greek goddess of love, and appropriated to herself all the myths belonging to the Greek deity, without adding a single one of Roman origin—her birth from the foam of the sea, her coming from Cyprus or Cythera, her

marriage with Hephæstus (Vulcan), her amours with Ares (Mars), Hermes (Mercury), Adonis, Anchises, and others. Of special Roman interest was her adventure with Anchises, to whom she bore Æneas, the founder of Rome. Originally, however, Aphrodite was not a Greek creation either, but was introduced to Greece from Phœnicia, where she was worshipped under the name of Astarte. The myth of Adonis is also of Phœnician origin. The so-called Venus of Milo, in the Louvre, is one of the most celebrated antique statues which have come down to us.

Venus's Flower-Basket, the common name of *Euplectella speciosa*, a beautiful silicious sponge found chiefly in the Philippine Islands, consisting of a delicate lace-like skeleton or framework, which, when the enveloping gelatinous animal tissue is removed by immersion in chloride of lime, assumes the shape of a cornucopia twelve or fifteen inches in height by two inches in width. A hermit crab has sometimes been found imprisoned within. These baskets are properly regarded as great curiosities, and bring high prices.

Venus's Fly-Trap. See DIONÆA.

Venus's Girdle. See GIRDLE OF VENUS.

Ve'ra, town of Spain, province of Almeria, on the Almanzora, near its entrance into the Mediterranean, has a small harbor, through which it carries on some export and import trade. Its manufactures of nitre are important, and its fisheries quite considerable. P. 8470.

Vera (AUGUSTO), b. at Amelia in 1818; studied in France, where he was appointed associate professor of philosophy. He lectured on philosophy at Toulon, Rouen, Strasbourg, and London; was appointed to a professorship in that faculty at Turin by Mamiani in 1860, and afterward transferred to a similar post at Naples; has ably translated, annotated, and supplemented the works of Hegel. Most of his writings have appeared at Paris in French. He published in Latin *De Platonis, Aristotelis, et Hegelii de Medio Termino Doctrina.*

Ve'ra Cruz, state of Mexico, extending along the Gulf of Mexico from Tamaulipas to Tabasco, nearly 500 miles, in a narrow belt between the Sierra and the sea, is bounded inland by the states of San Luis Potosí, Hidalgo, Puebla, Oaxaca, and Chiapas; consists of a low sandy tract along the sea averaging 30 miles in width, and a mountainous inland region having several lofty peaks, among which are the snow-clad volcano of Orizaba or Citlaltepetl, 17,176 feet high, the Cofre de Perote, near Jalapa, 14,309 feet, and the volcano of Tuxtla, 9708 feet; has several extensive lagoons; is traversed by the large navigable rivers Pánuco, Papaloapam, and Goatzacoalcos; is hot and malarious along the sea-coast, which is frequently visited by yellow fever, but enjoys a salubrious temperature in the fertile *tierras templadas* of Jalapa, Orizaba, and Huatusco; produces a great variety of valuable staples, including sugar, cotton, tobacco, cacao, coffee, vanilla, the jalap root, and many dyestuffs, as well as the cereals and fruits of both tropical and temperate climates, while cattle in vast numbers are pastured in the lowlands; is divided into 18 cantons; has several cotton and woollen factories; is well supplied with educational institutions, and traversed by two important railways, leading from the city of Vera Cruz to Mexico, and to Jalapa, the state capital. Area, 27,433 sq. m. P. 504,325.

Vera Cruz, city and the principal seaport of Mexico, state of the same name, of which it was formerly the capital, is situated on the coast of the Gulf of Mexico in lat. 19° 11′ 56″ N., lon. 96° 8′ 36″ W., 190 miles E. S. E. of the City of Mexico; is surrounded by strong walls with two redoubts, and defended by the famous castle of San Juan de Ulloa on the island of the same name, half a mile from the shore; is regularly and strongly built in the old Spanish style; has no regular harbor, but merely an exposed roadstead, but is nevertheless the entrepôt for more than half the foreign commerce of the republic, its imports and exports averaging each about $25,000,000, of which $2,000,000 are with the U. S.; has 16 churches, a municipal palace, a custom-house, a mole finished in 1875, several hospitals and seminaries, a library, and a theatre; has a horse railway and waterworks, and is lighted with gas. The city was founded by Cortés in 1519 upon its present site, to which it was brought back 1590, after having been for many years located at Antigua, some miles to the N., and received the city franchise 1615. The castle of Ulloa was held by the Spaniards until 1825, and both castle and city were bombarded and taken by the French in 1838. In Mar., 1847, Vera Cruz was besieged and captured by the army of the U. S. under Gen. Scott. (See BOMBARDMENT.) P. about 10,000.

Vera Cruz, v., cap. of Douglas co., Mo.

Vera Cruz, Siege of. See VERA CRUZ.

Vera'gua, or Santiago de Veragua, town of New Granada, on the river Soledad, near its mouth in the ocean, has 6121 inhabitants, mostly engaged in agriculture and the manufacture of mats and straw hats.

Vera'trin, a vegetable alkaloid used in medicine. It is obtained from cevadilla seed (fruit of *Asagræa officinalis* and *Veratrum sabadilla*). Pure veratrin commonly occurs as a white powder, but can also be obtained in rhombic crystals. It has no smell, but has a bitter, acrid taste, and is very irritating to both tongue and nostrils. It is scarcely soluble in water, but dissolves in alcohol and ether. Upon the animal system veratria acts as an intense local irritant, and if taken internally produces also the same peculiar constitutional effects as *Veratrum viride*. (See VERATRUM.) Veratria is too irritating to warrant its use as an internal medicine, but is considerably employed externally as a local application for the relief of neuralgia. For such use it is made into an ointment with lard. EDWARD CURTIS.

Veratrine. See VERATRIA.

Vera'trum, a genus of plants of the natural order Melanthaceæ. The most important species are the following: *Veratrum viride*, or American hellebore, called also Indian poke, poke-root, swamp-hellebore. This is an indigenous plant, growing in damp soil from Canada to the Carolinas. It is an herbaceous perennial, with a thick fleshy root-stock, from which rises a round solid stem from three to six feet high, bearing bright green leaves, larger below than above, and surmounted by a panicle of greenish yellow flowers. The root-stock is used in medicine, its activity residing in two alkaloids, *jervia* and *veratroidia*. It is a powerful drug, lowering the force and frequency of the heart-beats and respirations, and having a strong tendency to produce severe nausea and vomiting, with great muscular weakness and relaxation. In overdose it produces alarming prostration and feebleness of the heart, but, from the prompt vomiting which large doses occasion, cases of fatal poisoning are exceedingly rare. There is no antidote to the poison, and after evacuation of the dose from the stomach perfect rest on the back and the use of restorative means, such as alcoholics, ammonia, artificial respiration, etc., constitute the treatment. As a medicine, *Veratrum viride* is used to reduce the force and frequency of the pulse where the same is much above the normal standard, but like all remedies of its class its use requires caution. *Veratrum album*, white hellebore. This species is a native of Europe and Asia, and is closely allied to the foregoing in botanical characters. The root-stock contains the alkaloid jervia, like *Veratrum viride*, and has been commonly supposed to yield also the alkaloid *veratria*, found in cevadilla-seeds, but recent analyses make this doubtful. White hellebore affects the animal system much in the same manner as *Veratrum viride*, but is more violent and locally irritating, producing in overdose, in addition to the symptoms already described, severe pain in the abdomen, and even gastro-intestinal inflammation. On account of these objectionable properties, white hellebore root is now almost wholly obsolete as a medicine with American physicians. *Veratrum sabadilla* is a native of Mexico, and is said to be one source of cevadilla-seeds. EDWARD CURTIS.

Verazza'no, or Verrazano, da (GIOVANNI), b. near Florence about 1480, of a noble family settled at Val di Greve, is alleged on doubtful evidence to have travelled in Egypt and Syria, engaged in traffic in spices, silks, and other Oriental productions; early entered the French maritime service; made a voyage to the East Indies in 1517 in a Portuguese vessel; became an expert navigator; was employed as a corsair or privateer by the French government in 1521 and the following years; took many prizes of Spanish vessels returning from the West Indies, and captured in 1523 the treasure-ship in which Cortés had sent from Mexico to Charles V. a large portion of the personal spoils of Montezuma, valued at $1,500,000. According to the authorities received without question until recently, he sailed from the Madeira Islands Jan. 17, 1524, on a voyage of exploration to North America; discovered land at a point near Cape Fear (or possibly near Little Egg Harbor, N. J.); coasted thence northward, discovering a bay, usually supposed to be that of New York, though others argue for Narragansett Bay; proceeded thence 150 leagues N. E. to lat. 50° N.; returned thence to France, and addressed a letter to King Francis I. from Dieppe July 8 (O. S.), 1524, claiming to have discovered 700 leagues of coast, of which he gave a confused description. Of his later history it is only known that he communicated to persons in England a map of his alleged discoveries, and signed in 1526, with Admiral Philipe Chabot, Jean Ango, merchant of Dieppe, and other partners, an agreement to undertake a voyage to the Indies for spices, with which was combined the purpose of capturing Spanish merchantmen. This voyage seems, however, to have been inter-

rupted by his capture on the southern coast of Spain, and he was executed as a pirate at the village of Pico, near Colmenar de Arenas, New Castile, in Nov., 1527. His exploits as a corsair, his capture and execution, are narrated by Pietro Martire d'Anghiera, Bernal Diaz, and other Spanish chroniclers, who call him Juan Florin or Florentin, and it was not till the eighteenth century that this corsair was identified with the navigator by Barcia. No evidence concerning his discoveries has been found in the French archives, and they rest entirely upon the letter mentioned above, which was published at Venice in an Italian version by Ramusio in 1556, no French original being known. In 1835, Mr. G. W. Greene discovered in the Strozzi Library at Florence a MS. copy of this letter, varying somewhat in text from the Ramusio version, and containing some additional paragraphs. This was published, with a translation, in the *Collections* of the New York Historical Society in 1841. In 1864 the genuineness of this letter was attacked by Mr. Buckingham Smith in a paper read before that society, and subsequently in other monographs. The letter, however, found an able defender in Mr. J. Carson Brevoort, who published an elaborate memoir entitled *Verrazano the Navigator* (1874), giving an account of a planisphere of the supposed date of 1529, found at Rome, signed by Hieronimo Verrazano, and containing a map of the coast discovered by Giovanni. Mr. Henry C. Murphy in his *Voyage of Verrazzano* (1875) has impugned the authority of this map, which he considers based upon the discoveries of Estevan Gomez in 1525. A document just discovered at Rouen (1876) proves that the navigator had a brother Hieronimo (Jerasme de Varasenne), to whom he executed a power of attorney May 11, 1526. The account of the voyage published by Ramusio, whether true or fictitious, may probably be traced to the efforts of this Hieronimo to popularize in Italy his brother's fame as a discoverer: and to him may be ascribed the statement given by Ramusio that Verazzano was killed by savages during another voyage to America. PORTER C. BLISS.

Verb [Lat. *verbum*, "word," "verb"], in grammar, a word or part of speech whose chief function is to assert or declare, and which in many languages, including those of the Aryan stock, such as Greek, Latin, Sanskrit, Russian, and English, presents many inflections which are classified under divisions named voices, moods, tenses, person, number, and others. In comparison with Latin, English has few inflections, and must therefore often employ circumlocutional phrases to indicate the meaning of single words in that language; and it is usual to assign to it divisions which do not belong to it, as in the following comparisons of Latin and English: Active voice, indicative mood, present tense, *amo*, "I love;" imperfect, *amabam*, "I did love;" perfect, *amavi*, "I have loved;" pluperfect, *amaveram*, "I had loved;" future, *amabo*, "I shall love." Subjunctive mood, pres. tense, *amem*, "I may love;" imperf., *amarem*, "I might love;" perf., *amaverim*, "I may have loved;" pluperf., *amavissem*, "I might have loved;" fut., *amavero*, "I shall have loved." In the passive voice, indicative mood, we have *amor*, "I am loved;" *amabar*, "I was loved," etc.; passive subjunctive present, *amer*, "I may be loved," etc. The root *am-* of these and the remaining forms means "love" in a general way, but it is neither a verb nor any other part of speech, because it is not used in this independent condition. Greek has a tense named *aorist* of several forms. That of the active voice indicative mood appears in ἔγραψα, "I wrote," which differs from the imperfect ἔγραφον, "I was writing," and from the perfect γέγραφα, "I have written," of which the two latter would be represented by the Latin active indic. perfect, *scripsi*.

An English subjunctive mood which was in use formerly is becoming obsolete, and mistakes are often made in attempting to retain it. Speaking of language, Max Müller says (*Sci. of Lan.*, lect. 1), "If it be a production of nature," etc., instead of the indicative form, "if it *is*," etc., because at the moment of speaking it is or it is not such a production. The subjunctive pertains to examples like —"If the tide *be* in when we arrive at Dover, we will go on board," but even in such cases the indicative is frequently used.

Some languages have a dual number, in which, besides the singular and plural forms, nouns, pronouns, adjectives, and verbs have inflections which may be used instead of the ordinary plural to indicate two objects and their action, including such as occur in pairs, as the hands or a pair of speakers, as *we* for "thou and I," excluding others who may be present. The dual of Sanskrit verbs is of the three persons; in Greek it is of the second and third; in Gothic of the first and second; and in Dakota of the first only, as in *mangka'*, "I am;" *ungyang'ka*, "we two (thou and I) are;" *ungyang'kapi*, "we are," where the plural is based on the dual. The Cri or Cree has forms like *ni miyosinâu*, "we (I and he) are handsome;" *ki miyosinânow*, "we (I and thou) are handsome."

The most obvious division of verbs is into transitive and intransitive, the former indicative of passing to an object, as in "I wash dishes;" the latter independent of an object, as in "I work," "I wash daily." Forms like "I wash myself" are transitive, but when they are represented by special inflections, they are reflexive, as in Russian *myt'*, "to wash;" *myt'sya*, "to wash one's self." The same suffix represents reciprocal action, as in *obnimát'*, to "embrace;" *obnimát'sya*, to "embrace mutually." The Russian verb has but three tenses, the preterit, the present, and the future, but these are varied by certain inflectional and prepositional "aspects," which extend their functions and recall the Greek aorist tenses. In the singular number the Russian preterit indicates gender, as in *otrók zherál*, "the boy chewed;" *otrokobítsa zherála*, "the maid chewed;" *dityá zherálo*, "the child chewed;" pl. *zherâli*, "they (m., f., n.) chewed." The suffixed fragments of pronouns of the two Hebrew genders (m., f., also common) give gender forms to verbs in this language, going so far as to distinguish whether the suffixes for "thee" and "you" are masculine or feminine.

Latin deponent verbs are such as have a passive form and an active meaning, as *venerar* (for *venero*), which means "I revere," and not "I am revered." Latin inceptives (or inchoatives) are forms which represent the beginning of an action, as *liqrēre*, to "be liquid;" *liqrescēre*, to "become liquid," to "deliquesce." Impersonal verbs are without a personal nominative, and are present in many languages, as in Gr. ὕει; Lat. *pluit*; Chippeway, *gimiwan*; Eng. "it rains;" Lat. *pluet*, "it will rain."

The Lĕnâpĕ or Delaware Indian is without the verbs to "be" and to "have," either separate or auxiliary, yet he is able to say *n'pawalessin*, "I am rich;" *nowikin*, "I have a house;" *wiku*, "he has a house;" *wikuwek*, "they have a house." He has but few adjectives, and supplies their place with verbs, as in English for "it is bright" we may say "it brightens." So in Lenâpe, *gunen*, "it is long;" *gunenp*, "it was long;" *gunenuchtschi*, "it will be long." (*Zeisberger*.) In fact, in languages of this Algonkin stock (Lenâpe, Chippeway, Cri or Cree, Potewâtomi, Otâwâ, etc., absurdly called "Algic" by Mr. Schoolcraft) almost any part of speech may be turned into a verb, so that the language mechanism depends to an unusual extent upon verbs, and these comprise a variety of minute details, including two genders, which are here independent of sex, being divided into animate and inanimate. (See INDIAN LANGUAGES, by J. HAMMOND TRUMBULL, LL.D.) Many of these languages are well adapted to the narrative style, there being none of that confusion present as in English in the use of "he" and "him" when an action between two persons or parties is described; but the persons of the narrative being indicated at the outset, the construction keeps them distinct to the end. (*Rev. Thomas Hurlburt*.)

The Basque, spoken in the vicinity of the Pyrenees, is in some features akin to the North American languages. It has four forms of the first person, as in *nuk*, "I am," used in addressing a male familiarly; *nun*, "I am," addressing a female familiarly; *nuzu*, "I am," speaking respectfully to either sex; *niz*, "I am," used without special regard to the person addressed; and similarly there are four forms for the 1st person plural, and for the 3d pers. sing. and pl. in most of the tenses. In Welsh the pronoun may precede or follow its verb, or be omitted unless required for emphasis. It has several forms, as *mi*, *fi*, "I, me;" *myfi*, "I or me myself," and others. Hence we may say "I love" in the various ways, *caraf*, *caraf fi*, *mi garaf*, *myfi garaf*, *mi garaf fi*. (*Paghe*.)

In the Chinese languages, words used as verbs (and other parts of speech) are without inflections: consequently, the function of a word depends on the syntax. (See CHINESE LANGUAGE, by ADDISON VAN NAME.) A few examples will exhibit its extreme simplicity: *twän*, "cease, discontinue;" *jin*, "man, men, people;" *twän jin*, "the population has ceased, dwindled away;" *ge*, "fish, fishes;" *up*, "swallow, swallows;" *suy*, "water;" *ge up suy*, "fishes swallow water;" *to ma yen nung chin lin* (word for word), "single tree how can make grove;" *neaou*, "bird;" *teang*, "swell, swollen, raise, stretch;" *ke*, "he, she, it, its, his, her, their;" *ek*, "wing;" *neaou teang ke ek*, "the bird stretches its wings;" *sip*, "ten;" *way*, "make;" *yit*, "one;" *pek*, "hundred;" *sip sip way yit pek*, "ten tens make one hundred;" *kuĕ*, "ancient, distant, of old;" *cheâ*, "that which, who, what, person;" *puĕ*, "take up in the hollow hand, as water;" *yim*, "drink;" *kuĕ cheâ puĕ yim*, "the ancients used to take up water in the hand and drink;" *kok*, "grain;" *che*, "of;" *se*, "begin-ing;" *seng*, "live, grow;" *wat*, "say, speak, assert;" *beaou* (a name); *kok che se seng, wat beaou*, "when grain is beginning; to grow, it is called beaou;" *be*, "not;"

leng, "be able, may, can;" *sao*, "affair, duty;" *jin*, "man, men;" *gïen*, "how;" *kwang*, "ghost, spirit;" *be leng sao jin gïen, leng sao kwang?* "(if) not able (if you) cannot (do your) duty (to) men, how (are you) able (to) serve spiritual beings?" The poverty of inflection in English gives its syntax some resemblance to that of Chinese, and in natural history English we sometimes find a very condensed style, as in a description of a fish (1870): "Length from muzzle to pectoral equalling length from pectoral to ventral fin; depth less than length head; last dorsal ray more than half first; muzzle narrow. Brown above with brown cross-bars." S. S. HALDEMAN.

Verbe'na [Lat. for Eng. *vervain*], a genus of herbs and shrubs of the order Verbenaceæ, found in various warm and temperate regions. The U. S. have numerous species, some of them European also. One of the most interesting is *V. hastata*, the "simpler's joy," once highly prized in medicine and believed to possess magical virtues. The garden verbenas are fine border-plants of many varieties, belonging to *V. chamædrifolia* of the Argentine Republic, to *V. sororia* of Asia, and to *V. aubletia* of the U. S.

Verboeck'hoven (EUGENE JOSEPH), b. at Warneton, West Flanders, Belgium, June 8, 1799; was educated at Brussels, and received his first instruction in art, drawing, and modelling from his father, who was a sculptor, but devoted himself afterward to painting; attracted much attention in 1821 by his *Cattle-Market at Geneva*, and still more in 1834 by his *Herd of Cattle in an Autumn Landscape*. The best among his later works are—*A Herd of Sheep overtaken by a Storm* (1835), *Horses attacked by Wolves* (1836), *Cattle in the Roman Campagna* (1845). He published several volumes of etchings. D. Jan. 22, 1881.

Vercel'li [Lat. *Vercellæ*], a thriving and important town on the river Sesia, in the Piedmontese province of Novara in Northern Italy, about 50 miles N. E. from Turin, at an elevation of 428 feet above the sea. Vercelli has a certain notoriety as the town nearest to the field of Hannibal's first battle with the Romans in Italy; of the decisive defeat of the Cimbri (101 B. C.) by the Roman consuls Marius and Catullus; and of the battle of Palestro on May 30–31, 1859, in which the Austrians were defeated by the Piedmontese. To the stranger the interest of Vercelli lies principally in its churches, and in the libraries and artistic treasures in which they are rich. The cathedral is large, but not of great antiquity, suffered greatly during the French occupation, and has been restored with doubtful taste and judgment. Some of the MSS. in its library are of great value. Among them ranks perhaps first a copy of the Gospels written by the hand of Eusebius, bishop of Vercelli in the fourth century, in the ancient Italic version, older than the Vulgate, and probably the oldest existing copy of the Gospels in any language. Another MS. of great interest to English scholars is the Anglo-Saxon *Codex Vercellensis*, conjectured to have been brought to Vercelli by Cardinal Guala, papal legate in England in the time of John and of Henry III. The library contains also the *Leges Longobardiæ* in a MS. as old as the eighth century; an early *Epitome of the Constitutions of Justinian*; a *Capitulary of Hlodwig and Hlothair*, and the important *De Imitatione Christi*, a MS. ascribed to the thirteenth century, and confidently believed to be the work of John Gersen, a monk of Vercelli who lived two centuries before the time of Thomas à Kempis, the reputed author of that most celebrated work. The church of Sant' Andrea, founded by Cardinal Guala, is of interest as showing reminiscences of English ecclesiastical architecture, and that of St. Christopher is very noticeable for its fine frescoes by Gaudenzio Ferrari, who, as well as the more famous Bazzi (or Sodoma), was a native of Vercelli, though the greatest works of the latter were executed after his removal to Siena. The charitable and educational institutions of Vercelli are well endowed and highly respectable. P. 27,349.

Verchères', county of Quebec, Canada, bounded N. W. by the St. Lawrence and E. by the river Richelieu. Cap. Verchères. P. 12,717.

Verchères, p.-v., cap. of Verchères co., Quebec, Canada, on the S. shore of the St. Lawrence, 24 miles below Montreal. It has a college and convent. P. about 900.

Verd, Cape. See CAPE VERD.

Verde Antique' [Fr., "antique green," properly the name of the *verde nobilis*, or rust of bronze statues and coins], a fine dark-green stone, with patches of red, white, and sometimes black, highly prized in ancient and modern Italy. The name is sometimes applied to a marble, sometimes to a breccia, and again to a handsome porphyry. A marble called *verde antique* has been quarried at Milford, Conn. A kind of serpentine called *verde antique* has been quarried at Roxbury, Vt. It is a very handsome but brittle stone.

Ver'den, town of Prussia, province of Hanover, on the Aller, near its influx in the Weser, has a fine cathedral, large breweries, tobacco manufactures, and valuable fisheries. P. 5779.

Ver'di (GIUSEPPE), b. Oct. 9, 1813, at Busseto, near Parma. His first operatic production was *Oberto di San Bonifazio*; this was followed by an unsuccessful opera-buffa, *Un Giorno di Regno*. In 1842 he brought out with great success, at the La Scala in Milan, his *Nabucco*; in 1843, *I Lombardi*; in 1844–45, *Ernani*, *I due Foscari*, and *Giovanna d' Arco*; in 1846, *Attila*; in 1847, *Macbeth* and *I Masnadieri*; in 1848, *Il Corsaro* and *La Battaglia di Legnago*; in 1849, *Luisa Miller*; in 1850, *Stiffelio*; in 1851, *Rigoletto*; in 1853, *Il Trovatore*; in 1854, *La Traviata*; in 1855, *I Vespri Siciliani*. These were followed by *Aroldo*, *Simone Boccanegra*, *Una Vendetta in Domino*, *Il Re Lear*, *Un Ballo in Maschera*, *La Forza del Destino*, *Don Carlos*, *Aida*, and finally a *Requiem*. Verdi is a senator of the kingdom.

Ver'dict [Lat. *verè dictum*, "something said truly"], the decision of a jury as to the matters in issue submitted to them, and in respect of which they have sworn to find and declare the *truth*. A "general" verdict is one in which the jury render a complete decision on the facts in connection with the law applicable to them as laid down by the court. In a criminal prosecution the general verdict would be "not guilty" or "guilty;" in civil actions it would be "for the defendant" or "for the plaintiff," with such amount of damages or debt as had been found due. A "special" verdict is one by which the jury find the facts in a detailed manner and form, but do not apply the law to them by rendering a final decision in favor of either party. Upon the facts thus determined the court adjudicate. A verdict must be unanimous, and as a general rule it must be orally announced by the jury in open court and recorded by the clerk. If the jury agree upon their verdict after the adjournment of the court for the day, they are permitted to reduce it to writing, sign, and seal it up, and then separate. In such case they must be present at the reassembling of the court, when their verdict sealed will be opened and announced. After a verdict of guilty in criminal prosecutions, the jury may be "polled" by the prisoner—that is, each juryman may be asked by name if the verdict thus announced is his verdict. JOHN NORTON POMEROY.

Verdiere, tp., Colleton co., S. C. P. 3176.

Ver'digris [Fr. *vert-de-gris*; Ger. *Grünspan*]. Commercial verdigris, used as a pigment, is sometimes made by exposing the "marc" or "pomace" of grapes, left after pressing out the juice, spread on plates of copper. The plates become encrusted with a green crystalline matter, which is a mixture of several basic acetates, with some carbonate, of copper. Solution in warm water and spontaneous evaporation furnish a blue crystalline acetate, having the composition, according to some, $(C_4H_6CuO_4)$, $(CuO.H_2O).5H_2O$. The insoluble residue left by the warm water, which has a green color, is considered to be $(C_4H_6(CuO_4).2(CuO.H_2O).H_2O$. *Distilled verdigris* is the name given commercially to a preparation obtained by the use of so-called distilled or wood vinegar, sometimes by soaking cloths therein and applying them to plates of copper. HENRY WURTZ.

Verdigris, tp., Montgomery co., Kan. P. 1052.

Verdigris, tp., Wilson co., Kan. P. 687.

Verdun'-sur-Meuse [anc. *Verodunum*], town of France, department of Meuse, one of the numerous minor fortresses of the old system, the see of a bishop, the seat of a court of first resort and of an ecclesiastical seminary. P. 12,391. During the Franco-German war Verdun resisted a *coup-de-main* (Aug. 24, 1870) and an investment and bombardment (see SIEGE), surrendering Nov. 8, 1870.

Vere (Sir FRANCIS), b. in England in 1554, grandson of John de Vere, fifteenth earl of Oxford; served in the army in the Netherlands under the earl of Leicester 1585, and subsequently under Lord Willoughby; was knighted for gallantry at the defence of Berg-op Zoom 1588; relieved the garrison at Berg on the Rhine 1589; contributed to the capture of Zutphen; was instrumental in the retaking of Deventer and in the defeat of the prince of Parma near Nymwegen 1591; was lord-marshal in the expedition against Cadiz 1596; distinguished himself at Turnhout, and became governor of the Brill 1597; was recalled to England during the threatened Spanish invasion 1599; was severely wounded at Nieuport, where he determined the victory for Prince Maurice, July 5, 1600, and successfully defended Ostend against great odds 1601–02. D. in England Aug. 28, 1608, and was buried in Westminster Abbey. His *Commentaries*, narrating his services in the Netherlands, were published in 1657.—His younger brother, HORATIO, b. at Kirby Hall, Essex, in 1565, distinguished himself

under his brother's command in the Netherlands, and commanded the English auxiliaries in Germany 1620–23; was created Baron Vere of Tilbury July 25, 1625, and became master of the ordnance 1619. D. in London May 2, 1635.

Vere, de (Sir Aubrey **Hunt**), Bart., b. at Curragh Chase, co. Limerick, Ireland, Aug. 20, 1788, son and heir of Sir Vere Hunt, first baronet, to whose title he succeeded 1818, and subsequently took the name De Vere, and was an enthusiastic disciple of Coleridge. D. July 5, 1846. Author of two dramatic poems, *Julian the Apostate* (1822) and *The Duke of Mercia* (1823), and of *A Song of Faith, Devout Exercises, and Sonnets* (1842). His works have frequently been ascribed to his son, Aubrey Thomas (which see), and *vice versâ*.

Vere, de (Aubrey Thomas), son of Sir Aubrey, b. at Curragh Chase, Ireland, Jan. 10, 1814; educated at Trinity College, Dublin; has published *The Waldenses, and other Poems* (1842), *The Search after Proserpine, etc.* (1843), *English Misrule and Irish Misdeeds* (1848), *Picturesque Sketches of Greece and Turkey* (2 vols., 1850), *Poems, Miscellaneous and Sacred* (1856), *May Carols* (1857), *The Sisters, etc.* (1861), *The Infant Bridal, etc.* (1864), *The Church Settlement of Ireland, or Hibernia Pacanda* (1866), *Irish Church Property, and the Right Use of it* (1867), *Pleas for Secularization* (1867), *Irish Odes, and other Poems* (1869), *The Legends of St. Patrick* (1872), *Alexander the Great, a Dramatic Poem* (1874), and a poem on the centenary of Daniel O'Connell (1875).

Vere, de (Edward), seventeenth earl of Oxford, b. in England about 1540; educated at St. John's College, Cambridge; was in high repute as a wit and a poet at the court of Queen Elizabeth, and was famous for the prodigality of his living; had a rencontre, not much to his credit, with Sir Philip Sidney; married Anne, the eldest daughter of William Cecil, Lord Burleigh; is alleged to have treated her inhumanly to revenge himself upon Burleigh for not interfering to save the life of his relative, Thomas Howard, duke of Norfolk (beheaded for treason 1572); was made lord high chamberlain, and in that capacity sat on the trials of Mary Queen of Scots (1586) and the earls of Arundel (1589), Essex and Southampton (1601), and held a command in the fleet sent against the Spanish Armada (1588). D. in London in July, 1604. He wrote a number of comedies, not extant, and contributed poems to Richard Edwards's *Paradise of Dainty Devises* (1576) and other collections of that period. His countess (d. June 6, 1588) also wrote verses, some of which are in John Southern's *Pandora* (1584).

Vere, de (John), thirteenth earl of Oxford, b. in England about 1450, son of John, the twelfth earl, who took part as a Lancastrian in the wars of the Roses, and was beheaded in London Feb. 26, 1462, and descended from a long series of nobles dating from the Conquest, who had held high positions in the state; became a prominent Lancastrian leader; fought at Barnet 1471; joined the earl of Pembroke in Wales; was captured, imprisoned, and attainted 1474; took part with the earl of Richmond (Henry VII.), and commanded the van of his army at Bosworth 1485; contributed to the defeat of the insurgents on Blackheath June 22, 1497; was made lord high steward, and in that capacity pronounced sentence upon Edward Plantagenet, earl of Warwick, accused of conspiring with Perkin Warbeck 1499. D. in 1513. The last titled member of this proud family, which had become a synonym for long descent, was Aubrey de Vere, twentieth earl, b. about 1620, styled by Macaulay "the noblest subject in England." He fought for Charles I. in the great rebellion, became lord lieutenant of Essex under Charles II., and was dismissed from that post by James II. 1687, because he refused to aid him in packing a Parliament.

Vere, de (Maximilian Schele). See De Vere.

Vere'ja, town of European Russia, government of Moscow, on the Protva, has manufactures of tallow. It carries on a lively trade with the Don Cossacks. P. 5121.

Vergennes', tp., Kent co., Mich. P. 1342.

Vergennes, city of Addison co., Vt., chartered in 1783, on Central Vermont R. R., 6 miles from Lake Champlain, at the head of navigation, contains 5 churches, a public library, a graded school, 1 newspaper, a fire organization, and excellent waterworks. The State reform school is located here. MacDonough's fleet, with which he captured the British squadron off Plattsburg Sept. 11, 1814, was built here. It has steamboat communication with the lake-ports during the summer. P. 1570.

H. C. Johnson, Ed. "Vermonter."

Vergennes, de (Charles Gravier), Count, b. at Dijon, department of Côte-d'Or, France, Dec. 28, 1717; entered very early on the diplomatic career; was minister at Treves 1750–55, at Constantinople 1768, at Stockholm 1771, and became minister of foreign affairs in 1774. He concluded the treaty of alliance with the Swiss cantons in 1777, and with the American colonies in 1778, and negotiated the Peace of Teschen (May 13, 1779), which ended the Bavarian succession war, and the Peace of Versailles (Sept. 3, 1783). He was an adroit negotiator, but a very mediocre statesman, and his meddling with the finances became fatal to France; he drove Necker out and brought Calonne in. D. at Versailles Feb. 13, 1787.

Vergier de Hauranne. See Duvergier de Hauranne.

Ver'gil (Polydore), b. at Urbino, Italy, about 1470; became a priest and acquired a considerable literary reputation by his *Proverbiorum Libellus* (1498), several times reprinted in the sixteenth century, and by a treatise on the discovery of arts and sciences, *De Rerum Inventoribus* (1499); was sent by Pope Alexander VI. to England to collect the papal tribute called "Peter's pence" 1501, being the last to hold that office; remained in England for the most of his life; was made rector of Church Langton, Leicestershire, archdeacon of Wells, prebendary of Hereford and of Lincoln, all in 1507; exchanged the latter prebend for one in St. Paul's, London, 1513; was an intimate friend of Erasmus and the great scholars of the time; wrote, besides many miscellaneous treatises, a voluminous Latin history of England, *Historiæ Anglicæ Libri XXXVI.* (Bâle, folio, 1533; best ed. Leyden, 1651), and edited Gildas's *De Calamitate, Excidio et Conquestu Britanniæ* (1525). He returned to Italy in 1550, and d. probably at Urbino about 1555. Two volumes of an old English translation of his *Historiæ* were edited by Sir Henry Ellis for the Camden Society (1844–46), and a translation by John Langley of his *De Rerum Inventoribus* was edited for the Agathynian Club by Dr. W. A. Hammond, who prefixed an *Account of the Author and his Works* (New York, 1868).

Vergil (Publius Vergilius Maro), b. at Andes near Mantua B. C. 70 in humble circumstances, but received a careful education. His paternal estate was assigned (B. C. 41 and 40) to the veterans of Octavianus, but his application to the emperor effected a restoration of his lands or an indemnification for them. From this time Vergil lived partly in Rome, partly at Naples, always suffering from delicate health, but in the possession of sufficient means. He was himself a gentle and amiable character, and as a poet most successful in subjects which admit of genial treatment, as inanimate nature, one's native country, family ties, and love, but he allowed himself to be led on to subjects too grand for him; for, though pleasing in his episodes, he was hardly equal to majestic occasions. He collected his materials with great diligence, and polished his verse with extreme care; and this faithful labor won for him that elegance in style and correctness in metre which made him the standard of classicality in Roman poetry for a long period. Before the lapse of a century Vergil was used, as he is to this day, as a textbook in schools for learning Latin, and in subsequent times his writings were drawn upon for *centos*, superstition consulted them as an oracle, and in popular belief he was himself turned into a magician, upon whose name the nations of the West accumulated their fictions and legends in the Middle Ages. During the Renaissance his works exercised a great influence on Italian literature, and partly through that literature, but more by direct study, also on French and on English poets. He d. at Brundisium B. C. 19, and was buried near Naples, where his tomb is still shown.

Vergil's extant poems are (1) *Eclogæ*, ten bucolics, written B. C. 41–39, imitations, and to some extent translations, of Theocritus, but with an admixture of persons and events of his own time and country. Though Vergil can hardly be said to have improved on his original, yet these have always been regarded as very graceful and pleasing compositions, and themselves inspired one of the most brilliant and charming works of Pope, his *Pastorals*. (2) *Georgica*, in four books, composed B. C. 37–30, the first on agriculture, the second on the culture of trees, the third on domestic animals, and the fourth on bees. The prostrate condition of husbandry at the end of the civil wars induced Mæcenas, the influential favorite of Augustus, to propose husbandry to Vergil as the subject of a didactic poem. The task suited the taste of the poet, and he devoted himself to it with earnestness and enthusiasm. So successful was this attempt that in the *Georgics* we have confessedly the most perfect production of Roman art in this kind. In handling this theme Vergil could avail himself of his own personal experience in youth, but his studious bent would incline him also to consult and appropriate the works of others on this subject, which abounded in Greek and Latin, as of Hesiod, Aratus, and Xenophon, of Cato, Mago, and Varro. (3) *Æneis*, in twelve books, begun about B. C. 29,

but not finished when the poet died (B. C. 19), yet made public by his executors, L. Varius and Tucca, contrary to the express desire of the author. The *Æneid* turns on the fate of Æneas, the founder of a second Ilium and indirectly of Rome, and the ancestor of the Julian family. In this work Vergil in part had recourse to Greek sources and models, and in part relied on his own extensive study of Italian legends, history, and localities, thus blending Hellenic and Latin elements. According to Donatus (*Vit.* 46), Vergil read to Augustus books ii., iv., and vi., which, in the judgment of posterity, are, the two former the most real, and the latter the most curious and interesting of all. The style of the *Æneid* in general is rather sombre and unnatural, but always dignified; and we cannot but feel the fascination of its graceful and sonorous lines. Indeed, whatever faults criticism may have pointed out in this work, it has secured to its author an undisputed place among the few great epic poets the world has yet seen. Vergil derived from the Homeric poems the plan and style of the *Æneid*, as well as numerous details. Book vi. is quite in the manner of *Odyssey* xi., and the first half of the *Æneid* may be said to be in imitation of the *Odyssey*, as the rest is of the *Iliad*; the subject of book ii. is drawn from the Cyclic poets, and book iv. is imitated from Apollonius Rhodius. Of the Roman poets, Vergil has chiefly imitated Ennius (see *e. g.* vi. 846), as Servius and Macrobius remark. Aulus Gellius (i. 21) says: Non verba sola, sed versus prope totos et locos quoque Lucreti plurimos sectatum esse Vergilium; and Vergil himself in turn has been copied more or less by all the Latin epic and didactic poets, as Persius, Silius Italicus, Valerius Flaccus, Statius, Ausonius, Prudentius, and Paulinus Solanus.

Besides these great and genuine works of Vergil, certain minor poems have come down to us under his name: (1) *Culex*, a description of Hades. It is certain that Vergil in his youth wrote a brief epic of this name, but the general character of the poem which we have, especially its frequent imitations of the writings of Vergil, chiefly of the vi. *Ecl.* and the vi. *Æn.*, renders it probable that a new work, composed, however, soon after Vergil's death, occupies the place of the original. The extant poem, though puerile in composition, is masterly in metrical treatment. (2) *Ciris*, an account of the treacherous conduct of the Megarian princess Scylla against her father Nisus, and her transformation into the bird Ciris. This poem seems to have arisen in the circles of Messala, being dedicated to his son, who was consul A. U. C. 751. The author draws largely on Vergil, but also imitates Catullus, and reminds us here and there of Lucretius, Tibullus, and some of the Augustan poets. Metrically, this piece is less correct than Vergil, but in style it is more lively. (3) *Moretum*, a pleasing idyl, believed by Lachmann to belong to the time of Vergil, and perhaps translated by him from a Greek poem of Parthenius. It is vivid in description, amiable in spirit, and elaborate in form. (4) *Copa*, a short elegy of the best period, Vergilian in style, but more sprightly in tone. (5) *Catalecta*, fourteen poems in elegiac and iambic metre on various subjects. Only two are well attested as coming from Vergil, but two alone can be proved not to have come from him, and they all certainly belong to his period.

Of Vergil's prose, we know only of his correspondence with Augustus, which was probably published by the emperor's order. Seneca the Elder (*Exc. Controv.*, iii. 8) says of it: Vergilium illa felicitas ingenii in oratione soluta reliquit. Specimens of it are given in Donati *Vita Vergiliana*, and in Macrobius, i. 24.

As to the form of his name, the inscriptions of the time of the Republic and of the first centuries after Christ are in favor of *Vergilius*, and so the older MSS., as the Mediceau. The Greeks also generally wrote Βεργίλιος or Οὐεργίλιος. The earliest dated instance of the form *Virgilius* is of the fifth century. In the Middle Ages, about the ninth century, this form began to be common, caused by fictitious derivations of the name (from *virgo* or *virga*), and in the fourteenth and fifteenth centuries it prevailed, though the Italian scholar Angelo Poliziano proved it to be wrong.

CHARLES SHORT.

Vergniaud' (PIERRE VICTURNIEN), b. at Limoges, department of Haute-Vienne, France, May 31, 1759; studied law in his native city and in Paris, and settled in 1781 as an advocate in Bordeaux. Elected a deputy to the Legislative Assembly of 1791 from the department of Gironde, he soon became the centre and leader of a great majority, the so-called Girondist party: Oct. 16 he was chosen vice-president, Oct. 31 president, of the Assembly. The decisive measures which the Girondists advocated in order to carry into effect the free constitution brought them into bitter conflicts with the royalists, and Mar. 24, 1792, the king dismissed the Girondist ministry. The negotiations which were carried on between the king and Vergniaud by Boze failed, and on Aug. 10 Vergniaud himself proposed the suspension of the royal power. But the approaching anarchy, whose first outbursts (Aug. 10 and Sept. 2, 3) the Girondists had connived at, soon completely outgrew them. In the National Convention, opened Sept. 21, the Girondists still had the majority, but not the real power. In the trial of the king, Vergniaud supported by a brilliant speech the proposition of an appeal to the people; but when the proposition fell, he voted for the execution without delay (Jan. 30, 1793). In the terrible contest which now took place between the Girondists and the Jacobins, Vergniaud time after time swayed the whole assembly by the tremendous force of his eloquence, but he finally broke down before the argument which Marat used—the introduction of a yelling, howling, maddened mob into the very hall of the Convention. By this means the Jacobins finally succeeded (June 1) in carrying a decree for the arrest and trial of the Girondists. Oct. 24 the trial commenced, and Vergniaud, who for some time had fallen into a kind of mental insensibility, now rose once more to the full height of his genius, and actually caused the Jacobins to tremble by his speeches of defence. The trial was stopped, the sentence pronounced without scrutiny, and Vergniaud was guillotined Oct. 31, 1793. Several of his speeches are found in Barthe, *Les Orateurs français* (4 vols., Paris, 1820), and in *Choix de Rapports, Opinions et Discours* (Paris, 1818–25). (See also Touchard-Lafosse, *Histoire parlementaire et Vie intime de Vergniaud* (Paris, 1848).)

Veri'a, Verria, or **Karaveria,** town of European Turkey, eyalet of Salonica, manufactures a peculiar kind of half-woollen, half-linen stuff much used for bathing-clothes. P. 10,000. It is the ancient town *Berœa* (*Βερόια*) alluded to in Acts xvii. 10. The principal occupation of the inhabitants is quarrying red marble from the neighboring mountain.

Verifica'tion (in law). (1) In the common-law system of pleading, whenever new matter is alleged by a party, he must conclude his averments by a statement that he is prepared to establish the truth of the facts thus set forth. This statement is called the "verification," and the following is its ordinary form: "And this he is ready to verify." A plea by way of traverse or mere denial does not require a verification. (2) The term also denotes the affidavit which, in equity pleading and in the reformed pleadings established by the American codes of procedure, a party may or must annex to his complaint or answer. The equity practice of swearing to the truth of the matters alleged in pleadings has been borrowed by the reformed procedure, and applied to legal actions. The pleading is then said to be "verified," and the affidavit wherein the party makes oath either on his own knowledge or upon his information and belief is called the "verification."

JOHN NORTON POMEROY.

Verification [Lat. *verus* and *facere*], the operation of testing. Thus, the verification of the roots of an equation is the operation of showing that these roots will satisfy the given equation.

Ver'juice [Fr. *verjus*], the juice of unripe grapes, an austere drink, much prized by the ancients and by peasants in parts of modern Europe. The vinegar of cider and the juice of sour crab-apples are sometimes called verjuice.

Vermes. See WORMS.

Vermicelli. See MACARONI.

Ver'mifuges [Lat. *vermis*, "worm," and *fugare*, to "cause to flee"], also termed **Anthelmintics** [Gr. ἀντί, "against," and ἕλμινς, "worm"], also **Helminthagogues** [Gr. ἕλμινς, "worm," and ἄγω, to "lead" or "expel"], remedies intended to remove worms from the stomach and intestines, and prevent their recurrence by the destruction of their germs. Properly, they are to be distinguished as *vermicides*, or those which kill the worms, and *vermifuges*, those remedies which by moving the bowels violently or by their rough or irritating qualities dislodge and bring away the entozoa alive. The remedy that is destructive to the worm must at the same time be innocuous as regards the patient, and not injurious to the alimentary tract. Remedies which simply stupefy or destroy the worm must be followed by the exhibition of an efficient purgative to remove the destroyed parasite, as well as to demonstrate the success of their action. Pink-root (*Spigelia marilandica*) is well known, and for children much used in the form of fluid extract of spigelia and senna. The oil of wormseed (*Chenopodium anthelminticum*) is employed, as is *Spigelia*, against round worms. For the same purpose, and preferable, is santonine, the acid extract of *Santonica* or Levant wormseed (*Artemisia contra*). It is pleasantly administered in flavored lozenges; may be given at night, followed by catharics in the morning. Cowhage (*Mucuna pruriens*) is less used than formerly. Thread-worms are usually in the lower bowel, and easily removed by enemata

of salt and water, aloes in milk, or any irritating or astringent material in solution. The removal of tapeworm is often difficult. Remedies should, as a rule, be preceded by free evacuation of the stomach and bowels by cathartics, and little food taken at the time. The best opportunity is thus given to dislodge the head, which adheres by tentacles or hooklets; for, though many yards of the worm be evacuated, except the head be obtained there is no cure. The chief remedies for tapeworm are pumpkin-seeds broken up and given in an electuary of sugar or emulsion of water or milk, followed by a purge; turpentine in emulsion of acacia mucilage and castor oil; decoction of pomegranate; the oil of male fern (*Filix mas*); and, preferably, kousso (the flowers and fruit of *Brayera anthelmintica*, a tree of Abyssinia). It is efficient, yet safe to the patient, and gives little inconvenience. Each morning half an ounce of the powdered flowers is taken in water, or 20 to 40 grains of the active extract, *kousine*, may be taken in a wafer. No purge is necessary; watery stools are produced, and the worm is discharged dead.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Vermi'gli (Pietro Martire), generally known under the name of **Peter Martyr**, b. at Florence Sept. 8, 1500, entered the order of St. Augustine in 1516, and made a comprehensive study of theology and philosophy. While prior of the monastery of St. Peter ad Aram, near Naples, he became acquainted with several converts to the Reformed Church and with the writings of Luther and Zwingli, and in 1541, when removed to the monastery of San Frediano, near Lucca, began to preach openly the doctrines of the Reformed creed. The Roman Inquisition soon became aware of the movement which took place at Lucca, but Vermigli succeeded in escaping: fled to Switzerland in 1542, and was made professor of theology soon after at the University of Strasbourg. In 1547 he went to England on the invitation of Cranmer, and lectured on theology at Oxford, but on the accession of Queen Mary returned to Strasbourg; in 1556 was made professor of theology at Zurich, where he d. Nov. 12, 1562. He was considered one of the most learned theologians of his age, and besides giving commentaries on various parts of the Bible, especially the Old Testament, he took part largely in the theological controversies of his time. A selection of his works was published in 1575 by Robert Masson, and forms one of the principal sources of information concerning the theology of the Reformed Church of the sixteenth century.

Vermilin'guia [from Lat. *vermis*, "worm," and *lingua*, "tongue"], a sub-order of placentiferous mammals under the order Bruta or Edentata, containing the ant-eaters. The most prominent superficial characters in which the group contrasts with the other sub-orders in whole or part are the following: (1) The integumentary appendages are all developed as simple hairs; (2) the facial portion of the skull and snout are more or less elongated; (3) teeth are entirely wanting in both jaws; (4) they are adapted for an insectivorous diet, and especially for obtaining ants, and to this end have a long protrusible vermiform tongue, secreting a glutinous exudation which secures the insects for ingestion; the placenta is unknown. The only known representatives are the true ant-eaters of South America, forming the family Myrmecophagidæ (which see).

Theodore Gill.

Vermil'ion [Fr. *vermeil*; It. *vermiglione*], a pigment composed of mercuric sulphide, prepared by grinding red *cinnabar*, either the native mineral or generally an artificial product formed by subliming together sulphur and mercury. A very fine vermilion, of a deep color approaching to what is known in commerce as *Chinese vermilion*, is obtainable by agitating mercury and sulphur together for some hours with a warm solution of an alkaline sulphide. The mass first becomes black, and gradually changes to the vermilion color. (See Cinnabar.) Henry Wurtz.

Vermilion, county of E. Illinois, bordering on Indiana, drained by Vermilion and Little Vermilion rivers, and traversed by several railroads; surface level, soil very fertile. Bituminous coal is found in portions. There are flour-mills, woollen mills, and manufactories of carriages, furniture, iron castings, and machinery. Cattle, sheep, swine, horses, mules, and asses are very numerous. Staples, Indian corn, oats, wheat, potatoes, hay, wool, and dairy products. Cap. Danville. Area, about 1200 sq. m. P. 30,388.

Vermilion, p.-v., cap. of Clay co., Dakota Ter., on Missouri River at the mouth of the Vermilion River, about 35 miles N. W. of Sioux City, Ia., and 30 miles S. E. of Yankton, the capital of Dakota Territory. The Dakota Southern R. R. passes through Vermilion, making the town a ready market for farm-produce. Large quantities of wheat are shipped annually from this town by rail and by water. The Vermilion Valley and Northern Pacific R. R., which bids fair to be built at an early day, has been projected to connect Vermilion with the Northern Pacific R. R. by way of the valley of Vermilion River. The business portion of the town is built on the bottom-lands bordering Missouri and Vermilion rivers, and a portion of the residences have been built on a beautiful plateau of table-land overlooking the Missouri valley for miles. Good water is plenty. The first business-house was opened here in 1860, and Vermilion now contains 3 general merchandise houses, 2 hardware and tin stores, 3 drug stores, 2 meat-markets, 4 hotels, 2 churches, and 5 church societies, 2 clothing-houses, 1 steam flouring-mill, 1 steam saw-mill, 1 jeweller, 1 harness-shop, 4 blacksmith-shops, 2 wagon and repair shops, 1 photograph-gallery, 1 bakery, restaurant, news dépôt and fruit-store, 2 billiard-halls, 4 saloons, 2 schools, and a proportionate number of physicians, lawyers, tax-paying and insurance agents, etc. P. about 700.

Wm. L. H. Owens, Ed. "Clay Co. Register."

Vermilion, p.-v., Edgar co., Ill.

Vermilion, tp., La Salle co., Ill. P. 671.

Vermilion, p.-v. and tp., Dakota co., Minn. P. 652.

Vermilion, tp., Ashland co., O. P. 2087.

Vermilion, p.-v. and tp., Erie co., O. P. of v. 721; of tp. 1833.

Vermilion River, in Illinois and Indiana, is formed by three forks, the N., Middle, and S., which unite in Vermilion co., Ill. The river flows S. E., and joins the Wabash in Eugene tp., Vermillion co., Ind. It is navigable to Danville, Ill., for 30 miles, or almost its entire course.

Vermilion River, in Louisiana, rises in the vicinity of Opelousas, and flows S. into Vermilion Bay. It is navigable for 80 miles for steamboats, and traverses a fertile region.

Vermil'ionville, p.-v., cap. of Lafayette parish, La., junction of New Orleans and Texas and New Orleans and Shreveport R. Rs., contains 3 churches, a Roman Catholic convent, 4 schools (1 colored), Masonic hall, 1 newspaper, 1 carriage manufactory, and 3 hotels. Principal business, farming. P. 777.

W. B. Bailey, Ed. "Lafayette Advertiser."

Vermillion, county of W. Indiana, bordering on Illinois, bounded E. by the Wabash, intersected by Vermilion River, and traversed by Evansville Terre Haute and Chicago R. R.; surface generally level, much of it consisting of prairies; soil extremely fertile. Iron ore and bituminous coal abound. There are flour-mills, saw-mills, and woollen-mills. Live-stock is numerous. Staples, Indian corn, oats, wheat, potatoes, wool, hay, and dairy products. Cap. Newport. Area, 290 sq. m. P. 10,840.

Vermillion, parish of S. W. Louisiana, bordering on the Gulf of Mexico and intersected by Vermilion River, which is navigable by steamboats; surface level and often marshy. There are manufactures of carriages and of sugar and molasses. Cattle and horses are numerous. Staples, sugar, Indian corn, and rice. Cap. Abbeville. Area, about 1400 sq. m. P. 4528.

Vermillion, tp., Vermillion co., Ind. P. 2133.

Vermilye (Robert George), D. D., b. in New York City Mar. 3, 1813, of Huguenot ancestry; graduated at Columbia College 1831; was for several years a classical teacher in the college grammar school; was appointed adjunct professor (with Dr. Charles Anthon) of the Greek and Latin languages in Columbia College Dec., 1837; pursued meanwhile the study of theology; was licensed by the presbytery of New York Apr. 19, 1838; preached in the Duane street church 1838–39; was pastor of a Presbyterian church at German Valley, N. J., 1843–46, and of the Congregational church at Clinton, N. Y., 1846–57, taking an active interest in Hamilton College, located in that village; was a member of its board of trustees 1850–57, and in the latter year succeeded Dr. Bennet Tyler as professor of theology in the East Windsor Theological Institute; afterward removed to Hartford, Conn., and retained that position through life, supplying the pulpit at Newington, Conn., for several years. D. at Lyme, Conn., July 5, 1875. He published several sermons and addresses, and left in MS. his courses of theological lectures, as yet unpublished.

Vermilye (Thomas Edward), D. D., LL.D., brother of Robert George, b. in New York City Feb. 28, 1803; educated at Yale College, and studied theology at Princeton Seminary under Drs. Miller and Alexander, but did not graduate at either institution; was licensed and ordained by the presbytery of New York City; was for some years pastor of the Presbyterian church in Vandewater street, New York City, of the Congregational church at West Springfield, Mass., 1829–31, of a Reformed Dutch church at Albany, N. Y., 1834–39, and has been since 1839 pastor of the Collegiate Reformed church, New York City, having for

some years had a junior colleague in that post. He received the degrees of A. M. from Yale and Union, of D. D. from Rutgers and Union, and of LL.D. from Lafayette and Columbia colleges, the latter being in 1875. Author of a number of published sermons and discourses, including addresses before the St. Nicholas Society of New York and at the opening of the Roosevelt Hospital, a memorial discourse upon the life and services of Rev. Dr. De Witt before the New York Historical Society, and a bi-centennial discourse in commemoration of the organization of the town of West Springfield, Mar. 25, 1874.

Vermont', one of the Eastern or New England States of the American Union, but not one of the original thirteen, is situated wholly inland, is of trapezoidal form, and is between the parallels of 42° 44′ and 45° N. lat., and the meridians of 71° 30′ and 73° 26′ W. lon. from Greenwich. It is bounded N. by the province of Quebec, Dominion of Canada; E. by New Hampshire, from which it is separated throughout its whole eastern line by the Connecticut River; S. by Massachusetts; and W. by New

The Seal of Vermont.

York, the line of division running through Lake Champlain, of which nearly two-thirds belong to Vermont, for about three-fifths of the distance. Its area, including the water-surface of Lake Champlain belonging to it, is 10,212 sq. m., or 6,535,680 acres. Its length from N. to S. is 157½ miles, its greatest breadth 85 miles, and its least 35 miles.

Face of the Country.—The Green Mountain range is continuous throughout the State, but above the 44th parallel it divides into two chains, one maintaining the same direction (N. by E.) with the lower portion, and extending into Canada; the other, turning N. E., extends to the New Hampshire line, and finally loses itself in the Canadian highlands on the western border of Maine. This last range, beginning at Killington Peak, forms the watershed between the affluents of the upper Connecticut and the streams flowing northward or westward into Lake Champlain, and the lower portion fulfils a similar office between the waters flowing into the Hudson and those tributary to the Connecticut. The Green Mountains are not granitic, at least in the surface-rocks, and their rounded, grassy summits afford a marked contrast to the sharp, cold, and bare summits of the White Mountains in the adjacent State. None of the summits attain the height of some of the White Mountains, and there is a considerable diversity of statement in regard to the actual height of the principal summits. Prof. Guyot gives the following figures in regard to the higher summits: Mount Mansfield, three summits, the "Chin" and "Nose," 4430 and 4094 feet; the "Forehead" or South Peak, 3934 feet; Killington Peak, 4221 feet; Killington Dome (Pico), 3954 feet; Camel's Hump, 4088 feet; Equinox Mountain, 3872 feet; Shrewsbury Peak, 3845 feet; Green Peak of Eolus Mountain, 3148 feet; Lincoln Mountain, 4078 feet; Mount Sterling, 3700 feet; Hogback Mountain, 3648 feet; Jay Peak, 4018 feet; Bald Mountain, 3124 feet. Mount Ascutney is a detached mountain 3320 feet high, and commands a noble landscape. The eastern part of the State is drained by the Connecticut River and its numerous affluents; the northern portion sends some small streams to Lake Memphremagog, but the principal rivers of the western part of the State, the Missisquoi, Lamoille, Winooski or Onion River, and Otter Creek, with their tributaries, are feeders of Lake Champlain, while Hubbardton Creek and Poultney River fall into the southern arm or extension of the lake. The Hoosac, Battenkill, and other small tributaries of the Hudson drain the S. W. corner of the State. There are numerous beautiful waterfalls in the Connecticut, Winooski, Lamoille, Clyde, Missisquoi, Passumpsic, and other rivers, and many interesting caves, natural bridges, etc.

Lakes.—Besides Lake Champlain, which forms so large a part of the western boundary of the State, and Lake Memphremagog, which is partly in Vermont and partly in Canada, there are nearly 100 smaller lakes or ponds, some of them of considerable size and great beauty, in the State. The principal are Willoughby, Seymour, Muldstone, Great Trout Pond, Dummore, Bombazine, and Austin.

Islands.—There are several large islands in Lake Champlain belonging to Vermont, and one county (Grand Isle) is composed wholly of these islands.

Geology and Mineralogy.—The Green Mountain range is usually considered as belonging to the Eozoic period, and its rocks are undoubtedly metamorphic, consisting largely of gneiss, but it is still a question whether they are Lower Silurian or Eozoic. On the E. side of the mountains the groups of the Silurian age are found, and, as the Connecticut River is approached, they give place to Devonian limestones, and these to strata of slate of excellent quality, which form a continuous bed along the river bank, except at Bellows Falls, where there is an outcrop of granite. On the W. side of the mountains the Silurian system prevails, the sandstones belonging to the old red sandstone formations, though there is a difference of opinion as to their precise age. There are also some beds of crystalline limestone, called Eolian limestone, overlying the sandstones. Slates are found along Lake Champlain, which are regarded as Silurian. The whole State is overspread by the Drift formation, and in the river-valleys there are occasionally alluvial deposits of no great extent. The State is rich in minerals. Gold has been found, but not in veins which would repay the working. There are pyritous copper ores of considerable value. Lead ores, more or less argentiferous, occur at several localities; iron, in the form of chromic ores, hæmatite, magnetite, and bog ores, is found in almost every part of the State. Granite suitable for building purposes, black, white, and variegated marbles of excellent quality and great beauty, abound. Slates, both writing and roofing, as well as those used for mantels, bathing-tubs, etc., are quarried in great abundance. Porcelain clay or kaolin, steatite, fire-clay, talc, manganese, and limestone for burning are also among the mineral products of the State.

Soil and Vegetation.—The meadow and arable lands of the State are generally fertile, and, being largely underlaid with a disintegrating limestone, yield good crops to the careful tiller; the mountain-slopes, where not covered with timber, furnish rich and nutritious pasturage to the horses, cattle, and sheep, which are kept in large numbers and furnish a considerable share of the wealth of the State. The forest trees are the evergreens—hemlock, fir, and spruce, and some pine on the mountains; oak, hickory, beech, birch, elm, sugar, rock, and red maple, butternut, basswood, tulip tree, etc., on the lower slopes of the hills; and cedar and juniper in the swamps. The sugar maple is the most abundant of the forest trees of the State, and from its sap a larger quantity of maple sugar and syrup is made than in any other State in the Union. Four-fifths of the land in the State are in farms, and nearly three-fourths of this are under cultivation.

Zoology.—Of the larger wild animals in the State the number is diminishing. The moose, once abundant here, is now only found rarely around Lake Memphremagog. The elk is also rare; the black bear, panther, wild-cat, lynx, wolf, fox, and raccoon are still seen in considerable numbers, and deer are moderately plentiful. The smaller game, rabbits, squirrels, etc., are abundant. In the vicinity of Lakes Champlain and Memphremagog great numbers of aquatic birds make their appearance early in the season. The birds of prey and song-birds are those common to New England. Lake Champlain is remarkable for its excellent varieties of fish. The muscalonge is the largest and most highly prized, but its lake-trout, lake whitefish, pickerel, roach, and perch are abundant and of excellent quality. Among its reptiles is the proteus, which is not known to exist in any other waters so far N. The serpent tribe has only the species, either venomous or harmless, common to New England.

Climate.—The climate of Vermont is, in general, marked by wide extremes; the winters are cold and long, the summers short and, for a few days at a time, hot; but there are few more healthful climates in the U. S. The isothermal of 44° annual mean temperature intersects the State almost diagonally, entering from the N. W. corner and dipping down to near the central portion of the State on the E. In the N. E. the mean annual temperature is 40°; in the S. W. and S. it is about 46°. The following table gives meteorological data at three points in the State, representing the variations of temperature and rainfall:

Places.	Mean annual temp.	Maximum temp.	Minimum temp.	Range.	Mean temp. of spring.	Max. temp. of spring.	Min. temp. of spring.	Range of spring temp.	Mean temp. of summer.	Max. temp. of summer.	Min. temp. of summer.	Range of summer temp.	Mean temp. of autumn.	Max. temp. of autumn.	Min. temp. of autumn.	Range of autumn temp.	Mean temp. of winter.	Max. temp. of winter.	Min. temp. of winter.	Range of winter temp.	Annual rainfall.	Rainfall of spring.	Rainfall of summer.	Rainfall of autumn.	Rainfall of winter.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	in.	in.	in.	in.	in.
Burlington, lat. 44° 29′, lon. 73° 15′; elevation, 223 feet.	43.6	89	−20.5	109.5	38.8	86	1	85	67.1	89	43	46	45.8	80	1	79	22.7	56	−20.5	76.5	37.75	8.71	12.07	11.67	5 27
Montpelier, lat. 44° 17′, lon. 72° 36′; elevation, 524 feet.	42.1	84	−8.5	92.5	41.6	85	2	83	60.6	84	41	43	45.2	74	3	71	23	54	−8.5	62.5	41.05	9.21	13.72	11.80	6.32
Woodstock, lat. 43° 38′, lon. 72° 30′; elevation, 400 feet.	40.7	85	−21	106	36 6	85	−27	112	62.2	85	40	45	43.7	80	7	73	20 3	44	−21	65	47.02	10 75	10.70	18.63	6.94

The average highest temperature of the State in 1869 was 91°, as the result of observations at eight stations; the average minimum, —29°; the average range, 120°; the average mean temperature, 42.9°; the average annual rainfall, 48.60 inches, the greatest amount falling in October.

Agricultural Productions.—In 1870, Vermont had 4,528,804 acres of land in farms, and of these 3,073,257 were under cultivation; the average size of the farms was 134 acres. The estimated value of the farms was $139,367,075; of farming implements and machinery, $5,250,279; the value of all farm products was $34,647,027; of animals slaughtered and sold for slaughter, $4,320,619; of home manufactures, $181,268; of forest products, $1,238,929; of market-garden products, $42,225; of orchard products, $682,241; of wages paid, $4,155,385. The number of bushels of wheat raised was 454,703; of rye, 73,346; of Indian corn, 1,699,882; of oats, 3,602,430; of barley, 117,333; of buckwheat, 415,096; of pounds of flax, 12,899; of pounds of wool, 3,102,137; of tons of hay, 1,020,669; of pounds of hops, 527,927; of pounds of tobacco, 72,671; of pounds of maple-sugar, 8,894,302; of gallons of maple-syrup, 12,023; of bushels of Irish potatoes, 5,157,428; of bushels of peas and beans, 95,242; of pounds of honey, 142,932, and 5235 pounds of wax; of domestic wine, 1038 gallons. The value of all live-stock in the State in 1870 was $23,888,835; it consisted of 69,015 horses, 252 mules and asses, 190,285 milch cows, 38,475 working oxen, and 117,741 other cattle, 580,347 sheep, and 46,345 swine. We have the later statistics of some of these items. The agricultural department in its report for the year 1874 estimates the crops of that year as follows: Indian corn, 1,660,000 bushels; wheat, 418,000; rye, 61,000; oats, 4,151,000; barley, 112,000; buckwheat, 372,000; potatoes, 4,782,000; tobacco, 105,000 pounds; hay, 973,500 tons. The value of these crops was estimated at $18,803,710. The estimate of the number and value of live-stock in Jan., 1875, was as follows: horses, 72,400; milch cows, 201,500; oxen and other cattle, 130,500; sheep, 516,400; swine, 52,400. The value of live-stock was estimated at $20,660,594. It is hardly necessary to say that the agricultural department almost invariably under-estimates both the crops and live-stock of the States.

Manufactures.—Vermont is essentially an agricultural State, and is far behind the other New England States in the amount of her manufactures, ranking in the census of 1870 as the twenty-first State in the Union in this respect. In 1870 there were reported 3270 manufacturing establishments, driven by engines or water-wheels of 51,322 horse-power, employing 18,686 hands (16,301 men, 1872 women, and 513 children), having a capital of $20,329,637, paying $6,264,581 wages, using $17,007,769 of raw material, and producing in 1869–70 goods and wares valued at $32,184,606. The largest manufacturing interest was lumber, of which, planed and sawed and manufactured as sash, doors, and blinds, the annual product in 403 mills was $6,186,660; of woollen goods, in 43 establishments, the value was $3,550,962; of flouring-mill products, in 81 mills, $2,571,594; of leather, tanned and curried, in 150 tanneries, $2,012,513; of scales and balances, in 2 factories, $1,629,000; of marble and stonework, in 29 establishments, $960,984; of machinery, in 37 shops, $756,080; of furniture, including chairs, in 80 factories, $895,606; of carriages and sleds, in 169 factories, $839,029; of hosiery, in 7 establishments, $551,129; of boots and shoes, in 20 shops, $547,789; of cotton goods, in 8 mills, $546,510; of agricultural implements, in 15 factories, $523,669; of tin, copper, and sheet iron ware, in 97 shops, $505,005; 2 car-shops turn out $452,470 of cars; 28 cheese-factories make cheese to the value of $445,323; 26 iron-foundries make iron castings worth $191,520; 63 clothing-factories, $110,812 of clothing; 2 organ-factories make $348,999 of musical instruments and materials; and 123 saddlery and harness shops turn out $286,071 of goods.

Railroads.—In 1875, Vermont had 939.7 miles of railroad, costing for road equipment, etc., $45,108,722. Most of these roads are trunk roads, forming parts of the route between Quebec, Montreal, and New York, or connecting with the Grand Trunk, the Boston, Portland, or White Mountain routes. The principal are the Connecticut and Passumpsic Rivers, 123.5 miles in the State; the Rutland R. R., 120 miles; the Vermont Central Railway, 193 miles, and its Rutland and western divisions, which together have about 263 miles more; the Rensselaer and Saratoga, 33 miles, and a portion of the Troy and Boston; the Harlem Extension, having about 61 miles in the State; the Montpelier and Wells River R. R., 38 miles; portions of the New London Northern, of which 21 miles are in the State, and of the South-eastern, which has 31 miles of its route in Vermont, and a number of short connecting routes.

Finances.—The sessions of the legislature being biennial, our latest financial statement is that presented to the legislature in Oct., 1876, for the year ending Aug. 1, 1875. The receipts of that year, including balance, were $830,606.93, and the payments, including instalments on the funded debt, $510,230.09, leaving a balance of $320,376.84 to be divided between the sinking fund and the general treasury surplus. The entire debt of the State at that date was $328,584.26, including the agricultural college fund, $135,500, not due till 1890, so that the surplus was very nearly sufficient to pay off the whole indebtedness of the State.

Commerce.—Vermont has but one customs district, known as Vermont. The foreign commerce of the State is mostly conducted through Lake Champlain and Richelieu and St. John's rivers, and Burlington is her principal port of entry, though officers of customs are stationed at Alburgh and other points along the northern border, and there is a considerable amount of smuggling. In the year ending June 30, 1875, the amount of imports in the Vermont district was $6,911,691, and of domestic exports $2,496,830; there were no foreign exports. The same year there were 89 American and 639 foreign vessels which entered the district: their aggregate tonnage was 97,798 tons, and the aggregate number of the crews, 3156; 59 American and 631 foreign vessels cleared the same year, having an aggregate tonnage of 95,120 tons, and crews numbering 3062 men. The number of registered, enrolled, and licensed vessels in the district was 23, and their tonnage 4630.71 tons.

Banks and Savings Banks.—There were in Nov., 1875, 46 national banks in operation in Vermont, having a capital of $8,618,700, with $7,755,000 bonds on deposit, and an outstanding circulation of $6,898,440. There were 4 or 5 private banking-houses. There were June 30, 1875, 20 savings banks in the State, with 27,677 depositors and aggregate deposits amounting to $7,590,599.

Insurance.—There were in Nov., 1875, 7 fire insurance companies, all mutual, 3 of which had aggregate assets of $5,881,170.20, and 3 life insurance companies (1 joint-stock and 2 mutual), 1 of which had assets to the amount of $1,732,769.

Education.—Public school education has received much attention in Vermont, and the condition of the schools, though not all that could be desired, is yet in advance of that in many of the States. In 1874 the legislature abolished its board of education, the secretary of which had been the executive school-officer, and established the office of superintendent of instruction, which it filled by the appointment of the principal of one of its normal schools. The following statistics show the condition of its public schools in 1876: Number of organized school districts, 2371, of fractional districts, 206; of common schools, 2519; average number of weeks of school in the year, 24.18; number of school population (5 to 20 years), 92,577; number enrolled, 72,093; number attending other schools, 6175; total average daily attendance, 39,474; average monthly salary of male teachers, $40.34, of female teachers, $24.35. *Receipts.*—From public money divided to schools, $107,031.95; tax on grand list of districts, $373,126.12; from other sources, $84,886.50; total, $565,044.57. *Expenditures.*—For sites of buildings and furniture, $89,788.55; for salaries of superintendents and teachers, $437,471.27; for miscellaneous or contingent expenses, $127,573.30; total, $565,044.57. Amount of school fund, $669,086.79.

There are 3 normal schools—at Randolph, Johnson, and Castleton. The total number of students who had graduated from these schools to 1876 was 683, of whom 610 were in the first course and 73 in the second. The whole number who had been connected with these schools was over 2000. The effort has recently been made to consolidate the three normal schools into one, and to use the very meagre appropriation of the State in supporting more generously the single school. Teachers' institutes are held twice a year in each county; about 1000 teachers attend them. There are 26 incorporated academies and seminaries, and 61 other schools of high grade, not connected with the public-school system. Between 7000 and 8000 pupils attend these schools, and nearly 300 teachers are employed in them. The following are the statistics of the institutions for higher instruction in 1874-75:

Universities, Colleges, and Professional Schools.

Universities, Colleges, and Professional Schools.	Location.	When organized.	Under what control.	Professors and instructors.	Students. Preparatory.	Students. Collegiate.	Students. Male.	Students. Female.	Value of buildings, grounds, and apparatus.	Amount of productive endowment.	Income from productive endowment.	Income from all sources.	Number of scholarship funds.	No. of volumes in library.
Colleges, etc.									$	$	$	$	$	
Middlebury College	Middlebury	1795	Congregational	11	..	52	52	...	100,000	180,000	12,000	13,000	4,000	12,000
Norwich University	Northfield	1834	Prot. Episcopal	8	12	22	64	...	20,000	.....	.....	.....	.....	4,500
University of Vermont	Burlington	1791	State and Trustees	9	..	91	78	13	242,300	172,672	15,000	19,316	10,472	16,174
Vermont Female College	Montpelier	1869	Methodist Episcopal	14	52	200	..	252	100,000	.....	.....	4,000	.....	500
School of Science.														
State Agricultural College and State Univ.	Burlington	1865	State	7	..	37	32	5						
School of Theology.														
Vermont Episcopal Institute	Burlington	1860	Prot. Episcopal	7	38	12	50	...	35,000	.....	.....	12,000	.....	3,649
School of Medicine.														
Medical College of University of Vermont	Burlington	1809	Trustees	14	..	51	51	...	12,000	.....	.....	3,500		

Special Education.—Vermont provides for her indigent deaf mutes at the American Asylum at Hartford, Conn., and at the Clarke Institution at Northampton, Mass.; for the blind, at the Perkins Institution and Massachusetts Asylum for the Blind in South Boston, and for the feeble-minded and idiotic, to a limited extent at South Boston, Mass., and Lakeville, Conn.

Population.—The statistics are as follows:

Population.

Year of census.	Total population.	Males.	Females.	White.	Colored.	Natives.	Foreigners.	Density.	Ratio of increase	No. of families.	No. to a family.	No. of dwellings.	Persons to a dwelling.	Illiterate.	Of school age, 5 to 20 years.	Of military age, 18 to 45, males.	Of voting age, 21 years and upward, males.	Citizens, males.
1790	85,425	44,896	40,529	85,151	274	.....	.....	8.36										
1800	154,465	74,628	74,837	153,908	557	.....	.....	15.12	80.84									
1810	217,895	109,981	107,732	217,145	750	.....	.....	21.33	40.95									
1820	235,981	117,755	118,094	235,063	918	.....	.....	23.10	8.29									
1830	280,652	140,122	140,230	279,771	881	.....	.....	27.18	19.04									
1840	291,948	145,742	145,206	291,218	730	.....	.....	28.30	4.02									
1850	314,120	156,033	158,087	313,402	718	280,055	33,715	30.76	7.59	58,573	5.36	56,421	5.57	36,240	108,647	62,735	83,290	68,104
1860	315,098	158,786	156,312	314,369	*709	282,355	32,743	30.86	0.32	63,784	4.94	62,977	5.00	28,216	102,881	60,002	75,075	63,801
1870	330,551	165,721	164,830	329,613	†924	283,396	47,155	32.37	4.90	70,462	4.69	66,145	5.00	17,706	103,107	62,459	90,806	74,857

Charitable and Corrective Institutions.—The Vermont asylum for the insane is at Brattleboro'. It was founded in 1834, and has an average of 173 patients; in 1874, 19 were discharged restored, 37 improved, 18 not improved; 26 died. The Providence orphan asylum and hospital at Burlington is a well-endowed institution, under the care of the Roman Catholic Sisters of Providence: it has 75 orphans. The Vermont reform school at Waterbury, founded in 1865, is a State institution. It had in 1871, 145 boys; 427 had been committed since its organization. It had a library of 300 vols. Its annual expenses were $21,813, of which the boys earned $9414. In Dec., 1871, its buildings were totally destroyed by fire. The legislature in Jan., 1875, appropriated money for its rebuilding, but removed the school to Vergennes. Girls are also to be committed hereafter to the school. The State prison is at Windsor. It was established in 1807. In July, 1874, it had 85 prisoners. Receipts from convict labor, $28,331; expenses, $25,080.90.

Newspapers.—Vermont had in 1870, 47 newspapers, having an aggregate circulation of 71,390 and an annual issue of 4,055,300 copies. Of these, 3 were dailies, with 3190 circulation; 43 weeklies, with 56,200 circulation; and 1 monthly, with 250 circulation. In 1876 the whole number had increased to 55, of which 7 were dailies, 1 semi-weekly, 42 weeklies, 1 semi-monthly, and 4 monthlies.

Churches.

Denominations.	Church organizations, 1870.	Church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Church organizations, 1875.	Church edifices, 1875.	Clergymen or ministers, 1875.	Communicants, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations	699	744	270,614	$3,713,530	746	825	644	54,289	303,250	$4,162,400
Baptists (regular)	115	114	37,935	462,200	112	114	87	8,250	41,000	490,000
Free-Will Baptists, etc.	16	16	5,310	44,500	18	18	14	1,200	6,000	50,000
Christian Connection	14	14	4,350	31,200	14	14	12	840	4,100	33,000
Congregationalists	183	183	75,925	1,054,400	201	203	98	18,347	92,500	1,118,500
Protestant Episcopalians	33	34	11,223	348,100	40	36	31	2,846	15,400	390,000
Friends	5	5	1,280	6,100	5	5	.....	410	2,000	7,500
Methodists	180	184	60,325	884,530	216	221	198	18,096	89,000	1,073,000
Presbyterians (regular)	7	7	2,706	20,200	7	7	7	350	1,750	21,500
Presbyterians (other)	2	2	650	5,000	2	2	2	100	500	6,400
Roman Catholics	40	40	25,000	401,500	61	57	29	.....	34,000	503,500
Second Adventists	15	15	4,450	39,000	17	18	12	850	4,000	42,000
Spiritualists	1	1	300	2,500	1	1	.....	.....	300	2,800
Unitarians	4	4	1,900	53,000	4	4	4	360	1,500	55,000
Universalists	60	60	19,710	220,000	28	60	32	1,410	7,200	225,000
Union	24	65	19,550	111,300	20	65	18	1,000	4,000	115,000

Constitution, Courts, Representatives in Congress.—The constitution of the State provides for the meeting once in seven years of a council of censors, who propose, if they see fit, changes to the constitution, which are acted upon subsequently by a convention called by them. The first of these councils met in 1785, the thirteenth in 1869, and the fourteenth was to meet the present year (1876). By the last revision of the constitution it was prescribed that every man of twenty-one years of age, a native of any of the States of the Union or naturalized, who has resided in the State for one year next before an election, and who will take the prescribed freeman's oath, is entitled to the privileges of a freeman. The supreme executive of the State is the governor, or in his absence the lieutenant-governor. Both are chosen by ballot for two years, and must have resided in the State for four years next previous to their election. The treasurer is elected in the same way and for the same time. The secretary of state, auditor, superintendent of public instruction, and other State officers are elected by the legislature in joint ballot. The legislature consists of a senate of 30 members and a house of representatives

* Also 20 Indians. † Also 14 Indians.

‡ The illiterate of 1850 and 1860 were persons 20 years old and over; of 1870, persons of 10 years and over.

of 241 members, both elected for two years. The legislature is styled "The General Assembly of the State of Vermont." The legislature holds biennial sessions. The judiciary of the State consists of a supreme court of 7 judges, having original jurisdiction, but being also a court of errors; of a chancery court, which the supreme court judges also hold; of a county court in each county, presided over by one of the supreme court judges and the two county judges, having original jurisdiction in divorce cases, in all civil actions for over $200, and in relation to real estate; of justices' courts in the several towns, and of probate courts in each probate district. The State under the apportionment of 1872 is entitled to 3 Representatives in Congress.

Counties (14).

Counties.	Total pop., 1870.	Males, 1870.	Females, 1870.	Total pop., 1860.	True valuation, 1870.	Assessed valuation, 1870.*
Addison.....	23,484	11,668	11,616	24,010	$18,649,575	$8,133,537
Bennington..	21,325	10,678	10,647	19,436	13,927,385	5,732,586
Caledonia....	22,235	11,283	10,952	21,698	18,092,569	7,397,995
Chittenden...	36,480	18,292	18,188	28,171	18,317,263	11,766,766
Essex.....	6,811	3,605	3,206	5,786	4,537,927	1,744,049
Franklin.....	30,291	15,160	15,131	27,231	14,913,887	8,680,912
Grand Isle....	4,082	2,088	1,994	4,276	2,408,000	1,082,389
Lamoille.....	12,448	6,187	6,261	12,311	6,015,609	3,104,872
Orange.....	23,090	11,538	11,552	25,455	16,863,356	6,621,463
Orleans.....	21,035	10,724	10,311	18,981	12,570,640	5,421,080
Rutland.....	40,651	20,453	20,198	35,946	35,349,109	13,853,456
Washington..	26,520	13,197	13,323	27,622	18,614,189	7,941,202
Windham....	26,036	13,027	13,009	26,982	22,016,328	8,625,683
Windsor.....	36,063	17,821	18,242	37,193	33,073,716	12,412,518
Total.....	330,551	165,721	164,830	315,098	$235,349,553	$102,548,528

Principal Towns.—Montpelier, the capital, had 3023 inhabitants in 1870; Burlington, the largest town and only city, had 14,387 inhabitants; Rutland, the next largest town, 9834; St. Alban's, St. Johnsbury, and Brattleboro', between 4000 and 7500 each; Brandon, Colchester, Northfield, Middlebury, Woodstock, Poultney, Randolph, Swanton, Springfield, and Waterbury had between 2500 and 4000 each.

History.—Vermont was during the seventeenth century the battle-ground between the Algonkin tribes, and the New England tribes allied to them, and the Iroquois or Six Nations of New York. Champlain and his companions discovered it, and passed over the northern portion in 1609, but no attempt was made to effect a settlement within its present bounds till 1724, when Fort Dummer in the present town of Brattleboro' was erected by a party of settlers from Massachusetts, who supposed it to be within the bounds of that colony. In the French war of 1745 soldiers marched from this fort, and also from New Hampshire colony, against the French, who occupied points along Lake Champlain. The rich and fertile lands along Otter Creek, the Winooski and Lamoille rivers attracted the attention of these soldiers, who were farmers as well as soldiers, and after the French war of 1755–58 the emigrants began to come W. of the Connecticut River in large numbers. Gov. Wentworth of New Hampshire claimed that all this territory belonged to that colony, and between 1760 and 1768 granted 138 townships, reserving to himself, besides his fees, 500 acres of land in each township. It was only known at that time as the "New Hampshire grants." But about this time another claimant appeared, who was disposed to appropriate the title to the fee simple of these lands to his own benefit. This was the governor of the colony of New York, who made proclamation in Dec., 1763, that these lands belonged to New York under grants from Charles II. to the duke of York, and proceeded to order the sheriff to make returns of the names of all the settlers who had taken up lands W. of Connecticut River under titles from Gov. Wentworth. That magnate issued a counter-proclamation in Mar., 1764, maintaining his own jurisdiction. The matter went to England on an appeal to the king, and, Wentworth failing to put in an appearance, it was adjudged in favor of New York by default. But there was another party to the controversy. The settlers, under the leadership of Ethan Allen, were largely from Connecticut, and though they cared little personally for either claimant, they had paid Gov. Wentworth for the titles to their lands, and they had no intention of paying the New York governor for them a second time. They therefore resisted all attempts at ejection and dispossession, and flogged the New York officers with beechen rods without mercy. The controversy continued for ten years, and meantime the Revolutionary war came on, and the settlers in the "New Hampshire grants" took an active part in that struggle for liberty. In 1776 these settlers applied to the Continental Congress for admission into the Confederacy, but New York opposed, and they withdrew. In 1777 they formed a constitution and proclaimed themselves independent under the name of "New Connecticut," *alias* "Vermont." The British officers tried to intrigue with them, but they were true as steel to the cause of liberty. In 1781, Congress offered to admit them with smaller boundaries, giving a considerable tract to New York, but they refused and remained independent. In 1790, New York made new overtures for a settlement, and Vermont finally accepted them, paying New York $30,000 in satisfaction of all demands, and the State of Vermont was admitted into the Union in Mar., 1791. Vermont took an active part both in the Revolutionary war and the war of 1812; the capture of Ticonderoga, the battles near Bennington, and the actions on Lake Champlain in the former were all led by her sons; and in the latter they took an active part in the battle of Plattsburg and the naval action on Lake Champlain. In the Canadian troubles in 1837 and the Fenian raids since, the expeditions, though not of Vermont, started from her soil, and more than once during the late war rebel bands made a descent upon her northern towns from Canada. From 1790 to 1840 her growth was rapid, but for the last thirty years her population has been almost stationary. During the late war her quota was always promptly filled, and her sons distinguished themselves in the field as well as in the national councils.

Governors of Vermont.

Moses Robinson	1789–90	Charles K. Williams	1850–52
Thomas Chittenden	1790–97	Erastus Fairbanks	1852–53
Isaac Tichenor	1797–1807	John S. Robinson	1853–54
Israel Smith	1807–08	Stephen Royce	1854–56
Isaac Tichenor	1808–09	Ryland Fletcher	1856–58
Jonas Galusha	1809–13	Hiland Hall	1858–60
Martin Chittenden	1813–15	Erastus Fairbanks	1860–61
Jonas Galusha	1815–20	Frederick Holbrook	1861–63
Richard Skinner	1820–23	John G. Smith	1863–65
Cornelius P. Van Ness	1823–26	Paul Dillingham	1865–67
Ezra Butler	1826–28	John B. Page	1867–69
Samuel C. Crafts	1828–31	Peter T. Washburn	1869–70
William A. Palmer	1831–35	John W. Stewart	1870–72
Silas A. Jenison	1835–41	Julius Converse	1872–74
Charles Paine	1841–43	Asahel Peck	1874–76
John Mattocks	1843–44	Horace Fairbanks	1876–78
William Slade	1844–46	Redfield Proctor	1878–80
Horace Eaton	1846–49	Roswell Farnham	1880–
Carlos Coolidge	1849–50		

Electoral and Popular Votes for President and Vice-President.

Elect. year.	Candidates who received the electoral vote.	E. vote.	Elect. year.	Candidates who received the electoral vote.	E. vote.	Pop. vote.	Candidates of the opposition.	Pop. vote.	Third and fourth-party candidates.	Pop. vote.
1792	George Washington P....	3	1824	John Quincy Adams P....	7	By legis.	Andrew Jackson P.		Henry Clay P.	
	John Adams V.-P.....			John C. Calhoun V.-P....						
1796	John Adams P.....	4	1828	John Quincy Adams P....	7	By legis.	Andrew Jackson P.....			
	Thomas Pinckney V.-P...			Richard Rush V.-P.....			John C. Calhoun V.-P...			
1800	John Adams P.....	4	1832	William Wirt P.....	7	By legis.	Andrew Jackson P.....		Henry Clay P.....	
	C. C. Pinckney V.-P.....			Amos Ellmaker V.-P.....			Martin Van Buren V.-P..		John Sergeant V.-P.....	
1801	Thomas Jefferson P.....	6	1836	William H. Harrison P...	7	By legis.	Martin Van Buren P.....		Daniel Webster P.....	
	George Clinton V.-P.....			Francis Granger V.-P....			Richard M. Johnson V.-P.		William Smith V.-P.....	
1808	James Madison P.....	6	1840	William H. Harrison P...	7	32,140	Martin Van Buren P.....	18,009	James G. Birney P.....	319
	John Langdon V.-P.....			John Tyler V.-P.....			Richard M. Johnson V.-P.		Thomas Earle V.-P.....	
1812	James Madison P.....	8	1844	Henry Clay P.....	6	26,770	James K. Polk P.....	18,041	James G. Birney P.....	3,954
	Elbridge Gerry V.-P.....			T. Frelinghuysen V.-P....			George M. Dallas V.-P...		Thomas Morris V.-P.....	
1816	James Monroe P.....	8	1848	Zachary Taylor P.....	6	23,122	Lewis Cass P.....	10,918	Martin Van Buren P.....	13,837
	D. D. Tompkins V.-P.....			Millard Fillmore V.-P....			William O. Butler V.-P...		C. Francis Adams V.-P...	
1820	James Monroe P.....	8	1852	Winfield Scott P.....	5	22,173	Franklin Pierce P.....	13,044	John P. Hale P.....	8,621
	D. D. Tompkins V.-P.....			William A. Graham V.-P...			William R. King V.-P....		George W. Julian V.-P...	
			1856	John C. Fremont P.....	5	39,561	James Buchanan P.....	10,569	Millard Fillmore P.....	545
				William L. Dayton V.-P...			J. C. Breckenridge V.-P..		A. J. Donelson V.-P.....	
			1860	Abraham Lincoln P.....	5	33,808	Stephen A. Douglas P...	6,849	John Bell P.....	1,969
				Hannibal Hamlin V.-P...			H. V. Johnson V.-P.....		Edward Everett V.-P...	
			1864	Abraham Lincoln P.....	5	42,419	George B. McClellan P...	13,321	John C. Breckenridge P.	218
				Andrew Johnson V.-P			George H. Pendleton V.-P.		Joseph Lane V.-P.....	
			1868	Ulysses S. Grant P.....	5	44,167	Horatio Seymour P.....	12,015		
				Schuyler Colfax V.-P.....			Francis P. Blair, Jr., V.-P.			
			1872	Ulysses S. Grant P.....	5	41,481	Horace Greeley P.....	10,927	Charles O'Conor P.....	593
				Henry Wilson V.-P.....			B. Gratz Brown V.-P.....			
			1876	Rutherford B. Hayes P...	5	44,092	Samuel J. Tilden P.....	20,254		
				William A. Wheeler V.-P..			Thos. A. Hendricks V.-P.			
			1880	James A. Garfield P.....	5	45,567	Winfield S. Hancock P...	18,316	Weaver (Gbk.).....	1,215
				Chester A. Arthur V.-P...			William H. English V.-P.			

* In 1875 the assessed valuation was $99,493,526.

(The writer acknowledges his obligations to H. A. Huse, State librarian of Vermont, at Montpelier, for valuable documents.) L. P. BROCKETT.

Vermont, p.-v. and tp., Fulton co., Ill., has a private bank. P. 2289.

Vermont, tp., Dane co., Wis. P. 1244.

Vermont, University of. See BURLINGTON, Vt.

Vermont'ville, p. v. and tp., Eaton co., Mich., has a private bank. P. of v. 544; of tp. 1801.

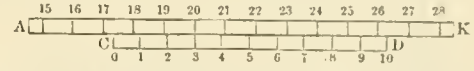
Vermuy'den (Sir CORNELIUS), b. in Zeeland, Holland, about 1590; was employed as an engineer in his native country in raising embankments against the sea; was invited to England 1621 to repair a breach in the embankment of the Thames at Dagenham; was engaged by James I. to drain Windsor Park; contracted with Charles I. to reclaim Hatfield Chase, an arduous task, which he successfully executed within three years, notwithstanding great opposition, employing a great number of Dutch, Flemish, and French laborers; was knighted Jan., 1629; contracted with the earl of Bedford and other great land-owners for draining the vast fens known as the "Bedford Level" 1630; was harassed by the opposition of the Fen-men, who did not like losing their commons, fish, and wild-fowl; failed in his first attempt, and also in the second, commenced in 1631, Oliver Cromwell, then a country squire, taking the lead in the local agitations against the project, which was interrupted for many years by the great rebellion; published *A Discourse touching the Draynng of the great Fennes lying within the severall Counties of Lincolne, Northampton, etc.* (London, 1642); served as a colonel in the Parliamentary forces; was a third time entrusted with the great drainage works 1649, and completed them 1653, when a solemn service in honor of the event was celebrated in Ely cathedral, Hugh Peters, the chaplain of Cromwell, preaching the sermon. Vermuyden was allotted considerable tracts of the reclaimed lands as his compensation, but his contract proved onerous, and he was obliged to sell his lands to pay his workmen. He applied to Parliament for redress in 1656, but seems not to have obtained any, and is supposed to have gone abroad and d. in obscurity, as no further data of his life are known. (See Donaldson's *Agricultural Biography*, 1854.) PORTER C. BLISS.

Vernal Grass. See ANTHOXANTHUM.

Verne (JULES), b. at Nantes, department of Seine-Inférieure, France, Feb. 8, 1828; studied law in Paris, and made his début in literature in 1850 with a comedy in verse, *Les Pailles rompues*, which was performed at the Gymnase Theatre in Paris; wrote subsequently several other plays, and struck in 1863, with his *Cinq Semaines en Ballon*, a vein of literary production which he has since pursued with great success. His most popular work is the *Tour du Monde en 80 Jours* ("Around the World in Eighty Days"), which was dramatized in 1874, and brought on the stage at the Porte Saint-Martin Theatre in Paris. He also wrote *A Journey to the Centre of the Earth, Twenty Thousand Leagues under the Sea, From the Earth to the Moon, Dropped from the Clouds, The Mysterious Island*, and an illustrated geography of France, with Théophile Lavallée (1867–68).

Vernet' (JEAN ÉMILE HORACE), generally called HORACE VERNET, b. in Paris June 30, 1789, descended from a celebrated family of painters. His grandfather, Joseph Vernet (Claude Joseph), (b. at Avignon Aug. 14, 1714; d. in Paris in Dec., 1789), was considered the greatest marine-painter of the age, and fifteen large pictures by him, representing French seaports and painted after the order of Louis XVI., are found in the gallery of the Louvre. His father, Carle Vernet (Antoine Charles Horace), (b. in Bordeaux Aug. 14, 1758; d. in Paris Nov. 28, 1836), was a painter of battle-pieces, and his *The Battle of Marengo, The Morning of Austerlitz, The Emperor giving Orders to his Marshals, The Bombardment of Madrid, The Battle of Rivali*, and *The Battle of Wagram*, became immensely popular. It was intended that Horace should go to Rome to study painting, but, too much occupied by all kinds of outdoor sport and the practical study of nature, he failed to obtain the prize and travelling stipend of the Academy; he became a conscript; served in the army as a soldier; married, and began to paint battle-pictures entirely according to his own ideas. In 1810 he exhibited *The Capture of a Redoubt*; in 1811, *The Dog of the Regiment* and *The Halt of French Soldiers*; in 1812, *The Taking of an Intrenched Camp*, for which the Academy gave him a medal. The impression which these pictures produced was most extraordinary. Instead of the conventional manner in which the members of the school of David used to imagine a battle, Vernet painted war-scenes and soldiers exactly as he had seen them himself; and instead of the cold elegance which with the old classicists keeps the whole in a solemn attitude, this young romanticist inspired everything with a stirring, fiery passion which never fails to communicate itself in some magic way to the spectator. The result was almost immediately a boundless enthusiasm. The Bourbons gave the young painter large orders, and he filled them. But he continued all the while to paint the hero of the nation, and through engravings and the newly invented art of lithography these enthusiastic representations of the grand army and its exploits, *The Death of Poniatowski, The Bridge of Arcola, The Soldier of Waterloo*, etc., passed into the hands of the humblest Frenchmen, and produced their effect. In 1822 his pictures were refused admittance to the exhibition of the Academy on account of their Bonapartistic tendency, but Vernet opened a private exhibition, and multitudes which under ordinary circumstances never dreamt of looking at a picture crowded his *salon*, and went away electrified. Charles X. became actually afraid of the painter, and sent him in 1827 to Rome as director of the French school there. In 1831 he returned to Paris, but his relation to Louis Philippe was, or soon became, very friendly. With great adroitness the king succeeded in alluring the artist's imagination to another subject—not relating to the emperor of the French, but to the king of France—namely, the conquest of Algeria. Vernet resided in Algeria from 1833–35, and visited it again in 1837, 1845, 1853, and oftener. He continued to paint Napoleon—the battles of Jena, Friedland, Wagram, etc.—but from 1836 to his death he chiefly treated subjects of the Algerian campaigns—*The Capture of the Smala, The Battle of Isly, The Siege of Constantineh*, etc.—whereby he afterward became almost as troublesome to Napoleon III. as he formerly had been to the Bourbons. Besides battle-pieces, he painted a number of excellent pictures, half genre and half history, such as *Rebecca at the Well, The School of Raphael, The Lion-Hunt*, etc.; several portraits, among which were those of Napoleon I., of Louis Philippe, of Napoleon III., etc.; and gave a great number of illustrations. D. in Paris Jan. 17, 1863. (See Durande, *Joseph, Carle et Horace Vernet*, Paris, 1845.) CLEMENS PETERSEN.

Ver'nier [named from the inventor, *P. Vernier*], a contrivance for measuring a fractional part of one of the equal divisions of a graduated scale or arc. It consists of an auxiliary graduated scale, the divisions of which differ from those of the primary scale. The vernier scale is formed by taking a space equal to an exact number of parts of the primary scale, and dividing it into a number of equal parts, either greater by 1 or less by 1 than the number that it covers on the primary scale. The former is the method of division usually adopted, and for that reason we shall explain the vernier as thus divided:



Let A K be a scale of equal parts, and let each part represent 1 foot; let C D be a parallel scale, such that it is exactly equal to 9 parts of the primary scale; suppose C D to be divided into 10 equal parts; then will each part represent .9 of 1 foot. By means of these scales we can measure distances to within .1 of 1 foot. Suppose the 0 of the vernier in the first instance to coincide with the division 17 of the primary scale; then is the distance from the 0 of the scale to the 0 of the vernier exactly 17 feet. If we suppose the vernier to slide along the primary scale till the division 1 coincides with 18, the distance from the 0 of the scale to the 0 of the vernier will obviously be equal to 17.1; if it slides along till the division 2 coincides with 19, the distance between the 0 of the scale and the 0 of the vernier is 17.2; and so on. In the present position of the vernier the reading is 17.3. This is obvious, for the distance from the 0 to the divisions which coincide is 20, and the distance from the 0 of the vernier to the same division is three times .9, or 2.7; hence, the difference is 17.3.

The difference between one space on the limb and one space on the vernier is called the *least count*; this is always equal to one space on the limb divided by the number of spaces on the vernier. To read an instrument by means of a vernier, we have the following rule: Read the principal scale up to the last division preceding the vernier, and call the result *the reading on the limb*; then look along the vernier for the division that coincides most nearly with a space on the limb, and multiply the number of that division by the least count; this result is called the *reading on the vernier*; then will the sum of the two readings be the *true reading* of the instrument. W. G. PECK.

Vernon', town of France, department of Eure, on the Seine, has some cotton manufactures and trade in wine and grain. P. 7410.

Ver'non, parish of S. W. Louisiana, separated from Texas by Sabine River, and drained by Bayou Lanacoco and affluents of Calcasieu River; surface level, soil gener-

ally fertile. Cattle are very numerous on the prairies. Staples, cotton, Indian corn, and sweet potatoes. Cap. Leesville. Area, about 1450 sq. m. Formed since the census of 1870. P. 4259.

Vernon, county of W. Missouri, bordering on Kansas, drained by Osage River and its affluents, and traversed by Missouri Kansas and Texas R. R.; surface undulating, soil fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, potatoes, and wool. Cap. Nevada. Area, about 700 sq. m. P. 11,247.

Vernon, county of S. W. Wisconsin, separated from Iowa and Minnesota by Mississippi River, and drained by Raccoon and Kickapoo rivers; surface mostly of undulating prairie, soil fertile. There are saw-mills, flour-mills, cloth-dressing establishments, and manufactories of carriages. Cattle, horses, sheep, and swine are numerous. Staples, wheat, oats, Indian corn, potatoes, hops, hay, maple-sugar, wool, and dairy products. Cap. Viroqua. Area, about 800 sq. m. P. 18,645.

Vernon, p.-v., cap. of Lamar co., Ala.

Vernon, tp., Sutter co., Cal. P. 799.

Vernon, tp., Tolland co., Conn. P. 5446.

Vernon, p.-v., cap. of Washington co., Fla. P. 53.

Vernon, tp., Lake co., Ill. P. 1259.

Vernon, tp., Hancock co., Ind. P. 1963.

Vernon, tp., Jackson co., Ind. P. 1508.

Vernon, p.-v. and tp., cap. of Jennings co., Ind., on Vernon River and the Madison division of Jeffersonville Madison and Indianapolis R. R., has manufactures, trade in lime, and a newspaper. P. of v. 673; of tp. 2385.

Vernon, tp., Washington co., Ind. P. 1101.

Vernon, tp., Dubuque co., Ia. P. 1243.

Vernon, tp., Humboldt co., Ia. P. 393.

Vernon, p.-v. and tp., Van Buren co., Ia. P. 1474.

Vernon, tp., Wright co., Ia. P. 175.

Vernon, p.-v. and cap. of Jackson parish, La.

Vernon, tp., Isabella co., Mich. P. 383.

Vernon, p.-v. and tp., Shiawassee co., Mich. P. 1797.

Vernon, tp., Blue Earth co., Minn. P. 665.

Vernon, p.-v. and tp., Dodge co., Minn. P. 850.

Vernon, tp., Clarke co., Mo. P. 902.

Vernon, p.-v. and tp., Sussex co., N. J. P. 1979.

Vernon, p.-v. and tp., Oneida co., N. Y., has a national bank. P. of v. 391; of tp. 2840.

Vernon, tp., Clinton co., O. P. 1513.

Vernon, tp., Crawford co., O. P. 988.

Vernon, tp., Scioto co., O. P. 1924.

Vernon, p.-v. and tp., Trumbull co., O. P. 930.

Vernon, tp., Crawford co., Pa. P. 1615.

Vernon, p.-v. and tp., Windham co., Vt. P. 764.

Vernon, p.-v. and tp., Waukesha co., Wis. P. 1180.

Vernon (Edward), b. at Westminster, England, Nov. 12, 1684, son of James Vernon, secretary of state to William III.; educated at Westminster School and at the University of Oxford; received a commission in the navy 1702; was engaged in the destruction of the French and Spanish fleets off Vigo Oct. 12, 1702, in the capture of Gibraltar July 23, and in the sea-fight off Malaga Aug. 13, 1704; became rear-admiral 1708; was in active service until 1727, when he was elected to Parliament, in which body he sat with little intermission to the end of his life, distinguishing himself in the ranks of the opposition; declared in Parliament 1739 that Puerto Bello, on the Spanish Main, could be taken with six ships; was taken at his word by the ministry, and given the command of six men-of-war, with the rank of vice-admiral of the blue; took Puerto Bello Nov. 22, 1739, after an assault of one day, with a loss of only seven men—a success which procured him unbounded popularity, as evinced by hundreds of medals and signs of public houses; sailed from Jamaica in Jan., 1741, with 29 ships of the line, 80 smaller vessels, 12,000 troops, including several American regiments, and 15,000 sailors; appeared before Cartagena Mar. 4; was repulsed with great loss, which was augmented by a fearful pestilence; made in 1742 an unsuccessful expedition against Panama; was made admiral 1745, and charged to guard the coasts of Kent and Sussex against an expected attack by the Pretender, but was stricken from the list of admirals Apr. 11, 1746, in consequence of a quarrel with the admiralty. D. at Nacton, Suffolk, Oct. 29, 1757. He published *A New History of Jamaica, from the Earliest Account to the Taking of Porto Bello* (1740), *Original Papers relating to the Expedition to Panama* (1744), and several pamphlets on naval topics, which were the cause of his dismissal from the service. The expedition against Cartagena was graphically described, both in his *Roderick Random* and in his *History of England*, by Smollett, who was present as a surgeon's mate. Lawrence Washington, elder brother of George, also participated in the expedition, and testified his esteem and friendship for the admiral by the name, Mount Vernon, which he gave to his estate in Virginia, afterward the residence of Gen. Washington. *The Life of Admiral Vernon, by an Impartial Hand*, appeared in 1758, and a *Memorial from Contemporary Authorities* was printed for private circulation in 1861 by William F. Vernon. His memory also survives in the word *grog*, applied by the sailors of his fleet to their rations of watered rum, in allusion to the admiral's *grogram* breeches.

Vernon (George John Warren), fifth Baron **Vernon**, b. at Stapleford Hall, England, in 1803; succeeded to the title 1835, and gained great distinction as a student of mediæval literature, especially that relating to Dante. D. in 1866. He published at Florence in 1842 the first seven cantos of Dante's *Inferno*, in grammatical order with notes, edited the Latin text of a *Commentary on Dante* by Pietro Alighieri (1835), and two other ancient commentaries (1846–48), and issued a magnificent reproduction of the first four printed editions of Dante, *Le prime quattro Edizioni della Divina Commedia litteralmente ristampate, etc.* (London, folio, 1858), printed by Whittingham under the direction of Antonio Panizzi.

Vernon (Robert), F. S. A., b. in England in 1774; was at one time a dealer in horses; acquired in commercial pursuits a large fortune, which he expended in the purchase of pictures, chiefly by British artists, being a generous patron of artists and literary men of genius, and formed a vast collection of works of art at his country-seat of Ardington House, Berkshire, the best portion of which, comprising 162 pictures and several pieces of statuary (valued at £150,000), he presented to the nation Dec. 22, 1847, to be known as the "Vernon Gallery," which now forms the nucleus of the National Gallery of British Art at South Kensington Museum. D. in London May 22, 1849. A portrait of Mr. Vernon by Pickersgill and a bust by Behnes, the latter presented by the queen, are in the National Gallery.

Vernon (Thomas), b. in England about 1660; was for a time secretary to the duke of Monmouth; became an eminent lawyer, and sat in Parliament for Whitechurch. D. at Twickenham Park Aug. 22, 1726. He left in MS. his famous *Reports of Cases in Chancery*, which after a lawsuit were published under the editorial care of William Melmoth and William Peere Williams (2 vols. folio, 1726–28). The best edition is that of John Raithby (2 vols., 1806–07).

Vernon Harcourt, Sir. See Harcourt.

Vernon Smith (Robert). See Lyveden.

Vernon Springs, tp., Howard co., Ia. P. 1450.

Ve'roli, town of Italy, province of Rome, in the Hernican Mountains, not far from Frosinone, contains some very good churches, and was formerly the seat of several large convents—the Casa Mario (Benedictine, 1005), the S. Domenico di Sora (Cistercian), etc. Veroli is of ancient origin, was fortified by the Pelasgians, and was christianized at a very early period. P. 11,036.

Veron' (Louis Désiré), b. at Paris Apr. 5, 1798; was educated in the Imperial Lyceum, and studied medicine; served in various hospitals, and published *Observations sur les Maladies des Enfants* (1825); wrote absolutist-ultramontane articles in different papers, and was appointed physician at the Royal Museum in 1824; bought a large interest in a patent medicine, "Pâte Regnauld;" brought it by his connections with the papers into vast notoriety, and laid the foundation of a fortune; took firmer hold of the journalistic business, and founded in 1829 the *Revue de Paris*, which was devoted to the creation of new celebrities; became director of the grand opera in 1831, not as a superintending royal official, but as a privileged manager; brought out the opera *Robert le Diable* and the ballet *La Sylphide*, and retired in 1835 with a considerable fortune; bought in 1839 a controlling share of the *Constitutionnel*, the tottering organ of Thiers; became its sole proprietor in 1844; brought it into a most flourishing condition by publishing in its columns *The Wandering Jew*, by Eugene Sue, and was introduced in the highest circles of French society by Thiers, who was made minister in 1840; became the enthusiastic eulogizer of the *coup d'état* of Dec. 2, 1851; was elected to the Legislative Assembly as a candidate of the government, and sold the *Constitutionnel* at an enormous profit; endowed anonymously several second-rate literary associations in Paris with large sums, and published *Mémoires d'un Bourgeois de Paris* (6 vols., 1854), *Cinq-cent mille Francs de Rente* (2 vols., 1855), *Quatre ans*

de Rêpne (1857), and *Les Théâtres de Paris de 1806 à 1860* (1860). D. in Paris Sept. 27, 1867.

Vero'na, a very strongly fortified town in the province of the same name in Northern Italy, picturesquely situated at the foot of the Alps, and traversed by the river Adige. Verona was a populous and important city of the Roman empire, and still retains many striking monuments of that as well as of the mediæval period. Foremost among these is the arena or amphitheatre, contemporaneous with the Flavian at Rome, the interior of which is well preserved, and in fact the whole structure appears to have suffered little except from earthquakes. Its interior dimensions are 511 by 404½ feet, and the highest remaining portion of the exterior wall measures 100 feet. There are also remains of a Roman theatre, and an arch, called the Porta de' Borsari, across one of the principal streets, of the time of Gallienus (third century), though parts of it may be older. This arch is remarkable for many of its architectural features, especially for its twisted or spirally fluted columns, a form of which few other so ancient examples exist. Another Roman gateway, the Porta de' Leoni, is still preserved, and many fragments of the old town walls have been incorporated into buildings for civil purposes or into fortifications of later date, of which Verona offers many examples of great interest in the history of military architecture. The palaces and public squares of Verona contain much to attract the notice of the stranger, and the group of monuments known as the Tombs of the Scaligers well deserves a careful examination. There is a picture-gallery containing some good works, but the collection as a whole does not rank with those of many other Italian cities. The Ponte del Castello, built of brick in the fourteenth century, one of the arches of which has a span of 161 feet, is perhaps the boldest structure of the kind of so early a date. The churches of Verona are numerous. The cathedral dates chiefly from the twelfth century, though the apse is believed to be older. It is decorated with many curious mediæval sculptures, and some of the chapels, of different ages, are of great richness. It contains an *Assumption* by Titian and other fine pictures. The baptistery belonging to the cathedral is of the twelfth century, and has a font ten feet in diameter, intended for baptism by immersion, hollowed out of a single block. The capitular library is among the most remarkable collections of MSS. in Italy. It contains parchments of the fourth and fifth centuries, including many palimpsests, among which is a Virgil, perhaps as ancient as the third century. It was here that were found the important *Institutes* of Gaius, re-written with the *Homilies* of St. Jerome. Sta. Anastasia is much admired for its architecture, paintings, and bas-reliefs, and the monument of Guglielmo da Castelbarco over the entrance to a detached chapel is described by Ruskin as "the most perfect Gothic sepulchral monument in the world." San Bernardino is remarkable chiefly for the Pellegrini chapel by Sanmicheli, a circular structure of exquisite beauty of design and most admirable delicacy of sculpture. San Fermo, of fine brickwork and with good pictures; San Giorgio Maggiore, excellent sculptures and paintings; Santa Maria in Organo and San Nazaro e Celso are remarkable for their works of art, and San Zenone, a large church of the twelfth century, built on the foundation of a more ancient structure, is surpassed in its design, its decorations, its monuments, and other appurtenances by few ecclesiastical edifices in Italy. The famous Sanmicheli enriched Verona with many fine palaces, still generally in good condition. The environs of the city are highly attractive, and among them the palæontologist will not fail to visit Monte Bolca, the most important deposit of fossil fishes yet discovered. During the Austrian occupation the garrison of Verona was always large, and the withdrawal of so considerable a part of the population after the war of 1866 was felt as a check to the industry and commerce of the town. Its material prosperity is now reviving from the establishment of manufactures of velvets and other silks, as well as various mechanical enterprises. The pop. at the latest enumeration was 67,080. Verona as a fortress constitutes with Peschiera, Mantua, and Legnano, the famous "quadrilateral."

Verona, tp., Hancock co., Me. P. 352.

Verona, tp., Huron co., Mich. P. 276.

Verona, tp., Faribault co., Minn. P. 607.

Verona, p.-v., Lee co., Miss.

Verona, p.-v., Spring River tp., Lawrence co., Mo. P. 240.

Verona, p.-v. and tp., Oneida co., N. Y., on New York Central R. R. P. of v. 229; of tp. 5757.

Verona, p.-v. and tp., Dane co., Wis. P. 1125.

Veronese (Paul). See Cagliari (Paoli).

Verplanck' (Gulian Crommelin), LL.D., b. in New York City Aug. 6, 1786; graduated at Columbia College 1801; studied law, and after being admitted to the bar spent two or three years in Europe; was in 1804 a candidate of the so-called "Malcontents" for the New York legislature, to which he was elected many years later, in 1820, when he took a prominent position and was chairman of the committee on education; became in 1822 professor of the evidences of Christianity in the General Protestant Episcopal Seminary, New York; was a member of Congress 1825–33; of the New York senate for several years, in the judicial duties of which he took a principal part; was one of the governors of the New York Hospital, vice chancellor of the State University, president of the New York board of emigration commissioners 1846–61, and prepared nearly all the *Annual Reports* of the latter body. D. in New York Mar. 18, 1870. Author of *The Backtoot Bards* (1819), a political poem in satire of De Witt Clinton, *Evidences of Revealed Religion* (1824), *An Essay on the Doctrine of Contracts* (1825), *Discourses and Addresses* (1833), of nearly half the *Talisman* periodical, in which appeared his *Memoir* of Sands, of several college addresses, reports, speeches, and papers, and of numerous contributions to magazines. He edited *Shakspeare's Plays, with his Life* (3 vols., 1844–47).

Verrazano, da (Giovanni). See Verazzano.

Ver'res, notorious in the history of Rome as one of the most cruel, rapacious, and shameless officials which that city ever sent out to govern her provinces. In 73 B.C. he went to Sicily as governor, and after three years' administration returned to Rome loaded with plunder. Sicily was the wealthiest and most prosperous province of Rome, but Verres carried away every valuable work of art or public ornament, impoverished commerce and manufactures, and devastated the island worse than ever its own tyrants or the wars between Carthage and Rome had done. The Sicilians succeeded in bringing the robber to trial, though he had both wealth and powerful connections—the Scipios, Metelli, etc.—by which to defend himself. Cicero was his accuser, Hortensius his defender. But before the trial came to a close, Verres fled from Rome. He settled in Gaul, near Marseilles, and brought along with him enough of his wealth to live in luxury and opulence for the rest of his life, and even to excite the greed of Antony, by whose proscription he was put to death in 43 B.C.

Verrill (Addison Emery), A.M., S.B., b. at Greenwood, Me., Feb. 9, 1839; educated at the Lawrence Scientific School, Harvard University; since 1864 he has been professor of zoology in Yale College, and is a member of numerous scientific societies; has published largely upon zoology in American scientific periodicals.

Versailles', town of France, capital of the department of Seine-et-Oise, 11 miles S. W. of Paris, is regularly built, with broad and straight streets, and intersected by elegant avenues planted with trees. It has few manufactures and little trade. The chief attractions of the place are the palace and the park. The palace is an enormous pile, 1400 feet long. It was erected by Louis XIV., and was the residence of the French kings till 1792. In 1837, Louis Philippe transformed it into a kind of national museum, unique of its kind, and exceedingly interesting and instructive. The park, with its terraces, alleys, and fountains, is stiff, formal, and tiresome. P. 61,686.

Versailles, p.-v. and tp., Brown co., Ill. P. 1171.

Versailles, p.-v., cap. of Ripley co., Ind., 52 miles W. of Cincinnati and 5 miles S. of Ohio and Mississippi R. R., contains the usual churches, schools, and 1 newspaper. P. 495. J. A. Wayland, Ed. "Ripley Index."

Versailles, p.-v., cap. of Woodford co., Ky., 15 miles S. E. of Frankfort, laid out in 1794, and the centre of a wealthy agricultural district, has 8 churches, 2 banks, an excellent public school and private academy, 1 weekly newspaper, 1 large carriage-factory, 1 flouring-mill, 1 hotel, and an orphan asylum. P. 3268.
Dan. M. Bennar, Ed. "Woodford Weekly."

Versailles, p.-v., cap. of Morgan co., Mo., on Missouri Pacific R. R., 20 miles S. of Tipton, and on the watershed between Osage and Missouri rivers, contains 1 church, 1 bank, an excellent high school, 1 newspaper, 2 lumber-yards, a court-house. Rich deposits of coal, lead, and iron underlie this whole section. P. 503.
John A. Hannay, Ed. "Gazette."

Versailles, p.-v., Darke co., O.

Verse. See Metre and Rhyme, by Prof. S. S. Haldeman, A.M., LL.D.; and Poetry.

Ver'secz, or **Werschetz,** town of Austria, Servian woiwodeschaft, has several educational institutions and some silk-spinning factories. Rice, wine, and silk are extensively cultivated in the neighborhood. P. 19,087.

Ver'shire, p.-v. and tp., Orange co., Vt. P. 1140.

Versifiers. See IMPROVISATION, by HON. G. P. MARSH, and POET-LAUREATE.

Vertebra. See SPINAL COLUMN, by E. DARWIN HUDSON, JR., M. D.

Vertebral Column. See SKELETON and SPINAL COLUMN, by E. DARWIN HUDSON, JR., M. D., and OSTEOLOGY, by PROF. E. D. COPE, A. M.

Vertebrata. See VERTEBRATES, in APPENDIX, by PROF. THEODORE GILL, A. M., M. D., Ph. D.

Ver'tex [Lat. *vertere*, to "turn"], a turning-point. A vertex of a polygon is a point at which two sides meet. The vertex of a cone or of a pyramid is its apex.

Ver'tical, a line perpendicular to the horizon. A *vertical line* is determined by a plumb-line. A vertical line at any point is always perpendicular to the free surface of a liquid at that point. A *vertical plane* is a plane through a vertical line, and any angle in such a plane is a *vertical angle*. A vertical line at any place passes very nearly through the centre of the earth; hence, vertical lines at different places on the surface of the earth are not parallel, but for places not far apart they are usually spoken of as parallel. In surveying, vertical lines are determined by means of the spirit-level.

Ver'tigo [Lat.], a subjective or apparent impairment of the equilibrium of the body. It assumes two principal forms: In one it appears to the subject as if the objects in his vicinity were whirling about him; in the other, he fancies that he is forced to fall in some definite direction, forward, backward, or to either side. Vertigo is rarely if ever continuous, but occurs in paroxysms provoked by some appreciable cause, as changing posture, eating, using the eyes, etc. The subjects of vertigo often stagger or fall in consequence of the sensation of motion. Vertigo is sometimes the expression of disease of the brain, or of interference with the circulation of blood in that organ, but more usually it is a sympathetic disorder, caused by indigestion, anæmia, sudden impairment of parallelism between the two eyes, disease of the internal organs of hearing, etc. Vertigo may be artificially produced by the administration of stimulants (alcohol), and by the application of galvanism to the head in a transverse direction or to the superior ganglion of the cervical sympathetic nerve. A variety of subjective unsteadiness, without definite direction to the apparent movement, is better designated as dizziness. The proper management of vertigo consists in the treatment of the disease causing it. E. C. SEGUIN.

Vert'ner (ROSA **Griffith**), formerly MRS. JOHNSON, now MRS. JEFFREY, b. near Natchez, Miss., about 1835, daughter of John Griffith (d. 1853), who was the author of several popular Indian tales; was adopted by a maternal aunt, MRS. VERTNER, whose name she took; passed her childhood at Burlington, her aunt's country-seat, near Port Gibson, Miss.; was educated in Bishop Smith's seminary at Lexington, Ky.; became in 1850 a contributor, chiefly of verses, to the *Louisville Journal*, and subsequently to the *Home Journal*; married at the age of seventeen, Claude M. Johnson, a wealthy gentleman of Louisiana; published a small volume of *Poems* (Boston, 1858), which were warmly received both North and South as indicative of "singular power and peculiar passionateness;" became by second marriage the wife of Alexander Jeffrey of Lexington, Ky., where she now resides (1876); has published *Woodburn, a Novel* (1864), and has written other novels.

Vertoa', town of France, department of Loire-Inférieure, has extensive manufactures of tiles, vinegar, soap, varnish, and gypsum. P. 6313.

Vertot', de (RENÉ AUBERT), b. at the château of Benetot, department of Eure, France, Nov. 25, 1655; became first a Capuchin, then a Premonstratensian monk, and was appointed secretary to the general of the latter order, but resigned this position afterward and became a secular priest in the neighborhood of Rouen; published in 1680 *Histoire des Révolutions de Portugal*, which attracted much attention, and in 1696 *Histoire des Révolutions de Suède* (2 vols.), which also proved a success; was elected a member of the Academy in 1701; removed to Paris; published in 1720 *Histoire des Révolutions dans le Gouvernement de la République romaine* (3 vols.); was chosen by the knights of St. John to become their historiographer, and received access to their archives; published in 1726 *Histoire des Chevaliers de Malte* (4 vols.). D. at Paris June 15, 1735. His first work is distinguished by a fluent and elegant style, the last rests on actual study of sources, but none of his works combine these two qualities.

Ver'tue (GEORGE), b. in Westminster, England, in 1684; became a distinguished engraver and antiquary; enjoyed the favor of Sir Godfrey Kneller and the patronage of Lord Somers and other wealthy nobles; was an original member of the Academy of Painting 1711; became engraver to the Society of Antiquaries 1717; made many journeys through England during forty years, taking drawings of churches, monuments, and ruins as materials for an intended history of the fine arts in England, for which he accumulated 13 folio vols. of MSS.; was a strict Roman Catholic and a man of singular piety, modesty, and artistic conscientiousness. D. in London July 24, 1756, and was buried in Westminster Abbey. Among his best-known works are sets of twelve *Portraits of Poets* (1730), ten *Portraits of Charles I. and his Friends*, and the series of kings of England in Rapin's *History*. His extensive materials fell into the hands of Horace Walpole, and a portion of them were published by him with little alteration under the title *Anecdotes of Painting in England*, etc. (Strawberry Hill, 5 vols. 4to, 1762–71; last ed. London, 3 vols. 8vo, 1862), to which was appended his *Catalogue of Engravers who have been Born or Resided in England*. The latter work was separately published, with an *Account* of Vertue's life and works (Strawberry Hill, 1763), by Walpole.

Vertum'nus, or **Vortumnus,** in Roman mythology, the god of the seasons, and, as the husband of Pomona, more especially the god of fruit. He was of genuine Italian origin, and derived his name from the Latin *vertere*, to "turn," "change." A feast, *Vertumnalia*, was celebrated in his honor on Aug. 23. By the artists he was generally represented as resembling Saturn.

Verulam, BARON. See BACON (FRANCIS).

Verus (LUCIUS). See ANTONINUS (MARCUS AURELIUS).

Vervain. See VERBENA.

Verviers', town of Belgium, province of Liege, on the Vesdre, is the centre of an extensive cloth-manufacturing industry which employs about 40,000 people in the city and adjacent district, and which annually produces cloth to the value of about $5,000,000. P. 38,875.

Ver'wick, town of Belgium, province of West Flanders, on the Lys, which separates Belgium from France, has manufactures of flax and tobacco. P. 7149.

Ver'y (JONES), b. at Salem, Mass., Aug. 28, 1813; made several voyages to Europe with his father, who was a sea-captain; graduated at Harvard 1836; was Greek tutor there 1836–38; published a volume of *Essays and Poems* (1839); was licensed as a preacher by the Cambridge (Unitarian) association 1843, but has never held pastoral charge, and has since lived a retired life at Salem, occasionally contributing to the Salem *Gazette* and to the religious organs of his denomination. His essays on *Epic Poetry*, *Shakspeare*, and *Hamlet* have been pronounced "fine specimens of learned and sympathetic criticism," and a high authority affirms that he "has written some of the best sonnets in our language."

Vesa'lius (ANDREAS), b. in Brussels Dec. 31, 1514; studied medicine at Louvain, Montpellier, and Paris; lectured on anatomy at Bâle, Pavia, Bologna, and Pisa; was appointed physician to Charles V. in 1544, and afterward to Philip II.; was accused of heresy by the Spanish Inquisition and condemned to death, but the sentence was commuted to a pilgrimage, and in 1563 he went to the Holy Land, returning from which he suffered shipwreck at Zante, and d. from starvation Oct. 15, 1564. His *De Corporis Humani Fabrica* first appeared at Bâle in 1543, and formed the foundation of the modern science of anatomy. It rests on actual observations made by dissection of the human body, and was received with the fiercest opposition by the Galenian school, who derived all their knowledge from dissections of the lower animals. His complete works appeared in 2 vols. fol. at Leyden in 1725.

Ve'sicants [Fr. *vésicant*], a term used in medicine to signify agents that produce blistering. Very many local irritants are capable of raising a blister, but many of these are too harsh and violent for medicinal use. For the ordinary purposes of blistering some preparation of cantharides (see CANTHARIS) is commonly used; but where haste is urgent, cotton soaked in water of ammonia may be employed or a hot iron momentarily applied to the skin. Both these means produce a blister, but they are painful and may cause severe inflammation, and are only used where a small blister is desired. Blistering, as a remedy, is far less employed nowadays than formerly, being at best a painful, distressing, and debilitating procedure. (For the management of the ordinary cantharidal blister see BLISTERS.) EDWARD CURTIS.

Vesoul', town of France, capital of the department of Haute-Saône, on the Drugeon, has some manufactures of calicoes, serges, and damasks, and a trade in grain, wine, and cattle. P. 7597.

Vespa'sianus (TITUS FLAVIUS SABINUS), b. at Reate, in the country of the Sabines, Nov. 17, 9 A. D., of a family

in mediocre circumstances; entered the army; held superior commands under Claudius in Germany and Britain; governed Africa as proconsul under Nero, and was sent by him in 66, at the head of a large army, to suppress the rebellion in Judæa. When, after the murder of Galba, the civil war broke out between Otho and Vitellius, Vespasian was proclaimed emperor (July 1, 69) by his own army, and shortly after was recognized by the whole eastern part of the empire. He left the final reduction of Judæa to his son Titus, and proceeded to Rome, where, after the murder of Vitellius, he was immediately recognized by the senate. A great change now took place in the government of the state. The new emperor was frugal and unostentatious in his personal habits, honest and open in his dealings with all persons, and parsimonious to niggardliness. The finances, which had been utterly disturbed by the wild prodigality of Caligula and Nero, were restored to order; the senate and the higher administration were purged, and the worst elements expelled; a firm discipline was established in the army. In his external policy he was also successful. Jerusalem, and with it the whole of Judæa, were taken in 70; an insurrection in Gaul was speedily suppressed; new conquests were made in Britain and Germany. For the city of Rome he did very much. He rebuilt the Capitol, which had been burnt down by the adherents of Vitellius; he erected a temple of peace, commenced the Colosseum, and encouraged the restoration and rebuilding of those parts of the city which had remained in ruins since the great conflagration under Nero. D. at Reate June 24, 79.

Ves'pers [Lat. *vesper*, "evening," the "evening star"], in the Roman Breviary, the last but one of the canonical hours, the one preceding compline and following the nones. It is celebrated in public in the churches, often with brilliant music. It occurs about the time of the lighting of the lamps.

Vespertilion'idæ [from *Vespertilio*—the ancient Latin name of the bats—the oldest established genus], a family of placentiferous mammals of the order Cheiroptera and sub-order Animalidora. They are destitute of complicated nasal appendages, and the nostrils open by simple crescentic or circular apertures at the end of the muzzle; the ears are moderate or large, mostly free, sometimes united, and each provided with a well-developed tragus; the teeth are normally developed, the molars with W-shaped ridges, the canines moderate, the incisors of the upper jaw in two groups separated by a median hiatus, in the lower jaw present all round; the wings are large; the middle finger generally provided with two phalanges, and with the first phalanx extended, in repose, in a line with the metacarpal bone; the stomach is sacciform, and the two extremities approximated; the premaxillary bones are small, and separated by a wide median interspace. The family is cosmopolitan in its range, and embraces most of the species flourishing in the northern temperate countries. Nearly twenty genera have been differentiated by modern systematists (*e. g.* Peters, Dobson, etc.), but almost, if not quite, the most comprehensive is *Vespertilio* itself. Most of the species found in the U. S. belong to the genera *Vespertilio*, *Scotophilus*, *Nyeticejus*, *Atalapha*, *Corynorhinus*, and *Antrozous*. THEODORE GILL.

Vespuc'ci (AMERIGO), better known under the Latinized form AMERICUS VESPUCIUS, b. at Florence, Italy, Mar. 9, 1451; was educated by his uncle, Giorgio Antonio Vespucci, an eminent scholar; devoted himself to astronomy and cosmography; engaged in mercantile pursuits; settled at Seville, Spain, as an agent of the Medici family, about 1490; became acquainted with Columbus on his return from his earlier voyages; was concerned in fitting out four caravels for voyages of discovery in 1496; accompanied Alonso de Ojeda in his voyage of 1499–1500, in which he visited Cape Paria and explored several hundred miles of the coasts of South America; wrote an account of this voyage July 18, 1500, addressed to one of the Mediecan family; made voyages to Brazil in the service of the king of Portugal 1501–02 and 1503–04; wrote to his friend at Florence two accounts of the second voyage, of which the later was published at Strasbourg 1505; was naturalized in Spain 1505; was appointed pilot-major Mar. 22, 1508, and was occupied for several years in examining pilots, constructing charts, and preparing descriptions of the newly-discovered regions. In a letter written from Lisbon in 1504 to René, duke of Lorraine, he gives an account of four voyages to the Indies, of which he says that the first sailed from Cadiz May 20, 1497, and returned in Oct., 1498. Other copies of the letter read 1494 instead of 1497, but neither of these dates is sufficiently corroborated by other evidence, and the reality of a voyage in either of those years has been denied by most historians, and Vespucci has been frequently accused of inventing voyages for the purpose of ascribing to himself the honor of the original discovery of the New World. The latter part of the charge is now generally admitted to be unfounded, as the name America was first applied, not by himself, but by the German geographer Martin Waldseemuller (Martinus Hylacomylus), who printed in 1507 at St. Die, Lorraine, a small volume, *Cosmographiæ Introductio, insuper quatuor Americi Vespucci Navigationes*, in which, on the strength of the Lisbon letter, the new continent was called *Americi Terra*. Vespucci d. at Seville Feb. 22, 1512. His letter concerning his earliest voyage was first published by Bandini in 1745, and that concerning the second voyage by Bartolozzi in 1789. The merits of his voyages, in none of which he seems to have held the chief command, have been exhaustively discussed by Humboldt in his *Examen critique*, and by Varnhagen, the historian of Brazil, in several publications. PORTER C. BLISS.

Vessels, Spiral. See SPIRAL DUCTS, by Prof. G. L. GOODALE, A. M.

Ves'ta, in Roman mythology, the goddess of the home or hearth, corresponding to the Greek Hestia. Very few and unimportant myths were formed on the idea of this deity, but the grave and sublime rites which her worship developed show that of the whole religious feeling which underlay the Roman mythology she formed the centre. She was not represented by any statue or image in her temples, but a perpetual fire burned on her altars, and each Italian city or community had raised an altar to her. The Vesta of the Roman empire had her temple at Lavinium, on the Via Appia, 20 miles from Rome, and hither the consuls and other high officials of the Republic went to offer up their sacrifice before entering on their duties. The Vesta of the city of Rome had her temple in the Forum, near that of the Penates, and here she was served by her own priestesses, the vestal virgins, and a festival, the *Vestalia*, was celebrated in her honor on June 9. The number of the vestal virgins was originally four, but afterward six. They were chosen by the pontifex maximus when between six and ten years old, and they served the goddess for thirty years, spending ten years in learning their duties, ten in the actual performance of them, and ten in teaching them to the novices. Their principal duty consisted simply in keeping alive the sacred fire on the altar of the goddess, but thereby the guardianship of the holiest which Roman life contained was entrusted to them; and although it has become impossible to us to discern clearly the whole bearing of this institution on the life of the community, numerous well-ascertained facts indicate the great importance ascribed to it. When a consul met one of the vestal virgins in the streets, he bowed with reverence, and the lictors lowered the fasces while she passed by. When a convict was seen by one of the virgins, he was immediately released if she demanded it. If the sacred fire went out from neglect, the priestess during whose watch it happened was stripped and scourged by the pontifex. If one of them committed adultery, she was buried alive and her seducer was flogged to death in the Forum.

Ves'ta, p.-v. and tp., Johnson co., Neb. P. 639.

Ves'tal, p.-v. and tp., Broome co., N. Y. P. 2221.

Vestals, or **Vestal Virgins.** See VESTA.

Vest'ments, Ecclesiastical, the dress appropriated to those who minister in the divine offices—viz. bishops, priests, deacons, sub-deacons, acolytes, servers, and choristers. The employment of vested choristers is a peculiarity of the English Church. In the papal chapels, and generally on the Continent, men are employed as singers, and in some of the French churches, and in the Roman Catholic churches in this country, the singers are of both sexes, but they are not reckoned among the ministers of the altar. In the English cathedrals, however, and in many parish churches, the singers, men and boys, are vested in cassock and surplice, and sit in a part of the church appropriated to their use, called the choir, between the presbytery, the place of the clergy, and the nave, the place of the people. The cassock (Fr. *sutane*) is a long coat reaching from the shoulders to the heels, with a low standing collar, and fastened through its entire length by a row of small buttons. The English cassock, however, is more properly made double-breasted and secured with hooks and eyes. A band around the waist, tied at the left side, called the cincture, serves to keep it in its place. The surplice is a linen garment hanging loose about the person and having large sleeves. The Anglo-Saxon surplice is large and full; it reaches nearly to the feet, and when it is properly made, without any opening in front, falls into ample and graceful folds. These surplices are still in use in the English Church, at least by the clergy. Choristers' surplices are generally made shorter and less full, approaching more nearly the form called *cotta* on the Continent. The Roman cottas are usually very small, reaching but little below the waist, and are sometimes made entirely of lace. The rochet and the alb are modifications of the surplice. The former is a

short, and the latter a long, surplice, with close sleeves. The rochet is commonly considered as the episcopal form of the surplice, but it is sometimes worn by acolytes. The alb is a eucharistic vestment. The surplice is worn by the clergy in the choir offices or daily services, and in the ministration of all rites and sacraments except the holy communion. On solemn occasions the principal minister wears also a cope and biretta. The cope is a cloak cut in such a way that when it is spread out the lower line forms half a circle, of which the front is the diameter. An opening, half an ellipse, is cut in the straight side for the head, and the garment is fastened in front by a large buckle called a morse. The cope is usually made of some valuable material, and is richly embroidered. One given by Queen Philippa (1328–69) to Durham cathedral is still kept there in excellent preservation. The biretta is a four-sided cap with a flat top, and ridges on it extending from the corners to the middle—four for doctors of divinity and three for ordinary clergymen. A ridgeless biretta appears to have been formerly common in England, and is often seen in old sculpture and in paintings. A stole is also worn at baptisms, marriages, and similar functions, but not, according to the old English rule, at the daily service. In the churches of the Roman obedience the public recital of the daily offices has so long been obsolete that the tradition seems to have been lost. The old rule, however, is probably the same as the English. This stole is 2½ inches wide and about 2½ feet long. It is usually made of silk, and is frequently embroidered.

The eucharistic vestments are the amice, the alb, the girdle, the maniple, the eucharistic stole, and the chasuble. The amice is a square piece of linen, embroidered on one side, which the priest rests for a moment on his head, and then spreads over his shoulders. It is seen as an embroidered collar above the alb. The alb is a long garment with close sleeves, secured about the waist with a girdle. It is commonly made of linen, but occasionally of lace, and it may have embroideries on the sleeves and lower part, called apparels. The Greek alb (*chitonion*) is sometimes made of richer materials, and is colored. The girdle is also of linen, and is made of strands of twisted cord. In the East a broad band (Gr. *zone*) is sometimes worn instead. The maniple (*sudarium*; Gr. *epimanikia*) was originally of linen, but is now made of the same materials and in the same form as the stole. It is worn upon the left wrist. The eucharistic stole (Gr. *orarion*) is three yards long and nearly three inches wide, sometimes widened at the ends to make room for embroidered crosses. It is crossed over the breast and secured by the girdle. The chasuble (Lat. *casula*; Gr. *phelonion*; in old English, "the vestment") is worn over all. It was originally, and is still sometimes in the Greek Church, cut in the form of a complete circle, in which form its ample folds are extremely graceful. It was at a later time made like an ellipse, or rather like the *vesica piscis*, which was a favorite shape in England. The modern Roman chasuble is very much cut away in front. In England, France, and Belgium a cross is commonly affixed to the back; in Italy and other Roman Catholic countries in the West, to the front of the chasuble. This is properly of the shape known as the Y-cross. The deacon (in England, "the gospeller") wears over his alb a dalmatic (Gr. *stoicharion*), and the sub-deacon (in England, "the epistoler") wears a tunicle, but no chasuble, which is reserved exclusively to the celebrant. The dalmatic is a coat partly open at the sides, with wide sleeves. The tunicle is a garment very similar to the last, but less highly ornamented. The deacon wears his stole over his left shoulder; the ends are brought together and fastened under his right arm. The sub-deacon wears no stole. In the Western churches acolytes at a high mass (in England, solemn service) wear albs and amices. At a low mass (plain service), where there are neither ministers nor choir, but only a single priest with a server, the latter wears a cotta or rochet over his cassock, which last is usually crimson. In the Greek Church servers and low masses are unknown. The priest is always attended by a deacon vested in alb and dalmatic. When a bishop is the celebrant, he wears a dalmatic in addition to the priestly vestments, to signify, it is said, that all the offices of the ministry are united in his person. The Western bishops also wear instead of the biretta a mitre, either plain or precious; the former is of white linen, the latter of gold and precious stones. The pall, pectoral cross, ring, gloves, sandals, and staff also appertain to the bishop.

In the churches now or formerly of the Roman obedience the color of the cassock is, for choristers, servers, or acolytes, crimson; for the principal acolyte, sometimes purple. Sub-deacons, deacons, and priests wear black, bishops purple, and cardinals crimson. The pope alone wears white. The surplice, cotta, rochet, alb, and amice are properly made of white linen, though in the West all except the last are sometimes made of lace. The maniple, stole, tunicle, dalmatic, and chasuble vary in their colors, following what is called the sequence of the seasons. The Roman sequence is now generally adopted in the West. This gives white for Christmas, Easter, and saints' days, purple for Advent and Lent, red for Pentecost and feasts of martyrs, black for Good-Friday, and green for ordinary days. The color for *ferias* or week-days usually follows that of the preceding Sunday. The English or Salisbury (Sarum) sequence differs from the Roman not only in the use of more colors—brown or gray being allowed instead of purple, blue instead of green, and yellow instead of white on the feasts of confessors—but also in the order in which the colors are used. According to this sequence, all Sundays at the festal seasons are white, and all other Sundays are red. White Sundays are followed by white ferias, but at the seasons of Advent and Lent the ferias are purple; at those of Epiphany, after the octave, and Trinity, they are blue or green. The old Sarum tradition, however, has been lost, and it has probably only been partially recovered. The Eastern calendars are numerous and complicated, and they do not appear to recognize any uniform sequence of colors.

This account includes all the vestments which are received by Catholic tradition, both in the Eastern and Western churches. There are, however, local variations, and there are other vestments which have been worn only at particular times and places. The Western mitre is unknown in the East, except among the Armenians; the Oriental bishops wear a peculiar cap. The patriarch of Alexandria wears a cap resembling a crown, which he never removes during the whole liturgy. The Eastern bishops wear attached to the stole a square ornament called the *epigonation*. This was originally merely a handkerchief, but it is now made of some stiff material like brocade, and richly decorated. The stole itself is joined together for nearly its entire length, and an opening is left at the top through which the head is put. Two maniples are worn instead of one. The Greek priest's cap is not square, but round. There are also local peculiarities in the West. The rochet and chimere worn by the English bishops are a modification of the daily dress, or perhaps the parliamentary robes, of their predecessors. The simple linen sleeves of the rochet have been superseded by lawn and the chimere of scarlet silk by one of black satin or velvet. The black gown is sometimes worn by English clergymen and Protestant ministers. The rival derivations of it from the gown worn by Calvin at Geneva or from the dresses of the mediæval monks may be dismissed as witty inventions. It is probably merely the academic gown which English clergymen were formerly accustomed to wear when they went about their parishes. A survival of this custom continued until nearly the middle of the present century. There are those yet living in New York who remember seeing the clergy of Trinity church and the Dutch dominies walking to church on Sunday mornings in gown and cassock. The square cap and the hood, much worn by the English clergy, are academic vestments. Hoods also form parts of several monastic dresses. As the latter, however, are for the most part modifications of the cassock, it is not necessary to describe them particularly. The amyss (which is not to be confounded with the amice) was at one time a favorite choir-vestment in Northern countries. It was in form not unlike a small chasuble, and was usually made of gray fur. It was only worn at the daily service.

Of the origin of the vestments little is certainly known. The linen ones have probably been inherited by Christians from the Hebrew Church. The others Dr. Rock believes to have been adopted from garments worn in daily life, retained by the Church after others had laid them aside, adorned and beautified and consecrated to sacred uses. Mr. Marriott states more specifically that they were dresses worn by persons of condition on state occasions, which were gradually adopted by the Church. This view is strengthened by the fact, alluded to by Mr. Planché, in his *Cyclopædia of Costume*, that emperors and kings were long allowed to wear the chasuble, and afterward the dalmatic and tunicle, at their coronations and when assisting at high mass. According to the view of Mr. Marriott, most of the vestments were introduced into the Church in the interval between the ninth and the twelfth centuries. Others, he thinks, can be traced back to the fourth, and some to the first century. He is also of the opinion that the color of all ecclesiastical vestments was originally white. As Mr. Marriott has made a careful study of the subject, the present writer thinks it fair to state his views, without, however, in all respects adopting them. The chief value of his work lies in the illustrations and in the elaborate quotations from ancient authors. The literature of the subject is extensive. Marriott's *Vestiarium Christianum*, Rock's *Hierurgia*, Neale's *Holy Eastern Church*, and Blunt's

Annotated Book of Common Prayer are perhaps the best modern authorities. They contain full references to the older writers. Dr. Schaff also has given, in his *Church History*, an article on the subject, with references to Bishop England, Bock, and Hefele. To sum up the whole matter, it is only necessary to add that the same vestments have been in use from time immemorial in both the Eastern and Western churches, and that, though they may have been, and doubtless were, introduced gradually in the way already mentioned, they varied from each other only in matters of detail or in bearing different names in different times and places. The idea of a dress peculiar to the ministers of religion at their ministrations is older than Christianity itself, and is recognized not only by Roman Catholics, but by several denominations of Protestants.

A word or two about the vestments of the altar will complete the subject. The stone slab (*mensa*) of the altar is first covered with a cere-cloth of waxed linen, fitting it closely to protect it from the damp. Over this is placed the superfrontal, hanging down about ten inches in front. Before the altar hangs the frontal, reaching nearly to the ground, and embroidered with two broad stripes called orphreys. Both superfrontal and frontal may have a rich fringe, and both are usually of the color of the season. The former, however, may with propriety be always red. Over all are placed three linen cloths. Two of these are of the exact size of the mensa, but the third is much longer, and hangs nearly to the ground at both ends. It is embroidered in a particular manner, and is usually adorned at the edges with lace. When the altar is not in use, a green covering of silk or baize or some similar material is laid upon it. B. R. BETTS.

Ves'tris, a famous family of dancers, descending from Italy, but settled in Paris. The two most celebrated members of the family were—(1) GAETANO APOLLINO BALDASSARE VESTRIS, b. in 1729, d. Sept. 27, 1808, ballet-master and first dancer at the opera in Paris from 1749 to 1781; and (2) MARIE AUGUSTE VESTRIS-ALLARD, or VESTRIS II., b. Mar. 27, 1760, d. Dec. 6, 1842, a natural son of the preceding by the celebrated dancer Madame Allard (first dancer at the opera from 1780 to 1816), and professor at the Conservatory till 1828. The ballet compositions of the Vestris family were insignificant, but their style of ballet-dancing became predominant on all stages of Europe, and reigned for more than a century, largely influencing also the social dances of the higher classes.

Vesunna. See PÉRIGUEUX.

Vesu'vian, or **Id'ocrase** [named from Vesuvius, in the lava of which it is often found], a hard silicate of lime and alumina, with iron and manganese, sometimes used as a gem, but not much esteemed, and is of various colors.

Vesuvius. See VOLCANOES, by PROF. A. GUYOT, LL.D.

Vesz'prim, town of Western Hungary, contains several handsome buildings and good educational institutions, manufactures salt, glass, and potash, and trades in grain, wine, and cattle, besides its own manufactures. P. 12,002.

Vetch, Fitch, or **Tare,** the name of several leguminous twining herbs of the genus *Vicia*. North America and Europe have each several species, some common to both continents. One of the most important is *Vicia sativa*, extensively cultivated in Europe as a forage-plant. The bitter vetches (*Orobus tuberosus*, etc.) are also leguminous forage-plants of Europe. The tubers of some sorts are used as food. Other so-called vetches are the genus *Lathyrus*, often called vetchlings.

Vetch (JAMES), F. R. S., b. at Haddington, Scotland, May 13, 1789; educated in the cadet college at Great Marlow and in the Royal Military Academy at Woolwich; was engaged upon the trigonometrical survey of Berkshire 1806–07; served in the Peninsular war as an officer of engineers 1810–14; conducted the operations of the ordnance survey in the Orkney, Shetland, and Hebrides islands 1821–24; was for eleven years manager of the silver-mines of Real del Monte and Bolaños, Mexico, 1824–35, constructing in Mexico many roads and other public works, and collecting data for a map of Mexico; was afterward a commissioner for settling Irish boundaries; was engaged upon the reclamation of tide-lands in Ireland and Scotland; formed the plans for the drainage of Leeds, of Southwark, and of Windsor town, castle, park, and forest; became consulting engineer to the admiralty, conservator of harbors, metropolitan commissioner of sewers, royal commissioner of harbors of refuge, and suggested the means of improving the water-supply of London. D. Dec. 7, 1869. Author of many professional publications, one of which, *An Enquiry into the Means of Establishing a Ship-Navigation between the Mediterranean and the Red Sea* (1843), made important suggestions, utilized by Lesseps.

Vet'eran, tp., Chemung co., N. Y. P. 2479.

Veteran Reserve Corps, an organization created in the army of the U. S. during the civil war (1861–65), to avoid any weakening of the armies in the field by employing a portion of them in enforcing the laws for enrolling and drafting the national forces and arresting deserters, etc. Gen. J. B. Fry, provost marshal general, submitted Apr. 17, 1863, a plan proposing—(1) to retain the military services, for garrison, hospital, and provost duty, of that class of deserving officers and men who from wounds received in action or disease contracted in the service were unfit for further duty in the field, and who would otherwise be discharged, but were still able to perform light duty; (2) to bring back for like purpose those who had previously been discharged on similar grounds, were unfit for active service, and not liable to draft. The necessity for the action taken on this plan is apparent; for while an intelligent economy of the public strength demanded that some portion of the vast numbers of soldiers unfit for field service should be utilized, the enlistment or conscription of such men except under the extremest pressure of necessity would have been cruelty and folly. The plan of organization of the Invalid or Veteran Reserve Corps was announced in orders Apr. 28, 1863. The provost-marshal general was charged with the execution of the order, and the troops raised under it were placed under his control. Stringent measures were adopted to secure the admission only of such disabled officers as were endorsed for good conduct in the field, and whose habits, education, and intelligence qualified them to make efficient officers and form an honorable and useful corps.

There were three sources from which the material for the formation of the corps could be drawn: (1) Men still in the field who had been disabled by wounds or by disease contracted in the line of duty; (2) men absent from their colors in hospitals or convalescent camps, etc.; (3) men who had been honorably discharged on account of wounds or other disability resulting from military service. Officers as well as soldiers were received from these three classes only. The material thus obtained from all the different arms of the service was organized into companies and battalions, and finally into regiments, of infantry. On May 31, 1865, the corps consisted of 762 commissioned officers and 29,852 enlisted men. Over 60,000 men entered the corps, and at one time it was twice as large as was the regular army at the commencement of the war. During its entire existence the corps was in the performance of duties which would otherwise have been necessarily performed by as great a number of able-bodied troops detached from armies in the field. Its services, always valuable, were too varied to be enumerated here. As soon as the war was over, additions to the corps were discontinued. In the reduction of the vast volunteer army, all who desired it were granted a discharge from this corps, and by Dec. 31, 1865, it numbered less than 1000 men. By act of July 28, 1866, fixing the military peace establishment, Congress provided for four regiments, to be called the Veteran Reserve Corps, the officers to be appointed from among those wounded in the line of duty during the war, and the men enlisted under similar conditions. In the reduction of the army Mar. 3, 1869, this regimental organization was discontinued. JAMES B. FRY.

Veterinary Science. See APPENDIX.

Veth'ake (HENRY), LL.D., b. at Essequibo, Guiana, South America, in 1792; came to the U. S. in early childhood; graduated at Columbia College 1808; studied law; was instructor in mathematics and geography in Columbia College 1813, professor of mathematics and natural philosophy at Rutgers College 1813–17, at Princeton 1817–21 and 1829–32, at Dickinson College, Carlisle, Pa., 1821–29, and at the University of New York 1832–35; president of Washington College, Lexington, Va., 1835–36, professor of mathematics at the University of Pennsylvania 1836–54, vice-provost 1846–54, and provost of that institution and professor of moral and intellectual philosophy 1854–59, and became professor of the higher mathematics in the Philadelphia Polytechnic College 1859. D. at Philadelphia Dec. 16, 1866. He published a number of occasional addresses on education; contributed to periodicals; edited and wrote most of the articles of the *Supplementary Volume* (xiv., 1847) *of the Encyclopædia Americana*; edited, with large additions, J. R. McCulloch's *Dictionary of Commerce* (Philadelphia, 2 vols., 1843), and was author of *The Principles of Political Economy* (1838; 2d ed. 1844).

Vet'iver, a highly-fragrant substance used for making mats, fans, palanquin covers, and baskets, and often placed in linen for its strong and persistent perfume. It is brought from India, and consists of the dried roots of *Andropogon muricatus*, a grass of that country.

Ve'to [Lat., "I deny"], the power of the executive in constitutional governments to interfere in his official capacity, and to prevent an act passed by the legislature

from becoming a law. It may be absolute or qualified. It is absolute when the executive interposition of itself completely arrests the legislation; it is qualified when the arrest is only partial, and the legislature may, by an increased majority—for example, of two-thirds or three-fourths—enact the measure notwithstanding the objections. The veto power as it exists in the U. S. was borrowed in a modified form from the British constitution. The British Crown *nominally* possesses the absolute veto; practically, it possesses none. In pure theory, the imperial legislature consists of King, Lords, and Commons, the concurrence of all three branches being required to the enactment of a statute. After a bill has been passed through the two houses of Parliament the royal assent is indicated by the entry, "*Le roy le veult*" (Norman French, "The king so wills it"). If this assent should be withheld, the formula employed is, "*Le roy s'avisera*" ("The king will take it under advisement"). The royal veto was common enough in ancient times among the Tudor and the Stuart monarchs, but it has practically ceased to exist. No prime minister would dare advise the Crown to exercise the prerogative. The latest instances of its use were once in the reign of William III. (1692), when a bill for triennial Parliaments was vetoed, but was passed two years after; and once in the reign of Anne. Although the President of the U. S. possesses only a qualified veto, his power by its means to restrain and to shape the legislation of Congress is real, and is far greater than the shadowy authority of the British king. The U. S. Constitution provides (Art. I. Sect. vii.) that "Every bill which shall have passed the House of Representatives and the Senate shall, before it becomes a law, be presented to the President of the U. S. If he approve, he shall sign it; but if not, he shall return it, with his objections, to that house in which it shall have originated, who shall enter the objections at large on their journal, and proceed to reconsider it." After the veto, the measure can only become a law by a vote of two-thirds of each house. A subsequent clause applies the same rule to "every order, resolution, or vote to which the concurrence of the Senate and the House of Representatives may be necessary (except on a question of adjournment)." It is provided, however, that "if any bill shall not be returned by the President within ten days (Sundays excepted) after it shall have been presented to him, the same shall be a law in like manner as if he had signed it, unless the Congress by their adjournment prevent its return, in which case it shall not be a law." It has been settled by the legislative practice that proposed amendments of the Constitution, when duly passed by Congress, do not require the President's assent and are not subject to his veto. The Constitution places no limits on the nature of the objections which the President may interpose. He may refuse his assent because he thinks the measure unconstitutional or because he regards it as inexpedient or opposed to true legislative policy. The governors of the several States are generally clothed with the same qualified veto that is conferred upon the President. In a few commonwealths, however, the bill becomes a law if subsequently assented to by a majority vote of both houses. Under these latter circumstances it is plain that the executive act is in no true sense of the term a veto. Its only effect is to require a second consideration of the matter and a second vote by the legislature, but it opposes no obstacle to the exercise of their law-making function; it is simply argumentative. The mayors of many American cities have under their charters a veto upon the acts of the aldermen.

JOHN NORTON POMEROY.

Vetral'la, town of Italy, province of Rome, on a hill about 9 miles S. W. of Viterbo, commanding a remarkably fine view. It occupies the site of the ancient *Forum Cassii*, and traces of the Via Cassia are still seen near it. Vetralla was of some importance during the mediæval centuries, but its walls and towers have nearly disappeared, and it is now a place of no special interest. P. 6759.

Veuillot' (LOUIS), b. in 1813 at Boynes, department of Loiret, France, in humble circumstances; grew up in one of the Parisian suburbs amidst cheap wine, cheap theatres, and cheap romances; obtained in 1832, through a public labor bureau, a position as "man of all work" on one of the ministerial provincial papers; gained notoriety by his polemical aptitude and his readiness to fight duels; was advanced by the government from one paper to another, from one position to another, and became in 1843 editor of *L'Univers Religieux*. During a visit to Rome in 1838 he was suddenly converted from frivolity to fanaticism, and began to write religious romances—*Pierre Saintine* (1840), *L'Honnête Femme* (1843), etc.—and books of edification—*Les Pèlerinages de Suisse* (1838), etc. His polemical talent, however, suffered nothing from his conversion, and many of his articles, collected in several volumes under the title *Mélanges religieux, historiques et littéraires*, and of his books, *Les Libres penseurs* (1848), *L'Esclave Vindex* (1849), *Le Parfum de Rome* (1865), *Les Odeurs de Paris* (1866), etc., in which he attacks every form of freedom and progress, and advocates a social order based on the monk and the soldier as its main supports, are conspicuous by their acridity.

Vevay', town of Switzerland, canton of Vaud, beautifully situated on the Lake of Geneva, at the mouth of the Vevayse, has manufactures of watches, jewelry, leather, and woollens, and a trade in wine. P. 7881.

Vevay, p.-v., cap. of Switzerland co., Ind., on Ohio River, equidistant from Cincinnati and Louisville, has 5 churches, good schools, 1 bank, 2 newspapers, 2 hotels, 2 furniture, 1 chair, and 2 cigar manufactories, and 1 flouring and 2 saw mills. Large quantities of honey, hay, and onions are shipped from this point. P. about 2100.

W. J. BAIRD, ED. "REVEILLE."

Vevay, tp., Ingham co., Mich. P. 2332.

Viada'na, town of Italy, province of Mantua, lying very near the Po, about 7 miles S. E. of Casalmaggiore. It had an ancient castle which was demolished in 1728, and other defences, and formed a part of the county or marquisate of Brescia. The house of Este, with its allies, the Pallavicini and the Malaspini, was master here at the close of the twelfth century. At the end of the thirteenth, Cavalcabò became marquis of Viadana, and its lordship remained in his family till the beginning of the fifteenth century, when the Gonzagas entered into possession, and they held it till it passed to Austria in 1707. Viadana was formerly a place of much industry; its manufactures of pottery, of leather, linen, silk, etc., were extensive and of a superior quality, but the town has not advanced in this respect during the present century. The principal streets of Viadana are flanked with porticoes; it contains 11 churches, a theatre, a gymnasium, and other public schools, and is not deficient in charitable institutions. P. 15,343.

Vi'aduct [Lat. *via*, a "way" or "road," and *ductus*, from *ducere*, to "lead"], the structure by which a way (or road of any kind) is carried over some break of continuity or gap in its wonted earth-bearings, as over a river, across a ravine, etc. A viaduct is therefore essentially *a bridge*. The modern development and extension of canals and railroads called for a new class of *way*-leading structures; and the name *viaduct* has been applied to some of the more important of them. For canals this distinguishing name might be very proper, but canal-*bridges* are more commonly called *aqueducts*, by which they are confounded with the real AQUEDUCT (which see) or water-*conducting* structure; whereas the canal structure simply *bears* the water-*way*—*i. e.* the canal. For railroads, while the word *bridge* has always been applied to its ordinary, and even its extraordinary, *river*-crossing structures, the word *viaduct* has been somewhat capriciously used when a structure of considerable magnitude spans a deep ravine, or a great valley in which the river or stream is relatively insignificant; *e. g.* the Carrollton viaduct of the Baltimore and Ohio R. R. (Washington branch), the Portage viaduct on the Erie R. R., etc.

J. G. BARNARD.

Via'na, town of Portugal, province of Minho, on the Lima near its mouth in the Atlantic, is well built and carries on a considerable fishing business. Its harbor is defended by a citadel, but much silted up. P. 9000.

Viardot' (LOUIS), b. at Dijon, department of Côte-d'Or, France, July 31, 1800; studied law in Paris; engaged in journalism; was manager of the grand opera from 1838 to 1841; founded in the latter year the *Revue Indépendante* in connection with George Sand and Pierre Leroux, and visited most of the European capitals in company with his wife, the celebrated singer, Pauline Viardot-Garcia (b. in Paris July 18, 1821), a daughter of Manuel Garcia and a sister of Madame Malibran. Besides numerous translations from the Spanish and Russian, he published *Études sur l'Histoire des Institutions et de la Littérature en Espagne* (1835), *Histoire des Arabes et des Maures d'Espagne* (2 vols., 1850), *Les Merveilles de la Peinture* (1868, *seq.*), of which a part, *Wonders of Italian Art*, was translated into English in 1870.

Viareg'gio [*Viaregium*], town of Italy, province of Lucca, lying on the seashore N. W. of Pisa. A century ago Viareggio was a small, unhealthy hamlet, containing about 300 inhabitants; now it is one of the most salubrious and frequented bathing-places of the Peninsula. This change is due to the hydraulic operations of the celebrated engineer Zendrini, who drained the stagnant pools which had so long poisoned the air of the neighborhood, and soon after its advantages as a place for sea-bathing attracted attention. The accommodations for visitors are now excellent, and the

constant agitation of the water at this point on the coast is believed to add to the efficacy of the baths. The Ospizio Marino is a charitable establishment intended for poor children of scrofulous constitutions, and it receives and provides for from 400 to 500 every season. There is considerable activity in the docks of Viareggio, but the land here is said to advance on the sea at the rate of 6 feet annually from the deposits of the Arno, Serchio, and Magra. P. 11,371.

Viat'icum [Lat., "provision for a journey"], in the Roman Catholic Church, the Eucharist as administered to a dying person. If life be prolonged, the viaticum may be repeated from time to time, if so desired by the sick person, provided the mental faculties are preserved. In the early Church the term was applied both to baptism and the Lord's Supper.

Viat'ka, government of European Russia, bounded S. by Nizhnee-Novgorod, comprises an area of 53,193 sq. m., with 2,106,024 inhabitants. The eastern part is occupied by spurs of the Ural Mountains, and covered with extensive forests of fir, pine, and birch; in the other parts the surface is level. The soil is not very fertile, except in the southern part, and here agriculture is successfully carried on; rye, barley, oats, and potatoes are raised, and a fine breed of horses is reared. The manufactures comprise iron, glass, and cotton; timber is largely exported. In the largest part of the country the climate is too cold for fruit to ripen.

Viatka, town of European Russia, capital of the government of the same name, on the Viatka, has several educational institutions, extensive ironworks, distilleries, and tanneries, and carries on a very active trade in timber, iron, and corn. P. 19,885.

Viaz'ma, town of European Russia, government of Smolensk, at the entrance of the Bebra into the Viazma, an affluent of the Dnieper, has many educational institutions and an extensive trade, as it forms the entrepôt for goods shipped to Riga and St. Petersburg. Gingerbread and dried and preserved fruits are largely manufactured here, and exported to all parts of the country. P. 10,853.

Vi'borg, one of the oldest towns of Denmark, on a small lake nearly in the centre of Jutland, carries on some manufacturing industry on a small scale and has a lively general trade. P. 8722.

Vibra'tion, the reciprocating movement consequent upon the effort of a body, or of the parts of a body, disturbed from the position or figure of equilibrium, to recover that position or form again. Of the first kind of vibration a common pendulum affords the simplest example; of the second, a metallic spring fixed at one extremity and free at the other. When at rest, the pendulum or the spring is held in position by the equal action of opposing forces. When disturbed from this position, it acquires in returning to it a moment or living force which carries it as far beyond the point of equilibrium as the distance to which the original disturbance had removed it, after which its course is reversed and it retraces its path, returning as far to the side of the first disturbance again. This supposes the motion not to be in any manner resisted by the action of extraneous forces, in which case the reciprocating motion once established would continue for ever. But as such resistances are always present, the living force of the vibrating body is gradually absorbed by them, and the body finally assumes once more its original condition of rest.

The laws of vibratory motion lie at the foundation of the theories devised by modern science to account for the phenomena of acoustics and optics. Light and sound are supposed to be propagated through elastic media, of which the particles have to each other the same mechanical relations as if they possessed the property of mutual repulsion. These particles, in the condition of equilibrium, are assumed to be equidistant from each other; their absolute distances being very great compared with the magnitude of the particles themselves. If a slow movement be excited among these particles by the action of a foreign body, they will not sensibly alter their relative distances; but if any one particle or stratum of particles be driven toward those adjacent by a sudden impulse, then the intervening distance will be momentarily diminished, or there will occur a local compression of the medium at that place. The second particle, or stratum of particles, being therefore acted upon, on the side of the compression, by a greater repelling force than on the other, will be driven forward toward the third, which in its turn will be impelled toward the fourth, and so on indefinitely. A molecular movement is thus propagated throughout the medium. It is obvious that such a molecular disturbance can only be created by a body foreign to the medium, since in the nature of things it is impossible that an elastic fluid should unequally compress itself. Moreover, if the foreign body exerts but one impulse, and then remains at rest, only a single tremor will pass through the medium, and there will be no vibration. But if, after giving a forward impulse, the foreign body as suddenly recedes, the particle or stratum of particles in contact with it, being deprived of its support, will yield to the repulsive force on the opposite side, and the distance between the first and second particles or strata of particles will be diminished, or there will be a local dilatation at that place. The third particle or stratum will similarly move backward toward the second, the fourth toward the third, and so on, and a tremor by dilatation will pass through the medium. If such alternate impulses be persistently maintained, a vibratory movement will be imparted to all the particles of the medium to which their influence extends. But in order to this the foreign body which produces them must itself be in a state of vibration.

It is found experimentally in acoustics that the pitch of a sound depends on the number of vibrations of the sounding body accomplished in a unit of time, and that the intensity or loudness of a given sound depends not on the number, but upon the amplitude, of the vibration—that is, upon the space passed over by the vibrating body in each alternate movement. Also, that variation of intensity produces no effect upon pitch; whence it follows that the vibrations of bodies producing musical sounds are strictly isochronous, whether the amplitude of vibration be great or small. It is hence inferred that the forces acting upon the vibrating body must be always proportional to the distance of displacement from the position of equilibrium. For as velocity, when time is constant, is proportional to force, and as space traversed is proportional to velocity, the condition of invariability of time requires an increase of force proportional to the amplitude of vibration.

The following propositions are of importance in their applications to the theory of undulation. (See UNDULATORY THEORY.) If a circle be described with the amplitude of displacement as radius, the centre of the circle being assumed as the point of equilibrium and any diameter as the path of the vibrating body, then the velocity of this body at any point of this path will be proportional to the perpendicular to the path drawn from such point and intercepted by the circumference of the circle. In the figure annexed AEDB is such a circle, C is the centre and point of repose, AB is the path of vibration, and CA or CB the amplitude of displacement. Then at the points F, H, C, L, the perpendiculars EF, GH, DC, and KL are proportional to the velocities which actuate the body when at these points respectively. For, if we make C the origin of co-ordinates, and put CA = a, CH, CF, or CL = x, employing t to represent the time elapsed from the beginning of the movement, v for the velocity, and p^2 for the force urging the body when at a distance from C equal to unity, then dx, the small space moved over in the small time dt, will be equal to vdt; or we shall have

FIG. 1.

$$vdt = dx.$$

Also, if dv be the small increment (or decrement) of velocity in the time dt, we shall have this force, at the distance x, equal to p^2x, and hence, at that distance,

$$p^2xdt = -dv;$$

dv having necessarily a sign contrary to that of x, as the velocity is diminishing when x is increasing, and *vice versâ*. Whence we derive

$$vdv = -p^2xdx: \text{ and } v^2 = -p^2x^2 + C.$$

But when $v = 0$, $x = a$; consequently,

$$v^2 = p^2(a^2 - x^2); \text{ or } v = \pm p\sqrt{a^2 - x^2} = \text{(in the figure)}$$
$$\pm p.\sqrt{CA^2 - CH^2} = p.GH; \qquad (1)$$

which proves that the velocity is always proportional to the ordinate in the circle drawn from the momentary place of the body in its path.

If in the first equation above we substitute for v, we have

$$\pm p\sqrt{a^2 - x^2}.dt = dx; \text{ or } dt = \frac{dx}{\pm p\sqrt{a^2 - x^2}};$$

$$\text{and } t = \frac{1}{p}\sin^{-1}\frac{x}{a} + C.$$

$$\text{If } t = 0, x = a: \text{ whence } t = \frac{1}{p}(90^\circ - \sin^{-1}\frac{x}{a}) = \frac{1}{p}\cos^{-1}\frac{x}{a}. \quad (2)$$

Now, putting $t + t'$ for the time later than t at which another complete vibration shall have been accomplished, the arc expressed by $\cos^{-1}\frac{x}{a}$ will have been increased by one entire circumference, and the expression will become

$$t + t' = \frac{1}{p}(2\pi + \cos^{-1}\frac{x}{a});$$

from which, if the preceding equation be subtracted, member for member, there will remain, $t' = \frac{1}{p}2\pi$, a constant quantity; which being independent of a, the amplitude, verifies the assumption that the time of vibration for all amplitudes is the same.

The common pendulum furnishes a familiar illustration of the case under consideration. When the pendulum is drawn out of the vertical, the force which urges it to return is very nearly proportional to its distance from the point of rest. If the pendulum be made to vibrate in a cycloid, this condition is strictly fulfilled. Its beats are therefore sensibly equal in time, whatever the length of arc through which it swings.

The movements of the pendulum are usually restricted to a single plane. If we suppose a pendulum, however, to be so suspended as to be equally free to swing in any direction, we may conceive it be acted on simultaneously or successively by impulses differently directed. Let it, for example, after having been set in motion along the line AB (Fig. 2), and just as it is passing the central point C, receive a second equal impulse in the direction CD at right angles to the first. By the law of the composition of forces, it will take the diagonal direction CM, and its subsequent vibrations will be performed along the line NM. It will be seen that the extent of its excursions in the directions AB and DP remain unaltered, but the actual amplitude of its vibrations is considerably increased. Suppose the second impulse to have been applied, however, not at C, but at A, where the body is momentarily at rest, and just as it is about commencing its return movement toward C. Its excursions in the two rectangular directions AB and DP will still be limited by the parallels RM and NQ, as before, but it will touch RM at D, and not at M, and NQ at P, and not at N. Apparently, the path described by it under these circumstances is a circle; and this may be shown to be so in fact. Take, for instance, in Fig. 3, r to represent the radius vector of the body, and put x and y for the co-ordinates to the axes AB and DP respectively; we shall have

Fig. 2.

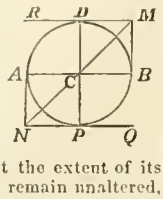
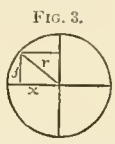


Fig. 3.



$$x^2 + y^2 = r^2; \text{ whence } xdx + ydy = rdr.$$

Now, by the law of velocities above given, if a represent the maximum velocity, and ϕ be the measure of the angular movement of the radius vector from the axis of reference AB, the velocity in the direction of this axis will be $= a \sin\phi$, and that in the direction of CD will be $a \sin(\phi + 90°) = -a\cos\phi$. It should be observed that as the revolution is here supposed to be in the direction opposite to that usually assumed in trigonometry, the cosines are essentially negative in the first and fourth quadrants, and essentially positive in the second and third. Then, putting t for time, we have

$$dx = a\sin\phi\, dt;\ dy = -a\cos\phi\, dt.$$

But, by construction, $x = r\cos\phi$, and $y = r\sin\phi$. Whence, by substitution,

$$ar\sin\phi\cos\phi\, dt - ar\sin\phi\cos\phi\, dt = rdr, \qquad (3)$$

or $\frac{dr}{dt} = 0$, and the radius vector is constant.

The orbit is therefore a circle. Moreover, the motion in the circle is uniform. For if $d\phi$ be the increment of the arc,

$$d\phi^2 = dx^2 + dy^2; \text{ or } d\phi^2 = a^2\sin^2\phi\, dt^2 + a^2\cos^2\phi\, dt^2 = a^2dt^2, \quad (4)$$

and $\frac{d\phi}{dt} = v = a.$

That is to say, the velocity in the circle will be uniform, and will be equal to the maximum velocity of the plane vibration. It hence follows that if, at the moment when a body vibrating in a rectilinear path leaves the limit of its excursion to return, a second body leaves the same point moving uniformly in the circumference of a circle described on the path of the first, and with a velocity equal to the maximum velocity of the first, the line joining these two bodies will move parallel to itself, and will always be perpendicular to the path of the plane vibration.

A convenient measure of the time after the beginning of vibration at which the body is at a given point of its path, as H, Fig. 1, may hence be deduced. The duration of a complete double vibration being taken as the unit of time, and the circumference of a circle whose radius is unity being represented by 2π, the entire space passed over by a body making its revolutions in such a circle isochronously with the movements of the vibrating body will be expressed by the product $2\pi t$; and t will then denote the entire number of vibrations, entire or fractional, which have taken place from the beginning. Every integral value of t will indicate the return of the body to its original position, and every fractional excess will express a corresponding progress in a new vibration. Thus, if, in Fig. 1, the movement be supposed to have commenced from A, AG will be the fractional part of $2\pi t$ when the body is at H, and this arc will have the same ratio to the entire circle which the time of describing AH has to the total time of double vibration.

If the second impulse, applied as last supposed, is greater or less than the first, the orbit of the vibrating body will not be circular, but elliptical, having for its axes the amplitudes a and a', corresponding to the two supposed impulses. The velocities in the direction of a will still be represented by $a\sin 2\pi t$; and those in the direction of a' by $a'\cos 2\pi t$; the ordinates of the orbit will be $x = a\cos 2\pi t$, and $y = a'\sin 2\pi t$.

In case the second impulse, still normal to the first, is not applied at the limit nor at the middle of its path, the velocity in the original direction at the moment of application will be $a\sin 2\pi t$, where the value of t is indeterminate. The velocity produced by the second impulse commences with the maximum—*i. e.* with the velocity belonging to the time $t = \frac{1}{4}$, and hence is $= a'\sin\frac{1}{2}\pi$, or $a'\sin 90°$. The difference of the two in respect to advancement in their respective vibrations—a difference called difference of phase—will therefore be $2\pi t - 90°$, or $90° - 2\pi t$, which difference put, for convenience, equal to θ. After a further time, t', the two velocities will be

1. $a\sin(2\pi t + 2\pi t') = a\sin(90° \pm \theta + 2\pi t') = a\cos(2\pi t' + \theta)$.
2. $a'\sin(90° + 2\pi t') = a'\cos 2\pi t'$.

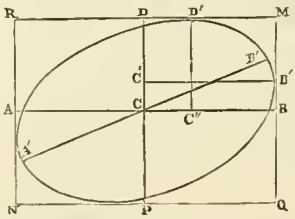
Hence, $x = a\sin(2\pi t' + \theta)$, and $y = a'\sin 2\pi t'$. And eliminating $2\pi t'$, there results the equation

$$a^2y^2 + a'^2x^2 - 2aa'xy\cos\theta = a^2a'^2\sin^2\theta; \qquad (5)$$

which is the equation of the ellipse referred to its centre. It follows that any two impulses applied at right angles to each other with any interval between them to a body susceptible of vibration, will cause the body to describe an elliptical orbit.

We may determine the axes of this ellipse, and their angular position with respect to the directions of the impulses a and a', by considering that if a rectangle be constructed (Fig. 4) upon those directions with the adjacent sides, RM, RN, equal to $2a$ and $2a'$ respectively, the curve must touch the opposite sides of this rectangle in points of which the co-ordinates are $C'B' = a$, $BB' = a'\sin\theta$, and $C''D' = a'$, $DD' = a\cos\theta$; as also in corresponding points with the same co-ordinates taken negatively. Moreover, a will be the perpendicular from the centre upon one of these tangents, and a' the perpendicular upon the other. Also, the semi-diameter parallel to the tangent on which a' falls, which is the distance of the body from the centre or position of repose at the moment of the second impulse, is evidently $= a\sin\theta$. Now, it is a property of the tangent that the rectangle of this diameter and perpendicular is equal to the rectangle of the axes. Hence, putting A and B to denote the semi-axes,

Fig. 4.



$$aa'\sin\theta = AB.$$

And from the necessary preservation of living force after impact, it is also true that

$$a^2 + a'^2 = A^2 + B^2.$$

From which we deduce

$$A = \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa'\sin\theta} + \sqrt{a^2 + a'^2 - 2aa'\sin\theta}\right); \text{ and}$$

$$B = \tfrac{1}{2}\left(\sqrt{a^2 + a'^2 + 2aa'\sin\theta} - \sqrt{a^2 + a'^2 - 2aa'\sin\theta}\right).$$

To find the angular position of A to a, or the relation of the resultant elliptic vibration in respect to phase to the original rectilinear vibration, we have, from the property of the ellipse (representing the inclination by ψ and taking a as the perpendicular upon the tangent),

$$a^2 = A^2\cos^2\psi + B^2\sin^2\psi.$$

Whence $\cos\psi = \pm\sqrt{\frac{a^2 - B^2}{A^2 - B^2}}$.

From which we infer that the elliptic revolution, assumed to commence at the extremity of the major axis, is virtually accelerated or retarded in its epoch by a time corresponding to ψ, according as the motion imparted by the second impulse is direct or retrograde, and according as the body

is advancing or returning, or is approaching or receding from the centre at the moment of application.

If the second impulse is in the same direction as the first, and is applied at the time t after the beginning, the velocity ($= a \sin 2\pi t$) will be increased by the maximum amount, a', which the second impulse is capable of separately imparting. If we then put A to represent the maximum velocity which, under the joint influence of these two forces, the body can receive, and assume,

$$a + a' \sin 2\pi t = A \cos \psi; \text{ and } a' \cos 2\pi t = A \sin \psi,$$

by multiplying the first of these equations by $\sin 2\pi t$, and the second by $\cos 2\pi t$, and adding member for member, we shall obtain

$$a'(\sin^2 2\pi t + \cos^2 2\pi t) + a \sin 2\pi t = A(\sin 2\pi t \cos \psi + \cos 2\pi t \sin \psi),$$

or,

$$a' + a \sin 2\pi t = A \sin (2\pi t + \psi). \qquad (6)$$

The first member of this equation shows the velocity assumed by the body at the moment of application of the second impulse, and the second member shows that this same velocity would have existed in the body at the same instant, had it been impelled by a force capable of producing the maximum velocity A, applied earlier than a by a time corresponding to ψ.

The foregoing conclusion is deducible by construction, as follows: Suppose (Fig. 5) the body under the original impulse $a = AC'$ to receive the additional impulse $a' = GG'$ at the point H corresponding to the time t. The velocity $a \sin 2\pi t$ proper to H, represented by GH, will be increased by $a' = GG'$, and will become $HG' = A \sin (2\pi t + \psi)$. The point of equilibrium, C, remains of course unaltered; hence, if CG' be joined, CG' is necessarily $= A$; whence it directly follows that

$$A \sin(2\pi t + \psi) = GG' + HG = a' + a \sin 2\pi t, \text{ as above.}$$

The values of $A \sin \psi$ and $A \cos \psi$ give the equation

$$A^2 = a^2 + a'^2 + 2aa' \sin 2\pi t; \text{ and}$$

$$A = \pm \sqrt{a^2 + a'^2 + 2aa' \sin 2\pi t}. \qquad (7)$$

If in these equations we substitute $\cos(2\pi t \pm 90°) = \cos \theta$ for $\sin 2\pi t$, they take a form analogous to those in the case foregoing—viz.

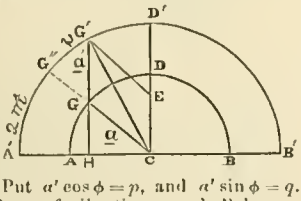
$$A^2 = a^2 + a'^2 + 2aa' \cos \theta; \text{ and}$$

$$A = \pm \sqrt{a^2 + a'^2 + 2aa' \cos \theta}. \qquad (8)$$

It thus appears that the resultant maximum velocity of the body under the influence of the two impulses is the diagonal of a parallelogram of which the sides represent the component forces a and a', and their inclination $= 90° - 2\pi t$. This parallelogram in the figure is CGG'E.

Should the second impulse be neither coincident in direction with the first, nor normal to it, it may be decomposed into two components, one reinforcing a, and the other at right angles to a. Thus, if in any plane passing through AB (Fig. 5) the force a' act upon the body at an inclination to $AB = \phi$, the components will be $a' \cos \phi$, coincident with a, and $a' \sin \phi$, normal to a. Put $a' \cos \phi = p$, and $a' \sin \phi = q$. Then in the original plane of vibration we shall have a resultant,

Fig. 5.



$$A = \pm \sqrt{a^2 + p^2 + 2ap \sin 2\pi t};$$

while the velocity in the moment after impact will be

$$a \sin 2\pi t + p = A \sin (2\pi t + \psi),$$

being that which would be produced by an impulse $= A$, applied earlier than t by a time corresponding to ψ. In equation (5), therefore, assume $\theta = 2\pi t + \psi - 90°$, or $90° - 2\pi t - \psi$, and substitute A for a, and q for a', and there will result the equation

$$A^2 y^2 + q^2 x^2 - 2Aq \cos \theta = A^2 q^2 \sin^2 \theta; \text{ or, restoring values,}$$

$$(a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t) y^2 + a'^2 \sin^2 \phi \, x^2 -$$

$$2\sqrt{a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t} . a' \sin \phi \sin (2\pi t + \psi) xy$$

$$= (a^2 + a'^2 \cos^2 \phi + 2aa' \cos \phi \sin 2\pi t) a'^2 \sin^2 \phi \cos^2 (2\pi t + \psi). \quad (9)$$

The orbit will be an ellipse of which the axes will be A and q, and the commencement of the revolution will be earlier than t by a time corresponding to ψ.

Vibrations of Stretched Strings.—When a cord firmly stretched between two fixed points is drawn aside at the middle from the position of rest, it is slightly elongated, and its molecules being more widely separated than in the condition of equilibrium endeavor to approach each other. Hence, when the cord is released, it returns to the position of rest, and in consequence of its inertia is carried beyond this position, and continues to vibrate until the resistance of the atmosphere and of its own rigidity brings it to rest once more. The number of vibrations performed by a stretched cord in a unit of time is dependent on the length, the tension or stretching weight, the thickness or diameter, and the density of the material.

(1) *As to Length.*—With a given tension, diameter, and density, the number of vibrations is inversely as the length. Thus, to double the number of vibrations per second, the cord must be taken half as long; to make the number threefold, one-third as long, and so on.

(2) *As to Tension.*—Other conditions remaining unaltered, the number of vibrations of a given cord is directly as the square root of the stretching weight, or the tensions are as the squares of the numbers of vibrations. That is, to triple the number of vibrations, the tension must be made nine-fold—to quadruple it, sixteen fold.

(3) *As to Diameter.*—Material, length, tension, and density remaining the same, the number of vibrations is inversely as the diameter of the cord. A cord of double diameter will make but half the number of vibrations.

(4) *As to Density.*—Other things being equal, the number of vibrations is inversely as the square root of the density. A cord of fourfold density will make half the number of vibrations.

These last two propositions may be included under the single one, that when length and tension remain the same, the number of vibrations is inversely as the square root of the weight, or of the weight of a unit of length.

Nodal Points.—If a stretched cord be stopped by touching with the finger at a point distant from its extremity by any aliquot part of its length, and an impulse be suddenly applied half way between the extremity and the stopped point, the line will vibrate in sections, each being of the same aliquot part of the entire length, while the intermediate points will remain at rest. The successive vibrations separated by these points are in opposite phases, and the points themselves, which are called nodal points, may be likened to pivots round which the vibrating sections turn. With a long cord (Fig. 6) the nodes and the intervening swells are very perceptible to the eye; and the difference of condition of the different parts of the cord is strikingly shown by placing paper riders at intervals along it. Those which rest upon the nodes will remain motionless, but those which fall upon the vibrating portions will either be thrown off or be hurried along to the nearest node.

Fig. 6.

By the skilful application of the bow with the use of stops, a cord may be made to vibrate in its whole length and in sections at the same time. It may be made also to vibrate simultaneously in larger and in smaller sections. The sound produced by a string so vibrating will be composed of several tones of different pitch.

Vibrations of Rods.—Elastic rods vibrate laterally like cords when fixed by their extremities. Owing to their rigidity, however, they may be made to vibrate when fixed only at one extremity or at some nodal point. When a rod fixed at one end forms nodes, the free extremity is the middle of a vibrating section, and the distance from this free extremity to the first node is only half such a section, or half the distance between the first and second nodes. Thus, in Fig. 7, a is the fixed and b the free extremity. The free end b is the middle of a swell, and the distance from b to the first node c is equal only to half the distance from c to c', the second node.

Fig. 7.

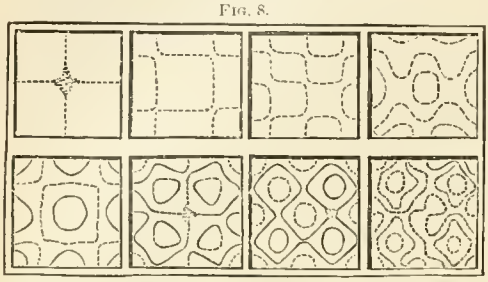
Both rods and stretched cords may be made to vibrate longitudinally by applying to them in the direction of their length an adhesive rubber. In rods or cords of the same material, the number of longitudinal vibrations is inversely as the length, and is unaffected by the area or form of the cross-section. Nodal points may be produced in longitudinal in like manner as in transverse vibration. Rods may also be made to vibrate by torsion: and in this case the number of vibrations per second is inversely as the length and directly as the thickness of the rods.

The paths described by the extremities of rods in vibration are often remarkably sinuous. An ingenious contrivance for observing them, employed by Prof. Wheatstone, consists in fixing to the extremity of the rod a polished bead which gives in a single point a bright reflection from a source of light. When the rod vibrates, the path described by this point, owing to the persistence of visual impressions upon the eye, appears as a brilliant curve more or less complicated, which is the resultant of the transverse vibrations of different lengths occurring simultaneously in the same rod.

Vibrations of Plates.—Elastic plates are easily made to vibrate, but their vibrations are seldom simple. They vibrate usually in segements, bounded and separated from each other by lines of repose, which lines are called nodal

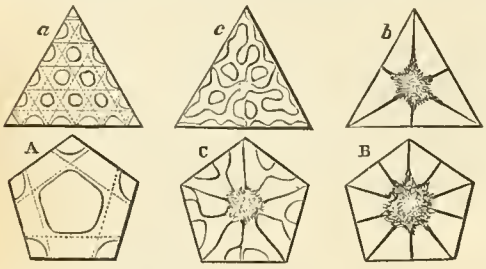
lines. The number and form of the vibrating sections are determined by the figure of the plate, the manner in which it is secured or "stopped," and the points of application of the exciting force. The plate is most conveniently excited by drawing the bow of a violoncello across its edge. The points which are firmly held by the immovable supports of the plate, and those whose movements are interfered with by stops, cannot, of course, participate in the vibration, and the segments must form themselves in reference to these. In order that the plate may vibrate freely, the stops must be placed so that lines drawn through them parallel to the principal linear dimensions or co-ordinate axes of the plate may be divided by them into parts having a simple numerical ratio to each other; and the exciting force must be applied at a point of the perimeter which is midway between two nodal lines. By varying the positions of the stops and the points of application of the exciting force, the nodal lines of any plate may be made to assume a great variety of configurations, and by employing plates of different forms this variety may be largely increased. These configurations become visible when the plate is lightly strewn with fine sand, the particles of which are driven by the vibration from the parts of the plate in motion and settle on the lines of repose. It is a curious fact that if a very light powder, like lycopodium,

Fig. 8.



be employed instead of sand, it will collect at the centres of the vibrating segments, and not on the nodal lines,—a paradoxical phenomenon which Mr. Faraday explained by showing it to be caused by the slight atmospheric currents produced by the vibration, which currents tend toward these

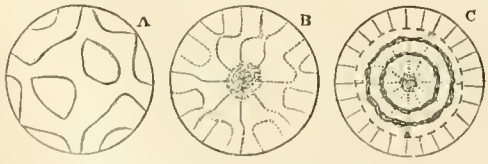
Fig. 9.



centres. In a vacuum the effect does not occur, all powders, whether light or heavy, going to the nodal lines.

The figures formed by the nodal lines are called acoustic figures. They are often so intricate as to be difficult of accurate delineation by the draftsman; on which account Savart, by whom they were first studied, made actual transfers of them to paper by pressing down upon the plate a

Fig. 10.



gummed surface to which the powder adhered. Photography, however, furnishes at the present time a much more expeditious as well as more effectual mode of making these copies. Figs. 8, 9, and 10 are examples.

When on superposing upon each other two acoustic figures formed by different modes of vibration of the same plate, the nodal lines are observed to have points of intersection; then by strewing the plate with sand, and causing it to vibrate successively in these two modes, it will be found, after a few alternations, that the sand will be chiefly accumulated upon these points of intersection, which may therefore be properly called nodal points.

The vibrations of plates obey the following laws: (1) When similarly secured and stopped, the number of vibrations performed by a plate in a unit of time is directly as the thickness of the plate. (2) In circular plates, or plates of regular geometrical figure capable of being circumscribed about a circle, the number is inversely as the square of the diameter. (3) In elongated plates the number is inversely as the square of the length, and is independent of the breadth.

Vibrations of Membranes.—As a plate may be regarded as a system of rods adhering to each other throughout their length, so any thin and flexible substance stretched upon a frame may be likened to a similar system of cords. Every such membrane has its own proper mode of vibration, which depends principally upon its tension, since the weight and thickness are small, but somewhat upon these also. It is easy to excite vibration in such a membrane by passing through it a thread knotted at one end and secured at the other to a steel diapason or tuning-fork, of which the mode of vibration is in harmony with it, fixed upon a stand. The thread being stretched, the membrane will be thrown into vibration whenever the fork is excited, and the acoustic figures formed by it will be shown, as in the case of plates, by loose sand. The thread may be attached at any point which is midway between the nodal lines of these acoustic figures.

Sympathetic Vibrations.—When a vibrating plate is brought near and parallel to a similar plate at rest, so supported as to be free to take on the same mode of vibration, it will excite vibration in the latter without contact, and the fact will be made evident by the appearance of acoustic figures. This is called vibration by sympathy. It is caused by the atmospheric pulsations which, excited by the vibrating plate, strike on the plate at rest at intervals coinciding with the period of its natural vibration, and in the parts where, when in vibration, it naturally tends to move. The energy of each of these impacts is very slight, but their number is very great, and as they so succeed in time as to reinforce each other, they produce presently a very sensible effect. If, however, the natural vibrations of the plate acted upon are not isochronous with those of the other, the successive impulses will be as often in conflict as in coincidence with its movements, and it will remain sensibly at rest.

A membrane so lightly stretched upon its frame as to have no decided tendency to vibrate in a given time, will respond by sympathy to vibrations in other bodies of any description. On this principle is constructed an instrument called the *phonautograph*, designed to make a graphic record, upon a properly-prepared surface, of the aërial vibrations produced by the human voice. The pulsations are concentrated by a large hollow paraboloid open at the apex, but closed by a membrane, the middle point of which is connected with a tracer. The prepared surface upon which the tracer rests is carried by a slowly-revolving cylinder, and the record is an irregularly sinuous line produced by the varying character of the vibration. This instrument is more fully described under Acoustics (which see).

Composition of Vibratory Motions.—Dr. Rudolph Kœnig of Paris has devised an ingenious mode of showing the path of a point affected by two vibrations, equal or unequal, at the same time. Two diapasons, or tuning-forks, with long and flexible limbs, are employed for this purpose, to a limb of one of which is attached a narrow plate of glass blackened with smoke, while a limb of the other carries a tracer resting on the glass. Both diapasons being excited, the one of them which carries the tracer is moved steadily in the direction of the length of the prepared plate, and the trace exhibits the resultant effect of the vibration. By varying the conditions of the experiment as to the relative directions and times of the component vibrations, a great variety of very curious and complicated curves may be produced.

In 1855, Prof. Lissajous of Paris communicated to the French Academy of Sciences an optical method of investigating the effects of compound vibrations which possesses considerable interest. It will be understood by supposing a small mirror to be attached to one limb of a fixed diapason in a dark room, into which a ray of sunlight is admitted through a small aperture. The ray is received upon the mirror and reflected upon a white screen, being passed first through a convex lens of long focus to give the image sharpness. When the diapason is excited, the slight vibratory movement of the mirror will be greatly magnified in the image on the screen; and, owing to the persistency of the impressions of vision, the point will be apparently transformed into a straight line. But if the reflecting ray be intercepted by a second mirror attached to another diapason, and both be put into vibration, the image, being received on a suitably-placed screen as before, will describe a path assuming a great variety of forms, according as the positions of the diapasons, and the times, amplitudes,

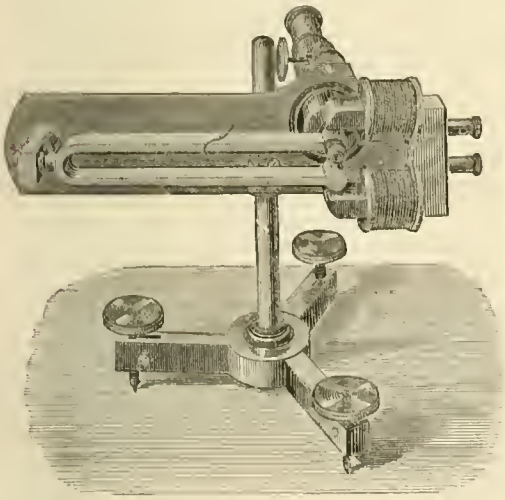
and respective initial phases of their vibrations are different. If the axes of the diapasons are parallel, the times and amplitudes equal, and the phases identical, the path will be a straight line of double the length of that produced by a single reflection; but if, the conditions remaining in other respects the same, the phases are opposite, the resultant is as if both diapasons were at rest, or is, in other words, a point merely. If the axes are at right angles, the resultant is a straight line inclined at an angle of 45° to the directions of the component vibrations. In this case, other conditions remaining unchanged, if one phase is one-fourth advanced on the other, the result will be a circle, or, if the amplitudes of vibration are unequal, an ellipse. With equal amplitudes and times, all relations of phase except that of one-quarter difference, and those of perfect identity or complete opposition, will give elliptical figures. When the times are different, the figures become complicated, and more so in proportion as the ratios of the

Fig. 11.

times are expressible in less and less simple numbers. Fig. 11 represents some of the figures obtained with two diapasons whose times are as 3 to 4, corresponding with the musical interval of a fourth. The first of these appears when the initial difference of phase is zero; the succeeding ones correspond to differences equal to the fractions $\frac{1}{24}$, $\frac{1}{12}$, $\frac{1}{8}$, and $\frac{1}{6}$ of the larger vibration, the shorter vibration beginning when the longer is advanced by such fraction of its length.

In order to study the vibrations of bodies to which mirrors cannot be attached—as, for example, of stretched strings—Prof. Lissajous made use of an ingenious apparatus which he called his comparator. This, which is represented in Fig. 12, consists of a diapason, to one limb of which is attached the object-glass of a compound micro-

Fig. 12.



scope, the body of the microscope being detached and supported by an independent stand. If the diapason be caused to vibrate, the image of any minute fixed object will seem to vibrate similarly, its motion being magnified by all the power of the instrument. But if the small object observed have itself a vibratory motion, its apparent path will be the resultant of the two vibrations, and figures will be produced resembling those above given, from the analysis of which the character of the vibration of the object observed may be deduced. When the vibrating body is a string, or other object without conspicuous points suitable to be used in the comparison, it is necessary in some manner to mark it. In order to avoid loading the body or altering its condition by adding coloring-matters, Mr. Lissajous, in the case of strings, employed a cylindrical lens to throw a sharp line of light across the object, thus creating a brilliant point which moves with the string without affecting its mode of vibration.

In order to maintain the vibration of the diapason for an indefinite length of time, without being under the necessity of exciting it mechanically, Mr. Lissajous introduced an electro-magnet to act intermittently on one of the limbs, the circuit being alternately closed and broken by an interrupter carried by the limb itself. The manner of making electric connection with the limb is shown in the figure, but the interrupter, which is a short bent wire attached to the end of the limb, does not appear. This expedient of Mr. Lissajous has since been made of extensive usefulness in arrangements of acoustic apparatus. (For the connection of vibration with undulation see Acoustics and Undulatory Theory of Light.)

F. A. P. Barnard.

Vib'rio [Lat., pln., *Vibriones*], a genus and a family (Vibrionidæ) of Infusoria having spindle-shaped bodies. Familiar examples are the so called *eels* of vinegar and paste. Some few kinds, like the cockle, which devours wheat (*Vibrio tritici*), attain the length of one-fourth of an inch, but others are microscopical. Vibriones are reported to have been found in unhealthy pus and in various diseased tissues (as in erysipelas), but whether as an essential element of disease is not settled. It is believed that "hay-fever" or autumnal asthma is caused by vibriones in the nostrils. (*Helmholtz.*)

Vi'broscope, an instrument designed to enable an observer to make direct observation of the movements of a vibrating body. Mr. Wesselhoft of Riga in Russia has constructed an instrument of this kind, which he calls a universal vibroscope, as it is equally adapted to the observation of bodies of every description and under all circumstances. This instrument is founded upon the principle of the well-known optical toy called the phenakistoscope; that is to say, the essential part of it is a rotating disk, perforated near the circumference with equidistant sight holes. Suppose, for instance, that an observer, with this disk before his eyes, directs his attention to a singing flame or a vibrating rod. If the duration of the vibration is just equal to the interval between the passages of the successive sight-holes before the eye, the aspect of the flame or of the rod will be unchanged. Thus, if the rod happen to be caught at the point of extreme flexure on one side of the mean position, it will appear to be a permanently bent rod; and if the flame should be on the point of extinction when first seen, it will seem to be a steadily faint flame. But such an exact coincidence of intervals could hardly occur. The object will therefore be seen at its successive reappearances in as many successive conditions; and owing to the persistence of impressions upon the eye it will not have been consciously lost sight of at all. The vibration, therefore, which is really rapid, will appear to be a motion comparatively deliberate, and the form of the path may be easily inferred. As it is necessary to give to the disk a high velocity of rotation, it should be made of light material. The inventor constructed it of aluminium blackened. Card-board in many cases would answer equally well. Some magnifying power is desirable. This is furnished by a small telescope mounted on an independent stand, and brought close to the revolving disk on the side opposite to the observer's eye. This instrument may serve as a means of determining the *rapidity* of vibration of the body observed. To this end it should be provided with a contrivance for regulating the velocity of rotation according to circumstances, and should have a register of its actual velocity during the time it is used for observation.

F. A. P. Barnard.

Viburnum. See Caprifoliaceæ.

Vic'ar [Lat. *vicarius*], in the Anglican Church, a clergyman who is the incumbent of a parish under a *rector*, the latter being the person who owns the great or rectorial titles, while to the vicar pertain the lesser tithes. A vicar is superior in rank to a curate, but in French parishes the *curé* is superior in rank to the *vicaire*. The latter usage of the terms was formerly prevalent in England.

Vicar-Apostolic, a person in episcopal orders, usually of some see *in partibus infidelium*, who holds from the pope episcopal authority over a district known as a vicariate-apostolic, usually an inchoate, new, and temporary, or a disordered and suppressed diocese. Missionary dioceses are usually vicariates-apostolic, and as such must report to the College of the Propaganda. In 1838 the difficulties between the king of Portugal and the pope with regard to the East Indian bishoprics led to the abolition of nearly all of them, and the substitution of vicariates-apostolic. So also the Scottish sees, suppressed by law, are represented by vicariates.

Vicar-Capitular, the administrator of a diocese, chosen by the chapter in case of a vacancy. He can perform acts for the government of the diocese, but has no episcopal authority.

Vicar-Forane [*vicarius foraneus*, "vicar out of doors"], the delegate of a bishop who exercises certain episcopal rights in a part only of the diocese. (See Vicar-General.) Not all dioceses possess such officers.

Vicar-General, an officer under a bishop, who as the representative of his superior exercises authority in all

parts of the diocese. Not all dioceses have a vicar-general, though many have two or more.

Vic'ars (JOHN), b. at London, England, in 1582; educated at Christ's Hospital, London, and Queen's College, Oxford; was for much of his life usher of Christ's Hospital, a Presbyterian preacher, and a violent writer on religious and political subjects. D. in 1652. Author of *Jehova Jireh, God in the Mount; or, England's Remembrancer* (1611), *God's Arke overtopping the World's Waves* (1646), and *The Burning Bush not Consumed* (1646), which were published together under the title of *Magnalia Dei Anglicani, or England's Parliamentary Chronicle* (1646), a curious book on *Prodigies and Apparitions* (1643), *England's Worthies* (1647), and other works.

Vic'chio, town of Italy, province of Florence, is composed of several fractions, the principal of which occupies a hill on the left bank of the Sieve, has its castle, and is surrounded by a wall. It became a part of the Florentine republic in 1324. P. 10,316.

Vice-Admiral, the second in rank of the officers in the U. S. navy, which has only one vice-admiral. The office was created in 1864. The vice-admiral's pay at sea is $9000 per annum, on shore duty, $8000, and while waiting orders, $6000. The British navy had in 1873, 15 active vice-admirals, besides 84 on the retired list. The old distinction into vice-admirals of the red, the white, and the blue has been abolished. (See ADMIRAL.)

Vice-Consul, in the U. S. service, an officer subordinate to a consul, is sometimes appointed to assist a consul or to perform a consul's duties in his absence, or, more frequently, to perform consular duties at ports of subordinate importance. Vice-consuls are appointed by the President or the secretary of state, and derive their pay from the consul under whom they serve.

Vicente (GIL). See GIL VICENTE.

Vicen'za, an ancient town in the province of the same name, in Northern Italy, on the torrent Bacchiglione and near Monti Berico. Vicenza is best known abroad for its palaces constructed by Palladio, which, though condemned by critics and now somewhat fallen into decay, are still justly admired for their proportions and the symmetry of their different members and decorations. The cathedral has pictures and terra-cottas, and is of fifteenth-century Gothic. San Lorenzo is a fine Gothic edifice lately restored. La Santa Corona, also Gothic, has a fine *Baptism in the Jordan* by G. Bellini, and other good paintings, as also remarkable sepulchral monuments. Besides the palaces erected by Palladio—the most conspicuous of which are the Barbarano, the Chieniceati, Del Conte Porto, Colleoni Porto, and Orazio Porto, and the Teatró Olimpico—the houses of Palladio and Pigafatta, which latter, however, is perhaps by another architect, are very noticeable. There are several of similar style by Scamozzi, and some after the older Venetian manner. There is a good collection of pictures in the magnificent Pinacoteca Civica which contains works by Van Eyck, Antonella da Messina, Titian, Luini, and John Bellini. The sanctuary on Monte Berico is approached by an arcade of 168 arches, contains some good pictures, and is much resorted to for its extensive and beautiful view, which embraces a wide range of Alpine peak and fertile plain. At the foot of Monte Berico is the stripped and mutilated villa of Palladio, once one of the most splendid monuments of modern architectural art, and still retaining its fine proportions and most important features. Vicenza has a tasteful cemetery with some remarkable tombs. Vicenza is well provided with educational institutions. P. 37,686.

Vicenza, DUKE OF. See CAULAINCOURT, DE.

Vice-President, an officer of the U. S. government, chosen at the same time and in the same manner as the President. His only official duty is to act as president of the Senate. In case of a failure of the electors to choose a Vice-President, a majority of the votes of the Senators (a quorum of two-thirds being present) will elect him; or if there be no majority, he is chosen from the two candidates who have received the highest number of Senatorial votes. In case of a vacancy in the Presidency he becomes President of the U. S. As president of the Senate he has a casting vote in case of a tie. His salary is $8000 per annum.

Vich, or **Vique,** town of Spain, province of Barcelona, at the foot of the Pyrenees, has cotton and flax weaving factories, tanneries, potteries, and manufactures of combs, knives, and hats; its sausages are famous. P. 13,712.

Vichy', in Central France, department of Allier, on the Allier, is beautifully situated, nine hours by rail from Paris, and is celebrated for its hot mineral springs and elegant bathing establishments. The principal ingredients of the water are carbonate of soda and carbonic acid gas. The great celebrity of the place is somewhat recent. P. about 6028.

Vicks'burg, p.-v., Kalamazoo co., Mich., at the junction of Grand Rapids and Indiana and Chicago and Lake Huron R. Rs., 12 miles S. of Kalamazoo, has 2 churches, a union school, 1 newspaper, 4 hotels, and several mills. It is located in the centre of a rich farming section. P. about 1200. J. D. VAN BUREN, ED. "UNION."

Vicksburg, city and cap. of Warren co., Miss., on Mississippi River, midway between Memphis and New Orleans. It has a regular line of packets plying the Mississippi River to St. Louis, a weekly packet to Memphis, a tri-weekly mail line to New Orleans, and a large fleet of boats plying on the tributaries. Vicksburg and Meridian R. R. has its western terminus here, and Vicksburg and Shreveport R. R. its eastern terminus on the opposite side of the river. It is the first city in size and importance in the State of Mississippi, and the second port of importance on the Mississippi River between St. Louis and New Orleans. Vicksburg is built on a range of hills that skirts the Yazoo and Mississippi Valley from Memphis, and touches the river-bank here. It is therefore the outlet for the products of the Mississippi delta and the fertile valleys of the Yazoo, Sunflower, and tributary streams. The leading staple is cotton, and the commerce of the city depends mainly upon the success of the cotton-crop. Vicksburg has a merchants' and cotton exchange, 2 banks, 3 saw-mills, 2 window-sash and door factories, a cotton-seed oil-mill which ships a large amount of cotton-seed oil, oil-meal, and oil-cake to Europe, a shoe-factory, iron-foundry, carriage-factories, and 1 daily and 2 weekly newspapers. A short distance beyond the city limits is the national cemetery, in which are interred 17,000 Union soldiers, and between the cemetery and the city is a stone-quarry giving employment to 150 or 200 men. The "Anchor line" of St. Louis and Vicksburg packets, the New Orleans and Vicksburg mail line, and the "Parisot line" of Yazoo River steamers have their termini here. The city has a volunteer fire department, well equipped. There are 7 churches attended by white people, and 6 attended by colored people with colored pastors. Vicksburg was situated on the E. bank of the river, with a long, narrow neck of land forming a sort of peninsula opposite the city. During the siege of Vicksburg in 1863, Gen. Grant attempted to divert the channel of the river through the peninsula about 3 miles below the city, but failed. On Wednesday, April 26, 1876, the peninsula, which had been gradually wearing away for years, had narrowed to 153 feet width, and at 2.10 P. M. on that day the water broke through, forming a cut-off directly opposite the city; so that Vicksburg is now upon a lake with an island in front. P. 12,443. JAMES H. SULLIVAN, ED. "DAILY HERALD."

Vicksburg, Siege of. Early in the war the strategic importance of Vicksburg as the key to the southern Mississippi Valley was comprehended, and measures taken for its fortification, a battery having been planted there immediately after the passage of the Mississippi ordinance of secession in Jan., 1861. By the capture of New Orleans (Apr., 1862) and the previous successes of the flotilla under Com. Foote, Vicksburg remained the only fortified point on the river held by the Confederate forces, and they were rapidly strengthened. A demonstration was made by the appearance of some vessels from Farragut's fleet May 8, but hostilities were not commenced until June 28, when Gen. Williams with four regiments and eight field-pieces occupied the peninsula opposite Vicksburg, and began the work of cutting a canal across the neck of the peninsula, so as to change the course of the river and leave Vicksburg inland. The forces in that town were gradually increased to about 34,000, under Gen. John C. Pemberton, and in the autumn Gens. Grant and Sherman approached with an army of some 40,000 men. By direction of Gen. Grant an attempt was begun by Gen. Sherman (Dec. 25) to penetrate to the rear of Vicksburg through the Yazoo swamps, but they proved impassable, and the plan was abandoned Jan. 1, 1863. After some skirmishing, which involved an aggregate Union loss of nearly 2000 men, Sherman was superseded by McClernand (Jan. 4), and Gen. Grant, with all his forces, moved against Vicksburg. Several vain attempts were made to gain a passage by water to the S., but after two canals had proved failures, and an attack by Porter's gunboats upon Grand Gulf had been repulsed, Gen. Grant, with the main body of his army, marched from Bruinsburg inland upon Jackson, captured that place May 14, defeated Pemberton on the Big Black River May 16–18, and crossed that stream on floating bridges May 18, on which date the formal siege of Vicksburg may be considered to have begun. Gen. Sherman had meanwhile made feints from Milliken's Bend, and Pemberton soon abandoned his outside intrenchments on Haines's Bluff and con-

centrated within the city. Gen. J. E. Johnston, his superior in command, wrote to him to abandon the place as untenable and march to the N. E.; but Pemberton replied that it was neither possible nor desirable to withdraw, and solicited reinforcements. Grant made an experimental assault upon Pemberton's lines May 19, and, being repulsed, settled down to a regular siege. His forces were gradually increased to 70,000 men, while Pemberton had but 25,000 effective men, was deficient in ammunition, and had rations for only sixty days. The investment continued with an almost constant bombardment until July 3, when, having no hope of relief, Pemberton invited an interview with Grant, and surrendered the city upon honorable terms, which took effect the following day (July 4, 1863), which, being also the day of the final battle of Gettysburg, is justly considered the decisive crisis of the war. The prisoners numbered 27,000, the total previous loss of the Confederates being reckoned at 10,000, and the total Union loss 8575.

PORTER C. BLISS.

Vi'co (GIOVANNI BATTISTA), b. at Naples in 1668; was educated by the Jesuits; studied law; lived for several years in the house of the bishop of Ischia as tutor to one of his nephews; was afterward appointed professor of rhetoric at Naples, and in 1735 royal historiographer. D. at Naples Jan. 20, 1744. His great work, *Principj di una Scienza Nuova d'Interno alla Comune Natura delle Nazioni*, which is the first attempt to create a philosophy of history, appeared at Naples in 1725, and in enlarged editions in 1730 and 1745. It represents Divine Providence as the governing power in the history of mankind, and demonstrates the formation, development, and decay of nations as realizations of ideas pre-existing in the Divine Mind. It is often obscure, but it is as often bold and striking, anticipating the results of later researches; and it exercised great influence when, in the beginning of this century, it became thoroughly known in Europe, introduced in Germany by Weber, in France by Michelet. Complete editions of his works were given in 1818 by Villa Rosa, and in 1834 by Ferrari.

Vi'co, de (FRANCESCO), b. at Macerata, Naples, May 19, 1805; was educated in the Jesuit college of Urbino, and was appointed assistant superintendent in 1835, and director in 1839, of the observatory of Rome; discovered several comets, and acquired celebrity by his observations of the rings of Saturn and the spots of Venus; was expelled with the other Jesuits from Rome in 1848; was chosen to take charge of a new observatory to be established in New York, but d. in London Nov. 15, 1848.

Vi'co del Garga'no, town of Southern Italy, province of Foggia, at the foot of Monte Gargano and surrounded by charming hills. The pasturage of the district is excellent and the olive thrives luxuriantly. P. 7813.

Vi'co Equen'se [*Vicus Æquensis*], town of Southern Italy, province of Castellamare, about 4 miles S. W. of the town of Castellamare, on a rocky cliff which overlooks the Bay of Naples and commands magnificent views of Vesuvius, of the city of Naples, of the neighboring islands, etc. It was built by Charles of Anjou about 1300, and was afterward a favorite resort of the Aragonese princes, but the numerous remains of ancient constructions found near it prove that it was the seat of a dense Roman population. Vico Equense is remarkable for its superior wines and rich fruits; excellent fish abound on the coast. P. 11,208.

Vicopisa'no [formerly *Vico Auserissola*], town of Italy, province of Pisa, on a spur of Monte Pisano, is composed of several fractions, the largest of which is still walled, though the towers are demolished. This town belonged, for the most part, to Pisa from about 1100 till 1496, when it became the head-quarters of the emperor Maximilian I., and soon after this the commonwealth of Florence obtained permanent possession of it. The mineral waters of the neighborhood have considerable reputation. P. 7965.

Vicq d'Azyr' (FÉLIX), b. at Valognes, department of Manche, France, Apr. 28, 1748; studied medicine at Paris; began to lecture there on physiology in 1773; became perpetual secretary of the Royal Medical Society in 1776, and first physician to Marie Antoinette in 1789. D. in Paris June 20, 1794. He wrote—*La Médecine des Bêtes à Corne* (2 vols., 1781), *Système anatomique des Quadrupèdes, Système anatomique* (6 vols., 1791 *seq.*). A collected edition of his works was published by Moreau in 1805.

Vic'tor, tp., De Kalb co., Ill. P. 926.

Victor, p.-v., Iowa co., Ia., on Chicago, Rock Island and Pacific R. R., contains several churches, excellent schools, 1 weekly newspaper, 2 elevators, 2 lumber-yards, 1 banking-house, and 2 hotels. It is surrounded by fine farming lands. P. about 700. MRS. H. M. CLAPP, ED. "INDEX."

Victor, p.-v. and tp., Clinton co., Mich. P. 940.

Victor, p.-v. and tp., Wright co., Minn. P. 596.

Victor, p.-v. and tp., Ontario co., N. Y., on the Syracuse and Rochester branch of New York Central R. R., has a private bank. P. of v. 506; of tp. 2137.

Vic'tor Amade'us, the name of three sovereigns of the house of Savoy, of whom the first bore the title of duke of Savoy, the two latter that of king of Sardinia. VICTOR AMADEUS I., b. in 1617, succeeded his father, Charles Emmanuel the Great, as duke of Savoy in 1630; was forced by Richelieu into an alliance with France against Austria and Spain; gained the victories of Pornavento and Montebaldone, but d. at Vercelli shortly after, Oct. 7, 1637.—VICTOR AMADEUS II., b. May 14, 1666, a grandson of the preceding, succeeded his father, Charles Emmanuel II., in 1675, and married in 1684 Anne Marie of Orleans, a niece of Louis XIV. Nevertheless, he allied himself with Austria, and although Catinat overran both Savoy and Piedmont after the battle of Marsaglia (Oct. 4, 1693), in which the duke lost 10,000 men, he still kept up the contest, and compelled Louis XIV. to buy him off by returning to him all his possessions and paying a handsome sum of money. After the peace his eldest daughter was married to the duke of Burgundy, by whom she became mother to Louis XV., and the younger to Philip of Anjou, soon after king of Spain. Nevertheless, in the Spanish war of succession the duke allied himself again with Austria. His country was the scene alternately of the exploits of EUGENE and VENDÔME (which see), but by the Peace of Utrecht (1713) he received Sicily and the title of king. In 1720 he exchanged Sicily for Sardinia, and on Sept. 2, 1730, abdicated. Next year he made an attempt to regain the royal power, but was imprisoned at the château of Moncalieri, where he d. Oct. 31, 1732.—VICTOR AMADEUS III., b. in 1727, a grandson of the preceding, succeeded his father, Charles Emmanuel III., in 1773; declared war against the French republic, but was compelled by Scherer and Bonaparte to accept the Peace of Paris (1796), by which he lost Savoy and Nice. D. in the same year.

Victor (AURELIUS). See AURELIUS VICTOR.

Victor (CLAUDE), duke of Belluno, b. at Lamarche, department of Vosges, France, Dec. 7, 1764; entered the army in 1781; was created a brigadier-general in 1795, general of division in 1797, marshal and duke after the battle of Friedland; commanded in Spain from 1809 to 1812, where he gained the victories of Uclés and Médellin, but was defeated at Talavera; fought with distinction in the Russian and German campaigns 1812–14; adhered to the Bourbons during the Hundred Days, and became afterward conspicuous on account of his harshness toward those generals who returned to Napoleon; was minister of war from 1821 to 1823; accompanied in the latter year the French army to Spain as commander under the duke of Angoulême, but was recalled on account of frauds in the administration of which he could not have been ignorant; was appointed minister to Vienna, but not accepted by that court, and lived afterward in retirement. D. at Paris Mar. 1, 1841.

Victor (ORVILLE JAMES), b. at Sandusky, O.; was editor of the Sandusky *Daily Register* 1852–56, of the *Cosmopolitan Art Journal* 1857–61, and of Beadle's "Dime" publications (1860–64), for which he wrote biographies of Garibaldi, Winfield Scott, Anthony Wayne, and John Paul Jones; contributed to magazines and to political papers in New York City, and was author of *Incidents and Anecdotes of the War* (1863), *History of American Conspiracies* (1864), and of a *History, Civil, Political, and Military, of the Southern Rebellion* (New York, vol. i., 1862; vol. ii., 1863; vols. iii. and iv., 1868).—In 1856 he married MISS METTA VICTORIA FULLER (b. at Erie, Pa., Mar. 2, 1831), a lady who became in 1847 a favorite contributor of poems to the *Home Journal*, has edited several periodicals, and published several volumes of poems, sketches, and novelettes. Among her books were *The Senator's Son, a Plea for the Maine Law* (1853), *The Two Mormon Wives* (1857), and *Miss Slimmens' Window, and other Papers* (1860).

Vic'tor Emman'uel I., king of Sardinia (1802–21), b. July 24, 1759, the second son of Victor Amadeus III.; ascended the throne on the abdication of his brother, Charles Emmanuel IV., June 4, 1802, and resided at Cagliari till 1814, his possessions on the mainland being occupied by the French. By the Congress of Vienna not only his hereditary lands were restored to him, but the duchy of Genoa was added to his dominions; but the reactionary measures he introduced caused a violent revolution, and he abdicated Mar. 13, 1821. D. at Moncalieri Jan. 10, 1824.

Victor Emmanuel II., king of Sardinia from 1849, and king of Italy from 1861, b. at Turin Mar. 14, 1820, the eldest son of Charles Albert; received an excellent education, both scientific and military; married (Apr. 12, 1842) Archduchess Adelheid of Austria; commanded the Savoy brigade in the campaigns against Austria in 1848–49, and

distinguished himself by his brilliant personal valor in the battles of Goito and Novara. On the very evening of the disastrous battle of Novara (Mar. 23, 1849) Charles Albert abdicated in favor of his son, and Victor Emmanuel ascended the throne under very critical circumstances. Peace had to be bought of Austria with great pecuniary sacrifices, and in the interior the state was divided into many contending political factions. The young king himself was as yet by no means popular. As the husband of an Austrian princess and a pupil of the Jesuits he had to earn the confidence of his subjects. Nevertheless, from the very first day of his reign the policy which he adopted, and which he invariably pursued, though at times it led him into very queer combinations, tended toward the establishment of the national unity of Italy and the elevation of the Italian people through free institutions. Supported by his celebrated minister Cavour, he succeeded in restoring the finances to order, reorganized the army, concluded commercial treaties with foreign powers, limited the privileges of the clergy, secularized the Church property, and established a new system of popular education independent of the control of the Church. The pope excommunicated him, but the thunderbolt proved cold, and the effect was simply that all intelligent men in Italy began to look on him as the coming liberator, the more so that he with great boldness gave all political refugees from the other Italian states an asylum in his dominions. By his participation in the Crimean war he made the kingdom of Sardinia a noticeable and noted part of the political system of Europe, and finally, in 1859, he was able to renew the contest with Austria by the aid of France. By the Treaty of Villafranca (July 11) and the Peace of Zurich (Nov. 10, 1859) Lombardy was added to his dominions. The aid of France he had to pay for by ceding Savoy and Nice; but at the same time Parma, Modena, Tuscany, and parts of the Papal States annexed themselves to Sardinia; and soon after, the campaign of Garibaldi in Sicily and Naples produced the same result with respect to the whole southern part of Italy. On Mar. 17, 1861, Victor Emmanuel assumed the title of king of Italy, and early in 1865 the royal residence was removed from Turin to Florence. Meanwhile, the situation continued to be very difficult. Venetia and Rome were still wanting, and their great success had at once made the Italian people very impatient and the relation to other powers, even to France, very delicate. As France was not likely to further support the Italian movement, Victor Emmanuel sought and found a new ally in Prussia; and although the Italians lost the battle of Custozza (June 24, 1866), by the Peace of Vienna (in October) Austria ceded Venetia; and when, during the Franco-German war, the French garrison was withdrawn from Rome, the city annexed itself by a popular vote to Italy, and on July 2, 1871, Victor Emmanuel entered the city and took up his residence in the Quirinal Palace. By his first wife, who died Jan. 20, 1855, he has two sons—Humbert, the crown prince, and Amadeus, for a time king of Spain; and two daughters—Clotilde, married to Prince Napoleon, and Pia, married to the king of Portugal. He married, morganatically, Rosa Vercellana, countess of Montefiore. D. at Rome, Italy, Jan. 9, 1878.

Victoria, city of HONG-KONG (which see).

Victoria, a British colony in Australia, formerly called **Australia Felix,** occupies the south-eastern part of the continent, comprises an area of 88,451 sq. m., and extends between lat. 34° and 39° S., and between lon. 140° and 150° E. The extent of its coast-line is nearly 600 miles. The principal harbor is Port Philip Bay, an inland sea of an extreme length of over 30 geographical miles from N. to S., and of about 35 geographical miles from E. to W. The entrance is about 2 miles across. Western Port is also of importance. The country is traversed throughout its whole length by a chain of hills completely dividing it into two parts, and thence called the Dividing Range. This range runs in an E. and W. direction, generally at a distance of 60 or 70 miles from the coast. The streams to the N. of it run toward the Murray, those to the S. of it toward the sea. There are also other ranges extending in different parts of the country, many of which are offshoots of the main chain. The highest peaks are the Bogong Range, 6508 feet; Cobberas, 6025; Cope, 6015; Feathertop, 6303; Hotham, 6100. The rivers are for the most part of inconsiderable size; many of them are liable to be partially dried up during the summer. With the exception of the Yarra, on the banks of which the metropolis, Melbourne, is situated, the Goulburn, which empties itself into the Murray about 8 miles to the eastward of Echuca, and the Murray itself, with perhaps some of the Gippsland streams, not one of them is navigable except by boats. As, however, they drain the watershed of large areas of country, they will ultimately be made feeders to permanent reservoirs for the purposes of irrigation, gold-washing, and manufactures. Of the numerous lakes which the country contains, and of which several are craters of extinct volcanoes, Lake Corangamite is the largest, and covers 76 sq. m. It is salt. Lake Colac covers 10 sq. m., Lake Burrumbeet 8½. The climate equals that of the most beautiful European countries; Melbourne has many of the advantages of Lisbon. The soil is fertile, offers excellent fields, meadows, pastures, and forests, and is rich in metals, especially in gold: 1,220,879 ounces were found in 1873; 1,155,972 in 1874. Since the discovery of gold in June, 1851, 44,414,177 ounces, worth £177,656,708, have been produced. Silver, copper, antimony, coal, iron, slate, etc., also abound.

Population.—The natives, whose number at the time when the first settlement was made comprised about 5000, have now become nearly extinct; there were 2693 in 1851, 1553 in 1875. The number of settlers amounted in 1851 to 77,345; in 1861, to 540,322; on Apr. 2, 1871, to 731,528. In 1874 the population was estimated at 808,437—namely, 439,159 males and 369,278 females. It increased in 1871 25,846; in 1872, 18,282; in 1873, 19,765; in 1874, 17,945. The excess of immigration over emigration amounted in 1871 to 8382, in 1872 to 1752, in 1873 to 3166, in 1874 to 3367. According to the census of 1871, 329,597 of the population were born in the colony, 28,669 in other parts of Australia, 164,287 in England, 52,210 in Scotland, 100,468 in Ireland, 1170 in France, 8995 in Germany, 6206 in other European countries, 2423 in the U. S. of America, 17,875 in China. With respect to creed, 257,835 belonged to the Church of England, 112,983 were Presbyterians, 170,620 Roman Catholics, 17,650 pagans. The number of houses returned in 1871 was 158,481, of which 6997 were unoccupied and 866 in course of construction; 33,461 were of brick or stone, 101,635 of wood or iron, and 21,155 were canvas tents. Melbourne, including the suburbs, comprised 206,780 inhabitants; Ballarat, 47,201; Sandhurst, 28,577; Geelong, 15,026. In all, there were 458 cities, towns, boroughs, and townships.

Occupations.—The principal occupations are agriculture and cattle-breeding. The land consists of—land alienated in fee-simple, 9,932,633 acres; land in process of alienation under deferred payments, 5,650,395 acres; roads, 779,157 acres; lands included in cities, towns, etc., 231,040 acres; reserves in connection with pastoral occupation, about 350,000 acres; auriferous lands, about 1,000,000 acres; state forests not included in unavailable mountain-ranges, 215,000 acres; timber reserves, 306,976 acres; unavailable mountain-ranges, lakes, lagoons, etc., about 23,000,000 acres. Area available for selection at the end of 1874, 14,981,419 acres. From the first settlement to the end of 1874 the amount realized by the sale of land has been £16,786,146, at the rate of £1 13*s.* 10*d.* per acre. The amount realized for lands sold during the year 1874 was £579,051, or an average of £1 1*s.* 9*d.* per acre.

Land under Principal Crops in 1865, 1870, and 1875.

Crops.	1865. Acres.	1870. Acres.	1875. Acres.
Wheat	125,040	288,514	332,936
Oats	144,303	144,791	114,921
Barley	7,648	28,115	29,505
Potatoes	31,172	41,216	35,183
Hay	85,146	140,435	119,031
Green forage	40,061	102,530	254,329

Gross Produce of Principal Crops in 1865, 1870, and 1875.

Crops.	1865.	1870.	1875.
Wheat, bushels	1,899,378	5,697,056	4,850,165
Oats, "	2,694,445	3,761,408	2,121,612
Barley, "	124,849	6,912,248	619,896
Potatoes, tons	59,828	127,645	124,310
Hay, "	97,731	224,816	157,261

Flax, hops, maize, mangel-wurzel, onions, peas, beans, millet, beets, carrots, parsnips, cabbage, rye, rye-grass for seed, tobacco, and vines were also cultivated, and 11,083 acres were occupied by gardens in 1874–75; 6317 by orchards. The value of wheat produced amounted in the same year to £1,071,078; of oats, £450,842; barley, £139,476; other cereals, £80,381; potatoes, £553,179; other green crops, £132,405; hay, £699,811; green forage, £762,987; wine, £115,498; garden and orchard produce, £348,000. Of live-stock there were—horses, 180,254; cattle, milch cows, 241,137, others, 717,521; sheep, 11,221,036; pigs, 137,941. The total value of pastoral produce was £9,840,562, of which that of milk and butter was £2,352,750; meat, £2,500,000; excess of exports over imports of wool, customs value, £4,347,199.

Industry.—There were 28,036 persons engaged in various kinds of manufacturing industry in 1874–75. The value of lands, buildings, machinery, etc., employed amounted to £6,798,820. There were 2109 manufacturing establishments—producing books and stationery, musical instruments, machines, tools, and implements, carriages and harness,

ships and boats, furniture, chemicals, textile fabrics, dress, fibrous materials, animal food, vegetable food, beverages and stimulants, coals, stone, clay, earthenware and glass, water, metals, etc. About 60,000 persons were engaged in gold-mining in 1874, and the value of the produce amounted to £4,659,341. The value of the produce of other metals and minerals amounted to £190,476.

Commerce.—The external commerce is very considerable. The discovery of gold in 1851 gave it at once a vigorous impulse.

	Value of exports.	Imports.
1851	£1,422,909	£1,056,437
1853	11,061,544	15,842,637
1861	13,828,606	13,532,452
1871	14,557,820	12,341,995
1874	15,441,109	16,953,985

The principal items of export are—apparel and ready-made clothing, gold, leather, live-stock, preserved provisions, specie (gold), sugar, tallow, tea, tobacco, wool. This last article is the most important of them all; its value amounted in 1874 to £6,373,676. The principal items of import are cotton, gold, grain of all kinds, hosiery, iron and steel, live-stock, spirits, sugar and molasses, wool, and woollens. According to value, nearly one-half of the imports is set down as the produce of the manufactures of the United Kingdom, and more than one-third of other British possessions. The navigation returns showed for 1874—entrances, 2100 vessels of 777,110 tons burden; clearances, 2122 vessels of 792,509 tons burden. Nearly three-fifths of the tonnage are colonial; about one-third is English. Of foreign vessels, 38 from the U. S. of America entered and 41 cleared; 23 from France entered and 26 cleared; 14 from Germany entered and 16 cleared. Of railways there were 457¼ miles in operation in 1874: between Melbourne and Sandhurst and Echuca; between Melbourne and Geelong and Ballarat, the Williamstown branch (6 miles) and the Melbourne and North-eastern road (187 miles); all of which are government lines. Of private lines there are only 17 miles, between Melbourne and Sandridge, St. Kilda, Windsor, Brighton, and Hawthorn. The postal department had in 1874, 802 stations, carried 15,738,888 letters, 6,866,918 newspapers, 1,269,822 packets, and had an income of £194,339, and an expenditure of £288,574. The telegraph had 148 stations and 4461 miles of wire, carried 701,080 despatches, and had an income of £42,825. The government of the colony consists of a governor and a council. According to the constitution of Nov. 23, 1855, the legislative council or upper house consists of 30, and the legislative assembly or lower house of 60 members, elected by the people. The financial returns for 1874 showed a revenue of £4,106,790, an expenditure of £4,177,388, and a public debt of £12,485,432. There were in that year 11 banks, with £8,503,033 paid-up capital, £20,456,852 assets, £11,105,160 liabilities; 157 saving banks, with 64,014 depositors and £1,617,301 in amount of balances. There were 2415 churches and chapels, 1721 schools, and 238,592 scholars. Melbourne has a university. Of charitable institutions, there were 32 general hospitals, 1 lying-in hospital, 1 blind asylum, 1 deaf and dumb asylum, 1 eye and ear hospital, 1 children's hospital, 5 benevolent asylums, etc.

History.—Capt. Cook was the first European who entered the country, Apr. 19, 1770. On Jan. 18, 1788, Capt. Philip landed at Botany Bay in order to establish a penal colony, but selected Port Jackson for the purpose Jan. 15, 1802. Port Philip Bay was discovered by Lieut. John Murray, and in 1803, Lieut.-Col. Collins founded a colony here. The place, however, was soon after given up on account of lack of good water, and for about twenty years this part of Australia lay forgotten. In 1824 the harbor of Geelong was discovered, and a settlement was attempted at Western Port, but also given up; a permanent settlement, however, was made in this year at Portland Bay. It was not until 1835 that John Batman founded a colony at Port Philip from Van Diemen's Land. More than half a million of acres were bought from the natives for a trifle, but the governor of New South Wales afterward declared the bargain invalid, and the land had to be bought again from the English crown. In 1839 the colony numbered 6000 inhabitants; in 1850 the population had increased to 76,000, and the colony had 52,000 acres of land under cultivation, 6,000,000 sheep, and 380,000 cattle; it was then separated from New South Wales and made independent. Shortly after, gold was discovered, and immediately the immigration increased immensely. AUGUST NIEMANN.

Victoria, town of Brazil, capital of the province of Espiritu Santo, on the bay of Espiritu Santo, has a good harbor and some coasting-trade. The vicinity produces much sugar. P. 5000.

Victoria, city, port of entry, and capital of British Columbia, at the S. E. extremity of Vancouver's Island, on the Strait of Fuca, in lat. 48° 27′ N., lon. 123° 25′ W., is beautifully situated and tolerably well built, having water and gas works, 2 banks, 2 daily and 2 weekly newspapers, 5 churches, a hospital, a theatre, an iron foundry, a shipyard, 2 lumber yards, 2 distilleries, and 1 breweries; has handsome buildings for the government, including Cary Castle, the residence of the governor; has a public park and a race course; is a free port, with considerable commerce and fortnightly lines of steamers to New Westminster, Olympia, and San Francisco. The harbor is shallow, and large vessels can only ascend to Esquimalt, 3 miles distant, where the British naval station is located. The climate is very severe in winter. The earliest establishment here was a trading fort of the Hudson's Bay Company (1843); it became the capital of the new colony of Vancouver's Island 1859, rose into importance on the discovery of gold in Columbia, and on the annexation to that colony in 1866 became its capital. It has been visited (Sept., 1876) by the earl of Dufferin, governor general of Canada. P. in 1871, 4540.

Victoria, county of New Brunswick, bounded W. by Maine and N. W. by the province of Quebec, Canada. It is traversed by the river St. John, and is in great part a dense forest. P. 11,641.

Victoria, county of Cape Breton Island, province of Nova Scotia, Dominion of Canada. On the E. it is bounded by the Atlantic Ocean and by the Bras d'Or. Much of it is very fertile. Cap. Baddeck. P. 11,346.

Victoria, county of the central part of Ontario, Canada. Its N. portion is a wilderness, but the S. is fertile. The lumber interest is important. The county is traversed by Midland Railway and by various streams and chains of lakes navigable for steamboats. Cap. Lindsay. P. 30,200.

Victoria, county of S. Texas, intersected by Guadalupe River; surface low and level, soil fertile and well adapted for stock-raising. Herds of cattle and horses are very numerous. Staples, Indian corn, wool, and a little cotton. Cap. Victoria. Area, 925 sq. m. P. 4860.

Victoria, tp., Jefferson co., Ark. P. 1263.

Victoria, p.-v. and tp., Knox co., Ill. P. 1190.

Victoria, p.-v., cap. of Victoria co., Tex., has a private bank. P. 2534.

Victoria Alexandrina, queen of Great Britain and Ireland and empress of India, b. at Kensington Palace, London, May 24, 1819, only child of Edward, duke of Kent, fourth son of George III., and of his wife, Victoria Mary Louisa, daughter of the duke of Saxe-Coburg-Saalfeld, and sister of Leopold, king of the Belgians. Her father having died Jan. 23, 1820, she was educated under the care of her mother and of the duchess of Northumberland; became heiress-presumptive to the crown on the accession of William IV. in 1830, and on his death without issue (June 20, 1837) assumed the throne of Great Britain and Ireland, that of Hanover falling by the Salic law to her uncle, the duke of Cumberland. She was crowned in Westminster Abbey June 28, 1838; was directed in politics by Lord Melbourne, the head of a Whig administration, an eminent statesman, to whom she was personally and politically much attached; was married at St. James's Palace to her cousin, Prince Albert of Saxe-Coburg-Gotha, Feb. 10, 1840; has enjoyed a reign of peace and prosperity unexampled in the annals of England under the successive administrations of Sir Robert Peel (1841–46), Lord John Russell (1846–52), Earl Derby (1852, 1858–59, and 1866–68), Earl Aberdeen (1852–55), Lord Palmerston (1855–58 and 1859–65), Earl Russell (1865–66), Mr. Benjamin Disraeli (1868), Mr. W. E. Gladstone (1868–74), and Mr. Disraeli (now (1876) earl of Beaconsfield) again from 1874. The principal events of her reign have been the repeal of the corn laws (1845), the Irish famine and emigration to the U. S. (1847), the Chartist agitation (1848), the Crimean war (1853–55), the Indian mutiny (1857–58), the assumption of the direct government of India (1859), the "cotton famine" and the delicate relations with the American belligerents (1861–65), the Mexican intervention and its rupture (1861–62), the Reform bill of 1866, the confederation of British America, the disestablishment of the Irish Church, the abolition of religious tests at the universities and of the system of purchase in the army, the Alabama Claims Treaty (1871), the introduction of the ballot, the Abyssinian and Ashantee wars, the assumption of the title of empress of India (1876), and the creation, rapid growth, and organization of the colonies of Australia and New Zealand. In the autumn of 1876 the agitation upon the massacres in Bulgaria presaged important action upon the "Eastern question." The loss of her mother (Mar. 16) and of her husband, Prince Albert (Dec. 14, 1861), within a few months, affected her with such profound grief that,

although performing all the duties of sovereignty, she did not appear in public, as before, for nearly fifteen years, having spent much of the intervening time at her favorite residence, Balmoral Castle, in the Highlands of Scotland. She has had nine children, all of whom are living (1877), and by whom she has above twenty grandchildren. Queen Victoria is beloved for her admirable personal qualities, and has given evidence of literary culture by the publication of *Leaves from the Journal of Our Life in the Highlands* (1868), and by supervising two biographical sketches of Prince Albert, *The Early Days of his Royal Highness, the Prince-Consort* (1867), by Gen. C. Grey, and *The Life of the Prince-Consort* (1874), by Theodore Martin. The "Victorian period" bids fair to be chiefly remarkable for the material prosperity of the British people, and for the magnificent scientific discoveries which have changed the face of modern civilization. PORTER C. BLISS.

Victoria Bridge, in Canada. See BRIDGE, by GEN. J. G. BARNARD, A. M., LL.D.

Victoria Falls. See ZAMBESI.

Victoria Land. See ANTARCTIC OCEAN.

Victoria Nyanza. See NYANZA, by JUDGE C. P. DALY, LL.D.

Victoria Regia, a great water-lily of the rivers of tropical South America. It has huge floating circular leaves, often six feet across, and large and very fragrant flowers, white without and rose-colored within. The starchy seeds are eaten by the natives. It is successfully grown in green-houses.

Vic'tory, p.-v. and tp., Mason co., Mich. P. 314.

Victory, p.-v. and tp., Cayuga co., N. Y. P. of v. 170; of tp. 898.

Victory, p.-v. and tp., Essex co., Vt. P. 263.

Victory Mills, p.-v., Saratoga tp., Saratoga co., N. Y. P. 870.

Vicu'ña, or **Vicugna,** the *Auchenia vicunna* (family Camelidæ), an extremely wild and active animal of the Andes, considerably smaller than the llama, and somewhat smaller than the alpaca. It is considered untamable. Its fine hair is even more valuable than that of the alpaca. It is obtained by hunting and killing the animal. Great numbers are annually slaughtered.

Vi'da (MARCO GIROLAMO), b. at Cremona, Italy, about 1485; studied theology at Padua and Bologna; became canon of St. John Lateran in Rome; acquired great fame by his Latin poems, and was made bishop in 1532 of Alba, where he d. Sept. 27, 1566. Of his epics, the *Christias*, in 6 books, is the most remarkable; of his didactic poems, his *De Arte Poetica*, both translated into English; his poem, *Scacchiæ Ludus*, was translated by Goldsmith.

Vida'lia, p.-v., cap. of Concordia parish, La.

Vidar. See ÆSIR.

Vidaur'ri (SANTIAGO), b. in the present state of Nuevo Leon, Mexico, about 1803; received a good education; became a lawyer; filled many minor offices; took part in several civil wars, in which he rose to the rank of general; became about 1853 governor of Nuevo Leon, to which he forcibly annexed (1856) the state of Coahuila; exercised for some years a species of dictatorship over the northern states of Mexico, where he was more than once suspected of intending to found the independent "republic of Sierra Madre;" aided in the campaign for the overthrow of Santa Anna 1854–55, though without political combination with Alvarez and Comonfort, his "plan" being distinct from that of Ayutla; was a candidate for the presidency at the junta of Cuernavaca Oct., 1855. He did not recognize the government of Comonfort until Nov., 1856; held the northern states against Zuloaga and Miramon during the "war of reform" 1857–60, and took part in the war against French intervention 1862–64, but was induced to recognize the "empire" of Maximilian, of whom he ultimately became a cabinet minister; was captured at the fall of the City of Mexico, and shot there as a traitor Aug. 8, 1867.

Vid'ius, or **Vidus** (GUIDO GUINI), b. at Florence about 1500; was body-physician to Francis I., afterward to Cosmo de' Medici, and finally professor of medicine at the University of Pisa, where he d. May 26, 1569. He gave his name to the Vidian nerve, and wrote largely on hygienic, therapeutic, and anatomical topics. His works were collected and published in 3 vols. at Venice in 1614.

Vidocq' (EUGÈNE FRANÇOIS), b. at Arras, department of Pas de Calais, France, July 23, 1775; began life with a series of dissipations and crimes, which compelled him to flee from his home in disgrace; entered the army, but deserted to the Austrians; left them too, and served for some time as a French spy, but deserted once more; was caught at Arras and condemned to death, but was saved by a friend and by marrying the sister of the Terrorist Lebon, whom, however, he immediately left; entered once more the army, but was convicted of fraud and forgery, and condemned to the galleys; escaped after six years' imprisonment from the bagnio of Brest, and was employed in 1808 by the secret police of Paris; was made chief of the *brigade de sureté*, consisting of convicts and other notorious characters acting as spies, and fully pardoned in 1818; left the service of the police in 1828, and settled at St. Mondé, near Paris, as a paper manufacturer; failed in business, and opened a *bureau de renseignement* in Paris for the recovery of stolen goods, but came into conflict with the police, and was compelled to close his office; lived afterward in obscurity and poverty, and d. in Paris May 10, 1857. His *Mémoires* (4 vols., 1828; translated into English in the same year) are not without interest, but their contents are considered unreliable, and even their authorship is doubted. Several other works which appeared under his name are not by him.

Viel-Castel', de (LOUIS), BARON, b. Oct. 14, 1800; entered the French diplomatic service in 1818; was sent to Madrid in 1821 as secretary of legation, and removed in 1828 to Vienna in the same quality; returned in 1829 to Paris, where he held various positions in the office of the ministry of foreign affairs till the *coup d'état*, when he retired into private life. Besides a number of articles for the *Revue des Deux Mondes*, he has written a *Histoire de la Restauration*, of which 17 vols. have appeared (1860–76).—His elder brother, HORACE, COUNT DE VIEL-CASTEL, b. in 1797; d. Oct. 1, 1864, wrote romances, and published a *Collection de Costumes, Armes et Meubles* (3 vols., 1826), and several volumes of documents relating to the history of Marie Antoinette and the Reign of Terror.

Vie'lé (EGBERT L.), b. at Waterford, N. Y., June 17, 1825; graduated at the U. S. Military Academy July 1, 1847, when commissioned brevet second lieutenant of infantry, and ordered to the seat of war in Mexico, serving at the capital 1847–48; in campaign against Indians 1848–52. Resigned June 1, 1853, to enter upon the profession of civil engineering; was State engineer of New Jersey 1854–56; chief engineer of Central Park, New York, 1856–57; served in the civil war (1861–64) as captain of engineers 7th New York militia Aug., 1861, in which month appointed brigadier-general U. S. volunteers, and engaged in the Port Royal expedition, siege and capture of Fort Pulaski, Ga., capture of Norfolk, Va., and military governor of that city 1862–63. Resigned Oct., 1863, and resumed his profession at New York. Author of *Hand-Book of Active Service*, and various professional papers and reports on railways, water-supply, sewerage, etc.

Vien (JOSEPH MARIE), b. at Montpellier, France, June 18, 1716; studied painting; went in 1740 to Paris, in 1744 to Rome; returned in 1750 to Paris, where he formed a school in which he educated many celebrated pupils, among whom was David; made director of the French school of art in Rome in 1775, and of the Academy of Paris in 1781; was created a count by Louis XVI. and a senator by Napoleon I., and d. in Paris Mar. 27, 1807. His most celebrated pictures are—*Hector and Paris, Hector and Andromache, Briseïs in the Tent of Achilles, The Hermit,* and *St. Denis preaching to the Gauls.*

Vien'na [Ger. *Wien*], capital of Austria, with 1,020,770 inhabitants Apr. 15, 1875, is beautifully situated on the right bank of the Danube, traversed by the river Wien and an arm of the Danube, the Donaukanal. An immense engineering undertaking by which the course of the Danube was regulated was finished in 1875, and the stream now passes by the city in a new straight bed. Vienna is one of the most beautiful and interesting cities in Europe, and it has improved wonderfully of late by the construction of magnificent squares, streets, and buildings. In the period from 1866 to 1876 there have been erected a greater number of buildings of architectural consequence in Vienna than were ever erected in an equal space of time in any other city in the world, with perhaps the exception of Rome. The city is divided into ten wards—the Innere Stadt, or city proper, Leopoldstadt, Landstrasse, Wieden, Margarethen, Mariahilf, Neubau, Josephstadt, Alsergrund, and Favoriten. The Ring, the liveliest and most brilliant part of the city, consists of a series of broad streets planted with trees, surrounding, almost encircling, the Innere Stadt, and leading through numerous large and beautiful open places: it occupies the site of the former fortifications. To the N. W. the Donaukanal, with the Franz-Joseph quay, forms the boundary of the Innere Stadt, and connects the two ends of the Ring. On the Ring are situated the most important public squares of Vienna. First, the great place to the S. E. of the imperial palace, traversed by the Burgring, and consisting of various minor parts, which together form a magnificent whole. Next to the palace extends the Aussere

Burgplatz, with the palace-gate and the colossal equestrian statues of Archduke Charles and Prince Eugene. It communicates on the one side with the palace gardens, on the other with the city garden, and in front with the Museumsplatz, not yet finished, but to be surrounded by the buildings of the museum. Another magnificent public square, as yet called the Paradeplatz, is in process of construction close by, and will be formed by four monumental buildings—the parliament-house by Hansen, the city hall by Schmidt, the university by Ferstl, and the new Burgtheatre by Semper. The Stadt-park, a lovely and much frequented garden, is situated on the Parkring. Noteworthy among the other public squares are Stephansplatz, Hoher Markt, Neuer Markt, Am Hof, Franzens Platz, and Josephs Platz in the Innere Stadt, and in the other districts, Rudolfs Platz, Schwarzenberg Platz, Obstmarkt, the garden of the Belvedere, etc. The most remarkable streets, besides the Ring, are—Kärnthnerstrasse, Graben, Singerstrasse, Herrengasse, Wollzeile, and Rothenthurmstrasse, all in the Innere Stadt. Generally, the principal streets which traverse the exterior wards issue from the Innere Stadt as from a centre. The most important bridges crossing the Wien and the Donaukanal are the Aspernbrücke, Ferdinandsbrücke, Carls Kettensteg, Brigittabrücke, Franzensbrücke, Sophienbrücke, and Elizabethbrücke. The edifices are generally remarkable for their solidity, and many of them also for the purity of their style. Even the tenement houses which have been erected on mere speculation show often a peculiar character which distinguishes them favorably from similar constructions in other cities. Numerous palaces belonging to the Austrian and Hungarian nobility or to rich burghers, and interesting partly by their age and art-collections, partly by their splendid modern architecture, adorn the city. The largest and most remarkable among them is the Burg, the residence of the emperor, erected at different times and in different styles. The principal part of the whole construction consists of four buildings—the Schweitzerhof, erected by Duke Leopold VII.; the Leopoldshof, finished in 1670; the Amalienhof, built by the emperor Rudolf II.; and the imperial chancellery, erected under Charles VI. after plans by Fischer von Erlach, and with an imposing entrance-gate, in front of which stand four colossal Hercules groups by Matthielli. These four buildings enclose the inner palace-court, called Franzensplatz, and connect with numerous other buildings—the Burgtheatre, erected in 1760; the riding-school, the stables, the ball-rooms, the magnificent imperial library, the zoological museum, etc. The imperial library contains over 300,000 volumes and about 20,000 manuscripts, among which many are very rare and interesting, and with it is connected a collection of about 300,000 engravings. The palace also contains a museum of natural history, a collection of minerals, a chamber of treasures, the richest and most interesting in Europe, and excellent collections of coins and antiquities. The most prominent among the other palaces are those of Archduke Albrecht, Prince August of Saxony, Prince Kinsky, Lobkowitz, Montenuovo, Count Harrach, Pallavicini, Hardegg, Schönborn, Schickh, Wimpfen, Czernin, Archduchess Elizabeth, the princess of Ligne, the countess of Erdödy, Archduke Wilhelm, Archduke Louis Victor, the prince of Würtemburg, Prince Schwarzenberg, Auersperg, Lichtenstein, Metternich, the duke of Modena, Prince Esterhazy, Dietrichstein, Schönburg, Sulkowski, etc. Several of these palaces were erected in the period of the rococo style, but are very graceful and elegant. Two palaces of that time, the Belvedere and the palace of Prince Lichtenstein, contain magnificent picture-galleries. The Belvedere was built in 1720 by Prince Eugene of Savoy, and consists of two palaces—the upper and lower Belvedere—between which stretches a large garden laid out in Italian style and adorned with numerous sphinxes of stone. The upper palace contains on the first floor pictures by Italian and Dutch, on the second by German, artists. The lower palace contains a collection of antiquities, the Egyptian museum, and the so-called Ambraser Museum, the most celebrated collection of armor and curiosities. Other remarkable edifices are—the opera-house, finished in 1869 by Siccardburg and Van der Nüll; the Heinrichshof, situated opposite the opera-house on the Operaring, a most original structure by Hansen, destined only for a tenement-house, but having its whole upper part gilded and covered with frescoes; the palaces of the ministries of foreign affairs, commerce, war, finance, and police; the Academy of Science; the Academy of Art; the Conservatory; the Polytechnic School; the Mercantile Academy; the building of the Horticultural Association; the Veterinary Institute, and the Austrian Museum. The last-mentioned building, erected in Renaissance style after plans by Ferstl, is especially interesting as an exhibition of Austrian manufactures. Furthermore, the city-hall; the Academy of Fine Arts, containing important collections, among which is a valuable picture-gallery; the Theresien Academy, with a large, beautiful garden; the Bank and Exchange, in Florentine style by Ferstl, the mint; the immense barracks on the Stubenring, etc. The arsenal is an immense establishment, forming a square 700 mètres long and 420 broad, and comprising a gun-factory, a cannon foundry, several barracks, etc., and a museum of arms, a magnificent structure in rich Byzantine style, by Hansen, and containing many interesting trophies. The general hospital has 3000 beds, and is the largest institution of the kind in Europe. Of the churches, St. Stephan's cathedral, situated in the centre of the Innere Stadt, is the most interesting, built in Gothic style from 1300 to 1510, in the form of a Latin cross, 108 mètres long and with a tower 136 mètres high. It has beautiful chapels and choirs, celebrated sculptures, a magnificent pulpit, the work of Meister Pilgram (1512), many sarcophagi, and 34 subterranean vaults filled with bones. The Augustine church is the parish church of the court, and contains a celebrated monument by Canova; the heart of the deceased members of the imperial family are preserved here in the Loretto chapel, erected in 1627; the church itself was built in 1339 and rebuilt in 1783. The church of St. Michael, begun in 1220 and rebuilt in the beginning of the fifteenth century, has valuable pictures. The church of St. Marie in Schnee, also called the church of the Minorites, was finished in 1330, and has a beautiful Gothic portal and a monument to Metastasio by Loccardi. The church of Marie Stiegen, belonging to the best period of the Gothic style, was restored in 1820, and has a tower 57 mètres high and ending in a calyx, a beautiful high altar, and good glass-paintings and sculptures. The parish church of St. Peter, built after the model of St. Peter's church in Rome in the beginning of the eighteenth century, by Fischer von Erlach, has a splendid portal and beautiful pictures. The church of St. Ruprecht is very small, but it is the oldest church of Vienna, and is said to have been built in the eighth century. The university church is a richly ornamented basilica, finished in 1631, and containing frescoes and altar-pieces by Pozzo. The church of the Capuchins, finished in 1632, contains the vault in which all the members of the imperial house have been interred since the emperor Matthias; the coffins of Maria Theresa and Francis I. are especially magnificent. The Innere Stadt contains, in all, 20 churches, besides chapels. The other parts of the city contain 35 large churches, of which the most important is the Carls church in Wieden, built under Charles VI. by Fischer von Erlach in Italian rococo style, with a high dome and a portal resting on six Corinthian columns and ornamented in the frontispiece with an interesting relief representing the effects of the plague. Remarkable are the two columns, 44 mètres high, inlaid with spiral reliefs representing the exploits of Cardinal Charles Borromeus, and terminating in two belfries. Very beautiful also is the Altlerchenfelder church, finished in 1853, after the plans by Müller, in mediæval Italian style, with an octagonal dome and magnificent interior decorations. Furthermore, the Elizabeth church in Wieden, built in 1866 by Bergmann in Gothic style; the evangelical church in Gumpendorf, finished in 1849 by Förster and Hansen; the church of the Visitation, finished in 1719, with a magnificent dome and richly decorated with gold, marble, and pictures; the votive church or church of the Saviour, a Gothic structure, begun in 1853 after plans by Ferstl, in commemoration of the escape of the emperor from assassination, with two tall towers of open-work, and richly decorated with statues; the church of St. Leopold, in Leopoldstadt, finished in 1728; the parish church of Marie Annunciation, finished in 1639 by Carlona; the parish church of St. Joseph, founded by Maria Theresa, etc. Of the non-Roman Catholic churches, that of the non-United Greeks, in the old meat-market, is a very interesting structure by Hansen in Byzantine style and richly decorated; also the Evangelical church, situated in Leopoldstadt, built by Förster and finished in 1849, is an imposing edifice. Of the two synagogues, the one in Moorish style, built by Förster and finished in 1849, is an interesting structure. The city has 25 monasteries and ecclesiastical orders. Of the educational institutions, the university is the most prominent, founded in 1365 by Rudolf IV., next to that of Paris the largest institution of the kind, and richly provided with all kinds of apparatus for scientific investigation. There are also various higher ecclesiastical seminaries; a polytechnic school which is richly endowed; a medico-chirurgical academy, which is one of the most celebrated institutions of the kind; an Oriental academy for the education of diplomatic agents in the Orient; an academy of fine arts; a military school; several gymnasiums and schools for commerce and industry, etc. Among the scientific institutions are an academy of science, a geological institute, a military-geographical academy, a

zoological and botanical association, etc. Besides the imperial library, the libraries of Archduke Albrecht, Prince Lichtenstein, and Prince Metternich are important. Of the benevolent institutions, the general hospital is the largest. The lunatic asylum is arranged on a grand scale. Furthermore, may be mentioned the hospitals of Wieden, of the Brothers of Mercy, of the Sisters of St. Elizabeth, and the asylums for children, for the blind, for the deaf and dumb, etc. Vienna is very rich in establishments of recreation and amusement. The Prater, a park and forest, E. of Leopoldstadt, was laid out by Joseph II., and is traversed by magnificent avenues, of which the principal one is the rendezvous of the elegant world, and is lined with crowded cafés, while another, the so-called Wurstel-prater, is filled with transportable museums, dancing establishments in the open air, etc. The World's Exhibition of 1873 took place in the Prater. The Augarten, to the N. of Leopoldstadt, is a large square of park and forest, traversed by straight avenues, and was opened to the public in 1775 by Joseph II. Among the theatres, the Burgtheatre, both for comedy and tragedy, occupies a very high rank.

The commerce and industry of the city are very important. Several branches of industry have been carried to a high degree of perfection, such as the manufacture of leather, carriages, furniture, meerschaum and amber goods, etc. The musical, mathematical, optical, and physical instruments made here enjoy a high reputation. The principal articles of commerce are wool, cotton, silk, fur, paper, leather, metal, and glass ware, objects of art, chemicals, spices, and colonial ware.

In ancient times Vienna was a Roman camp, called *Vindobona;* the emperor Marcus Aurelius died here. During the migration of nations, Huns, Longobards, Avars, and others successively fell upon the city. In 791, Charlemagne established a margrave here, and in the eleventh and twelfth centuries the margraves Leopold and Heinrich Jasomirgott did much for the prosperity of the city. In 1237 the German emperor Frederick II. made it a free city of the empire, and under Ferdinand I. it became the residence of the German emperor. In 1529 it was besieged by Sultan Solyman, but was victoriously defended. In 1640 the Swedes appeared before its gates, but without effect. In 1683 it was again besieged by the Turks, but saved by King John Sobieski of Poland. In 1704 a new line of fortifications was formed, including also the suburbs. During the wars with Napoleon the French twice occupied Vienna —Nov. 13, 1805, and May 13, 1809. In 1815 sat the famous congress. (See VIENNA, CONGRESS OF.) In 1848 it was the scene of several contests between the revolutionists and government, and suffered much. AUGUST NIEMANN.

Vienna, p.-v., Elgin co., Ont., Canada, 2 miles N. of Port Burwell, and on Big Otter Creek. The sawing of lumber is the chief business. A court sits here six times in the year. P. 593.

Vienna, tp., Madison co., Ala. P. 1660.

Vienna, tp., Pickens co., Ala. P. 1435.

Vienna, p.-v., cap. of Dooly co., Ga.

Vienna, tp., Grundy co., Ill. P. 900.

Vienna, p.-v. and tp., cap. of Johnson co., Ill., on Cairo and Vincennes R. R., 34 miles N. of the former city, has several churches, good schools, 2 newspapers, and is located in the fruit-producing belt of the state. P. of v. 550; of tp. 1496. A. J. ALDEN, ED. "JOHNSON CO. JOURNAL."

Vienna, p.-v. and tp., Scott co., Ind. P. of v. 166; of tp. 1510.

Vienna, p.-v. and tp., Marshall co., Ia. P. 905.

Vienna, p.-v. and tp., Pottawattamie co., Kan. P. 1288.

Vienna, p.-v., cap. of Lincoln parish, La.

Vienna, p.-v. and tp., Kennebec co., Me. P. 740.

Vienna, tp., Genesee co., Mich. P. 1916.

Vienna, p.-v., cap. of Maries co., Mo.

Vienna, p.-v. and tp., Oneida co., N. Y. P. of v. 156; of tp. 3180.

Vienna, p.-v. and tp., Forsyth co., N. C. P. 836.

Vienna, tp., Clark co., O. P. 239.

Vienna, p.-v. and tp., Trumbull co., O. P. 1132.

Vienna, tp., Dane co., Wis. P. 1176.

Vienna, Congress of, opened Oct. 3, 1814, and closed June 9, 1815. There were present the monarchs of Austria, Prussia, Russia, Denmark, Bavaria, and Würtemburg, besides a crowd of minor princes and diplomatic representatives of all European states except Turkey—Talleyrand from France, Castlereagh from England, Metternich from Austria, Nesselrode from Russia, Hardenberg from Prussia, Münster from Hanover, etc.—besides a multitude of diplomates without any distinct official character, such as Stein, Wilhelm von Humboldt, Pozzo di Borgo, etc. The congress assembled and carried on its work under a series of festivities whose sumptuousness and frivolity had never been equalled before—Austria alone spent 30,000,000 florins on dinners, balls, masquerades, illuminations, etc.—and the principal method of transacting business employed by the assembly was intrigue, often of the meanest and most infamous kind; as, for instance, in the case of the elector of Hesse, who only wanted to have the title of king bestowed on him. The members assembled with good-will toward each other, but Talleyrand soon succeeded in arousing all the slumbering jealousies and vanities, and one month had hardly elapsed before egotism, rapacity, pride, and envy were the ruling spirits of the assembly. A new general war seemed inevitable. Austria, Russia, Prussia, and even France, were arming, when, on Mar. 5, 1815, during a grand court-ball, a courier from Turin announced that Napoleon had left Elba and landed on the coast of Provence. The event proved most effective in bringing about an agreement between the carousing gentlemen. The task of the assembly was to restore to Europe that state of affairs which prevailed before the French revolution, and which Napoleon had almost entirely broken up. It was not possible to effect a complete restoration, but the congress did its best. The pope was reinstated in all his possessions, with the exception of Avignon and Venoissin, which were given to France, and some small Italian districts, which were given to Austria. These cessions, however insignificant, were nevertheless too much for His Holiness; he protested in a most solemn manner against the whole congress. The rest of Italy was again parcelled out in domains for French and Austrian princes. Austria was re-established in its old glory as an utterly artificial agglomeration of chips from seventeen different nationalities. A kingdom of Poland was erected, but the Polish provinces which Russia, Prussia, and Austria had seized twenty years before by open robbery were not returned to the new Polish crown, and the crown itself was tendered to the Russian czar; it looked like something, but it was nothing. Norway was taken from Denmark and added to Sweden, in order to pay Bernadotte for his treachery against Napoleon, and Denmark was paid with Lauenburg and other German districts. The Spanish Netherlands or Belgium were added to the Dutch Netherlands, and the whole formed into the kingdom of Holland, in spite of the absolute opposition which exists between these countries in language, religion, and economical interests; but it was the only way in which England could retain the Dutch colonies which she had conquered during the Napoleonic wars. To restore the German empire was found impossible, on account of the rivalry between Prussia and Austria, but, having restored as many of the petty princes as possible, the congress manufactured a *Bund*, which turned out to be simply a means of intrigue. The whole business transacted by the congress was simply a distribution of spoils, a division of the lands which had fallen out of the grasp of Napoleon, between a number of families which formerly had been *reigning* families, and thence inferred that they had a legal claim on a certain amount of land to reign over—a divine right, a right of *legitimacy*. To the aspirations of the nations, to their most apparent interests and most sacred instincts, no regard whatever was paid, and the history of Europe from 1815 up to our day, with all its bloody wars and terrible revolutions, is chiefly a series of attempts at correcting the blunders and crimes of the Congress of Vienna. (See *Acten des Wiener Congresses* (9 vols., Frankfort, 1815–35); *Uebersicht der diplomatischen Verhandlungen des Wiener Congresses* (Frankfort, 1816); Flassan, *Histoire du Congrès de Vienne* (3 vols., Paris, 1829); Lagarde, *Fêtes et Souvenirs du Congrès de Vienne* (2 vols., Paris, 1843).)

Vienna Paste, or **Vienna Caustic.** See LIME, MEDICINAL USES OF.

Vienne', an inland department of Western France, on both sides of the river Vienne, an affluent of the Loire, comprises an area of 2690 sq. m., with 320,598 inhabitants. The surface presents an elevated plain, with a general slope to the N. The soil is not very fertile, yet more wheat and wine are produced than necessary for home consumption. Hemp, flax, and chestnuts are also extensively raised, and good breeds of mules and horses are reared. Much iron is mined, and building-stone and lithographic stones are quarried. Of 43,778 children of school-age, 20,750 received no instruction in 1857.

Vienne, one of the most ancient towns of France, department of Isère, on the Gère, near its influx in the Rhone, contains many interesting remains of the Roman epoch, such as a triumphal arch, an amphitheatre, and a temple. Pilate is said to have been banished to this place. It was the cradle of Western Christianity. The fifteenth œcumenical council of the Roman Catholic Church met

here in 1311. Its vicinity contains rich silver and iron mines, and produces an excellent wine. Its manufactures comprise woollen and linen fabrics of different descriptions, cutlery and hardware, glass and leather. Its trade is brisk. P. 26,017.

Vienne, Haute. See HAUTE-VIENNE.

Vier'sen, town of Rhenish Prussia, has extensive manufactures of woollen, cotton, linen, and silk fabrics, ribbons, leather, tobacco, vinegar, soap, and straw hats. P. 18,550.

Vierzon', town of France, department of Cher, at the confluence of the Yèvre and Cher, has cannon-foundries, tanneries, slips for building river boats, and manufactures of linen, woollen, and silk fabrics, and porcelain. P. 7740.

Vies'te, town of Southern Italy, province of Foggia, at the foot of Monte Gargano, on the shore of the Adriatic, about 60 miles N. E. of the town of Foggia. It is washed by the sea on three sides, is surrounded by a wall, has a most fertile country behind it, and was once considered a place of strength. It was here that Pope Celestine was arrested by order of Boniface VIII. In the latter half of the sixteenth century Barbary pirates landed here, wasted the neighboring coast and country, and carried 7000 of the inhabitants into slavery. Vieste was for a time an episcopal see. P. 6595.

Vie'ta, or **Viète** (FRANÇOIS), b. at Fontenay-le-Comte, department of Vendée, France, in 1540; held various offices in the civil service of the French government during the reigns of Henry III. and Henry IV., and d. in Paris in 1603. It is, however, as a mathematician he has become known to the after-world, being the creator of modern algebra, which he developed into a purely symbolical science and applied to the extension of trigonometry. Most of his works were collected by Van Schooten and published at Leyden in 1646. His *Harmonicon Cæleste* and *Canon Mathematicus* were not discovered until quite recently.

Vie'tri sul Ma're, town of Southern Italy, province of Salerno, charmingly situated in a mountain-nook among dark crags which are reflected in the blue waters of the Gulf of Salerno. The climate is always extremely mild, the air of a delicious pureness, and the productions almost tropical. The town is not badly built, and not without some industry, there being several paper-factories, etc. Fragments of columns, mosaic pavements, vases, etc., have been found along the seashore, and there is a tradition that Vietri rose from the ruins of *Marcina*, which was destroyed by the Vandal Genseric in 455. P. 8441.

Vieussens' (RAYMOND), b. in the countship of Rouergue, present department of Gironde, France, in 1641; studied medicine in Paris; held for several years a position at the hospital of St. Eloi, Montpellier, and acquired great reputation for his investigations of the brain (the *valve of Vieussens*) and the spinal cord. D. at Montpellier in 1720. He wrote *Nevrographia Universalis* (1685) and *Traité des Liqueurs du Corps humain* (1715).

Vieuxtemps' (HENRI), b. at Verviers, Belgium, Feb. 20, 1820; made his first concert-tour as a virtuoso on the violin when only eight years old; studied afterward under Boriot and Rischa; resided from 1846 to 1852 in St. Petersburg, subsequently in Paris, but spent most of his time in concert-tours; visited America in 1843, 1855, and 1870, and published a considerable number of compositions for the violin and pianoforte. Both as a composer and as a performer he is more remarkable for correctness and elegance than for any original power of impression.

Vie'yra (ANTONIO), b. at Lisbon, Portugal, in 1608; became a Franciscan monk and the most celebrated Portuguese preacher of his age; was employed on public missions at the courts of Paris (1646), London, and Rome (1650), and spent his latter years as a missionary in Brazil, where he preached to the Indians in the Tapi or Guarani language and advocated the abolition of slavery. D. at Bahia in 1697. Sixteen volumes of his *Sermons* (1688–1751) and 3 of his *Letters* (1735–46) were printed mostly after his death, as was also his *History of the Future* (1718). He enjoys a distinguished place among Portuguese classics. Biographies were written by F. de Fonseca (1734) and A. de Barros (1746).

Vigan', Le, town of Southern France, department of Gard, has manufactures of silk, woollens, gloves, and leather. P. 5376.

Viger' (JAMES), b. at Montreal, Canada, May 7, 1787; served as an officer of militia in the war of 1812–15; filled several political offices; was the first mayor of Montreal, and a distinguished archæologist. D. at Montreal Dec. 12, 1858. Among his publications were *Le Petit Registre*, forming the groundwork for a history of the early settlers of Montreal, a *History of the Parishes of the Diocese of Montreal*, and a *History of the Lemoyne de Longueuil Family*; and he furnished all the documents which appeared in De Courcy's *Serviteurs de Dieu en Canada*.

Vige'vano (*Vicus Veneris*), town of Italy, province of Pavia, in a healthful position on a rising ground above the banks of the Ticino. The adjacent country is very fertile, and has been famous for game since the days of King Arduin, who was very fond of hunting here, as was also Charles V. Vigevano is a well built town, with churches and private palaces of some interest, and the castello, modified by Bramante under Ludovico il Moro, was a grand edifice, but is now used for military purposes. The Torre, designed by Bramante, has fine architectural features. The Piazza del Duomo, a large rectangular space flanked on three sides with porticoes supported by solid granite columns, the fourth being occupied by the cathedral, is also the work of Ludovico Sforza il Moro. Vigevano, originally settled by a race of Ligurians, after having passed under Roman, Lombard, Gothic, and Frankish rule, governed itself independently for several centuries, since which time, having been obliged to accept the Visconti and Sforza as lords, it has generally shared the fortunes of Milan. It is now an active town, with thriving manufactories of silk, velvet, linen, cotton, etc., and the agriculture of the vicinity is also very prosperous. The fish of the Ticino are a considerable source of income to Vigevano, and very pure gold, in small quantities, has been found in the bed of the river ever since the days of Queen Theodolinda, who, it is said, bestowed the privilege of collecting it upon the Biffignandi family, with whom it is still a monopoly. The educational and charitable provisions of Vigevano are excellent. The handsome school of arts and trades was recently established by a private legacy of $200,000. P. 18,436.

Viggianel'lo, town of Southern Italy, province of Potenza, about 32 miles from Lagonegro, without activity from want of roads. P. 5030.

Viggia'no, town of Southern Italy, province of Potenza, on a high rocky hill, at the foot of which flows a torrent on either side. The neighboring district is fertile in grain, vines, and olives, and the inhabitants are given to music, many of them gaining their livelihood as wandering harpists. P. 5242.

Vig'il [Lat. *vigilia*, a "watching"], in ecclesiastical language the evening before any church fast, festival, or other important day of the calendar. Special services are appointed in the Roman Catholic Church for the more important vigils. Vigils are retained in the English calendar, but no particular service is directed for any one of them.

Vigil'ius, POPE (540–555), a native of Rome; was appointed a deacon by Boniface II., and accompanied Agapetus to Constantinople in 536. Here the pope died in 537, and by the intrigues of Theodora, Vigilius was appointed pope by Justinian, on the condition that he should lend his authority to those measures by which the emperor hoped to reconcile the Monophysites with the orthodox Church. On his return to Rome, however, he found the papal see occupied by Sylverius; but partly by money, partly by the intrigues of Antonina, the wife of Belisarius, he obtained the aid of the Byzantine commander at Ravenna, and in 540 Sylverius was expelled. Vigilius was a rapacious and ambitious man, without talent or character, and probably also without convictions. Placed between the African and the Byzantine churches, with their diametrically opposite tendencies, he was alternately bought by the emperor and bullied by the bishops to make decisions which the next moment he retracted.

Vignola, da (GIACOMO BAROZZIO). See BAROZZO (JACOPO).

Vigny', de (ALFRED VICTOR), COUNT, b. at Loches, department of Indre-et-Loire, France, Mar. 27, 1799; entered the royal guard in 1816, but retired from military service in 1828, and devoted himself exclusively to literary pursuits. D. in Paris Sept. 18, 1863. His *Poëmes* (1822), among which are *Hélène*, *La Fille de Jephté*, *La Femme adultère*, etc., and his *Poëmes antiques et modernes* (1824–26), among which are *Moïse*, *Le Déluge*, *Dolorida*, etc., passed by almost unnoticed, though they belong to the best which the romantic school has produced in France. But in 1826 his historical novel, *Cinq-Mars* (2 vols.), attracted much attention, and was translated into various languages; and in 1835 his drama, *Chatterton*, made his name celebrated. He also wrote *Stello* (1832), *Servitude et Grandeur militaires* (1835), two novels: *Les Destinées*, a philosophical poem, published after his death, etc. A complete edition of his works appeared in 8 vols. in 1863–66.

Vi'go, town of North-western Spain, province of Pontevedra, is beautifully situated on a bay of the same

name, and has valuable sardine and tunny fisheries. It is irregularly built, and old but picturesque, and its beautiful surroundings abound in wine, oil, and fruits. P. 8214.

Vigo, county of W. Indiana, bordering on Illinois, drained by Wabash River and traversed by Wabash and Erie Canal and by several railroads centring at the county-seat; surface undulating, and diversified by forests and prairies; soil very fertile. Bituminous coal, limestone, and freestone abound. There are more than 200 manufacturing establishments, including saw-mills, flour-mills, woollen factories, iron, machinery, bricks, cooperage, carriages, railway cars, and wagon materials. There are large numbers of cattle, sheep, horses, and swine. Staples, manufactured articles, Indian corn, wheat, potatoes, wool, hay, lumber, and dairy products. Cap. Terre Haute. Area, about 400 sq. m. P. 33,549.

Vigo, tp., Knox co., Ind. P. 2426.

Vigo'ne [*Ficus Odonis*], town of Italy, province of Turin, in a mountainous region, about 9 miles S. E. of Pinerolo. It was formerly a walled town of considerable strength, but was ruined in the wars of the sixteenth century. Vigone has the honor of having maintained a public school in the fourteenth century, and primary instruction is now largely provided for. P. 6410.

Vihāra meant in post-Vedic times in India, first, pleasure, relaxation, and then a pleasure-ground or place of relaxation; and after the rise of Buddhism, it was applied to the Buddhist temples, these being at first only meeting-places for the Buddhist monks; but after images of Buddha began to be put up, and dwellings for the priests to be permanently erected round the image-house, the word *vihāra* was used, as it still is, to denote, first and more exactly, the temple itself, or, secondly and more generally, the whole monastic establishment. This usually consists, in all Buddhist countries alike, of one or more of the following buildings: (1) the *image-house* or temple, containing one or more figures of Buddha, represented standing, sitting cross-legged, or lying on his side; before these images, or before the dāgaba or before the bo-tree, the pious Buddhist goes through his simple worship, bowing with his palms placed together and raised to his forehead, repeating the creed or some moral sentences from the Buddhist books, and offering flowers; (2) the *dāgaba*, a solid bell-shaped dome, sometimes of enormous dimensions, under which some relic of Buddha is supposed to be buried; (3) *the sacred bo-tree* (*Ficus religiosa*), round which is raised a stone terrace; it is always supposed to be a descendant of the tree under which Buddha attained to Buddhahood, and holds the same position among the Buddhists as the cross does among Christians; (4) a *preaching-hall;* (5) an *assembly-hall* for the priests; and (6) their *sleeping apartments.* (See, for Ceylon, Davy's *Ceylon*, p. 220; Tennent's *Ceylon*, i. 347–349; for Siam, Pallegoix, *Annales de la Propagation de la Foi*, Jan., 1854; for Burmah, Bigandet, *Legend of the Burmese Buddha*, p. 176; for Nepāl, Hodgson, *Sketch of Buddhism*, p. 241; for Thibet, Köppen, *Religion des Buddha*, ii. 258, and ch. i. 376.) Among the Southern Buddhists the word is always pronounced *Wihāra.*

T. W. RHYS DAVIDS.

Vi'king [Norse, from *vik*, a "bay;" it has nothing to do with our word *king*], a name for the Norse pirates who formerly vexed and plundered the seas and coasts of Europe. The name is often incorrectly confounded with *sea-king.* The sea-kings were naval chieftains of royal blood, who were not necessarily pirates.

Vilayets and Eyalets. See TURKEY, by CAPT. A. NIEMANN.

Vilkomir', town of Russia, government of Kovno, on the Sventa, has some trade and manufactures. P. 7480.

Villafran'ca de los Bar'ros, town of Spain, province of Badajoz, has some trade in wheat and wine. P. 7575.

Villafran'ca de Pana'des, town of Spain, province of Barcelona, is old, gloomy, and uninteresting, but has a large trade in wine, oil, and fruits, especially figs. P. 6284.

Villafran'ca di Vero'na, commune in the province of Verona in Northern Italy, about 11 miles S. of that city and 12 miles N. of Mantua, consisting of eleven hamlets with a total population of 8344. The largest of these, which gives name to the commune, is a well-built and flourishing town, with a fine castle of the fourteenth century. It was at Villafranca that Napoleon III. terminated the war which he had commenced against Austria "to liberate Italy from the Alps to the Adriatic," by negotiating, without the participation or knowledge of his ally, King Victor Emmanuel, a peace with the emperor of Austria, in which the professed object of the campaign was ingloriously sacrificed.

Vil'lage, tp., Jackson co., Ark. P. 660.

Village, tp., Van Buren co., Ia. P. 1540.

Village Springs, p.-v. and tp., Blount co., Ala. P. 700.

Villajoyo'sa, town of Spain, province of Alicante, at the mouth of the river Orcheta, has a good harbor and a large trade. P. 9110.

Villa'ni (GIOVANNI), b. at Florence about 1280; occupied a prominent position in his native city, and held various offices, military and diplomatic, as a member of the Guelph party. D. at Florence by the plague in 1348. He wrote a chronicle of Florence, *Istorie Fiorentine*, in 12 books, from its origin to his own time, to which his brother Matteo added a thirteenth book, carrying the narrative down to 1363. According to the style of composition then reigning; this history of Florence is also a history of the world, but whenever the author speaks of Florence or of his own time, the book is considered to have great historical value. Its principal merits, however, are its simple and noble style and its pure language. It was first printed by Giuntini in 1562–87: last ed. in 7 vols. (Milan, 1848).

Villanovanus (ARNALDUS). See ARNALDUS VILLANOVANUS.

Villanue'va, de (JOAQUIN LORENZO), b. in Valencia, Spain, in 1757; became court-preacher at Madrid and confessor to the king; was elected to the Cortes 1810; took a prominent part as a liberal constitutionalist; was confined several years in a monastery on the return of Ferdinand VII.; went into exile on the overthrow of the constitution in 1823, and d. in Ireland in 1827. Author of *El Año Cristiano* (19 vols.), of a Latin dissertation on the Phœnician colonization of Ireland, of treatises on politics and in favor of the reading of the Bible in the modern languages in church services, and translated into Spanish Paley's *Natural Theology* and other English works.

Villanue'va de Cor'dova, town of Spain, province of Cordova, on the slope of the Sierra Morena, trades in cattle, horses, and hogs. P. 5535.

Villanueva de la Sere'na, town of Spain, province of Badajoz, in an exceedingly fertile plain called Serena, which is traversed by the Guadiana and encircled by high mountain-walls. P. 9630.

Villa Real', an old but handsome and regularly built town of Spain, province of Castellon, on the Mijares, near its mouth in the Mediterranean, has large distilleries and manufactures of woollen fabrics. P. 8207.

Villa Ridge, p.-v., Pulaski co., Ill.

Vil'lari (PASQUALE), b. at Naples in 1827. Taking part with the university students in the movements of 1848 and 1849, he was obliged to emigrate; retired to Tuscany, where he devoted himself to historical researches, and especially to preparation for his great work, *Gerolamo Savonarola e i suoi Tempi*, one of the foremost historical writings of this century, published at Florence in 2 vols., 1859–61, which led to his appointment to the chair of modern history at Pisa, where he also had charge of the superior normal school. From Pisa he was transferred to a similar position in the Instituto di Studii Superiori at Florence. The *Life of Savonarola* was translated into French, English, and German. He has published also a volume on public instruction in England and Scotland, another of critical essays, and many articles in periodicals on public instruction and other subjects, among which his *Antiche Leggende e Tradizioni che illustrano La Divina Commedia*, published also separately at Pisa (1 vol. 4to, 1865), deserves notice. He has lately edited *Dispacci di Antonio Giustinian, Ambasciatore Veneto in Roma dal 1502 al 1505* (Firenze, 1876, 3 vols. 12mo), a hitherto unpublished but important contribution to the history of that period; and he is understood to be now engaged on a work on the life and times of Machiavelli, which excites much expectation in Italy. For several years Villari has been a member of the superior council of public instruction and of the chamber of deputies in Parliament.

Villaro'sa, town of Sicily, province of Caltanisetta, about 28 miles from Piazza Armerina. The inhabitants are chiefly engaged in working the numerous and extensive sulphur-mines in the neighborhood, and the exportation of sulphur from this place is very large, as it is in railway communication with the nearest Sicilian ports. The district is also very rich in fruits and other agricultural products. P. 6879.

Villars', de (CLAUDE LOUIS HECTOR), DUKE, b. at Moulins, department of Allier, France, May 8, 1653; was educated as a page at the court of Louis XIV.; entered the army in 1672; fought with distinction under Turenne, Luxembourg, and Crequi; was also employed with great success in diplomatic negotiations, especially as ambassador to Vienna 1699–1701, and received in 1702, in the

Spanish war of succession, his first independent command. Oct. 14, 1702, he defeated Prince Louis of Baden at Friedlingen, and was made a marshal; next spring he penetrated through the passes of the Black Forest and joined the elector of Bavaria, but although, on Sept. 20, 1703, he won a new victory over the imperial forces under Styrum at Höchstädt, he nevertheless resigned his command and returned to France, disgusted at the follies of his ally, the elector. Having distinguished himself greatly at various points of the theatre of war as a commander of minor corps, he succeeded Vendôme in 1709 in the command of the grand army in the Netherlands, numbering 120,000 men, but was defeated and severely wounded at Malplaquet, Sept. 12, 1709. Having recovered, he again took command of the grand army, now the last which France was able to raise, and gained a brilliant victory over the allied English-Austrian force under the earl of Albemarle at Denain, July 24, 1712, which contributed much to the conclusion of the Peace of Utrecht. After a successful diversion against Prince Eugene, he finally negotiated and signed the Treaty of Rastadt (Mar. 6, 1714). During the regency and the reign of Louis XV. he continued to have much influence on the foreign policy and all military affairs, and when, in 1733, a new war with Austria broke out, he was placed in command of the army in Northern Italy and received the title of marshal-general. Although eighty-one years old, he still displayed remarkable energy; but disagreement with the king of Sardinia caused him to resign his command, and on his return to France he d. at Turin June 17, 1734. His *Mémoires*, published after his death, are only partially genuine. His biography has been written by Anquetil in 4 vols. (Paris, 1784).

Villefranche', town of France, department of Aveyron, at the confluence of the Aveyron and the Alzon, has ironworks and manufactures of copper-ware. P. 10,172.

Villefranche'-sur-Saône, town of France, department of Rhone, on the Saône, manufactures cottons, linens, spirits, leather, and trades in corn and wine. P. 11,650.

Villegagnon', de (Nicholas **Durand**), Chevalier, b. at or near Provins, France, in 1510, was a nephew of the grand master of the order of Malta, Villiers de l'Isle Adam; entered the naval service; commanded the vessel which conveyed Mary Queen of Scots to France 1548; became a knight of Malta and a commander of that order; distinguished himself at the sieges of Algiers and of Malta; was a scholar, a linguist, and a keen Protestant controversialist; engaged Admiral Coligny in the enterprise of founding a Protestant colony in Brazil, which he established in 1555 upon the island now bearing his name in the Bay of Rio de Janeiro; returned while there to the Church of Rome, and endeavored to compel the colonists to do the same; returned to France 1557, and engaged in a theological controversy with Calvin. His colony was soon abandoned, and he d. in 1571.

Villegas, de (Francisco). See Quevedo y Villegas.

Ville'gas, de (Esteban Manuel), b. at Nájera, Old Castile, in 1596; educated at Madrid and at the University of Salamanca; became a lawyer; wrote several dissertations on the classics and a work on the Theodosian code, and translated Boethius (1665), but is best known by his elegant amatory verses, *Las Eróticas* (1617), published when twenty-one years of age. D. at Nájera Sept. 3, 1669.

Vil'lein, or **Villain** [from Lat. *villa*, a "hamlet"], a feudal serf, the lowest order of "unfree" persons during the prevalence of the feudal system. In the feudal ages the class of serfs existed under different names throughout Western Europe. The Saxons possessed "theows." The "villains" in England after the Norman Conquest were partly the descendants of the ancient Britons, and partly the lower and poorer of the Saxons. Their condition was far different and far better than that of the Roman slaves (*servi*), or of the African slaves of modern times, and rather resembled the social position of the Roman *coloni*. The villains, in fact, possessed a double personal status. In respect to their owners or lords they had no rights, except that the latter might not kill or maim them or commit rape on the females. They could acquire or hold no property as against their lord; they were obliged to perform all the menial services which he might demand; and the cottages and plots of land which they possessed were held completely at his will. On the other hand, in respect to all other persons besides their lord they were absolutely free, with the rights and privileges of free men. Their condition was rendered the more endurable by the fundamental legal principle which made all possible presumptions in favor of freedom. The operation of these presumptions, and the gradual extinction of serfdom by their means, with little direct legislation as an aid, make one of the most interesting and instructive chapters in the English legal history. Villains were either *regardant* or *in gross*. The regardant were annexed to the soil, and belonged to a manor as fixtures, passing with it when it was conveyed or inherited; they could not be sold as persons separate from the land. Villains *in gross* were not thus affixed to a manor; they belonged personally to their lord, and could be transferred by him at will. Their condition was much inferior to that of the other class, but their number was very small. By far the greater part of the villains in England were annexed to the soil (*adscripti glebæ*). J. Norton Pomeroy.

Villeinage. See Villein.

Villele, de (Jean Baptiste Séraphin Joseph), Count, b. at Toulouse, department of Haute-Garonne, France, Aug. 14, 1773; entered the navy in 1791; went to the West Indies, and remained there during the Revolution; returned in 1803 with a large fortune, and settled in his native city; was elected a member of the Chamber of Deputies in 1815, and became in a few years the leader of the ultra royalist party. After the fall of Decazes in 1820 he entered the cabinet as minister without a portfolio, and became minister of finance in 1821, and president of the council in 1822. An able financier, he brought the finances of France into an orderly shape; but his reactionary measures made him very odious to the people, without fully satisfying the court. The principal events of his administration were the war with Spain for the reinstatement of Ferdinand VII., the indemnity of one milliard to the emigrants, the lowering of the interest on the public debt to 3 per cent., the prolongation of the electoral term for the Chamber of Deputies to seven years, the re-establishment of the right of primogeniture, the limitation of the freedom of the press, the law of sacrilege, and the dissolution of the national guard of Paris. In Jan., 1828, he was compelled to give way to the cabinet of Martignac. He was created a count when he entered the ministry, and a peer when he left it. After 1829 he lived in retirement in Toulouse, and d. there Mar. 13, 1854.

Villemain' (Abel François), b. in Paris June 9, 1790, studied first law, afterward literature and philosophy; was appointed professor of rhetoric at the Lycée Charlemagne in 1810; won the prize of the Academy three times between 1812 and 1816 for his *Éloge de Montaigne, Avantages et Inconvénients de la Critique*—which he read himself in a sitting Apr. 21, 1814, at which the emperor of Russia, the king of Prussia, and other prominent members of the alliance against Napoleon were present—and *Éloge de Montesquieu*; published in 1819 his *Histoire de Cromwell d'après les Mémoires du Temps et les Recueilles parlementaires* (2 vols.); received in 1820 a position in the department of the interior as *chef de l'imprimérie et de la librairie*, and was shortly after made *maître des requêtes* to the council of state. But his connection with politics soon carried him into the ranks of the opposition, and in 1827 the Academy, of which he had become a member in 1821, commissioned him, together with Lacretelle and Chateaubriand, to draw up its protest against the re-establishment of the censorship of the press. He now lost his position in the government, but his lectures at the Sorbonne gathered immense audiences, and greatly contributed, like those of Guizot and Cousin, to foment the movement which terminated with the Revolution of 1830. In 1831 he became a member of the council of public instruction; in 1832 was created a peer; in 1839–40 and 1840–41 was minister of public instruction. But of all the *doctrinaire* leaders he proved the one least fitted for actual government. Unable to take or to keep a firm position between the conflicting interests of the Church and the university, the liberals and the conservatives, etc., he resigned his office in 1844, and retired altogether from politics in 1848, devoting himself exclusively to literature. As a writer, however, both as a critic and as a narrator, he occupies a high rank. His principal works are *Cours de Littérature française* (last ed., 6 vols., 1864), *Discours et Mélanges littéraires* (last ed. 1860), *Études de Littérature ancienne et étrangère* (last ed. 1859), *Souvenirs contemporains d'Histoire et de Littérature* (2 vols., last ed. 1859–62), *La Tribune moderne* (2 vols., 1858), *Histoire de Grégoire VII.* (2 vols., 1872), etc. As he altered and enlarged his works very much, it is of consequence to have the last editions, published by himself. D. at Paris May 8, 1870.

Villemont, tp., Arkansas co., Ark. P. 407.

Villemur', town of France, department of Haute-Garonne, on the Tarn, manufactures iron goods. P. 5304.

Ville'na, town of Spain, province of Alicante, on the Vinalapo, has distilleries, soapworks, and linen-weaving factories. P. 8350.

Villena (Enrique), Marquis, b. in Spain in 1384, was of royal descent; became celebrated at the Spanish courts for his erudition; translated Virgil and Dante into

Spanish, and wrote several original works, one of which was a treatise on the *Gaya Sciencia*, or art of poetry. D. in 1434.

Villena, de (Juan **Pacheco**), Marquis, b. in Spain about 1425; became the favorite and chief minister of the imbecile king of Castile, Henry IV., about 1454; was supplanted by Beltran de la Cueva, upon which he joined the confederacy of nobles which deposed Henry, and ultimately placed Isabella (the Catholic) on the throne. D. in 1474.

Villeneuve'-sur-Lot, town of France, department of Lot-et-Garonne, on the Lot, which here is crossed by a remarkable bridge spanning the river by one single arch, manufactures faïence, tiles, and bricks, and carries on a very brisk trade in corn, wine, prunes, and other products of the adjoining districts. P. 13,830.

Villeneuve'-sur-Yonne, town of France, department of Yonne, carries on a very varied manufacturing industry, and an active trade in wood, coal, and wine. P. 5018.

Villeno'va, tp., Chautauqua co., N. Y. P. 1401.

Ville Platte, p.-v. and tp., St. Landry parish, La. P. 135.

Villers', de (Charles François Dominique), b. at Boulay, Lorraine, Nov. 4, 1765; was educated at the school of artillery in Metz, and entered the army in 1782, but emigrated in 1793; served for a short time in the army of Condé; lived in various places in Germany, and settled in 1797 in Lubeck, devoting himself to literature. He published *La Philosophie de Kant* (2 vols., 1801), *Essai sur l'Esprit et l'Influence de la Réformation de Luther* (1804), which was translated, with notes, by James Mill (8vo, 1805), *Coup d'œil sur les Universités de Allemagne protestante* (1808); but his *Lettre à Madame la Comtesse Fanny de Beauharnais*, in which he made a report of the atrocities committed by the French soldiers at the storming of Lubeck in 1806, drew upon him the hatred of the French army, and exposed him to many persecutions. On the annexation of the Hanseatic cities to France in 1811, he removed to Göttingen, and thence to Leipsic, where he d. Feb. 26, 1815.

Villiers. See Clarendon, Earls of, and Clarendon (G. W. F. Villiers).

Villiers (George). See Buckingham, Duke of.

Villis'ca, p.-v., Montgomery co., Ia., on Burlington and Missouri and Brownsville and Nodaway Valley R. Rs., 66 miles E. of Council Bluffs, has 4 churches, a large school-building, a public reading-room, 1 bank, 1 newspaper, marble-works, 1 carriage manufactory, and several hotels. It is a prominent shipping-point for cattle, hogs, and grain. P. 457. C. K. Kennelly, Ed. "Review."

Villoison', de (Jean Baptiste Gaspard d'Ausse), b. at Corbeil-sur-Seine, present department of Seine-et-Oise, France, about 1750; acquired a great reputation as a Greek scholar; visited Venice, various places in Germany, Constantinople, and the islands of the Grecian Archipelago; was made professor at the National Institute of Paris, and d. there Apr. 26, 1805. His principal publications are—Apollonius's *Lexicon Græcum Iliodis et Odysseæ* (2 vols., 1773), Longus, *Pastoralia* (2 vols., 1778), *Anecdota Græca* (2 vols., 1781), *Epistolæ Vimarienses* (1785), and *Scholia Vineta* (1788), besides a number of essays in the *Mémoires de l'Académie des Inscriptions.*

Vil'na, or **Wilna,** government of Western Russia, bounded S. by the Niemen and W. by East Prussia, comprises an area of 16,434 sq. m., with 973,574 inhabitants. The surface is mostly flat, seldom broken by low hills of clay and sand, but often occupied by marshes and lakes or covered with extensive forests. The climate is mild and the soil generally fertile. Rye, barley, oats, potatoes, flax, hemp, and tobacco are largely cultivated and exported, together with timber, tar, potash, skins of elks, bears, wolves, and martens. The wild bull is found in these forests.

Vilna, or **Wilna,** town of Russia, capital of the government of Vilna, on the Wilia, is surrounded with old walls and mostly built of wood, for which reason it has several times suffered severely from fire. It contains, however, many fine buildings, both among its churches and its private residences, and has many good educational institutions, an observatory, a botanical garden, a chemical laboratory, and several museums. It has no manufactures, but an extensive trade in corn and timber. P. 79,265.

Vilvoor'den, town of Belgium, province of Brabant, on the Senne, has some cotton manufactures. P. 7602.

Vimeur, de (Donatien). See Rochambeau.

Vi'nal Ha'ven, tp., Knox co., Me. P. 1851.

Vinaroz', town of Spain, province of Castellon, on the Ebro, near the Mediterranean, is a well-built and enterprising place, with extensive fisheries, excellent wine-cultivation, and a brisk coasting-trade. P. 9795.

Vinca. See Periwinkle.

Vince (Samuel), F. R. S., b. at Fressingfield, Suffolk, England, about 1752; graduated at Caius College, Cambridge, 1775; became fellow of Sidney-Sussex College; took orders in the Church of England; held several ecclesiastical preferments, including the archdeaconry of Bedford, and was Plumian professor of astronomy and experimental philosophy at Cambridge from 1796 to his death, in Dec., 1821. His mathematical attainments were extraordinary. He published a series of textbooks, including *Elements of Conic Sections* (1781), *Principles of Natural Philosophy* (1793), and *A Complete System of Astronomy* (3 vols., 1797–1808); also *A Confutation of Atheism from the Laws and Constitution of the Heavenly Bodies* (1807).

Vincennes', a commune (or township) of France, adjoining Paris on the E., celebrated for its château and forest (Bois de Vincennes). The present château was commenced by Philip de Valois (1333), and finished by his successors. It constitutes a fortress, in form a parallelogram 1200 by 670 feet. An interior fort, "the donjon," was flanked by nine towers, all of which except one were removed in 1818 in remodelling the work, it having become the chief arsenal of Paris. The château of Vincennes was, up to the time of Louis XI., a royal residence. Subsequently, it became a state prison. The list of prisoners scarcely rivals that of the Tower of London, yet contains some of the greatest names of France. The unfortunate Duc d'Enghien (see Enghien, d') was shot here in the ditch at the S. E. angle, a locality still pointed out. The church (La Sainte Chapelle) where his remains are deposited contains a monument to his memory. There are extensive barracks and stables for cavalry; and, besides being a great arsenal, Vincennes comprises the École de Tir (firing school) where officers from all regiments are sent to learn the use of modern arms, and to which the regiments of the garrison of Paris and environs send their contingents for practice both with artillery and small-arms. The Bois de Vincennes (park) covers an area of nearly 4 sq. m., and is much resorted to by the middle classes of Paris. P. 17,064. J. G. Barnard.

Vincennes, city and tp., cap. of Knox co., Ind., on the E. bank of the river Wabash, 90 miles from its mouth, in lat. 38° 53′, lon. 87° 23′. It is built on a level, dry, sandy plain, and is entirely above overflow, behind which rises a beautiful plateau having an elevation of 100 feet above high-water mark, and occupied by well-tilled farms, vineyards, and gardens. Vincennes is an important railroad centre, having a direct connection with St. Louis and Cincinnati by Ohio and Mississippi R. R., with Indianapolis by Indianapolis and Vincennes R. R., with Cairo and Southern cities by Cairo and Vincennes, and with Evansville and Chicago by Evansville and Crawfordsville road. It has 10 churches, 3 banks, 3 high schools, and a public library, and has a Roman Catholic orphan asylum for boys. There are 3 weekly newspapers and 1 semi-weekly. The Vincennes University, a well-endowed school, chartered in 1807, is a prosperous institution of learning. Vincennes is the entrepôt for a rich agricultural region, in which there are vast quantities of valuable timber and coal of a superior quality. There are 5 flouring-mills, 1 producing annually 56,000 barrels of extra fine flour, an extensive factory for making starch and syrup from Indian corn, 2 woollen-mills, 3 iron-foundries, 1 hub and spoke factory, and extensive machine-shops for the railroads. There are 3 artificial earth-mounds standing upon the high land overlooking the city, representing an ancient civilization. There are about 800 of these mounds in Knox co., which are attracting considerable attention in certain scientific circles. The largest is 60 feet in height and covers an area of 4 acres. Human bones, broken pottery, and arrow-heads have been found in it. The town was settled by the French in 1702, and was the capital of the North-west and Indiana Territories until 1813. The inhabitants are Americans, Germans, and French, nearly equally divided. P. of city, 5440; of tp. 1426.

A. Patton, Ed. "Western Sun."

Vincennes, de (Jean Baptiste **Bissot**), Sieur, b. at Quebec, Canada, in Jan., 1688; was a near connection of Joliet; took part from childhood in expeditions to the Western country; was at Michilimackinac in 1698; entered the army as ensign; resided long among the Miami Indians, with whom he was a great favorite; rescued some Iroquois prisoners from the Ottawas 1704; came in collision with La Mothe Cadillac, the commander at Detroit; rendered valuable services against the Foxes near Detroit 1712; built soon afterward a fort and trading-post on the site of the present city of Vincennes, Ind., and in 1736 joined the expedition of D'Artaguette against the Chickasaws, by whom, after several victories, he was taken prisoner and burned alive, along with D'Artaguette, Père Senat, and several others.

Vin'cent, tp., Coosa co., Ala. P. 511.

Vincent, p.-v., Barlow tp., Washington co., O. P. 162.

Vincent (John H.), D. D., b. at Tuscaloosa, Ala., Feb. 23, 1832; educated at Lewisburg Academy and Wesleyan Institute; entered the Methodist Episcopal ministry at an early age, and became distinguished by his efforts to improve the organization and the literature of Sunday-schools; in 1872 was placed by the General Conference at the head of its Sunday-School Union and Tract Society; founded the *Sunday-School Teacher* at Chicago, Ill., and has written and published on behalf of his special interest.

Vincent (William), D. D., b. in London, England, Nov. 2, 1739; educated at Westminster School and at Trinity College, Cambridge, where he became a fellow 1761; took orders in the Church of England; was usher in Westminster School 1762–71, second master 1771–88, and head-master 1788–1802; became rector of All-Hallows, London, 1778, prebendary of Westminster 1801, and dean of Westminster 1802. D. in London Dec. 21, 1815. Author of *The Greek Verb Analyzed* (1795), *The Voyage of Nearchus from the Indus to the Euphrates, etc.* (1797), from the original journal of Arrian, and *The Periplus of the Erythræan Sea* (2 parts, 1801–05), both of which latter works were republished as parts of *The History of the Commerce and Navigation of the Ancients in the Indian Ocean* (2 vols., 1807). He also wrote a *Defence of Public Education* (1802) and various other works, and a posthumous collection of *Sermons on Faith, Doctrines, and Public Duties* (2 vols., 1817) was preceded by a *Life* by Rev. Robert Nares.

Vincent de Paul. See Paul, de (Vincent).

Vincen'tians, a congregation of secular Roman Catholic priests not under a monastic rule, but under special obligations to preach and hear confession among the poor, to assist in the education of clerics, and to further the annual devotion called the "ecclesiastical retreat."

Vincent, St., Island of. See Saint Vincent.

Vin'centtown, p.-v., Burlington co., N. J.

Vin'ci, town of Italy, province of Florence, on a hill 6 or 7 miles N. of Empoli, is distinguished as being the birthplace of the celebrated Leonardo da Vinci, who was born here in 1452. The Castello Vinci first appears in history in the eleventh century, and the famous captains Castruccio Castracani and Sir John Hawkwood both carried on military operations against it in the fourteenth century. P. 6576.

Vinci, da (Leonardo). See Appendix.

Vindhyas. See India, by R. C. Caldwell.

Vindobona. See Vienna.

Vinds. See Sloventzi.

Vine. See Grape, and Vine-Culture.

Vine-Culture. *History.*—The culture of the vine (*Vitis vinifera*) and the making of wine by the fermentation of the juice of the grape are among the most ancient industries of mankind. As the vine has accompanied the Aryan race to every congenial climate, its origin is usually referred to the same regions as that of its cultivators. It is said to attain its highest perfection in Persia, and in the forests of Mingrelia and Georgia it assumes proportions even more gigantic than do the American vines in our own. The Mosaic narrative mentions the planting of a vineyard by Noah, as well as his use and abuse of wine. The vine and its product are interwoven with the earliest myths of the Greeks and the Romans, and the estimation in which they were held by them is sufficiently indicated by the fact that the vine was the symbol and special attribute of one of their principal deities (Bacchus), whose service and feasts formed no small portion of their public religious ceremonies. In India wine was also known from the earliest times. Its use was interdicted to the Brahmans, as also to the kings of Egypt and to the Jewish priests when at the altar. In Carthage, Phœnicia, and most of Asia known to the ancients, wine was well known. Spain and Gaul doubtless received the vine from the Romans. From Gaul its culture extended into Germany, and later its character as a Christian symbol caused it to be carried by Christian missionaries to the remotest regions, from many of which it has since again disappeared. The advent of Mohammedanism checked vine-culture in the conquered countries; in China, where at one time it flourished, it was prohibited by law.

The early Norse discoverers of America were delighted to find the native vine on the coast of Southern New England. Wine is said to have been made in Florida from native grapes as early as 1561. The Spanish and Portuguese colonists carried the European grape to the temperate portions of South America at an early date; in 1602, some 2,000,000 vines were in bearing near the city of Asuncion in Paraguay. About 1620 the London Company sent French and Spanish vines to Virginia, and some time afterward French vine dressers went out to take care of them, but failed of success. In 1648 vines trained on trees existed in Tyedale, now Delaware. In 1683, William Penn set out a vineyard near Philadelphia; this also failed. During nearly two centuries after these first attempts, the effort to establish the culture of the European vine on a large scale was often renewed, by colonies as well as individuals, in the Atlantic and Western States; and while sometimes attended with temporary success in favored localities, the uniform ultimate failure induced, at last, the cultivation and improvement of several native American species, now developed into numerous varieties. The first step in this direction that became of general importance was the bringing out of the *Catawba* grape by Major Adlum of Georgetown, D. C., about 1835. It seems to have been first planted on a large scale by Nicholas Longworth, near Cincinnati, and his success caused a rapid increase of vine-culture in that region. In 1858 the area of vine-culture near Cincinnati was estimated at 1200 acres; in 1867 it exceeded 2000. From Cincinnati the culture of the Catawba spread rapidly to the westward, especially to Illinois and Missouri, between 1845 and 1850. Heavy investments were made, both fruit and wine finding ready sale at high prices, and vine culture in the Mississippi Valley seemed to be established upon a firm basis. Gradually, however, many failures began to be reported. Vineyards that had been in profitable bearing for several years began to be seriously affected by rot and mildew; in some even the vines languished and died, and viticulturists were getting to be seriously alarmed. Evidently, the Catawba had been too hastily accepted for general culture. Very soon, however, hardier and in many respects superior varieties were found or developed by culture. The success of *Norton's Virginia*, *Concord*, and other now well-known varieties revived the drooping spirits of the vine-growers, so that the total acreage of vines in 1867 was estimated by Mr. Husman at 2,000,000.

On the Pacific slope, in Northern Mexico, and California, vine-culture has had its independent history. About 1771 missionaries brought with them probably the seeds of Spanish grapes, which throve without any of the difficulties encountered on the Atlantic slope. Vineyards everywhere surrounded the missions, and wine for home consumption was abundant, though not, it would seem, of very choice quality, the mode of preparation being quite primitive. After the breaking up of the missions, the vineyards and orchards were neglected, but the "Mission grape" soon attracted the attention of the immigrants, after the first flush of the gold-fever had subsided; and after it was proved in 1858 that the vine could be grown in California without irrigation, its culture increased rapidly, the chief variety planted being the blue "Mission." The fiery and somewhat insipid character of the wines manufactured from this grape soon induced the introduction of other varieties, both of European and (quite lately) of the American stock; all of which seem to thrive in appropriate localities in the varied climates of California.

Geographical Distribution.—The culture of the vine on a large scale belongs to the warmer portions of the temperate zones. In the Old World, beginning at the mouth of the Loire, it reaches its extreme northern limits about the confluence of the Rhine and Moselle, 51° N. lat.; in the neighborhood of Berlin, 52° 30′ N. lat.; and about lat. 49° in Hungary. To the southward we find its outposts on the island of Ferro, lat. 27° 45′ N., and on that of Bahrein in the Persian Gulf, lat. 26° N. The production of palatable wines, however, usually falls far within these extreme limits, and is, moreover, largely controlled by local conditions of soil and climate. Farther N. the vine is still cultivated in favored localities or under glass for its fruit, which, however, fails to acquire sufficient sweetness and flavor for wine-making wherever the summer temperature falls below 18° to 20° C. (64.4° to 68° F.). In the tropics, on the other hand, the vine, while growing luxuriantly, bears but scantily, and the berries, when they ripen at all, are small, sweet, and insipid. Thus, we find the vine but sparingly cultivated on the southern slope of the Himalaya Mountains; in Southern Persia it already requires protection from the sun under lat. 29°, but in the northern and more elevated provinces of that country, as well as in Bokhara and the Caucasian region, its fruit is produced in the greatest profusion and perfection, with but little care on the part of cultivators.

The chief wine-producing countries of the Old World are, in the order of their commercial importance, France, Spain and Portugal, Germany (especially the valley of the Rhine), Austria (especially Hungary), and Italy. The vintages of Greece, Turkey in Europe, the Black Sea and Caucasian provinces of Russia, of Asia Minor, Syria, and Persia, are at present mainly of local importance, but the small raisin of the Greek islands—"currants," corrupted from *Corinth*—and the seedless "Sultana" raisins of Smyrna, are

everywhere known as articles of commerce. S. of the equator we find the vine in successful cultivation at the Cape of Good Hope, in lat. 32° S.; in South Australia, especially in the Hunter River region in New South Wales; and in New Zealand. On the South American continent it ranges nearer to the equator, partly, as in Peru, on account of the temperate climates produced by considerable elevation above the sea, partly because of the more rigorous climate of the southern continent. In North America also the zone of vine-culture lies nearer the equator than in the Old World, as might be presumed from the course of the isothermal lines. Although some of the more hardy varieties of the native stock thrive in the open air as far N. as Massachusetts, the northern limit of wine-production on a manufacturing scale is about lat. 42° N., in Southern New York, Pennsylvania, and the group of islands at the western extremity of Lake Erie. The culture of grapes chiefly for table use is extensively pursued on the eastern shore of Lake Michigan, about St. Joseph. Away from the tempering influence of the Great Lakes, however, we see little of vine-culture until we approach, to the southward, the wine-growing region of the Ohio River, Southern Illinois, and Missouri. Thence southward to the shores of the Gulf of Mexico and to the Rio Grande various species of vine flourish in the forests, and the European grape itself on the sandy shores of the Gulf. Thus far, vine-culture has been attempted on a limited scale only in the Southern States, but the results obtained render it highly probable that with a careful selection of varieties adapted to climatic and local circumstances good wines may be produced throughout this extensive region. Beyond the northern limit of wine-production the growing of grapes for table use, in favorable locations, on trellises on the sunny side of buildings, or finally in glass-covered graperies, is sometimes extensively pursued, as in Northern Germany, England, New England, and the Northern Middle States.

The vine is the type of the natural order Vitaceæ, which includes, besides, the Virginia creeper (*Ampelopsis*) and the numerous *Cissi* of the tropics. In the genus *Vitis* the calyx is minute, at the base of the petals; the latter, five in number (as are also the stamens), cohering at their points and detaching themselves at the base as the flower expands; style simple; ovary two-celled; the berried fruit 1 to 4-seeded. The flowers are polygamous—*i. e.* part of the plants obtained from seed are always sterile, the pistil being abortive, while the rest have perfect flowers, with both stamens and pistils, and bear fruit. The grapevines proper climb by tendrils placed opposite the leaves, mostly to two out of every three; the bunches of fruit occupy a corresponding position.

The main products of vine-culture, apart from the fresh fruit, of which enormous quantities are consumed, are *wine*, *brandy*, dried grapes or *raisins*, and *tartar*.

Species and Varieties.—The varieties of the vine heretofore almost exclusively planted in the Old World are all derived from the *Vitis vinifera*. As has been already stated, the culture of the latter on the North American continent has met with but very little success outside of California—whether, as some allege, from unsuitability of climate, or, as is believed by others, on account of its liability to the attacks of certain indigenous insect enemies and diseases, from which most of the varieties of native American grapes are comparatively exempt. The cultivated varieties of the latter are derived from four or five wild species, which may be briefly characterized as follows:

(1) *Vitis riparia* and *cordifolia*,* *or Frost Grape.*—Leaves three to five inches wide, more or less deeply 3-lobed, rather thin, glabrous, shining, rarely slightly hairy; lobes long and pointed, teeth acute; berries usually smaller than in the succeeding species, and usually with a bloom; one or two seeds in each; bunches loose, not very large; berries three to six lines in diameter. W. of the Alleghany range, from Canada to the Gulf of Mexico, on the banks of streams, often running over tall trees. Among the more important cultivated varieties of this species are the *Taylor*, *Clinton*, and perhaps the *Delaware*.

(2) *Vitis æstivalis, or Summer Grape.*—Leaves large, four to six inches wide, thicker and firmer in texture than the preceding, entire, or often more or less deeply and obtusely 3 to 5-lobed, sinus rounded, teeth short and broad; young leaves always very woolly or cottony, bright red or rusty; on maturity becoming smoothish, but dull, never shining; berries usually larger than in the preceding, with a distinct bloom, and two to three seeds; bunches usually compact, often so as to deform the berries. In the Middle and Southern States, on uplands, in open woods or thickets, not usually climbing as high as the preceding; fruit ripening in September; sweeter than the preceding, and of all natives the least foxy in taste. Exceedingly variable even in the wild state. The chief cultivated varieties are *Norton's Virginia*, *Cynthiana*, *Herbemont*, *Louisiana*.

(3) *Vitis vinifera*, of the Old World, is in many respects intermediate between the frost grape and the summer grape of the U. S. Its leaves are smoothish, and, when young, shining, bright green; more or less deeply 5- or even 7-lobed; lobes pointed and sharply toothed. The berries of most of the cultivated European grapes approach in size those of the two American species mentioned, and among the wild grapes of Italy, of the lower Danube, of the Caucasus, etc., the American species *riparia*, *cordifolia*, and *æstivalis* seem to be represented. While some regard these as varieties sprung from the cultivated vine, others incline to consider them as parent stocks from which, as in America, the cultivated varieties have gradually been produced. Of the numerous (some 2000) varieties of the European vine, but a few of the most prominent may find mention here. Of wine grapes, *Riesling*, *Traminer*, *Black Burgundy*, *Chasselas*, *Orleans*, *Rulander*, *Black Hamburg*, *Tokay of* Hungary, *Mission* of California. Of table and raisin grapes (more pulpy than the above), the *Spanish* or *Alexandrian Muscat* (from which the Malaga raisins are chiefly made), the *White Damascus*, *White Malvoisie*, *Black* and *White Gutedel*.

(4) *Vitis Labrusca, or Northern Fox Grape.*—Usually not very tall; leaves large, four to six inches, entire to deeply lobed, slightly dentate; covered when young with a thick, rusty, or sometimes whitish woolly down, which remains on the under side of the mature leaf; berries with three or four seeds as a rule, in small or middle-sized bunches; a tendril opposite each leaf, and as many as three or four bunches on each shoot; berries large, seven to ten lines in diameter. Native of the eastern slope of the Alleghanies from New England to South Carolina; not in the Mississippi Valley. The chiefly important cultivated varieties of this species are the *Catawba* (supposed to have originated on the Catawba River in North Carolina), *Isabella*, *Concord*, *Cunningham*, *Hartford Prolific*, *Delaware* (?). All possess to a greater or less extent the peculiar "foxy" flavor of their wild ancestor.

(5) *Vitis vulpina, or rotundifolia; Southern Muscadine*, *Bullace*, *Scuppernong*.—Bark, except of old trunks, not scaling off; stems casting aërial roots in damp places; tendrils not forked; leaves rounded, heart-shape, firm, glossy, smooth, or slightly hairy on under side, and with coarse and large teeth, 2 to 2.5 inches wide; berries few (6 to 20), in a rounded bunch, up to an inch in diameter, globular, thick-skinned, easily detached when ripe, strongly scented. Differs greatly in habit from all other cultivated species, and occurs only in the States S. of the 36th parallel. The mustang grape of Texas (*V. candicans*, Eng.) is probably a variety. Of cultivated varieties there are the black, red, and white *Scuppernong*.

Besides the varieties that may be considered as derived from the wild species by simple variation, a number of hybrids have been purposely bred, such as *Arnold's* (between foreign and *Clinton*) and *Rogers's* (foreign and *Labrusca*). Some of these give high promise of usefulness.

The *Soil* and *Location* of vineyards exert a very marked influence upon the kind and quality of their product, to an extent and in a manner often very difficult to explain. A southward (or at least eastward) slope is almost everywhere preferred; in the more northerly regions the value of the vintage depends very largely upon the increased warmth thus secured. The soils best adapted to the growth of the vine are light and even sandy loams, provided only that they be sufficiently rich in mineral plant-food, especially in potash. Hence the light soils resulting from the disintegration of feldspathic, and especially volcanic, rocks are everywhere among those producing the choicest vintages; on the Rhine, in Southern France, in Madeira, on the flanks of Mounts Etna and Vesuvius, in Sonoma co., Cal., and elsewhere. The American vines, moreover, both in the wild and cultivated condition, show a decided preference for calcareous soils. But there are local differences in soils, not understood, whose influence causes the market-value of vintages from contiguous and apparently exactly similar locations to vary as much as 200 per cent. Experience alone can determine questions of this kind. The soil of vineyards, moreover, should be deep and well drained. "Wet feet" are very generally considered injurious to the vine, and in heavy and badly-drained soils, as well as in wet seasons and damp climates, it is apt to become diseased. Its roots, however, will go far in search of moisture, and only extreme drought is seriously injurious. The vine resists the rainless summers of California and of the Med-

* It is doubtful whether the *V. cordifolia* of Michaux can properly be considered a distinct species from *V. riparia*, from which it differs only in the somewhat smaller and less deeply lobed leaves, and fruit sometimes fetidly aromatic, without bloom. Its habit is otherwise the same, and in the South-western States transitions from one to the other seem to occur frequently. In fruit catalogues both names are used indifferently.

iterranean region without irrigation; in some of the best vineyards of Malaga it is not unfrequently planted in cavities in the soft clay slate rock. It has been found especially important to maintain in the soil of vineyards the supply of available potash, which is heavily drawn upon in the form of the tartar (bitartrate of potash) deposited in the fermentation of wines. Hence it should be made a rule to return to the vineyard all offal, such as prunings, pomace, stems, etc., as well as the lees not manufactured into tartar. Potassic manures have been found especially efficacious in strengthening the vine against the attacks of diseases and parasites.

Propagation.—Most grapevines root easily, hence propagation by cuttings (from the previous year's canes, three buds on each) is the mode generally used on a large scale. The varieties of *riparia* root most readily; those of *æstivalis* and *vulpina* with more difficulty; such may be rooted by layering of branches, and plants thus produced bear sooner. The rooting of single buds with only an inch or two of wood is extensively practised by nurserymen, but requires special care. The rooting of green shoots is also feasible, but seems to produce weakly plants. Grafting does not succeed as readily as with other fruits, but has been more extensively practised of late for the purpose of getting hardy roots for delicate varieties. Seedlings are grown in order to obtain new varieties, and some very valuable ones have been produced by hybridization.

Culture, Training, etc.—Since the natural climbing habit of grapevines would soon take them out of convenient reach and control, it has been usual from remote times to restrain it by pruning and training. Long culture has rendered the European vine capable of bearing the most severe pruning without seriously injuring its vitality, while all the American grapes must as yet be allowed a closer adherence to their natural habits. The varieties of *V. vulpina* will not, as a rule, bear pruning at all, but succeed best when allowed to form their natural arbors. The other kinds will also flourish when thus treated, but not with the best results as regards quality and quantity of fruit from a given area. The action of the direct rays of the sun upon the fruit, especially in its later stages, is of such importance, particularly in the more northerly regions, that all means must be used to secure that object; which of course cannot be done in arbor-training. Again, in restraining the excessive development of wood, and in bending the canes, we increase the tendency to bear fruit, and favor the improvement of its quality. The nearest approach to the natural arbor, that yet secures most of the advantages alluded to, is the open trellis or frame training. The trellis consists of stakes 6 to 10 feet apart, 3 to 6 feet high, connected by one to three horizontal "rails," upon which the canes are trained. Being from 6 to 9 feet apart in the row, these frames allow the sun and air free access on two sides. The expense of wood, as well as of repairs, rendering the trellis very costly for large culture in the chief vine-growing countries, it has to a considerable extent been superseded by the use of single stakes. This mode of training requires, of course, more severe pruning, but it admits of a larger number of vines to the same area. Finally, in the Mediterranean countries, where wood is and has been scarce for ages, even the stake is dispensed with, the main trunk of the vine being so shortened by cutting-back every year that it forms a mere stump or "stock"* 10 to 18 inches high, from the gnarled topknot or "head" of which the bearing wood annually springs; three or four spurs, with two or three buds each, having been left for the purpose from the previous year's canes. The climber is thus converted into a small but self-sustaining tree, with slender branches crowded with fruit; the latter thus being also somewhat shaded from excessive noonday heat. In the U. S. this mode of training, not being applicable to the native varieties, is confined to California and New Mexico, where the European vine is mainly cultivated. Frame- (and to some extent stake-) training prevails in the vine-growing regions of the Atlantic States.

Diseases and Insect Enemies.—The vine is subject to numerous diseases, affecting the stem, leaves, or fruit. Most of these, however, are of a sporadic character, and directly referable to local or temporary causes, especially want of proper drainage, unsuitable soil, excessive damp and cold, or very warm wet weather, especially if followed by hot sunshine; injudicious or excessive irrigation, incautious or excessive pruning, etc. Among these diseases are the "jaundice," "consumption," "blight," "dropsy," "cancer," etc. There is no record of the occurrence of diseases of a general or epidemic character up to the year 1845, when the vine-disease, commonly called *mildew* in this country, first made its appearance in Europe. It did not, however, excite general alarm until (in 1851) it broke out in its most virulent form in the island of Madeira, whose grape crop it completely annihilated in 1852, after which it attacked and destroyed the vines themselves, so that since 1859 the wine trade of Madeira has been practically extinct. The disease appeared in Spain and Portugal in 1853-54, and almost simultaneously in France and Germany, where at first it committed fearful ravages. The disease manifests itself by the development of a fungous parasite, covering the leaves or shoots, as well as the berries themselves, with a white, powdery-looking network of beaded fibres. Growth is soon arrested, and decay or drying up follows. The fungus in its various phases has received a number of names, the best known of which is that of *Oidium Tuckeri*. But it is doubtful whether it is anything more than one of the numerous forms of the zymotic fungus, of which the common mould is usually considered the typical or mature form. Among hundreds of remedies proposed for this disease, the one that has proved generally efficacious is to dust over the part affected flowers of sulphur. If this is carefully attended to early in the season, before the hibernating spores of the parasite have had time to multiply and spread, the disease may be arrested with comparatively little trouble.

Another fungous disease, especially fatal to certain varieties in the Western States, is the "black rot" of the *berries*; a similar disease affects chiefly the *leaves* of the vine in Europe.

Scarcely had the alarm consequent upon the *Oidium* epidemic subsided on the discovery of a remedy in the application of sulphur, when (in 1865) a new alarm was sounded from certain districts of France. This time it was the "root rot" or *pourridié*; and its devastations and rapidity of progress threatened, for a time, to throw into the shade even the former plague. In 1868, Planchon showed it to be caused by the attacks of wingless lice upon the roots. These were ultimately proven to be the larvæ of a species of bark louse, having wings in its perfect state, and in some grape varieties feeding on the leaves only. To this insect, after many changes owing to a gradual acquisition of a knowledge of its most complicated natural history, the name of *Phylloxera vastatrix* has been affixed. (See PHYLLOXERA.) It is now almost beyond question that this insect is at home on the indigenous vines of the U. S., and has been introduced into Europe with them. It is especially fatal to the European vine, but hardly less so to the more delicate American varieties, particularly those of the *Labrusca* type; and it is exceedingly probable that most of the failures experienced in this country in the cultivation of the European vine have been owing to the attacks of this native American enemy, rather than to general unsuitability of climate. Of the numerous remedies proposed against the *Phylloxera*, but two thus far have proved effectual in eradicating the evil without material injury to the vine: and these, unfortunately, are difficult of universal application. One is, to submerge the vines for at least thirty days during winter; the other, to apply a very weak (1 in 8000) solution of the sulphocarbonate or xanthate of potash, in sufficient quantity to reach all the infested roots; 1 pound of the potash-salt being required for every 1000 to 1500 cubic feet of earth to be freed from insects. A most promising preventive is based upon the fact that the roots of some American varieties are practically *Phylloxera* proof, and may therefore be used as stocks upon which to graft (above ground) the more susceptible varieties. Wet and sandy soils are the least favorable to the development of the *Phylloxera*. The *Phylloxera* has lately made its appearance among the European or *Mission* grapes of California, and locally with very fatal effect.

There are numerous other insects that infest the vine more or less, and if allowed to increase unchecked will at times become seriously injurious. Foremost among these are, in this country, the rose-chafer (*Melolontha macrodactylus*, Latr.), several species of leaf-rolling caterpillars, the green-plant louse (*Aphis*), and the red spider (*Acarus tellarius*). Timely attention to the early broods will generally keep these and other locally-injurious insects under control.

(For details of the manufactures connected with vine-culture see the articles on WINE, BRANDY, RAISIN, TARTAR.)

EUGENE W. HILGARD.

Vine, Diseases and Insect Enemies of. See PHYLLOXERA and VINE-CULTURE.

Vin'egar [Fr. *vin*, "wine," and *aigre*, "sour;" Ger. *Essig*], a dilute solution of ACETIC ACID (which see), mixed with small quantities of sugar and other organic and vegetable matters. It is produced by the oxidation of alcoholic solutions. In the oxidation of alcohol an intermediate compound, *aldehyde*, is at first formed, which by the continued action of oxygen is ultimately converted into

* Vine-growers distinguish in a growing vine the main trunk, or *stock*; its main subdivisions, or *arms*; the previous year's growth, or *canes*; and the current year's growth, or *shoots*; non-bearing side-shoots are *laterals*; a cane cut back to a few buds is a *spur*.

acetic acid. (See FERMENTATION, by PROF. C. F. CHANDLER.) A dilute solution of alcohol is not, however, oxidized to acetic acid by simple exposure to air or oxygen; it is usually necessary that a peculiar fungoid plant (*Mycoderma aceti*), which appears to contain a minute quantity of proteine compounds, in a state of activity which serves as the carrier of the oxygen of the air to the alcohol, should be present. This fungus, which is often developed in old casks that have been used for making vinegar for a long time, and is also termed *mother of vinegar*, forms a gelatinous mass, having the appearance of glue that has been soaked in cold water. Its surface becomes rapidly coated with a bluish mould (*Penicillium glaucum*), which is sometimes observed in old bread. Pasteur regards acetification as a product of the development of the *Mycoderma aceti*—*i. e.* as a physiological fermentation—but it appears probable that the process is rather one of oxidation, and that the fungus accelerates the change by condensing the oxygen upon its surface and delivering it to the alcohol, possibly in the form of ozone. Indeed, the process of vinegar-making takes place in the entire absence of the *Mycoderma aceti*, as when metallic platinum (spongy platinum or platinum black) is brought into contact with alcoholic solutions; and Buchner has quite recently examined shavings that had been in use in a vinegar-factory for over twenty-five years (see below, under *Quick Process*), and found them to be absolutely free from the fungus. The formation of vinegar occurs more readily when, in addition to the presence of the *Mycoderma*, the following conditions prevail: The alcoholic fluid should be sufficiently dilute, not containing more than 10 per cent. of alcohol; the temperature should not be much below 70° F.; air (oxygen) should be supplied in abundance, and come into intimate contact with the solution to be acetified. During the oxidation of alcohol to acetic acid an increase of the temperature and specific gravity of the liquid occurs. In France and Germany the greater part of the vinegar is made from inferior grades of wine; in England infusions of malt and soured beers are extensively employed; while in the U. S. cider and alcoholic liquors are largely used. The culture of the vine is increasing in importance in this country, and it is probable that at no very distant date vinegar will be obtained from this source.

Wine vinegar is manufactured in Paris by the following process: The wine is first mixed with wine-lees, and is then put into sacks, which are placed in a large vat and submitted to pressure from above. It is next introduced into large upright casks having an opening at the top, and allowed to acetify. The regulation of the temperature exerts an important influence upon the quality of the vinegar produced. In summer, when the casks are exposed to the heat of the sun, the oxidation is usually completed in two weeks, but in winter, when they are placed in a warmed chamber, a month's time is often required. The liquid is then run off into barrels containing shavings of birch-wood, in which it is allowed to remain for two weeks, when the vinegar will be clarified and ready for use. In Orléans, where the best vinegar is made, wine unfit for drinking is collected from all parts of the country. The casks, which have a capacity of about 400 pints, are placed in rows, one over the other. The wine used is preserved in a vat containing beech-shavings, by which it is separated from the lees and clarified. About 100 pints of boiling vinegar is first introduced into each cask, where it is allowed to remain for several days, after which a small quantity (10 pints) of the wine is gradually added until the casks are filled, when they are allowed to remain at rest for fifteen days. Half of the vinegar is then drawn off and stored, and more wine is added to the remainder in the same manner as before. In this way the process is continued uninterruptedly. In order to ascertain how the "mother of vinegar" is working, a spatula is dipped into the liquid at short intervals, and the quantity of fresh wine added regulated by the amount of froth shown. The "souring casks," as they are termed, often last for ten years, at the lapse of which time, however, a sediment of yeast, argol, etc., accumulates, rendering a cleansing of the entire vessel necessary. Although in the above operation no extensive contact between the wine and air is apparent, a change of the surface of the fluid is constantly taking place, owing to the greater density of the vinegar formed; a continuous circulation of air is also produced, as the air from which the oxygen has been absorbed acquires a lower specific gravity, and therefore rises upward through the casks. Usually, wines a year old furnish the best vinegar; those of a greater age, which have lost their extractive matter, are not suitable for use. Vinegar prepared from wine is either white or red according to the color of the wine from which it is made. It contains, in addition to acetic acid and water, small quantities of acetic ether, bitartrate of potash, and aldehyde; its specific gravity ranges from 1.014 to 1.022. The process just described is termed the *old method*; it is also occasionally used in the manufacture of vinegar from malt. *The Quick* or *German process* (*Schnellessigbereitung*), which is based upon the older method of Boerhaave (1720), and was first introduced by Schützenbach in 1823, effects the oxidation of the alcohol to acetic acid in the most rapid and complete manner possible by bringing an enlarged surface of the liquid into intimate contact with the air. This is accomplished by causing the alcoholic liquid to fall in drops and meet an ascending current of air. The vessel employed consists of a large vat—of which several are frequently in use at the same time—about 8 feet in height, and having a diameter of 3½ feet at the top and 3 feet at the bottom. About a foot from the real lower bottom it contains a false bottom, similar to a sieve in construction, which supports a layer of beech-shavings extending nearly to the top of the vat. Between the true and false bottom a row of air-holes half an inch in diameter is bored in a slanting direction from the outside downward. The beech-shavings are first boiled in water and dried; they are then "soured," or allowed to soak in warm vinegar for twenty-four hours, with which they become impregnated. The vinegar employed to acetify the shavings should not contain any mineral acid; it should also be free from essential oils and pyroligneous acid, the presence of which greatly retards acetification. At a short distance (8 inches) from the top of the vat a perforated wooden disk is fitted in, the perforations of which have about the diameter of a goose-quill (⅛ inch); this also has several larger orifices enclosing glass tubes which permit the escape of the air from below. The space about the disk is filled with cotton batting or yarn, which becomes swollen and penetrates through the holes, for a short distance, thus causing the liquid to trickle slowly upon the shavings. At the top of the vat is a closely-fitting wooden lid, having in its centre a circular hole through which the liquid is introduced. During the oxidation of the alcoholic liquid a large amount of heat is developed in the interior of the cask, whereby the air is made to ascend, and fresh air to enter at the lower air-holes, a constant circulation being thus produced, which is very essential to the success of the process. After the shavings have been "soured," the liquid to be converted into vinegar—usually diluted spirits—is poured into one vat, and, as it flows off, is introduced into a second. If not over 4 per cent. of alcohol were contained in the original liquid, that drawn off from the second vat will be converted into good vinegar. The vinegar, as it collects between the true and false bottoms of the vat, is removed by a tap, which is so constructed that its end dips in the lower stratum of the liquid (that is, in the strong vinegar), and has its exterior end raised so that the liquid cannot flow out until quite a layer has accumulated, the presence of which assists in the process of acetification by evolving acid vapors, which ascend to the upper part of the vat. The temperature of the vinegar-room should be from 75° to 85° F., that of the vat from 95° to 100° F. Occasionally, a layer of white sand is introduced just above the lower false bottom, which is then covered with a flannel cloth to prevent the holes from becoming obstructed. This arrangement assists in the clarification of the vinegar. The composition of the liquid to be acetified varies greatly. The following mixtures are frequently used: 60-per-cent. whisky, 50 gallons; beer or malt wort, 37 gallons (also employed to sour the beech-shavings): common whisky, 3 gallons; prepared vinegar, 4 gallons; pure water, 33 gallons: brandy, 20 parts; vinegar, 40 parts; water, 120 parts; to which an infusion of a mixture of bran and rye meal is first added in order to promote the formation of the *Mycoderma aceti*. It is usual to draw off four gallons of the vinegar every hour, the same quantity of one of the above mixtures being added, together with an additional quart to compensate for the waste in manufacture. The prepared vinegar is preserved in a large vat to which half a gallon of molasses is added every day, until a layer having a thickness of 2 to 3 inches is formed; in this way a fine color is imparted to the product. Owing to the development of heat in the vats, a loss of alcohol, aldehyde, and acetic acid by evaporation occurs in the above process, frequently amounting to 10 per cent. This objection is remedied in Singer's generator, which consists of a number of vessels, one placed above the other, connected by wooden tubes, through which the liquid slowly trickles from one vessel into the other, a longitudinal slit being cut in each tube, thus permitting a free circulation of the air. The quick method of vinegar-making has largely superseded all others, and is in general use in this country.

Malt vinegar, which is the variety chiefly used in England, is generally prepared by submitting the wort obtained by mashing malt or a mixture of malt and barley to vinous fermentation, and oxidizing the resulting alcoholic liquor. This latter process can be effected as in the preparation of

wine vinegar, or by repeatedly passing the liquid through vats containing beech-shavings as in the quick process. Singer's generator is also often employed. Dilute solutions of sugar, and even mixtures of starch with yeast, furnish good vinegar. A good article for domestic use can be made by adding ¼ pint of yeast to a solution of 1½ pounds of sugar in 1 gallon of water, allowing the mixture to stand for three days at a temperature of 80° F., then drawing off into a ripening cask, and adding 1 ounce of bruised raisins and 1 ounce of crude tartar. Malt vinegar possesses a yellowish-red color, and an aromatic odor, which is imparted to it by the acetic and other ethers present. It is sold of four degrees of strength, known in the trade as Nos. 18, 20, 22, and 24. The last, which is the strongest and contains 5 per cent. of real acetic acid, is called *proof vinegar*; its sp. gr. is 1.019. The putrefactive fermentation of vinegar was formerly thought to be prevented by sulphuric acid, the addition of $\frac{1}{1000}$ part of which is allowed by law in England; but although this is now known to be unnecessary, the practice is still continued.

Cider vinegar, if made from good sweet and ripe apples, is perhaps the most agreeable variety in use; it is met with chiefly in this country. In its preparation fresh cider is allowed to ferment in barrels having the bungholes open, which are exposed either to the heat of the sun or to that of a warm cellar. It is well to allow several separate fermentations to take place, fresh quantities of cider being added to the barrels every two weeks; the acetification of the cider being also greatly accelerated by the addition of mother of vinegar. Cider vinegar contains, in addition to acetic acid, varying proportions of acetic ether and malic acid.

Pasteur has suggested a process of vinegar-making by the direct aid of the *Mycoderma aceti*. This fungus is first propagated in an aqueous solution containing 2 per cent. of alcohol, 1 per cent. of vinegar, and small amounts of phosphates of potash, lime, and magnesia. The plant soon spreads out, and ultimately covers the entire surface, the oxidation of the alcohol being at the same time gradually effected. When one-half of the alcohol has been acetified, small quantities of wine or alcohol, mixed with beer, are daily added, the complete conversion of the alcohol into vinegar being allowed to take place as soon as the acetification becomes weaker. The vinegar formed is then drawn off, and the plant again used in the same apparatus. The vessels employed are circular or rectangular shallow wooden tanks, into which the air is allowed access by means of two small apertures at the side, and are covered with lids. The alcoholic liquid is introduced through two gutta-percha tubes, which connect with the vessels at their bottoms. Wine or malt liquors can be directly converted into vinegar by this process; but when only alcohol is used, the addition of sulphate of ammonia and phosphates of potash and magnesia, and a little vinegar, is necessary in order to furnish the organic and inorganic food needful for the vinegar-plant.

A vinegar-making process in which the oxidation of the alcohol is effected with the aid of finely-divided platinum was first proposed by Döbereiner. Several shelves are arranged in a tall glass case, upon which are placed a number of porcelain capsules containing alcohol. Directly over each capsule is a tray supported on a tripod containing a little platinum black or spongy platinum. At the top and bottom of the case ventilators are so constructed that the access of air can be easily regulated. Upon heating the apparatus, by placing it in the sunshine or by means of a steam pipe, to about 85° F., the alcohol is slowly evaporated, and on coming in contact with the platinum is oxidized to acetic acid. So long as the ventilation is maintained, the platinum retains its property of conveying oxygen to the alcohol; when the acetification is completed, fresh air is admitted and the process recommenced. The vapors of alcohol and acetic acid carried off by the outgoing current of air can be collected by a condensing apparatus. Vinegar prepared from pure alcohol does not possess the pleasant flavor of that obtained from wine and cider, but the addition of a little acetic ether renders it more agreeable in taste. Small quantities of fusel oil, oil of cloves, or butyric ether are also occasionally added to the alcohol to be acetified in order to impart a fine aroma.

In countries where a high duty on alcoholic liquids exists, table vinegar is frequently prepared from wood vinegar or pyroligneous acid. For this purpose the crude acid is carefully purified, either by conversion into acetate of soda and distillation with sulphuric acid, or by saturation with lime, then adding hydrochloric acid, removing the tarry matters separated, and distilling. It is afterward further deodorized and purified by distillation with bichromate of potash and filtration through animal charcoal. Small quantities of acetic ether and burnt sugar are often used to impart flavor and color.

Distilled vinegar—which is generally employed for pharmaceutical purposes—is weaker than ordinary vinegar, since the boiling-point of concentrated acetic acid is above that of water. It is often contaminated with small quantities of alcohol, aldehyde, and empyreumatic substances. The quantity of acetic acid in vinegar differs greatly. The specific gravity is not an accurate indication of the strength, owing to the presence of foreign bodies. A preferable method consists in determining the amount of a standardized alkaline solution necessary to saturate the acetic acid present. (See VOLUMETRIC ANALYSIS.) The results given by this test are, however, not absolutely correct, as neutral alkaline acetates possess an alkaline reaction. The vinegar can also be supersaturated with a baryta solution, the excess of the salt eliminated by a current of carbonic acid, and the baryta salt in the filtrate precipitated as sulphate; from which the amount of acetic acid is calculated by multiplying by 0.515. Sulphuric acid, added to increase the acidity of vinegar or for other purposes, is best detected by boiling the suspected vinegar with a small quantity of potato-starch, and, after the *complete cooling*, adding a solution of iodine; if the vinegar be pure, the blue color of iodide of starch will become apparent; but if sulphuric (or hydrochloric) acid be present, the starch will be converted into dextrine by the boiling, and the blue coloration will fail to appear. Free sulphuric acid can also be detected by means of chloride of calcium, which causes a precipitation of sulphate of lime in presence of the free acid, but not in that of the minute quantities of sulphates generally present. Hydrochloric acid is indicated by a white precipitate with nitrate of silver; nitric acid can be detected by a yellow color when the vinegar is boiled with indigo, or by the deflagration of the residue obtained by evaporating with a little carbonate of soda. Such acrid substances as red pepper, mustard, etc., are recognized by evaporating the vinegar to an extract, which in their presence will possess a biting taste. Copper is detected by the formation of a brown precipitate upon addition of ferrocyanide of potassium; lead, by the black precipitate produced by sulphuretted hydrogen, and the yellow one given by iodide of potassium. J. P. BATTERSHALL.

Vin'egar Hill, tp., Jo Daviess co., Ill. P. 693.

Vinegar-Plant. See VINEGAR.

Vine'land, p.-v., Cumberland co., N. J., 34 miles S. of Philadelphia, on the direct line of West Jersey R. R. to Cape May, and 115 miles from New York, on the direct line of New Jersey Southern R. R. The town-plat is 1 mile square (the Vineland tract of 35,000 acres extends into Atlantic and Gloucester cos.), not closely built, except for a few blocks on the main avenue. The principal avenues are 100 feet wide; the remaining avenues and streets 60 feet in width. Outside the town-plat the tract is laid out in fruit-farms of from 5 to 25 acres, and there being few fences the appearance is that of an extended park. The place was founded by Charles K. Landis in 1861; is devoted mainly to the culture of small fruits, to which the soil is especially adapted; contains 10 churches, 18 district schools and a central high school, erected at a cost of over $25,000, several private schools, Kindergarten, bank, a variety of manufactories, including 8 shoe-factories, straw-sewing, paper-box, fruit-crate, carriage, wallet, button and glove factories, lumber-yards, steam flour and feed mills, machine-shops, etc. Vineland has 5 post-offices, 2 daily, 4 weekly, and 2 monthly newspapers, besides occasional publications, and 2 hotels. The temperance policy of the place, its mild and healthful climate, the abundance of superior fruit produced, and the general beauty of the town, serve to attract settlers here from all parts of the world. The shipping of fruit is an important industry, there having been shipped for the season of 1875, 345,791 quarts of berries, 23,791 crates of peaches and pears, and 1,210,188 pounds of grapes, besides which large quantities were disposed of in other ways. P. about 11,000.

MISS ESTELLE THOMSON, ED. "DAILY ADVERTISER."

Vine Prairie, tp., Crawford co., Ark. P. 338.

Vi'ner (CHARLES), b. at Aldershott, Hampshire, England, in 1680; became a lawyer; was employed above fifty years in the preparation of *A General Abridgment of Law and Equity* (23 vols., 1742–51), printed at his own house at Aldershott, to which an *Alphabetical Index* (London, 1758) was prepared by Robert Kelham. D. at Aldershott June 5, 1756. He bequeathed £12,000 to the University of Oxford to found the Vinerian professorship of common law, of which Sir William Blackstone was the first incumbent.

Vines (RICHARD), b. in England about 1580; received a medical education; was sent by Sir Ferdinando Gorges in 1611 or 1616 to act as his agent in planting a settlement on Saco Bay, Me.; spent there the winter of 1616–17, during the great pestilence which depopulated the New England Indians; gave them medical assistance; ascended the

Saco River in a canoe to Crawford's Notch 1617; was the first white man who visited and described the White Mountains, and received from the council of the Plymouth Company in 1630 a grant of land on the Saco River, where he founded the village of Biddeford.

Vines (Richard), b. at Blaston, Leicestershire, England, about 1590; educated at Magdalen College, Cambridge; became a celebrated Presbyterian preacher, expositor, and scholar; was rector of Weddington, Warwickshire, and subsequently minister of St. Clement Dane's and vicar of St. Lawrence Jewry, London; was one of the famous Westminster Assembly of Divines 1643–49, and became in 1645 master of Pembroke Hall, Cambridge, which post he resigned in 1650 on account of the Engagement. D. in 1655. He published a volume of *Sermons* (1644) and some single discourses. Four volumes of *Sermons* appeared after his death (1657–67).

Vinet' (Alexandre Rodolphe), b. at Ouchy, canton of Vaud, Switzerland, June 17, 1797; studied at Lausanne; was appointed professor of the French language and literature at Bâle in 1819; engaged with great energy in the Free Church movement going on at that time in several of the Swiss cantons, and was made professor of practical theology at Lausanne in 1837. D. at Clarens, on the Lake of Geneva, May 4, 1847. His theological writings, *Mémoire sur la Liberté des Cultes* (1823), *Discours sur quelques Sujets religieux*, *Essai sur la Manifestation des Convictions religieuses*, *Théologie pastorale*, etc., were often reprinted, and translated both into German and English. He also wrote *Histoire de la Littérature française au 18me siècle* and *Études sur la Littérature française au 19me siècle*, etc. His biography has been written by Scherer (Paris, 1853) and Rambert (Lausanne, 1875). (See also Sainte-Beuve's *Portraits contemporains*.)

Vineur. See Rochambeau.

Vine'yard, tp., Washington co., Ark. P. 887.

Vineyard, tp., Lawrence co., Mo. P. 1419.

Vineyard Grove, p.-v., Dukes co., Mass.

Vineyard Haven, p.-v., Dukes co., Mass.

Vineyard Sound, the passage between Martha's Vineyard and the Elizabeth Islands, on the S. coast of Massachusetts. It is 20 miles long and 6 broad, and is a great thoroughfare for coasting vessels.

Vin'land (the "wine-land"), the name which Leif the Lucky gave to those regions of North America—probably the coasts of Massachusetts and Rhode Island—which he visited in 1000 A. D. Leif was a son of Eric the Red, who had made the first settlement in Greenland, and it was on their road from Greenland to their home (Iceland) that these settlers discovered America. In 1003 came Thorvald, a brother of Leif, and in 1007, Thorfinn Karlsefne, his brother-in-law. But when Thorfinn, after three years' stay, returned to Iceland, no more attempts were made to explore and settle the new country. All facts relating to this early discovery of America—which, however, are few and not very interesting—have been collected by Rafn in his *Antiquitates Americanæ*, but another Danish antiquarian, the celebrated Finn Magnussen, has established the fact that Columbus visited Iceland in 1477, and this visit gives the old traditions of Vinland a curious interest.

Vinland, p.-v. and tp., Winnebago co., Wis. P. 1040.

Vinnit'za, town of Russia, government of Podolia, on the Bug, has 8991 inhabitants.

Vinous Fermentation. See Fermentation, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Vin'ton, county of S. Ohio, drained by Salt and Raccoon creeks, and traversed by Marietta and Cincinnati R. R.; surface undulating, soil fertile. Iron ore and bituminous coal abound. There are saw-mills, flour-mills, tanneries, currying establishments, and manufactories of charcoal and pig lead. Cattle and sheep are numerous. Staples, Indian corn, oats, wheat, potatoes, tobacco, hay, and dairy products. Cap. McArthur. Area, 414 sq. m. P. 15,027.

Vinton, p.-v., cap. of Benton co., Ia., on Burlington Cedar Rapids and Minnesota R. R., and upon the S. bank of Cedar River, 25 miles N. W. of Cedar Rapids, has 6 churches, 1 academy, 3 banks, 2 newspapers, and 1 planing and 2 flouring mills. The State college for the blind is located here. P. 2460. J. W. Rich, Ed. "Eagle."

Vinton, p.-v., Gallia co., O., on Gallipolis McArthur and Columbus R. R., and on Raccoon River, 40 miles from its mouth, has several churches, excellent schools, 1 newspaper, and several mills. P. 137.
C. M. Holcomb, Ed. "Gallipolis Journal."

Vinton, p.-v. and tp., Vinton co., O. P. 656.

Vinton (Alexander Hamilton), M. D., D. D., b. at Providence, R. I., May 2, 1807; studied medicine at New Haven; practised as a physician 1828–32; pursued a theological course in the Protestant Episcopal Seminary at New York; was ordained 1835; was pastor of churches at Portland, Me., 1835–36, Providence, R. I., 1836–42, Boston, Mass., 1842–58, Philadelphia, Pa., 1858–61, and New York City 1861–70, since which time he has been rector of Emanuel church, Boston. He has published a volume of *Sermons* (1855) and several separate discourses and addresses.

Vinton (David H.), brother of following, b. in Providence, R. I., May 4, 1803; graduated at the U. S. Military Academy in 1822, and entered the 4th Artillery; transferred to the infantry in 1823. After a term of garrison and special duty, he was sent to Florida in 1836, where employed on quartermaster duty, and in 1837 made quartermaster-general of Florida. Continued in the same service until 1846, he was in that year made chief quartermaster on the staff of Gen. Wool, with rank of major, serving with the latter in Mexico; was chief quartermaster department of the West 1852–56, of the department of Texas 1857–61, and taken prisoner upon the surrender of Twiggs. Exchanged soon after, he was in Aug., 1861, made deputy quartermaster-general, and as chief quartermaster at New York during the civil war rendered valuable service. Promoted to be colonel in 1864, in 1866 he became assistant quartermaster-general, and the same year was placed on the retired list. For "faithful and meritorious services" he was brevetted colonel and brigadier-general. D. at Stamford, Conn., Feb. 21, 1873.

Vinton (Francis), brother of Alexander, b. at Providence, R. I., Aug. 29, 1809; graduated at West Point 1830; became second lieutenant of artillery; was stationed at Fort Independence, Boston harbor, during which time he studied law at Harvard Law School; acted as civil engineer to several railroads; was admitted to the bar at Portsmouth, N. H., 1834; served in the Creek war in Alabama and Georgia 1836; left the army in that year; studied theology in the Protestant Episcopal seminary, New York; was ordained 1838; was successively rector of churches at Providence and Newport, R. I. (1840–44), and Brooklyn, N. Y. (1844–55); declined the bishopric of Indiana 1847; became assistant minister of Trinity church, New York, 1855, and professor of ecclesiastical law and polity at the General Theological Seminary 1869. D. in Brooklyn Sept. 29, 1872. Author of *Arthur Tremaine, or Cadet Life* (1830), and a *Manual Commentary on the General Canon Law of the P. E. Church in the U. S.* (1870).

Vinton (Francis Laurens), nephew of Dr. Francis, b. at Fort Preble, Me., June 1, 1835; educated under the care of his uncle; graduated at West Point 1856; entered the 1st Cavalry, but soon resigned; studied metallurgy at the Imperial School of Mines, Paris; examined the mineral resources of Central America; was appointed captain of the 16th U. S. Infantry, 1861; became colonel of the 43d New York Vols.; was engaged in the Peninsular campaign in Hancock's brigade; was wounded at Fredericksburg; became brigadier-general of volunteers Mar. 13, 1863; resigned May 5, 1863; and was made professor of engineering in Columbia College Sept., 1864. D. Oct. 6, 1879.

Vinton (Frederick), b. at Boston, Mass., Oct. 9, 1817; graduated at Amherst 1837; studied divinity at New Haven, but was not ordained; taught at Nantucket, Mass., 1846–47, at Eastport, Me., 1847–48; librarian at St. Louis, Mo., 1851–55; assistant in the Public Library, Boston, Mass., 1857–65; in the Library of Congress 1865. Distinguished for bibliographical labors.

Vinton (John Adams), b. in Boston, Mass., Feb. 5, 1801; graduated at Dartmouth 1828, at Andover 1831; became a Congregational minister, and was settled over several churches in Maine, Vermont, and Massachusetts 1832–52. Author of *The Vinton Memorial* (Boston, 1858), *The Giles Memorial* (1864), and *The Sampson Family in America* (1864); edited a reprint of Deborah Sampson's *Female Review* (1866), and contributed to several religious and literary periodicals.

Vinton (John R.), b. at Providence, R. I., about 1795; graduated at the U. S. Military Academy in 1817, and entered the artillery; he served for three years on the northern boundary survey; in garrison and on special duty until 1836; in the Florida war 1837–42, and in the war with Mexico 1846–47, gaining the brevet of major for gallantry at Monterey. Transferred to the army of Gen. Scott, he was killed in front of Vera Cruz Mar. 22, 1847.

Vio, de (Thomas). See Cajetan.

Vi'ola, or **Tenor Violin,** a very large violin, having four strings, two of catgut alone and two wound with wire; it stands an octave above the violoncello, and is employed almost exclusively for playing the middle part in orchestral music.

Vio'la, tp., Lee co., Ill. P. 639.

Viola, p.-v., Green tp., Mercer co., Ill. P. 407.

Viola, p.-v. and tp., Olmsted co., Minn. P. 728.

Viola, p.-v., Warren co., Tenn. P. 911.

Vi'olet, tp., Fairfield co., O. P. 2087.

Violet [Lat. *viola*], a large genus (*Viola*) of exogenous herbs of the order Violaceæ. Of the 200 recorded species, most are natives of the N. temperate zone. Many varieties have resulted from cultivation. Among these are the sorts called pansies, heartsease, etc. The cultivated sorts are mostly of the Old World species, *V. tricolor*, *V. odorata*, *V. grandiflora*, *V. altaica*, and their hybrids. One fine North American species, *V. pedata*, is becoming common in gardens, but most of our American violets are not very showy plants in culture. The successful culture of pansies of the better sorts requires skill and experience.

Violin' [It. *violino*], a musical instrument with four strings, played with a bow, anciently called a fiddle (Ang.-Sax. *fythel*), consists of three parts—the neck, the table, and the sounding board; has at its side two S-shaped apertures of unequal size. Above these is a bridge, over which pass the strings from the lower extremity or tail-piece to the neck, where they are tightened or loosened by means of turning-pins. It is considered the most perfect of musical instruments, on account of its capabilities of fine tone and expression, and forms with its cognates, the viola, violoncello, and double bass or bass-viol, the main element of all bands and orchestras. It is of considerable antiquity, being traced in England to the twelfth century. The most prized instruments are those made in the seventeenth and eighteenth centuries in Italy by the Amatis at Brescia, Stradivari and the Guarneris at Cremona, and Stainer in the Tyrol.

Viollet-le-Duc' (Eugène Emmanuel), b. in Paris Jan. 27, 1814; studied architecture under Leclère, afterward in Italy 1836–39; was employed after 1840 in the restoration of the principal mediæval architectural monuments of France, among which was the cathedral of Notre Dame in Paris, and was appointed professor of the history of art in 1863. His principal works are—*Dictionnaire raisonné de l'Architecture française du XI. au XVI. Siècle* (10 vols., 1853–68), *Dictionnaire raisonné du Mobilier français de l'Époque carlovingienne à la Renaissance* (1855–75), *Essai sur l'Architecture militaire au Moyen Age* (1854; translated into English by M. Macdermott, London, 1860), *Entretiens sur l'Architecture* (2 vols., 1863–72), *Histoire d'un Maison* (1873), *Histoire d'une Forteresse* (1874), *Histoire de l'Habitation humaine* (1875); the four last have been translated into English by B. Bucknall. D. at Paris, Sept. 18, 1879.

Violoncel'lo, a bass violin with four strings tuned in fifths, A, D, G, and C, the two latter strings being wound with wire.

Vioménil', de (Antoine Charles **du Houx**), Viscount, b. at Fanconcourt, Lorraine, France, in 1728; entered the army at the age of seventeen; served in Holland, Hanover, and Corsica, gaining the rank of field-marshal; assisted the Polish confederation against Russia 1770, and captured the castle of Cracow; came to the U. S. in 1780 as second in command to Count Rochambeau; distinguished himself at the siege and capture of Yorktown 1781, where he led his troops in the storming of the redoubt; was promoted to a lieutenant-generalship; returned to France and became governor of La Rochelle 1782, and was so severely wounded while defending the king during the assault upon the Tuileries, Aug. 10, that he died a few weeks later, Nov. 9, 1792.—His brother, Charles Joseph Hyacinthe du Houx, Marquis de Vioménil, b. in 1734; served in Germany during the Seven Years' war; was a major-general under Rochambeau in the U. S. 1780–82, bearing the title of baron; was at Yorktown; was governor of Martinique 1789–90; emigrated from France as a royalist 1791; served under the prince of Condé 1791–97; became a peer 1814, a marshal of France July 3, 1816, and a marquis 1817. D. at Paris Mar. 5, 1827.

Viper. See Viperidæ.

Viper'idæ [from *Vipera*—the old Latin name—the typical genus of the group], a family of the order of serpents and the sub-order Solenoglypha, embracing the viper of Europe and related species. The form is typified by the common viper; the scales on the back and sides are oblong and imbricated, those on the abdomen transverse scutellæ; the head is well distinguished from the body, and depressed oval; the upper surface covered with plates or scales; the eyes have, mostly, elliptical pupils; no lachrymal fossæ are developed; the poison-fangs are truly solenoglyph, and destitute of external grooves. The family includes a number of poisonous serpents peculiar to the Old World, and is at first sight distinguishable from the Crotalidæ (rattlesnakes, etc.) by the want of the deep pits between the eyes and nostrils which so much enhance the vicious look of the latter. The most notable species are the viper of Europe (*Vipera berus*), the cobra de capello (*Naja tripudians*), and the Egyptian *Naja haje* and *Cerastes Hasselquistii*, each of which has been supposed by different writers to have been the asp fatal to Cleopatra. Theodore Gill.

Vir'chow (Rudolf), b. at Schivelbein, Pomerania, Oct. 13, 1821; studied medicine in Berlin; was appointed prosector at the Charité Hospital in 1843, and sent in 1848 by the Prussian government to Silesia to investigate a typhoid fever raging there; received in 1849 a professorship of pathological anatomy at the University of Würzburg, and was in 1852 sent by the Bavarian government to the Spessart to investigate a famine fever which had broken out there; returned to the University of Berlin in 1856, and acted as director of the hospitals during the campaigns of 1866 and 1870–71, taking part all the while with great energy in the political movements as a representative of the city of Berlin in the Prussian house of representatives. He is the creator of the cellular theory in pathology, which he has developed in *Die Cellularpathologie in ihrer Begründung auf physiologische und pathologische Gewebelehre* (1858), and in his *Archiv für pathologische Anatomie*, which he founded in 1844 in conjunction with Reinhardt. He also wrote *Handbuch der speciellen Pathologie und Therapie* (3 vols., 1854–62) and *Vorlesungen über Pathologie* (4 vols., 1862–67), besides a great number of minor essays on various subjects, among which are *Goethe als Naturforscher* (1861), *Ueber Pfahlbauten und Hünengräber* (1866), *Ueber Erziehung des Weibes für seinen Beruf* (1865), *Die altnordische Schädel zu Kopenhagen* (1871), etc.

Vir'den, p.-v., Macoupin co., Ill., has a private bank.

Vire, town of France, department of Calvados, on the Vire, has large cloth and paper manufactores. P. 7617.

Vireo. See Vireonidæ.

Vireon'idæ [from *Vireo*, the generic name of the type], a family of birds of the group of Passeres, admitted by most recent ornithologists, although based on characters of dubious importance. It has been best defined by Baird in essentially the following terms: The general form is normal; the bill conical, much compressed, decurved at end and notched, but scarcely toothed; the gonys is more than half the length of lower jaw (from tip to angle of mouth), and usually longer than the width of the mouth, which is narrow; the nostrils are lateral and overhung by membrane; the frontal feathers are bristly and erect, or bent but slightly forward; the wings have mostly ten primaries, but the spurious one is wanting in certain *Vireos*; the tail is moderate; the tarsi have the lateral plates undivided, except at the extreme lower ends, and they are longer than the middle toes with the claws; the three anterior toes have their basal phalanges abbreviated, and the basal phalanx of the median toe is decidedly shorter than the basal of inner, or the two basal of outer, and adherent for its whole length on both sides to the lateral (*i. e.* not free at all); the outer claw reaches about halfway along middle claw. The family is peculiar to America, and according to Sclater and Salvin is represented by 7 genera and 50 species—viz. (1) *Vireosylvia*, with 9 species; (2) *Vireo*, with 10; (3) *Neochlæ*, with 1; (4) *Hylophilus*, with 16; (5) *Laletes*, with 1; (6) *Vireolanius*, with 4; and (7) *Cyclorhis*, with 9: 10 or 11 have since been described. In the U. S., according to Baird, Brewer, and Ridgway, are 14 species, belonging to *Vireosylvia* and *Vireo*. The species are all moderate or rather small-sized singing birds. According to Brewer they mostly build pensile nests of considerable architectural ingenuity and beauty. The eggs are usually five in number (sometimes not more than three), and, in *Vireo* at least, "of a brilliant crystal-white, sparingly spotted at the larger end with markings of dark brown, and others of a lighter shade" (*Brewer*). Theodore Gill.

Virey' (Julien Joseph), b. at Hortes, department of Haute-Marne, France, in 1775; studied medicine in Paris; was for some time first pharmaceutist to the military hospitals, and member of the superior council of health from 1831 to 1838. D. at Paris Mar. 29, 1846. His principal works are—*Histoire naturelle du Genre humain* (3 vols., 1801), *Art de perfectionner l'Homme* (2 vols., 1808), *De la Physiologie dans ses Rapports avec la Philosophie* (1814), *Histoire des Medicaments, des Aliments et des Poisons* (1820), and *Philosophie de l'Histoire naturelle* (1835).

Virgil. See Vergil.

Vir'gil, tp., Kane co., Ill. P. 1273.

Virgil, tp., Vernon co., Mo. P. 979.

Virgil, p.-v. and tp., Cortland co., N. Y. P. 1889.

Virgil (Polydore). See Vergil.

Virgil City, p.-v., Cedar co., Mo.

Virgil'ia, a genus of South African leguminous trees, to which the American yellow-wood (*V. lutea*) is ascribed by Michaux; and though Rafinesque denies the connec-

tion, calling it *Cladrastis tinctoria*, it is usually known in the U. S. by the former name. It is a beautiful tree, about forty feet in height, with flowers in loose pendent racemes twenty inches long: is much prized for lawn-planting, and is hardy and easily grown from the seed.

Vir'ginals, or **Pair of Virginals** [so called because it was designed to be played by young ladies], a sort of spinet: a small piano-shaped stringed and keyed instrument, long since obsolete.

Virgin'ia, one of the Middle Atlantic States of the American Union, and one of the original thirteen of the first Confederation, lying between the parallels of 36° 31′ and 39° 27′ N. lat., and between the meridians of 75° 13′ and 83° 37′ W. lon. from Greenwich. Maryland (from which it is separated by the Potomac River and Chesapeake Bay for 205 miles, and by a line of 25 miles across the Eastern Shore) forms its northern and north-eastern boundary; the Atlantic Ocean borders it for 125 miles on the E. and S. E.; on the S. it is bounded by North Carolina for 326 miles, and by Tennessee for 114; on the W. and N. W. Kentucky bounds it for 115 miles, and West Virginia for 450 miles more. The longest line in the State is from the Atlantic S. W. to the Kentucky line, 476 miles. The longest line from N. to S. is 192 miles. The area of the State, exclusive of tidal waters, bays, sounds, etc., is, according to

Obverse.

Reverse.

The Seal of Virginia.

the census of 1870, 38,348 sq. m., or 20,062,720 acres; but Major J. Hotchkiss, whose *Geographical and Political Summary of Virginia* is just published by the State, reckoning all tidal waters, etc., as well as the mountains to their highest summits, estimates the area at 45,000 sq. m., or 27,201,000 acres. He arranges the State in six divisions, and assigns the following areas to each: Tidewater Virginia, 11,350 sq. m.; Middle Virginia, 12,470; Piedmont, 6680; Blue Ridge, 1230; the Valley, 7550; Appalachia, 5720 sq. m.

Topography and Physical Geography.—Tidewater Virginia is the alluvial and diluvial plain in the E. portion of the State, and is divided by Chesapeake Bay and the large tidal rivers which flow into it into nine primary and many subordinate peninsulas; among these is that portion of the Eastern Shore of the bay belonging to Virginia, and including the counties of Northampton and Accomac. It extends as far W. as Richmond. No part of this region is elevated more than 100 feet above the sea, and considerable tracts are low and marshy. Middle Virginia, a triangular tract extending from a N. and S. line running through Richmond to the foot-hills of South-west Mountain, is a wide undulating plain of no great elevation (perhaps an average of 400 feet), through which the many rivers which traverse it have cut their channels to a considerable depth and are bordered by alluvial bottom-lands. Its rocks belong to the Triassic and Jurassic systems, with occasional extensive outcrops of granite, gneiss, and other Eozoic groups. Piedmont includes both slopes of South-west Mountain, and an undulating plain, broken into valleys in some portions, extending to the foot-hills of the Blue Ridge. It has many small streams, and its hills are rounded and fertile. It occupies a belt of territory from 18 to 28 miles in width, and extending from N. E. to S. W. through the State. Its prevailing rocks are crumbling greenstone and granite. The Blue Ridge country is a still narrower belt, parallel with the preceding, including both slopes of the Blue Ridge Mountains, and forming the eastern wall of the Valley of Virginia. The summits of the Blue Ridge rise to a height of 2500 to 3000 feet; they are mostly dome-like, and between them stretch, especially in the S., broad plateaus. The Valley of Virginia is a part of the great Appalachian Valley, lying between the Blue Ridge on the E. and the Kittatinny or Endless Mountains on the W. It is a broad belt of rolling country, from 1200 to 1600 feet above the sea, diversified by hills and valleys, with many winding streams of water. Its soil, underlaid with disintegrating limestones, shales, slates, and clays, is very fertile, and it is sheltered by the mountains on either side from chilling winds. Appalachia is the region covered by that part of the Kittatinny Mountain range (which has here a score of local names) traversing Virginia. It is made up of a number of parallel mountain-chains, with trough-like valleys between them, the mountains often running 50 miles or more in an unbroken, single, straight, lofty ridge, with a narrow and equally uniform valley alongside; sometimes the mountains slope gently down and the valleys widen. Some of the sharp, bold ridges rise to a considerable height: Elliot's Knob is nearly 4200 feet, Warm Spring and Alleghany Mountain about 3500 each. Two points of the Blue Ridge are said to be still higher—the Balsam Mountain in Grayson co., 5700 feet, and a point near the Tennessee line, 5530 feet; the Peaks of Otter are 3993 feet, and Mount Marshall, near Front Royal, 3369 feet.

Rivers and Lakes.—Of the numerous rivers which drain the State, six-sevenths belong to the Atlantic system, and one-seventh to the Ohio and its tributaries: and of the latter, a part, as the Holston and Clinch, are affluents of the Tennessee: a part, as the Louisa, Russell, and Tug Forks, of the Big Sandy; while the Kanawha or New River flows into the Ohio directly. Of the streams flowing into Chesapeake Bay and the Atlantic, the principal are—the Potomac, with its large tributaries, the Shenandoah and South Branch, and the smaller ones, Potomac Creek, Occoquan River, Broad Run, Goose, Kittoctin, and Opequan creeks; the Rappahannock, with its principal affluent, the Rapidan, and numerous smaller ones; the Pianketank; the York, with its branches, the Pamunkey and Mattapony, as well as smaller tributaries; the James, one of the largest rivers in the State, which receives the Chickahominy, Elizabeth, Nansemond, Appomattox, Rivanna, Willis, Slate, Rockfish, Tye, Pedlar, South, Cowpasture, Jackson's, and other rivers and creeks. All these flow into Chesapeake Bay. The Chowan, with its affluents, the Blackwater, Nottoway, and Meherrin; the Roanoke, by its branches, the Dan, Otter, Pig, and other streams, fall into Albemarle Sound in North Carolina; and the Yadkin joins the Great Pedee and falls into the Atlantic in South Carolina. All these rivers drain the S. and S. E. portions of the State. Virginia is not a country of lakes. The largest in the State is Lake Drummond in Dismal Swamp; but, aside from the great Chesapeake Bay, which forms so large a portion of its coast-line, it has a number of small bays and extensive estuaries at the mouths of its rivers. There are a considerable number of islands belonging to Virginia in Chesapeake Bay and around the Eastern Shore.

Geology and Mineralogy.—We can only indicate in general terms the geological structure of the State. The Tidewater region is, along the shores of its estuaries, bays, and ocean-beach, Quaternary and Alluvial; the first step or terrace above this, the low plain of the Eastern Shore and Norfolk peninsulas, is Pliocene or Upper Tertiary; the next terrace, extending from this to about the 77th meridian, is Miocene or Middle Tertiary, mainly beds of sand, gravel, yellow and blue marl, and pebbles; from this line to the head of tidewater, a strip of about 15 miles in width, is Eocene or Lower Tertiary, a green sand-marl mingled with yellow and sulphur-colored clays, and yellowish-gray and blue marls, with many fossils. There are in the western portion of this region transported boulders of Triassic

or new red sandstone, and small outcrops of Azoic or Primary rocks. Middle Virginia is mostly Eozoic, the rocks mainly crystalline—gneiss, syenite, granite, with porcelain clays, micaceous, talcose, and argillaceous slates, and sandstones. The gold-belt runs through this section. At various points in this middle country are patches of greater or less extent of Triassic and Jurassic rocks, usually known as "brownstone," or geologically as new red sandstone. This is mostly a conglomerate, and includes some beautiful building stones, such as the brecciated marble of the Potomac; many fossils are found in this formation, and in what is known as the Richmond coal fields there are valuable beds of rich bituminous coal. The Piedmont region is also Eozoic, but the gneiss contains more talc or chlorite, hornblende, and iron pyrites, and near the base of the Blue Ridge belts of granite and micaceous and talcose slates. The eastern border of this region is largely composed of epidotic or greenstone rocks, with abundant crystals of epidote and quartz and bands of iron ores. The Blue Ridge is a transition region. On its eastern face the epidotic or greenstone rocks are very fully charged with crystals of epidote, and the granites; the rocks of the western slope are mostly of the Potsdam sandstone group, a close-grained white or light-gray sandstone, with beds of coarse conglomerate, brown sandstones, and olive-colored shales. Here are beds of specular iron ore and hæmatite. The Valley of Virginia is a limestone region, the limestones, slates, and shales ranging in geologic age from the Potsdam to the Hudson River group of the Cambrian and Lower Silurian ages. These formations are not only rich in mineral products—iron ores, umber, lead, zinc, etc.—but they invariably underlie a rich and fertile soil. A portion of the Appalachian country belongs politically to the Valley counties, and in this portion we have some of the formations of the Upper Silurian and Devonian systems, and fragments of the sub-Carboniferous formation, sometimes containing beds of semi-anthracite coal. The geological formations of Appalachia comprise a wide range. There are narrow outcrops of Lower Silurian; broader beds and tracts of Upper Silurian; mountains along whose sides the Corniferous, Hamilton, Chemung, and Catskill groups of the Devonian system, each in their turn, are exposed; the various formations of the sub-Carboniferous rocks, with their deposits of coal, gypsum, and rock-salt; and finally, in the S. W., the Carboniferous or true coal-bearing system, covering an area of 1000 sq. m., and yielding a good bituminous coal in thick workable seams.

Minerals.—We have already noticed some of these. Gold is found in the gold-belt of Middle Virginia, averaging in favorable localities from $10 to $24 to the ton of ore. Its working has not been found very profitable. Silver and copper are also found in the same region, the latter mostly in the form of sulphurets or copper pyrites. Plumbago of good quality occurs in Halifax, Amelia, and other counties. Iron is found in the forms of limonite, magnetite, hæmatite, specular ores, micaceous peroxides, chromates, sulphurets, etc., and the cheap and abundant coals of the State will cause its smelting in large quantities. Coal, as we have already said, abounds in several parts of the State. In the S. W. it is bituminous; in the Valley, semi-anthracite; in the Richmond and other Middle Virginia coal-fields, bituminous—an excellent coking coal, and accompanied by carbonite or natural coke of good quality. Gypsum (sulphate of lime) is found in extensive beds along the N. fork of Holston River, and so nearly pure that it yields within 1 per cent. of an absolutely pure sulphate. Rock-salt and salt springs of very strong brine are found in the same vicinity, and from the artesian salt wells at Saltville more than 1000 bushels of salt a day are now made. This salt is of great purity, surpassing in this respect any other known salt or brine. Lead and zinc ores are found in the Valley, and are shipped to other States for smelting. Umber exists in many places. There is a large deposit of kaolin in Augusta co., and barytes in Smyth and other counties. Manganese also occurs with hæmatite in Augusta co. Of building material—marble, breccia, limestone, freestone, Potsdam sandstone, slate, granite of excellent quality, brick and fire clays, etc.—there is a great abundance in all parts of the State except the Tidewater region; and of agricultural and fertilizing minerals—marls, greensand marls, gypsum, and the rich decomposed material of the epidotic rocks—the Tidewater region, S. W. Virginia, and even the Blue Ridge region, furnish unlimited quantities. Virginia is remarkable for its mineral springs, both sulphurous and chalybeate; they have been noted for their medicinal virtue for almost two centuries. There are many caves, natural bridges, rock-pillars, and other objects of interest in the State; among them, the Natural Bridge in Rockbridge co., so celebrated in song and story, Weir's, Madison's, and the Blowing Cave, Caudy's Castle, the Tea-Table, the Ice Mountain, etc.

Soil and Vegetation.—The soils of the first or alluvial bottoms deposited by the rivers and estuaries is of perpetual fertility. The second bottoms are of excellent quality, yielding large crops, but are improved by the use of marls or other fertilizers when they have been long cultivated. The slope or third terrace, running back to the watershed or head of tide-water, is thinner and less fertile, but can be made very productive by the use of the marls and shells which are close at hand. The ridge lands of the Tidewater region are always level and very poor, but by the use of manures can be made to produce fair crops. Middle Virginia has much good and fertile land, especially where the Triassic and Jurassic or new red sandstone belts come to the surface; but it has also much very poor and sterile soil. The soils of the Piedmont region, consisting largely of decomposed greenstone or epidotic rocks, are very fertile, as are also portions of the Blue Ridge country; but where the sandstones prevail on the western slope, they are sandy and poor. The greater part of the soils of the Valley of Virginia are very rich and productive. This has been called the "garden of America." In some portions of the Valley, however, stimulating manures are required, as the land is cold. It is generally a limestone region. The valleys in the Appalachian region are generally rich and productive, but many of the ridges and mountain-slopes are sterile. There are considerable alluvial tracts here which are very rich. The forest trees of Virginia are numerous, and differ on different soils. The Tidewater region has large forests of yellow pine, oak, cypress, cedar, and locust, and the usual shrubs of marsh and low lands. Middle Virginia has much hard pine, black, white, and other oaks, hickory, locust, persimmon, gum, cedar, holly, and other trees, and among the shrubs sassafras and sumach; the latter, indeed, is found all over the State, and is becoming a valuable article of commerce. Piedmont has many varieties of oak, hickory, tulip tree (*Liriodendron*), black walnut, locust, cedar, chestnut, butternut, and some pines. The Blue Ridge region is mostly covered with forests of white, black, red, rock, yellow, and black-jack oaks, hickory, chestnut, locust, birch, and some yellow pine. The Valley has nearly half its surface covered with oaks, hickories, locusts, black and white walnuts, yellow and other pines. Portions of Appalachia have forest trees, oaks, walnuts, white and yellow poplars, birches, beeches, locusts, wild cherries, sycamores, etc., of sound growth and immense size, but generally very few pines, firs, or hemlocks. In other sections the trees are small, but grow in thickets, and are only fit for charcoal. Wild fruits and nuts are abundant all over the State.

Climate.—The variety of surface and the great breadth of Virginia give it a varied climate. The mean annual temperature for the State ranges from 60° to 64° in the S. E. to 48° to 52° in the Valley and Appalachia, while the annual range from the severest cold of winter to the greatest heat of summer is not more than 86°. The following table represents the temperature and rainfall at nine different representative points in the State: it is compiled from Hotchkiss's *Summary* and the Signal Service reports:

Meteorological Data.	Johnsontown, lat. 37° 23′, lon. 79° 53′; elevation, about 60 feet.	Hampton, lat. 37° 01′, lon. 76° 21′; elevation, 53 feet.	Zoar, lat. 36° 53′, lon. 76° 51′; elevation, about 60 feet.	Cumero, lat. 38° 17′, lon. 77° 18′; elevation, about 75 feet.	Vienna, lat. 38° 53′, lon. 77° 17′ 38″; elevation, 425 feet.	Lynchburg, lat. 37° 30′, lon. 79° 02′; elevation, 515 feet.	Staunton, lat. 38° 10′, lon. 79° 4′; elevation, 1100 feet.	Lexington, lat. 37° 14′, lon. 79° 25′; elevation, about 925 feet.	Wytheville, lat. 36° 56′, lon. 81° 3′; elevation, 2300 feet.
Temperature.	°	°	°	°	°	°	°	°	°
Mean temp. of year...	57.1	58.5	59.5	56.8	55.9	57.3	53.6	56.5	53.8
Highest temp. of year	95	100	104	104	93	95	93	101	95
Lowest " "	9	6	−4	6	8	9	5	−3	4
Range of annual temp.	86	94	108	98	85	86	88	107	89
Mean temp. spring...	52.4	54.7	57.1	54.3	54.2	55.6	51.3	54.8	51
Highest temp. sprng.	87	96	96	92	86	84	84	92	85
Lowest " "	18	18	19	17	23	18	14	17	−1
Range spring temp...	69	78	77	75	63	66	70	75	86
Mean temp. summer .	76.3	78.6	81.2	77.3	75.4	78.1	73.7	77.1	71.5
Highest temp. summer	95	100	104	104	93	95	93	101	95
Lowest " "	57	60	60	52	57	55	56	52	49
Range summer temp..	38	40	44	52	36	40	37	52	46
Mean temp. autumn..	58.4	58.9	55.3	57.8	57.8	57.1	52.8	53.5	50.9
Highest temp. autumn	90	92	91	86	86	82	82	90	82
Lowest " "	27	25	20	28	27	29	28	18	18
Range autumn temp..	63	67	71	58	59	53	54	72	64
Mean temp. winter ...	41.3	44.7	44.6	38.2	36.5	41.3	37	40.7	35.6
Highest temp. winter.	74	78	74	72	69	66	69	74	62
Lowest " "	9	6	−4	6	8	9	5	−3	−4
Range winter temp...	65	72	78	66	61	57	64	77	66
Rainfall	in.	in.	in.	in.	in.	in.	in.	in.	in.
Annual amount.....	33.16	40.15	42.97	29.27	48.51	44.74	41.99	48.58	35.10
Rainfall of spring... .	10.69	11.35	14.81	7.81	13.90	11.62	12.15	14.77	[illegible]
" of summer ..	7.45	12.60	8.80	7.32	13.90	14.00	8.78	8.[illegible]	11.[illegible]
" of autumn...	6.75	6.80	8.52	8.68	9.51	9.16	11.49	15.[illegible]	7.[illegible]
" of winter....	8.27	9.40	10.84	5.46	11.20	9.46	9.27	1[illegible]	8.0[illegible]

Zoology.—The wild animals of Virginia are those common to the Atlantic States which have extensive forests—

the black bear, panther, wild-cat, and in some districts the wolf, the lynx, raccoon, red fox, opossum, ground-hog, rabbit, squirrels of several species, the Virginia deer, and possibly the elk; of birds, many species of ducks, teal, brant, wild-geese, swans, and the game-birds generally, especially wild-turkeys, grouse, pheasants, quail, partridges, pigeons, snipe, woodcock, etc. Song-birds and birds of prey are likewise very numerous. The fish are equally abundant, especially of edible species—the shad, herring, rockfish, bass, perch, sturgeon, sheepshead, chub, spot-fish, hog-fish, trout, tailor-fish, Spanish mackerel, etc. The Crustacea, crabs, lobsters, terrapins, turtles, tortoises, etc., are also well represented. Oysters of excellent quality abound in Chesapeake Bay; more than 15,000,000 bushels are taken annually from the beds in the Tidewater region.

Agricultural Productions.—The census of 1870 gives the amount of land in farms in Virginia that year as 18,145,911 acres, of which 8,165,040 acres were improved and 9,980,871 acres (55 per cent.) unimproved. The average size of farms was 246 acres, against 324 in 1860. The value of farms in 1870 was $213,020,845, and of farming implements, $4,924,036. The value of all farm productions of the year was $51,774,801; of animals slaughtered or sold for slaughter, $8,375,975; of home manufactures, $556,307; of forest products, $686,862; of market-garden products, $505,117; of orchard products, $891,231; of wages paid, $9,753,041. Of the cereals, 7,398,787 bushels of wheat were grown in 1869–70, 582,264 of rye, 17,649,304 of Indian corn, 6,857,555 of oats, 7259 of barley, and 45,075 of buckwheat. The State produced the same year 183 bales of cotton, 130,750 pounds of flax, 31 tons of hemp, 877,110 pounds of wool, 199,883 tons of hay, 10,999 pounds of hops, 37,086,364 pounds of tobacco, 245,093 pounds of maple-sugar, 329,155 gallons of sorghum and 11,400 gallons of maple molasses, 1,293,853 bushels of Irish potatoes, 865,882 of sweet potatoes, 162,102 of peas and beans, 26,438 pounds of beeswax and 505,239 pounds of honey, 26,283 gallons of domestic wine, 11,367 bushels of clover-seed, 9699 of flax-seed, and 12,709 of grass-seed, 6,979,269 pounds of butter, 71,743 pounds of cheese, 266,812 gallons of milk. The value of all live-stock in the State was estimated at $28,187,669; the number of horses, 168,938; of mules and asses, 26,903; of neat cattle, 573,152, of which 188,471 were milch cows; of sheep, 370,145; of swine, 674,670. Of some of these items we have later statistics. The report of the State assessors for the year ending Dec. 31, 1874, gives the total value of live-stock as $21,562,808; the number of horses, mules, asses, and jennets, 220,909; of cattle, 567,289; of sheep and goats (the latter not enumerated in the U. S. census), 362,627; and of swine, 571,779. The U. S. agricultural department in its report of Jan., 1875, makes a somewhat different showing. The value of live-stock is estimated at $31,937,662, and the numbers as follows: horses, 191,900; mules, 29,800; cattle, 626,800, including 229,300 milch cows; sheep (goats not estimated), 367,500; swine, 662,700. The same report gives the quantity of Indian corn grown in 1874 as 19,082,000 bushels; wheat, 5,672,000; rye, 460,000; oats, 4,587,000; barley, 6300; buckwheat, 40,000; Irish potatoes, 1,068,000; tobacco, 35,000,000 pounds; hay, 166,400 tons. These crops are valued at $29,415,437.

Manufactures and Mining Products.—Virginia is not largely engaged in manufacturing. In 1870 there were in the State 5933 manufacturing establishments, employing 26,974 hands (22,175 men, 2259 women, and 2540 children), reporting capital to the amount of $18,455,400, paying wages to the amount of $5,343,099, using raw material valued at $23,832,384, and producing manufactured articles to the value of $38,364,322. Of these, the most prominent were: Tobacco, chewing, smoking, and snuff, of which 94 establishments produced $6,935,249; flooring-mill products, of which 282 mills produced to the value of $6,581,396; iron as pig, cast, rolled, etc., in 85 establishments, $3,733,240; lumber sawed, 173 saw-mills produced $1,609,966; cotton goods, in 11 cotton-mills, were manufactured to the value of $1,435,800; 7 machine-shops made freight and passenger cars to the value of $613,036, and 26 other machine-shops produced machinery to the value of $511,485. No other industry in the State produced goods to the value of half a million dollars. Manufactures have materially increased since 1870, the manufactures of the city of Richmond alone amounting in 1874 to $17,746,720, or almost half of the entire product of the State in 1870. In 1870, 27 mining establishments employed 997 hands and $1,113,000 capital, paid wages to the amount of $248,270, used raw material valued at $31,067, and produced minerals valued at $409,914.

Railways and Canals.—There were Jan. 1, 1876, 1617 miles of completed railway in the State, aside from the horse-railroads of Richmond, Alexandria, and Norfolk. These roads cost, according to Poor's *Manual*, for road equipment, etc., $74,361,222. The most important of these roads were the Atlantic Mississippi and Ohio, and its branches, 427 miles in length; the Washington City Virginia Midland and Great Southern, with 2 branches, 315 miles; the Chesapeake and Ohio, with 2 branches, having 232 miles in Virginia; the Richmond and Danville, 141 miles in Virginia; the Richmond Fredericksburg and Potomac, 120 miles; the Richmond and Petersburg, with 3 branches, 108 miles; the Seaboard and Roanoke, 60 miles in the State; the Richmond York River and Chesapeake, 38 miles; the Washington and Ohio, 52 miles; the Valley R. R., 104 of its 207 miles in the State; and the Fredericksburg and Gordonsville, 20 miles. Eight of these lines are parts of trunk-roads. The James River and Kanawha Canal has been long in construction; 198 miles of it from Richmond to Buchanan are completed and in use; 32 miles more, between Buchanan and Clifton Forge, are in progress, and 15 miles of it will probably be finished within a year. It has also a branch 19¾ miles long. (See JAMES RIVER AND KANAHWA CANAL.) The Albemarle and Chesapeake Canal, with 2 cuts—one from the S. branch of Elizabeth River to the North Landing River, and the other from Norfolk to Albemarle Sound—is a ship-canal of great importance. The Dismal Swamp Canal connects the same waters by another route. There is also a canal from Alexandria to Georgetown, connecting with the Chesapeake and Ohio Canal, and a slackwater improvement on the Roanoke and Dan, owned by the Roanoke Navigation Co.

Finances.—The receipts of the fiscal year ending Sept. 30, 1875, including a balance of $192,394.79 on hand at the beginning of the year and $230,000 borrowed, were $2,840,184.84, and the expenditures for the same period, $2,814,614.32. The public debt of the State at that date was $29,514,426.38, aside from a sum of $15,239,370.74 which it is claimed should be settled by West Virginia. On the recognized public debt but 4 per cent. interest has been paid since July, 1874, and there are arrears on this. The whole interest due and unpaid Sept. 30, 1875, according to report of the second auditor, was $2,781,030.53, and the interest accruing annually $1,752,681.83. There is also a little more than $476,000 due for interest to the literary and sinking fonds. The assessed value of real and personal estate for the year ending Sept. 30, 1875, was $336,484,466.

Banks, Savings Banks, and Insurance Companies.—There were in 1875, 20 national banks, having a paid-up capital of $3,590,000, bonds on deposit to the amount of $3,676,750, and outstanding circulation to the amount of $3,615,000. There were also 33 State banks, with an aggregate capital of $3,413,600; 13 savings banks, with capital and deposits amounting to $982,300; and 37 private and individual banking-houses. There were in 1876, 19 fire and marine insurance companies in the State, and 5 life insurance companies. Of the latter, 2 were mutual, and of the former 4. The assets of the fire insurance companies were in round numbers about $5,400,000, and of the life insurance companies about $2,800,000.

Commerce, Navigation, and Immigration.—Virginia has an extensive commerce, especially in the coastwise trade. The following table gives the statistics of her commerce, navigation, and direct immigration:

Customs Districts.	Value of foreign imports for the year ending June 30, 1875.	Value of domestic exports for the year ending June 30, 1875.	Entrances of vessels into Virginia ports in year ending June 30, 1875.			Clearances of vessels from Virginia ports in year ending June 30, 1875.			Entrances and clearances of vessels engaged in the coasting trade and fisheries for year ending June 30, 1875.			Registered, enrolled, and licensed tonnage for year ending June 30, 1875.		Immigrants landed in Virginia ports in 1871.	Immigrants landed in Virginia ports in 1872.	Immigrants landed in Virginia ports in 1873.	Immigrants landed in Virginia ports in 1874.
			Number of vessels.	Tonnage.	Crews.	Number of vessels.	Tonnage.	Crews.	Number of vessels.	Tonnage.	Crews.	Vessels.	Tonnage.				
	$	$															
Alexandria	8,060	.....	17	5,445	16	....	.....	....	372	173,032	4,931	93	3,199				
Norfolk and Portsmouth	18,929	5,243,986	24	13,299	301	106	49,332	1241	2219	2,044,797	54,503	380	13,977	70	664	1190	508
Petersburg	26,188	699	11	2,413	78	1	282	7	871	885,363	19,809	6	62				
Richmond	433,905	2,914,642	44	16,775	352	103	29,144	885	1235	1,052,385	24,188	38	4,615				
Tappahannock	.....	.....	..	.....	....	....	.....	....	240	188,216	5,949	78	1,809				
Cherrystone	.....	.....	..	.....	....	....	.....	....	....	.....	.....	363	5,925				
Yorktown	.....	.....	..	.....	....	....	.....	....	426	412,886	12,416	114	2,289				
Totals	487,082	8,189,327	96	31,962	747	210	78,758	2133	5363	4,756,679	121,796	1072	31,876	79	664	1190	508

Population.

Census year.	Total population.*	Males.	Females.	White.	Free colored.	Slave.	Natives.	Foreigners.	Density	Ratio of increase.	No. of families.	Persons in a family.	No. of dwellings.	Persons in a dwelling.	Illiteracy.	Of school age, 5 to 20.	Of military age, 1—45, males.	Of voting age, 21 and upward, males.	Citizens, males.
1790	691,737	.....	.....	691,524	7,586	292,627	.....	.....	18.05										
1800	801,608	.....	.....	444,386	12,426	345,796	.....	.....	20.92	17.63									
1810	883,131	.....	.....	458,159	18,436	392,516	.....	.....	22.63	10.73									
1820	938,551	.....	.....	482,849	20,351	425,148	.....	.....	24.24	9.51									
1830	1,044,481	.....	.....	537,216	27,508	469,753	.....	.....	27.00	13.71									
1840	1,015,260	.....	.....	537,952	28,321	448,987	.....	.....	26.50	2.34									
1850	1,119,348	565,271	554,077	616,069	30,751	472,528	1,101,438	17,910	29.11	14.67	167,530	5.67	165,815	5.72	88,520†	105,591	182,083	258,315	
1860	1,219,630	615,913	603,727	691,775	36,898	490,865	1,201,117	18,513	31.80	12.28	201,521	5.49	207,305	5.33	86,452†	115,798	200,134	291,835	
1870	1,225,161	597,058	628,105	712,089	512,841	.....	1,211,409	19,751	31.96	.045	201,571	5.29	223,917	5.47	145,891	174,940	206,658	269,747	266,680

Education.—The present public-school system of Virginia is of recent origin, having been organized in 1870. Previously, the free schools had been of low grade, and had been regarded as intended only for the very poor whites, who often refused to avail themselves of their instruction. Under the new organization there is decided progress, though there is still room for a great advance, the amount of illiteracy being alarming. The statistics of public schools in the State in 1875 were as follows: Number of school population (between 5 and 21 years of age), 482,789, of whom 280,149 were white and 202,640 colored; number of pupils enrolled, 181,486 (38.2 per cent. of school population), of whom 129,545 were whites, 51,941 colored; average daily attendance, 103,927 (74,056 whites, 29,871 colored) —21.5 per cent. of school population; number of public schools, counting each grade of one teacher in a graded school as one school, 4185, of which 3121 were white and 1064 colored; average number of months taught, 5.59; number of graded schools, 155, of which 108 were white and 47 colored; number of schools yet needed, 953; whole cost of public education per month per pupil in average attendance, $1.58; number of teachers in the public schools, 4262, of whom 2360 were white males and 351 colored males, 1363 white females and 188 colored females; the average monthly wages of these teachers were—males, $33.52; females, $28.71; the number of school-houses used was 4561, of which 2101 were log, 1617 frame, 129 brick, 38 stone; the number built during the year was 292; of the whole number, only 1256 were owned by the districts; the value of school property owned by the districts was $757,181; the number of pupils of school age attending private schools was 23,285 (19,466 whites, 3819 colored); the number of teachers of private schools was 1319 (451 white males and 33 colored males, 775 white females and 57 colored females). The total amount received from all sources for school purposes was $1,021,396.68, of which $178,750.16 was from State funds, $165,414.09 from local taxation, $23,750 from the Peabody fund, and $53,482.13 from private donations.

Special Instruction.—The institution for the instruction of deaf mutes and the blind at Staunton had in Oct., 1875, 90 deaf-mute pupils and 37 blind; 13 mutes and 5 blind pupils had been received during the year, and 9 mutes and 5 blind discharged; 1 mute had died. The receipts of the year from all sources had been $49,949.14; the expenditures, $47,787.59.

The following table gives many particulars in regard to the universities, colleges, and professional schools of the State. It should be remarked that two of the State institutions, the University of Virginia and the Virginia Military Institute, are heavily embarrassed with debt, the former having a funded debt of $87,000, and an unfunded one of $6823.15; and the latter a bonded debt of $89,337.25, and other liabilities amounting to $97,666.30; against which are assets, not all now available, of $119,990.46, consisting mainly of bills receivable and dues by the cadets and the principal departments of the institute:

Universities, Colleges, and Professional Schools.

Universities, Colleges, and Professional Schools.	Location.	Date of organization.	Under what control.	Professors and instructors.	Students. In preparatory department.	Students. In collegiate department.	Students. Male.	Students. Female.	Value of buildings, grounds, apparatus, etc.	Amount of productive endowment.	Income from productive endowment.	Income from all sources.	Volumes in library.
Universities and Colleges.									$	$	$	$	
College of William and Mary	Williamsburg	1693	Prot. Episcopal	7	15	50	65	...	60,000	75,000	4,800	.....	4,900
Emory and Henry College	Emory	1838	M. E., South	7	82	94	176	...	125,000	.....	.....	7,534	13,580
Hampden-Sidney College	Hampden-Sidney	1775	Presbyterian	5	...	82	82	...	150,000	85,000	5,600	.....	7,000
Randolph-Macon College	Ashland	1834	M. E., South	11	...	215	215	...	70,000	25,000	1,500	13,275	11,000
Richmond College	Richmond	1844	Baptist	7	...	128	128	...	180,000	75,000	4,500	12,500	5,700
Roanoke College	Salem	1853	Lutheran	8	55	112	167	...	60,000	.....	.....	8,000	14,000
University of Virginia	Near Charlottesville	1825	State	18	..	373	373	...	.....	.....	.....	37,779	40,000
Washington and Lee University	Lexington	1749	Non-sectarian	18	...	196	196	...	150,000	200,000	.....	.....	15,000
Schools of Science.													
Virginia Military Institute	Lexington	1839	State	20	...	248	248	...	350,000	40,000	2,200	37,200	6,000
Virginia Agricultural and Mechanical College	Blacksburg	1872	State	7	...	222	222	...	49,947	172,000	20,685	36,145	750
Scientific department University of Virginia	Charlottesville	1819	Non-sectarian	Report edwith the classical department.									
Scientific depart. Washington and Lee Univ.	Lexington	1782	Non-sectarian	Report edwith the classical department.									
New Market Polytechnic Institute	New Market	1870	Trustees	31	...	71	71	...	1,800				
Hampton Normal and Agricultural Institute	Hampton	1872	Am. Miss. Asso.	14	165	200	191	174	163,674	85,500	10,360	.....	1,268
Schools of Theology.													
St. John's College and Theological Seminary	Norfolk	1869	Roman Catholic	9	...	39	39						
Theological Seminary of General Synod of Evangelical Lutheran Church in N. A.	Salem	1831	Lutheran	3	...	4	4	...	.....	.....	.....	.....	400
Theological Seminary Prot. Episcopal Church	Near Alexandria	1823	Prot. Episcopal	5	...	51	51	...	100,000	115,000	7,500	.....	10,000
Union Theological Seminary of Gen. Assembly	Hampden-Sidney	1825	Presbyterian	4	...	76	76	...	50,000	230,000	16,500	.....	9,800
Colver Institute	Richmond	1867	Baptist (colored)	4	75	...	70	5	60,000	.....	.....	.....	1,800
Schools of Law.													
Law School of Richmond College	Richmond	1868	Richmond College	2	...	16	16						
Law department University of Virginia	Charlottesville	1825	Univ. of Virginia	2	...	110	110	...	.....	.....	.....	5,000	3,000
Law department Washington and Lee Univ.	Lexington	1871	Wash. and Lee Un.	2	...	25	25						
Schools of Medicine.													
Medical College of Virginia	Richmond	1851	Trustees	14	...	42	42	...	60,000	.....	.....	5,000	1,200
Medical department University of Virginia	Charlottesville	1824	Univ. of Virginia	5	...	70	70						

There are also 21 female collegiate schools and seminaries of high grade—5 under the control of the Presbyterians, 3 of the Baptists, 4 of the Protestant Episcopal Church, 4 of the Methodist Episcopal Church, South, 3 of the Roman Catholics, and 1 each of the Lutherans and Christian Connection. Most of these are endowed, and all are prosperous. There are also more than 40 academies or high schools of high grade for boys in the State. There are 2 normal schools for colored teachers—1 at Richmond and 1 at Hampton—and 1 has been projected, but not yet fully organized, for white teachers.

Charitable, Corrective, and Penal Institutions.—There are three insane hospitals, or, as they are generally called, lunatic asylums, in the State—viz. the Eastern Asylum at Williamsburg, said to be the oldest in America. On Oct. 1, 1875, this asylum had 305 patients (141 males, 164 females); 72 had been admitted during the year, and 61 discharged, of whom 19 died, 33 were recovered, 8 improved, and 1 stationary. The receipts of the year were $65,932.95, of which $60,000 was from the State; the disbursements, $65,094.28. The Central Asylum, at Richmond, exclusively for colored insane, which had 243 patients at the close of the year (109 males, 134 females); 80 had been admitted during the year, and 44 discharged, 12 by death; 30 recovered, and 2 improved. The receipts were $52,045.26, of which over $50,000 was from the State; the disbursements, $51,998.14. The Western Asylum, at Staunton, which had Oct. 1, 1875, 356 patients (198 males, 158 females), and during the two years previous had admitted 135 and discharged 113, 26 of

* The total population and the white, free colored, and slave and native and foreign populations for each decade are those of the counties now composing Virginia, the counties now in West Virginia being deducted.

† The illiterate in 1850 and 1860 are only those over twenty years of age, but they include West Virginia. The number of illiterates in 1870 includes all over ten years of age, but is confined to Virginia as now constituted.

them by death; 73 had recovered, 11 improved, and 3 not improved. The receipts of the year 1875 were $74,488.39, of which $60,000 was from the State, and the remainder, balance on hand, receipts from pay patients and from articles sold; the expenditures were $71,413.52. The State penitentiary at Richmond had Sept. 30, 1875, 942 prisoners (182 whites and 760 colored; 861 males, 81 females). Of these, 380 had been received during the year, and only 234 pardoned, discharged, escaped, and died. The prison was so crowded that not all the prisoners could be packed into it, and 367 were employed on contracts outside the prison under guard. These were all colored men. The whole expenditure of the prison was $77,778.91, of which all was paid in labor except $26,008.08 drawn from the State. There is a hospital, but no library, chaplain, religious services, or attempt at mental or moral culture. The jails of the Sttae are mostly in a deplorable condition.

Newspapers.—Virginia in 1870 had 114 newspapers, having a circulation of 143,840 and an annual issue of 13,319,578 copies; of these, 16 were dailies, with 24,099 circulation; 7 tri-weeklies, and 8 semi-weeklies; 69 weeklies, with 75,488 circulation; 4 semi-monthlies, 10 moothlies, and 1 quarterly. Four years later the whole number was 126, of which 17 were dailies, 8 tri-weeklies, 8 semi-weeklies, 78 weeklies, 4 semi-monthlies, 11 monthlies, and 1 quarterly.

Churches.

Denominations.	Organizations, 1879.	Church edifices, 1879.	Sittings, 1879.	Church property, 1879.	Church organizations, 1875.	Church edifices, 1875.	Ministers, clergymen, or priests, 1875.	Church members or communicants, 1875.	Adherent population, 1875.	Church property, 1875.
All denomioatioos*	2582	2405	765,127	$5,277,368	3166	2922	1805	285,279	1,169,500	$5,327,700
Baptists (regular)	795	749	240,075	1,279,048	1172	1128	547	165,619	650,000	1,819 500
Baptists (other)	54	44	16,755	66,000	59	51	29	2,900	10,000	78,500
Christian Connection and Disciples	100	88	29,225	92,170	137	120	76	6,490	21,500	123,400
Episcopalians (Protestant)	185	177	60,105	843,210	160†	161†	139†	11,925†	40,000	900,000
Friends	12	13	4,925	35,625	14	14	.....	1,000	4,000	45,500
Jews	8	7	1,890	35,300	9	8	8	500	1,500	48,000
Lutherans	80	73	25,350	160,800	121	109	53	7,219	28,150	209,200
Methodists	1011	901	270,617	1,449,565	1090	945	660	63,797	286,000	1,647,200
Presbyterians	204	200	70,065	837,450	217	212	176	17,719	76,000	945,000
Reformed Church in U. S. (late Ger.)	24	16	5,900	38,500	37	21	20	2,708	10,800	57,700
New Jerusalem (Swedenborgian)	3	3	550	2,200	4	4	3	175	650	3,100
Roman Catholics	19	17	9,800	343,750	45	25	27	.....	18,500	561,000
United Brethren in Christ	42	30	7,700	23,300	59	44	36	3,127	12,400	39,500
Union	42	84	21,570	62,600	42	80	31	2,100	10,000	60 000

Counties.—There are ninety-nine organized counties, as follows:

Counties.	Pop., 1870.	Males, 1870.	Females, 1870.	Pop., 1860.	Assessed valuation, 1870.‡	True valuation according to census, 1870.
					$	$
Accomack	20,409	10,099	10,310	18,586	4,033,435	4,033,435
Albemarle	27,544	13,441	14,193	26,625	10,886,680	13,242,985
Alexandria	16,755	7,819	8,936	12,652	6,082,337	6,082,337
Alleghany	3,674	1,870	1,804	6,765	1,391,005	1,391,005
Amelia	9,878	4,840	5,038	10,741	2,431,576	2,546,059
Amherst	14,900	7,365	7,535	13,742	2,670,461	2,697,891
Appomattox	8,950	4,384	4,566	8,889	1,478,767	1,478,767
Augusta	28,763	13,996	14,767	27,749	16,292,184	16,292,184
Bath	3,795	1,954	1,841	3,676	1,231,500	1,231,500
Bedford	25,327	12,422	12,905	25,068	5,473,365	5,712,936
Bland	4,000	1,955	2,045	.....	797,432	797,432
Botetourt	11,329	5,444	5,885	11,516	3,744,317	3,744,317
Brunswick	13,427	6,506	6,921	14,809	1,691,550	1,877,603
Buckingham	13,371	6,558	6,813	15,212	2,358,394	2,358,394
Buchanan	3,777	1,938	1,839	2,793	455,457	455,457
Campbell	28,384	13,607	14,777	26,197	9,004,674	12,053,612
Caroline	15,128	7,094	8,034	18,464	3,896,160	5,510,230
Carroll	9,147	4,407	4,740	8,012	819,917	1,188,402
Charles City	4,975	2,517	2,458	5,609	904,594	1,057,545
Charlotte	14,513	6,992	7,521	14,471	3,112,863	3,500,000
Chesterfield	18,470	9,023	9,447	19,016	5,275,667	5,275,667
Clarke	6,670	3,305	3,365	7,146	3,674,914	4,307,215
Craig	2,942	1,427	1,515	3,553	831,619	1,258,382
Culpeper	12,227	6,053	6,174	12,063	4,403,046	4,403,046
Cumberland	8,142	3,948	4,194	9,961	2,047,042	2,047,042
Dinwiddie	30,702	14,325	16,377	30 198	11,265,579	12,664,915
Elizabeth City	8,303	4,258	4,045	5,798	1,194,358	1,194,358
Essex	9,927	4,678	5,249	10,469	1,518,317	2,199,761
Fairfax	12,952	6,730	6,222	11,834	5,568,284	8,244,307
Fauquier	19,690	9,698	9,992	21,706	11,724,455	12,490,980
Floyd	9,824	4,721	5,103	8,236	1,381,806	1,755,220
Fluvanna	9,875	4,774	5,101	10,353	2,301,231	2,460,918
Franklin	18,264	8,797	9,467	20,098	2,478,896	2,726,584
Frederick	16,596	8,104	8,492	16,546	8,025,565	9,100,000
Giles	5,875	2,899	2,976	6,883	1,478,312	1,656,269
Gloucester	10,211	5,006	5,205	10,956	2,010,136	2,040,136
Goochland	10,313	5,027	5,286	10,656	2,528,775	2,528,775
Grayson	9,587	4,667	4,920	8,252	1,061,891	1,643,831
Greene	4,631	2,231	2,403	5,022	1,067,147	1,100,777
Greensville	6,362	3,051	3,311	6,374	980,232	1,339,725
Halifax	27,828	13,511	14,317	26,520	5,431,795	5,785,610
Hanover	16,455	8,230	8,225	17,222	3,035,207	3,062,098
Henrico	66,179	31,351	34,828	61,616	41,310,061	41,310,061
Henry	12,303	5,912	6,391	12,105	1,388,640	1,773,108
Highland	4,154	2,015	2,106	4,319	1,579,573	1,900,000
Isle of Wight	8,320	4,092	4,228	9,377	1,630,461	1,735,484
James City	4,425	2,149	2,276	5,798	1,071,477	1,133,050
King George	5,742	2,820	2,922	6,571	1,511,329	1,511,329
King and Queen	9,709	4,565	5,144	10,328	1,466,660	1,916,713
King William	7,515	3,643	3,872	8,530	1,695,742	1,954,241
Lancaster	5,355	2,660	2,695	5,151	929,661	1,867,538
Lee	13,268	6,436	6,832	11,032	1,808,195	2,500,000
Loudoun	20,929	10,190	10,739	21 774	16,584,414	16,584,414
Louisa	16,332	7,905	8,427	16,701	3,653,300	3,653,300
Lunenburg	10,093	5,120	5,283	11,983	1,128,800	1,128,800
Madison	8,670	4,151	4 519	8,854	2,424,903	2,467,530
Matthews	6,290	3,979	3,221	7,091	968,326	968,326
Mecklenburg	21,318	10,273	11,015	20,096	2,855,779	6,090,785
Middlesex	4,981	2,477	2,504	4,364	965,396	1,005,170
Montgomery	12,596	6,164	6,392	10,617	3,314,183	4,703,030
Nansemond	11,576	5,638	5,938	13,693	2,195,619	2,195,619
Nelson	13,898	6,888	7,010	13,015	3,024,640	3,890,454
New Kent	4,381	2,210	2,171	5,884	11,091,774	1,091,774
Norfolk	46,702	22,277	24,425	56,227	8,045,487	20,512,605
Northampton	8,046	3,949	4,097	7,832	1,727,347	1,727,347
Northumberland	6,862	3,262	3,601	7,531	1,229,143	2,000,000
Nottoway	9,291	4,535	4,756	8,836	1,582,525	2,353,911
Orange	10,396	5,102	5,294	10,851	3,595,977	4,178,177
Page	8,462	4,116	4,346	8,109	2,912,764	3,503,840
Patrick	10,161	4,912	5,249	9,359	1,291,131	1,291,131
Pittsylvania	31,343	15,580	15,763	32,104	6,182,572	6,182,572
Powhatan	7,667	3,820	3,847	8,392	2,133,314	2,161,272
Prince Edward	12,004	5,812	6,192	11,844	2,440,025	2,827,982
Prince George	7,820	4,043	3,777	8,411	1,786,334	1,792,904
Princess Anne	8,273	4,263	4,010	7,714	2,055,203	2,055,203
Prince William	7,504	3,680	3,824	8,565	3,262,696	3,262,696
Pulaski	6,538	3,214	3,324	5,416	2,087,318	3,797,018
Rappahannock	8,261	4,030	4,231	8,850	2,795,840	3,200,000
Richmond	6,503	3,177	3,326	6,856	1,263,458	1,263,458
Roanoke	9,350	4,535	4,815	8,018	3,725,047	3,725,047
Rockbridge	16,058	8,140	7,918	17,248	7,258,604	7,258,604
Rockingham	23,668	11,567	12,101	23,408	10,136,588	13,443,160
Russell	11,103	5,491	5,612	10,280	1,896,159	2,129,922
Scott	13,036	6,359	6,677	12,072	1,700,294	1,700,294
Shenandoah	14,936	7,252	7,684	13,896	5,401,157	6,728,100
Smyth	8,898	4,403	4,495	8,952	2,786,768	2,810,080
Southampton	12,385	5,984	6,301	12,915	2,117,570	2,117,570
Spottsylvania	11,738	5,464	6,264	16,076	3,473,197	5,926,132
Stafford	6,420	3,123	3,297	8,555	1,719,545	2,000,000
Surry	5,585	2,886	2,699	6,138	1,153,934	1,153,934
Sussex	7,885	3,886	3,999	10,175	1,273,979	1,343,560
Tazewell	10,791	5,380	5,411	9,920	2,364,597	2,364 597
Warren	5,716	2,804	2,912	6,442	2,442,201	2,637,184
Warwick	1,672	849	823	1,740	494,289	494,289
Washington	16,816	8,325	8,491	16,892	5,172,190	5,899,881
Westmoreland	7,682	3,762	3,920	8,282	1,589,991	1,879,492
Wise	4,785	2,422	2,363	4,508	502,871	708,342
Wythe	11,611	5,712	5,899	12,305	3,980 602	4,041,571
York	7,198	3,603	3,595	4,949	896,725	896,725
Total	1,225,163	597,058	628,105	1,219,630	365,139,917	408,588,133

*There are included in this aggregate 1 Reformed Church in America (late Dutch), with 1 church edifice, 100 sittings, and $350 of church property; 1 Moravian (Unitas Fratrum) church, with 1 church edifice, 350 sittings, and $550 of church property; and 1 unknown (local mission), with 1 church edifice, 150 sittings, and $6000 of church property

† These statistics include the parishes, clergymen, and communicants of West Virginia also.

‡ The assessed valuation of 1870 is about $29,000,000 more than that of 1873 and 1875, owing, in part, to a different mode of assessing property for taxation.

Principal Towns.—Richmond, the capital, is also the largest city in the State, having 51,038 inhabitants in 1870; Norfolk and Petersburg had between 18,500 and 20,000 inhabitants each; Alexandria and Portsmouth had from 10,500 to 14,000 each: Lynchburg, Staunton, Winchester, and Fredericksburg, from 4000 to 7000 each; Danville, Charlottesville, Lexington, Manchester, Hampton, and Harrisonburg, between 2000 and 3500 each; and Williamsburg, Culpeper, Wytheville, Farmville, Salem, Warrenton, Liberty, and Leesburg, from 1200 to 2000 each.

Constitution, Government, Courts, and Congressional Representation.—The present constitution of the State was adopted in July, 1869. The qualifications of a voter are that he shall be a male citizen of the U. S., twenty-one years old or upward, a resident of the State for one year or more, and of the county, city, or town where he offers to vote for three months next preceding any election, and is a registered voter and resident in the election district in which he offers to vote. Soldiers, sailors, and officers of the U. S. army and navy temporarily stationed in the State do not thereby acquire the right to vote. Idiots, lunatics, persons convicted of bribery or embezzlement, or of treason and felony, and any persons who since July 6, 1869, have taken part in a duel, are excluded. The governor is the

chief executive officer of the State. He, as well as the lieutenant-governor, must have been a citizen of the U. S. for ten years (if not a native), must be thirty years of age, and for three years previous a citizen of the State. He is elected for four years, and at the close of his term is ineligible for the next four years. He possesses the pardoning power, and has a veto on the acts of the general assembly which can only be overridden by the vote of two thirds of the members of each house. The secretary of the commonwealth, treasurer, and auditor of public accounts are chosen for two years by the general assembly, and the superintendent of public instruction also by the general assembly for four years. The general assembly consists of a senate of 43 members, elected for four years, one-half at each biennial election, and of a house of delegates of 132 members, elected for two years. Its sessions are annual. The judiciary consists of a supreme court of five judges, chosen by the general assembly for twelve years; this court has appellate jurisdiction only, except in cases of *habeas corpus*, *mandamus*, and prohibition; 16 circuit courts, one for each judicial district, presided over by the same number (16) of judges, elected for eight years, having general jurisdiction in matters of law and chancery, and appellate jurisdiction from the county courts; and county courts for each county, the judges of which are elected by the general assembly for terms of six years. There are also justices' courts, and three justices of the peace are elected for each district (of which there are three or more to each county). There are special courts in the cities. The State is entitled to 9 members of Congress under the apportionment of 1872.

History.—Virginia was the earliest settled of the English colonies, preceding Plymouth by twelve or thirteen years, but the first attempts at planting a colony there well-nigh miscarried, from the improvidence and worthlessness of the colonists. On May 13, 1607, the first party of 105 colonists, sent out by the London Virginia Company, landed at what is now known as Old Jamestown, on the N. bank of the James or Powhatan River. They were mostly a company of needy adventurers; their president, Edward Wingfield, proved to be a knave, and the whole company would have perished but for the courage, enterprise, and shrewdness of Capt. John Smith, himself a noted adventurer, but the only sensible man of the party. Smith, after the escape of Wingfield and the failure of Ratcliffe, took command of the colonists, and held it until the officers appointed by the London Company, which had reorganized as the Virginia Company, should make their appearance. Nine vessels had been sent out by the company with 500 colonists, and the new governor, Lord De la Warr, being delayed for a time in England, the admiral, Sir George Somers, the vice-admiral, Christopher Newport, the lieutenant-governor, Sir Thomas Gates, and the high marshal, Sir Thomas Dale, all embarked with the fleet and on the same vessel; this vessel was wrecked on the Bermudas, but all the passengers were saved; one of the other vessels was lost, but the remaining seven arrived safely at Jamestown, but without any rulers. They were as worthless as their predecessors, and Smith had great trouble with them. Having been severely wounded by an accident, he was compelled to return to England for surgical treatment in Dec., 1609. He left 500 colonists, well supplied with all necessaries, and provided with a fort, storehouse, church, and 60 dwellings. Six months later, the number of colonists had dwindled to 60, and these on the verge of starvation. At this juncture (June, 1610) Newport, Gates, and Somers arrived at Jamestown, in vessels which they had built in the Bermudas, with 150 men and a moderate store of supplies; but finding the colonists in so sad a plight, they resolved to abandon Virginia and sail for Newfoundland with the remaining colonists, to seek further supplies and a passage home. As they descended the river, they met Lord De la Warr with three ships, bringing supplies and colonists. They then returned to Jamestown, and Lord De la Warr established a trading-post at Hampton, and punished the Indians for their barbarities to the previous colonists. Lord De la Warr's health failing, he returned to England, leaving Capt. George Percy as his deputy. Soon after, Sir Thomas Dale arrived with 300 more colonists and some cattle, and in Aug., 1611, Sir Thomas Gates with 350 more colonists. New settlements were made at Henrico and at what is now City Point, and the lands, which had previously been held in common, were divided among the colonists. The government of Gates, Dale, and their deputies was very stern, and gave much dissatisfaction. Lord De la Warr accordingly returned to resume the governorship, but died at the entrance of the bay which, with some modification, still bears his name. Sir George Yeardley, who succeeded him, was more popular. The culture of tobacco became profitable, and the number of colonists increased; new and more favorable laws were made; servants began to come into the colony in 1619 from two sources—felons or convicts sent over from English prisons and sold to the planters for a term of years, and negro slaves brought by Dutch vessels from the African coast. In the years that followed many redemptioners (*i. e.* persons who, being unable to pay for their passage, were sold as farm and house laborers for one or two years by the captains of the vessels for their passage money) came over, and in most cases proved good citizens. In 1622, James I., then king of England, made strenuous efforts to introduce silk culture to supersede tobacco growing, but with no great success, though considerable silk was produced. In 1624–25 the Virginia Company was dissolved by writ of *quo warranto*, and the colony reverted to the Crown. The company had expended £150,000 more than they had received from the colony in their attempts to establish it. In 1632 the laws of the colony were revised and consolidated, and the colony was prosperous for the next twenty years. In 1649 there were 15,000 white inhabitants and 300 negro slaves, and the colonists had a large amount of live-stock. Tobacco was the colonial currency. In 1652 the colonists reluctantly submitted to the rule of Cromwell, but in 1660 they reaffirmed their loyalty to the Stuart dynasty. They had had since 1619 a house of burgesses or colonial legislature, which had exercised a considerable share of authority in the enactment of the colonial laws; and this during the Commonwealth made some addition to its powers which it never afterward relinquished. Suffrage, which had been almost universal, was restricted to freeholders and householders after 1670, in compliance with the wishes of the prominent aristocratic planters, and not from any considerable stress of the royal authority in that direction. The Church of England was again established by law, and persecuting laws passed against "nonconformists, Quakers, and Anabaptists." In 1671 the population was estimated at "40,000, including 2000 negro slaves and 6000 Christian servants (convicts and redemptioners), of whom about 1500 were imported yearly, principally English." The principal export was tobacco, of which 15,000 to 20,000 hogsheads were shipped to England yearly. There were no printing-presses or free schools in the colony at this time, the governor (Sir William Berkeley) opposing both with great vigor. "Bacon's rebellion" (see BACON, NATHANIEL), which occurred in 1676, was the result of the rapacity of this same Gov. Berkeley and two favorite courtiers of Charles II. (Arlington and Culpeper), to whom he had given a patent of the Virginia colony, and who were determined to squeeze all the money possible, in the way of taxes, out of the colonists. In 1681 a printing-press was set up in the colony, but was not long suffered to remain. In 1693, William and Mary College was founded. In 1689 the colony reluctantly acknowledged the accession of William and Mary. In 1698, Williamsburg became the capital of the colony. In 1736 the first newspaper, 6 by 12 inches in size, was established in the colony; it was enlarged in 1761. There were occasional conflicts with the Indians, but these were not serious until 1754, when the French war commenced. The French had established a line of military posts W. of the Alleghanies, and had induced many of the Indian tribes to become their allies. In this war Virginia troops were called into the field as a contingent to the regular British force, and Col. Washington commanded the colonial troops at Fort Necessity in 1754, and was Braddock's chief of staff in the disastrous battle of Fort du Quesne in 1755, and brought off the Virginia forces after Braddock's defeat and death. Virginia resented the levying of taxes by the mother-country without representation as warmly as did Massachusetts, and in 1765 adopted resolutions denying the right of any foreign body to levy such taxes. The colony was not a member of the first colonial congress of Oct., 1765, but approved its action, and asserted strongly, four years later, their rights and liberties. Thomas Jefferson was her spokesman for the first time in the discussion of the resolutions on this subject. A non-importation agreement was very generally signed by her merchants the same year. The imports of Virginia and Maryland from Great Britain at this time were $3,186,952. But it was not until the accession of Lord Dunmore as governor in 1772 that the opposition to the measures of the British ministry began to be generally manifested. Lord Dunmore aggravated the difficulties which his predecessor had striven to allay. He became at length so obnoxious to the people by his tyranny that he took refuge on board a British man-of-war off Yorktown, and in June, 1775, sailed down the river, and was declared by the general assembly to have abdicated his office. He subsequently attacked with a British and Tory force several of the towns along the coast, but was eventually driven S. with heavy losses. In the autumn of 1774 a battle occurred between the Indians, under Logan, Cornstalk, and other chiefs who were supposed to be under British influence, and a Virginian force of about

1200 men, at Point Pleasant on the Ohio River. The Indians were defeated, but the Virginians sustained considerable losses. In May, 1776, a convention of delegates met at Williamsburg, issued a declaration of rights, and on the 12th of June adopted a State constitution, said to have been the first permanent American constitution adopted for the government of an independent State. Committed thus to the cause of the Revolution, to which she contributed its commander-in-chief, Virginia was one of the theatres of the Revolutionary war, especially in its closing acts. Naval attacks were made on Norfolk, Portsmouth, and Gosport in 1779, and Benedict Arnold captured and burned Richmond in Jan., 1781. The battle of Jamestown was fought July 9, 1781, and the surrender of Cornwallis (the real close of the war) took place at Yorktown Oct. 19 of the same year. Virginia led the way in calling the national convention which framed the Constitution of the U. S., and ratified that Constitution June 25, 1788. In 1784 she ceded to the U. S. her claim to the lands lying N. W. of the Ohio. For thirty years or more after the Revolution the State maintained its pre-eminence in the national councils, and of the Presidents of the U. S., seven, whose united terms of service were more than thirty-eight years, were natives of the State, and five of them residents of it for most of their lives. After a time, however, the great States N. of the Potomac began to gain the ascendency in numbers, wealth, and political influence. In 1860 and 1861 the people of Virginia were divided in their views on the subject of secession. Many of them were strongly attached to the Union, while others sympathized heartily with the seceding States. Her convention, called Feb. 13, 1861, to consider the subject, was composed of three classes—unconditional Unionists, unconditional secessionists, and conditional Unionists; the latter were largely in the majority. There was a long discussion, but on Apr. 17, three days after the capture of Fort Sumter, the ordinance of secession was passed by 88 yeas to 55 nays. It was subsequently submitted to the people, and a majority of 94,000 was said to have declared in favor of secession. The western counties opposed it, and as a result the State of West Virginia was formed in October of the same year. (See WEST VIRGINIA.) Richmond became the capital of the Confederate States in the summer of 1861. The State was occupied by hostile armies during the whole of the civil war that followed. The battles of Bull Run, Carnifex Ferry, Ball's Bluff, Williamsburg, Winchester, Hanover Court-house, Seven Pines and Fair Oaks, "the seven days," June and July, 1862, Cross Keys and Port Republic, Cedar Mountain, Manassas, Fredericksburg, Chancellorsville, Hanover Junction, the series of battles from the Wilderness to Cold Harbor in May and June, 1864, Petersburg, Cedar Creek, Winchester, Fisher's Hill, the battles in the Valley, Lynchburg, Hatcher's Run, Five Forks, the capture of Petersburg, and the surrender at Appomattox, together with many less important actions, were all on Virginian soil. During a part of this time there were two State governments, the counties which were loyal and under Federal control having instituted a State government at Alexandria in 1863, and F. H. Pierpont being elected governor. The legislature of this State government called a convention, which met Feb. 13, 1864, and abolished slavery. After the close of the war, an attempt was made to convene the old Virginia legislature to restore the State to the Union, but there being evidence that that legislature would act in hostility to the government, its assembling was prohibited, the Pierpont government recognized by Pres. Johnson May 9, and Gov. Pierpont made provisional governor. The State remained under military control till Jan. 26, 1870, when it was restored to the Union by Congress under a constitution adopted by the people July, 1869, and compliance with the other provisions of the reconstruction acts. This constitution was the fifth adopted by the State. Recent measures adopted by the State give the promise of a more prosperous future.

Governors of Virginia.

I. *Officers under the Virginia Company.*

Edward M. Wingfield, president.....1607–07
John Ratcliffe, pres.....1607–08
Capt. John Smith, pres..1608–09
Sir George Percy, pres...1609–09
Thos. West, Lord De la Warr, governor.....1609–11
Thos. Dale, high marshal.....1611–16
George Yeardley, lt.-gov.1616–17
Capt. Saml. Argall, lieutenant-governor.....1617–19
Sir Geo. Yeardley, gov...1619–21
Francis Wyatt.....1621–25

II. *Governors and Lieutenant-Governors under the Crown.*

Sir George Yeardley.....1626–27
Francis West.....1627–28
John Potts.....1628–29
John Hervey..... 1629–35
John West.....1635–35
John Hervey.....1635–39
Francis Wyatt.....1639–41
Sir William Berkeley.....1641–45
Richard Kemp, lt.-gov...1645–45
Sir William Berkeley....1645–52

III. *Governors under the Commonwealth.*

Richard Bennett.....1652–56
Edward Digges.....1656–58
Samuel Matthews.....1658–60

IV. *Governors under the Crown.*

Sir William Berkeley.....1660–77
Herbert Jeffries, lt.-gov.1677–77
Herbert Jeffries, gov.....1677–78
Henry Chicheley..... 1678–79
Thomas, Lord Culpeper.1679–80
Henry Chicheley, lieut.-governor.....1680–84
Lord Howard of Effingham, governor.....1684–89
Nathaniel Bacon, lt.-gov.1689–90
Francis Nicholson, lieutenant-governor.....1690–92
Sir Edmund Andros, governor.....1692–98
Francis Nicholson, governor.....1698–1704
The earl of Orkney.....1704–05
Edward Nott, lt.-gov.....1705–06
Edmund Jennings, lieutenant-governor.....1706–10
Robert Hunter, lt.-gov...1710–10
Alexander Spotswood, lieut.-governor.....1710–22
Hugh Drysdale, lt.-gov..1722–26
Robert Carter, lt.-gov....1726–27
William Gooch, lt.-gov...1727–49
John Robinson, Sr., lieutenant-governor.....1749–49
Lord Albemarle, gov.....1749–50
Lonis Burwell, lt.-gov....1750–52
Robert Dinwiddie, lieutenant-governor.....1752–58
John Blair, lt.-governor.1758–58
Francis Fauquier, gov...1758–68
John Blair, lt.-governor.1768–68
Norborne Berkeley, Lord de Botetourt, gov.....1768–70
William Nelson, lt.-gov..1770–72
John, Lord Dunmore, governor.....1772–76

V. *State Governors of the Revolutionary Period.*

Patrick Henry.....1776–79
Thomas Jefferson.....1779–81
Thomas Nelson.....1781–81
Benjamin Harrison.....1781–84
Patrick Henry.....1784–86
Edmund Randolph.....1786–88

VI. *Governors after adoption of U. S. Constitution.*

Beverly Randolph.....1788–91
Henry Lee.....1791–94
Robert Brooke.....1794–96
James Wood.....1796–99
James Monroe.....1799–1802
John Page.....1802–05
William H. Cabell.....1805–08
John Tyler.....1808–11
James Monroe.....1811–11
George W. Smith.....1811–12
James Barbour..... 1812–14
Wilson C. Nicholas.....1814–16
James P. Preston.....1816–19
Thomas M. Randolph...1819–22
James Pleasant.....1822–25
John Tyler.....1825–27
William B. Giles.....1827–30
John Floyd.....1830–34
Littleton W. Tazewell...1834–36
Windham Robertson (acting).....1836–37
David Campbell.....1837–40
Thomas W. Gilmer.....1840–41
John Rutherford.....1841–42
John M. Gregory.....1842–43
James McDowell.....1843–46
William Smith.....1846–49
John B. Floyd.....1849–52
Joseph Johnson.....1852–56
Henry A. Wise.....1856–60
John Letcher.....1860–64
Francis H. Pierpont.....1864–68
Henry H. Wells.....1868–70
Gilbert C. Walker.....1870–74
James L. Kemper.....1874–78

Electoral and Popular Votes for President and Vice-President.

Elect. year.	Candidates who received the electoral vote.	Elect. vote.	Elect. year.	Candidates who received the electoral vote.	Elect. vote.	Pop. vote.	Opposition candidates.	Pop. vote.	Third-party candidates.	Pop. vote.
1788	George Washington P.....	10	1824	William H. Crawford P...	24	8,489	John Quincy Adams P...	3,189	Andrew Jackson P.....	2,861
	John Adams V.-P.....	5		Nathaniel Macon V.-P....			John C. Calhoun V.-P...		John C. Calhoun V.-P..	
	John Jay V.-P.....	7	1828	Andrew Jackson P.....	24	26,752	John Quincy Adams P...	12,101	Henry Clay P.....	416
	John Hancock V.-P.....	1		John C. Calhoun V.-P....			Richard Rush V.-P.....			
	George Clinton V.-P.....	3							John Floyd P.....	No report.
1792	George Washington P....	21	1832	Andrew Jackson P.....	23	33,609	Henry Clay P.....	11,451	William Wilkins V.-P...	
	George Clinton V.-P.....			Martin Van Buren V.-P...			John Sergeant V.-P.....		William Wirt P.....	No report.
1796	Thomas Jefferson P.....	20							Henry Lee V.-P.....	
	John Adams P.....	1	1836	Martin Van Buren P.....	23	30,261	William H. Harrison P...	23,368	Hugh L. White.....	No report
	Samuel Adams V.-P.....	15		William Smith V. P.....			Francis Granger V.-P....		John Tyler V.-P.....	
	Thomas Pinckney V.-P....	1	1840	Martin Van Buren P.....	23	43,893	William H. Harrison P...	42,501		
	Aaron Burr V.-P.....	1		Richard M. Johnson V.-P...	22		John Tyler V.-P.....			
	George Clinton V.-P.....	3		James K. Polk V.-P.....	1					
	George Washington V.-P...	1	1844	James K. Polk P.....	17	49,570	Henry Clay P.....	43,677		
1800	Thomas Jefferson P.....	21		George M. Dallas V.-P....			T. Frelinghuysen V.-P...			
	Aaron Burr V.-P.....		1848	Lewis Cass P.....	17	46,963	Zachary Taylor P.....	45,439		
1804	Thomas Jefferson P.....	24		Wm. O. Butler V.-P.....			Millard Fillmore V.-P....			
	George Clinton V.-P.....		1852	Franklin Pierce P.....	15	73,858	Winfield Scott P.....	58,572		
1808	James Madison P.....	24		William R. King V.-P....			Wm. A. Graham V.-P....			
	George Clinton V.-P.....		1856	James Buchanan P.....	15	89,706	Millard Fillmore P.....	60,310	John C. Fremont P.....	291
1812	James Madison P.....	25		J. C. Breckenridge V.-P..			A. J. Donelson V.-P.....		William L. Dayton V.-P..	
	Elbridge Gerry V.-P.....								Stephen A. Douglas P..	16,290
1816	James Monroe P.....	25	1860	John Bell P.....	15	74,681	John C. Breckenridge P..	74,323	H. V. Johnson V.-P....	
	Daniel D. Tompkins V.-P			Edward Everett V.-P.....			Joseph Lane V.-P.....		Abraham Lincoln P.....	1,929
1820	James Monroe P.....	25	1864	No vote.					Hannibal Hamlin V.-P..	
	Daniel D. Tompkins V.-P		1868	No vote.						
			1872	Ulysses S. Grant P.....	11	93,468	Horace Greeley P.....	91,054	Charles O'Conor P.....	42
				Henry Wilson V.-P.....			Benj. Gratz Brown V.-P..			
			1876	Samuel J. Tilden P.....	11	139,670	Rutherford B. Hayes P...	95,558	Peter Cooper P.....	No report.
				Thos. A. Hendricks V.-P..			Wm. A. Wheeler V.-P....		Samuel F. Cary V.-P....	

(The writer acknowledges his obligations to Hon. James MacDonald, secretary of state of Virginia, for documents. He has also made use of Hotchkiss's *Summary* to some extent.) L. P. BROCKETT.

Virginia, city and tp., cap. of Cass co., Ill., at the junction of Peoria Pekin and Jacksonville and Springfield and Illinois South-eastern R. Rs., 32 miles W. of Springfield, has 5 churches, graded schools, 2 banks, and 1 newspaper. It was laid out by H. H. Hall in 1836. P. of city, 951; of tp. 1789. W. M. SUMMERS, ED. "GAZETTE."

Virginia, tp., Warren co., Ia. P. 521.

Virginia, tp., Pemiscot co., Mo. P. 370.

Virginia, city and cap. of Storey co., Nev., on Central Pacific and Virginia and Truckee R. R., is the chief mining-centre of the Pacific coast, containing the famous Comstock Lode, yielding gold and silver ore to the amount (May, 1876) of $5,000,000 per month. The city is built at the eastern base of Mount Davidson, has several churches, good schools, 2 newspapers, 1 savings bank, and agencies of the Nevada Bank of San Francisco and Bank of California. The principal mines have machinery capable of pumping water and hoisting ore from a depth of 4000 feet. The greatest depth yet reached is about 2250 feet. P. 7048. D. E. MCCARTHY, ED. "EVENING CHRONICLE."

Virginia, tp., Coshocton co., O. P. 1011.

Virginia, or **Verginia,** a Roman maiden, daughter of Lucius Virginius, a patrician, and betrothed to Lucius Icilius, a popular democratic leader who had signalized himself in the office of tribune by procuring the passage of the law assigning the Aventine Mount to the plebeians. According to the ordinary histories—which, however, do not merit great confidence—the decemvir Appius Claudius, captivated by the beauty of the maiden, devised with one of his clients an infamous plot to obtain possession of her, under pretence that she was a slave; and when, in spite of all the efforts of the maiden's father and lover, the decemvir had in his magisterial capacity adjudged her to be the slave of his accomplice, Virginius plunged a knife into his daughter's breast in the midst of the Forum, and the people, excited by this tragedy, overthrew the government of the decemvirs, and Appius committed suicide in prison. The resemblances between this story and that of the fall of the Tarquins through the similarly tragic fate of Lucretia are too many and too minute to be casual, and as neither of the periods in question falls within the domain of well-authenticated history, it may be considered nearly certain that the same event, whatever it may have been, served as the foundation of the two narratives. That both the Lucretian and the Virginian myth were originally connected with the myth of the Horatii and Curiatii (one of whom slew his sister) may also be inferred from several indications, one of which consists in the facts that the names of those four families constantly recur in chronological connection with each other in the early *Fasti*, but no two of them ever appear as colleagues; that the Curiatian *gens* bore the surname of *Trigeminus*, the Virginian *gens* that of *Tricostus*, and the Lucretian *gens* those of *Trio* and *Triciptinus*, all evidently mere variations from the same original. The consuls who replace the fallen Tarquins are, according to the most plausible account, a Horatius and a Valerius, and the former obtains the honor of consecrating the Capitoline temple, from which the official chronology of Rome was reckoned. The consuls who replaced the decemvirs were also Horatius and Valerius, described as descendants of the earlier pair, but an inspection of the acts ascribed to them shows that they are the same persons appearing in another form of the legend. It may be remarked that the agnomen *Opiter*, which evidently has a religious significance, is found only in the Lucretian and Virginian families. P. C. BLISS.

Virginia City, city, cap. of Madison co., Mon., on the N. bank of the Alder Creek and on the E. slope of the Rocky Mountains, nearly 6000 feet above the sea, in the vicinity of the gold-mines of Alder Gulch, to which it owes its settlement in 1863, and which had yielded in 1876 above $10,000,000, has commodious county and public-school buildings, 3 churches, 2 weekly newspapers, 2 banks, a public library, and regular stage communication with Utah and with Helena, and was the capital of the Territory until Jan., 1875, when it was removed to Helena. P. 867; in 1875 estimated at 1200.

Virginia Creepers. See AMPELOPSIS.

Virginia Deer, a name given to the *Cariacus virginianus*, or common deer of the Eastern U. S. (See DEER.)

Virginia Military Institute, at Lexington, Va., established by Virginia in 1839 upon the basis of the U. S. Military Academy. (See MILITARY ACADEMIES.) A State arsenal, containing 30,000 stand of arms, was located here and guarded by a company of soldiers at an annual charge to the State of $6000. Through the earnest efforts of J. T. L. Preston, Esq. (who has been a professor in the institution since its organization), this appropriation was transferred to the support of the Virginia Military Institute, the cadets admitted by the State, free for board and tuition, doing duty as a guard in consideration therefor. The president of the first board of visitors appointed by the State was Col. Claude Crozet, an *élève* of the Polytechnic School of Paris, and a former professor of the U. S. Military Academy, while the superintendency of the Virginia Military Institute has been held since its organization by Gen. Francis H. Smith, LL.D., a graduate of West Point of the class of 1833. Besides the State cadets admitted upon the basis of free board and tuition, a large number of pay cadets are received each year, whose annual expenses are about $500. The departments of instruction embrace—(1) mathematics; (2) Latin and English; (3) practical engineering; (4) animal and vegetable physiology; (5) infantry, cavalry, and artillery tactics; (6) natural and experimental philosophy; (7) practical astronomy, physics, descriptive geography, and geodesy; (8) mineralogy, geology, and metallurgy; (9) general and applied chemistry; (10) modern languages, French and German; (11) civil and military engineering and applied mechanics. Each of these departments is under the charge of a professor, with assistant professors from the graduates as instructors. In its instruction it provides a carefully-arranged curriculum, which all are required to pursue, embracing the fundamental scientific branches with their applications, and the study of the Latin, French, and German languages, all auxiliary to the better knowledge of the structure of the mother tongue. When these are completed in the four years' academic course, provision is made for an extension of these studies in *special schools* of application, in which graduates and others may qualify themselves for their professional career in scientific or other practical pursuits. During the whole period of academic life the cadet is subjected to a rigid system of military discipline, the effect of which is to impart energy, system, subordination, and self-reliance to the youth, and to give to his education such a practical character as shall best qualify him for the active business of life.

During the late war the value of the military education given at this institution was prominently illustrated. The élèves of the Virginia Military Institute officered one-tenth of the armies of the South, and 170 of these fell in battle. In civil pursuits the departments of education, civil engineering, manufactures, agriculture, the bar, divinity, etc., have been supplied from its graduates, while the report of the late board of examiners, embracing the names of Prof. Charles Davies, Prof. D. H. Cochran, Gen. W. F. Barry, U. S. army, and Gen. J. W. Grigsby of Kentucky, closes with this strong testimonial: "In conclusion, your committee cannot too highly commend what has seemed to them the marked and distinguishing features of this institution—the happy combination of the military system of instruction with the departments of science and of literary culture, and the more ennobling culture of the heart and soul. Nowhere else have we seen this combination so complete and perfect. We cannot speak of it too highly. It is such a system as fits a pupil for life and for death. Under its guidance he is sure to tread always the path of duty, virtue, and honor." The State makes an annual appropriation of $15,000 toward its support, and this fund, with the income from tuition and from vested funds, secures a revenue of some $35,000. The buildings, library, apparatus, etc., were burned in 1864 by the order of Gen. D. Hunter, commanding the army of the U. S. in the Valley of Virginia, but all these buildings, which had been erected by the State at a cost of $250,000, have been restored by the institute itself. FRANCIS S. SMITH.

Virginian Quail, a name applied to the bob-white (*Ortyx virginianus*) of the Eastern U. S. (See ORTYGINÆ.)

Virginian Snake-root. See ARISTOLOCHIA.

Virginia, University of, an institution of learning near Charlottesville, Albemarle co., Va., chartered in 1819 through the influence of Thomas Jefferson, its first rector, who drew up all the statutory enactments relating to it, as well as its basis of organization, code of government, and plan of studies. It was opened in 1824, having among its faculty several young English professors, two of whom, George Long and Thomas Hewitt Key, subsequently achieved eminence in connection with the London University. Among the peculiar features which distinguish the University of Virginia from all other American institutions, the principal one is its division into separate schools, sixteen in number, each under the charge of a professor, who in several instances has assistant instructors. There is no general curriculum, but students select their schools,

usually three in number, for each year, and receive upon examination their respective degrees, which may be of six different kinds—namely, for proficiency in separate branches, for graduation in a single school, and the degrees of bachelor of letters, of science and of arts, and the degree of master of arts, reserved for those who have graduated in a sufficient number of the schools. There is no strictly academic head of the university, the faculty being presided over by a chairman annually chosen, and the government being vested in a board of visitors composed of a rector and eight members, appointed every fourth year by the governor of Virginia. The institution is under State patronage, having enjoyed from the beginning an annual appropriation of $15,000, a sum which in 1875 was increased to $30,000 on condition of free tuition for suitably-prepared students who may be natives. There are eleven competitive scholarships open to students from any State, and forty agricultural scholarships in connection with the department of agriculture founded in 1869 by Samuel Miller of Lynchburg with an endowment of $100,000. The discipline of the institution is largely left to the honor of the students. The library contains above 36,000 volumes; the number of alumni is about 15,000; and the number of students for the year 1876–77 about 330, under the tuition of 17 instructors. The office of rector since the death of Jefferson has been filled by James Madison, Chapman Johnson, J. C. Cabell, and R. G. H. Kean, the present incumbent (1877).

Virgin Islands, the name commonly given to a group of numerous small islands in the West Indies, situated between the Greater and Lesser Antilles. Three of these islands—namely, St. Thomas, St. Croix, and St. John—belong to Denmark; the rest, among which the most remarkable are Tortola, Virgin, Gorda, and Culebra, belong to Great Britain.

Virgin Mary. See IMMACULATE CONCEPTION OF THE VIRGIN MARY, by PROF. P. SCHAFF, PH. D., S. T. D.; MARY, THE BLESSED VIRGIN, by REV. W. F. BRAND, A. M.; and PURIFICATION OF THE VIRGIN.

Virgin's Bower. See CLEMATIS.

Vir'ial [Lat. *vis*], a term introduced by Prof. Clausius of Bonn to denote a particular form of energy for which an expression is needed in the dynamical theory of gases. Clausius has established by a simple mathematical process the following equation:

$$Vp = \tfrac{2}{3}T - \tfrac{2}{3}\Sigma\Sigma(\tfrac{1}{2}Rr);$$

in which p denotes the presence of a gas, and V the volume of the containing vessel. At constant temperature, according to the law of Marriotte, Vp is constant. T denotes the kinetic energy of the system, or that part of the energy which is due to the motion of its components. The kinetic energy of a particle is half the product of its mass into the square of its velocity, and the kinetic energy of the system is the sum of the kinetic energies of all its particles. The symbol r represents the distance between any two particles, and R is the force of attraction or repulsion between them. Half the product of this force into this distance—viz. $\tfrac{1}{2}Rr$—is what Clausius calls the *virial*, which may be either positive or negative according as R is an attractive or a repulsive force. The virial of the system is the sum of the virials of all the pairs of particles which can be formed in the system; and is expressed by the double sum $\Sigma\Sigma\ \tfrac{1}{2}Rr$), which indicates that the value of $\tfrac{1}{2}Rr$ is to be found for every possible pair of particles, and the results added.

If there is neither attraction nor repulsion between the particles, there will be no virial, and the equation of Clausius becomes

$$Vp = \tfrac{2}{3}T, \text{ or } Vp = \tfrac{1}{3}Mc^2;$$

putting M for the entire mass, and c^2 for the mean square of the molecular velocity; and it is demonstrable that, in this case, assuming the mean square of the velocity of the moving particles to be dependent only on the temperature, which on the kinetic theory is capable of independent proof, $\tfrac{2}{3}T$ is constant, and this equation exactly represents the law of Marriotte.

If, on the other hand, the pressure of a gas arises wholly from the repulsion of the particles for each other considered as at rest, the kinetic energy must be zero, and the equation will become

$$Vp = -\tfrac{2}{3}\Sigma\Sigma(\tfrac{1}{2}Rr);$$

where R must be negative. In this expression, in order that Vp may be constant, R must be inversely as r, or the repulsion must be inversely as the distance—a law which Newton proved to be inadmissible.

The kinetic theory must therefore be true; but inasmuch as most gases depart from the law of Marriotte, especially at low temperatures and great densities, it follows that the form of energy expressed by the virial must in general exist. Prof. Clerk-Maxwell has made the equation of Clausius the basis of very interesting investigations in molecular dynamics. F. A. P. BARNARD.

Viri'athus, a Lusitanian by birth and a herdsman by profession, became a leader in the guerilla war which was carried on in the middle of the second century B. C. on the border between Lusitania and the Roman province of Spain. In 147 he defeated the Roman proprætor, Vetilius, at Tribola, a town of Lusitania, S. of the Tagus, and invaded Spain. In 144 he was driven back into the Lusitanian mountains by the consul, Q. Fabius Æmilianus, but in 143 he utterly routed the proprætor, Q. Pompeius, and shut him up in Corduba in Andalusia. In 142, however, he was again driven back into Lusitania by the consul, Q. Fabius Servilianus, but in the following year he succeeded in alluring the consul into a mountain-pass, surrounded him on all sides, and compelled him to surrender himself and his whole army unconditionally. Peace was now concluded with the Romans, by which the Lusitanians were acknowledged as an independent nation and the allies of Rome. But in 140 the consul, Q. Servilius Cæpio, saw fit to invade Lusitania, bribed some persons to murder Viriathus while sleeping in his tent, and subjugated the country after a protracted but ineffectual resistance by the natives.

Vir'idine ($C_{12}H_{19}N$), a base of the pyridine series, is contained in the products of the distillation of coal, and is therefore present in coal-tar. (See GAS-LIGHTING, by PROF. C. F. CHANDLER.) It has a sp. gr. of 1.024, and boils at 450° F., is slightly soluble in water, and dissolves in alcohol and in ether. It forms mercuric and platinic salts. The properties of viridine and its compounds have been imperfectly investigated. J. P. BATTERSHALL.

Viro'qua, p.-v. and tp., cap. of Vernon co., Wis., 25 miles W. of Mississippi River, has an excellent graded school and 2 newspapers. The neighborhood is full of streams abounding in trout, and game of all kinds is to be found in season. P. 1988.

HENRY CASSON, ED. "THE CENSOR."

Virtue. See MORAL PHILOSOPHY, by PRES. NOAH PORTER, S. T. D., LL.D.

Vi'rus [Lat.], animal fluids produced in diseased conditions or by morbid processes, and capable of developing disease when transmitted to other animal bodies. Thus, man may be inoculated by the virus of human origin, small-pox, syphilis, etc., vaccinia of the cow, glanders of the horse, and rabies canina or hydrophobia. A minute amount of the virus gaining access to the body is sufficient, by self-multiplication, to infect the entire volume of the blood and contaminate every part of the body. Peculiar cells or germs, having temporary vitality and tendency to reproduce themselves (*contagium vivum*), constitute the active elements of all viruses. (See GERM THEORY OF DISEASE.) Having gained entrance to the system, they for a time seem dormant, but are really multiplying, and this period is well designated as one of "incubation." Thus, small-pox appears twelve or more days after admission of virus, vaccinia within a week, hydrophobia on an average forty days. There are no specifics against the effects of viruses when once in the system. Hygienic and supporting measures may prepare the body to meet those effects and pass safely through. (See also VENOM.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Visa'lia, p.-v. and tp., cap. of Tulare co., Cal., about 200 miles S. E. of San Francisco, contains 5 churches, excellent schools, 1 private bank, U. S. land-office, 4 hotels, and 3 restaurants. It is within the delta of Kaweah River, and is surrounded by groves of native oak. P. of v. 913; of tp. 1626. E. M. DEWEY, PROP. "WEEKLY DELTA."

Viscacha, or **Biscacha.** See LAGOSTOMINÆ and LAGOTIS.

Viscai'no (SEBASTIAN), b. in Spain about 1560; commanded an expedition sent from Acapulco in 1602 to the N. W. coast of America, and made an accurate chart of the coasts of the two Californias.

Viscelli'nus (SPURIUS CASSIUS), a Roman statesman and general of the earliest period of the Republic, who has received scant justice from the imperial annalists, but who, according to Niebuhr, deserves to be considered as the greatest and most illustrious historical figure of the Republic. He was consul with Opiter Virginius Tricostus, B. C. 502; triumphed over the Sabines; was *magister equitum* to the dictator T. Lartius Flavus 501; again consul with Post. Cominius Auruncus 493, when he negotiated the first great league with the Latins; was once more consul with Proculus Virginius Tricostus 486, when he made that league with the Hernicans which was the basis of Roman success for the century following; but having in the same year proposed and carried an "agrarian law"—*i. e.* an equi-

table division of the conquered lands—he was accused of aiming at kingly power, was put to death 485 B. C., his house razed to the ground, and his family degraded from the patriciate.

Visch'er (Friedrich Theodor), b. at Ludwigsburg, Würtemburg, June 30, 1807; studied theology at Tübingen, and entered an ecclesiastical career, but turned by degrees to the study of philosophy and æsthetics; travelled much (1839–43) in Italy and Greece; was appointed professor of æsthetics at Tübingen in 1844; removed to Zurich in 1855, but returned to Tübingen in 1866. His *Æsthetik* (3 vols., 1847–58) is the most complete representation which exists of the philosophy of the beautiful, and contains in its details many acute and striking analyses. The fundamental ideas of his system he set forth as early as 1837 in his *Ueber das Erhabene und Komische*. His *Kritische Gänge*, a collection of literary criticisms, is not of great consequence, but made a great sensation on account of its fierce attacks on all bigotry and pietism.

Vischer (Peter), b. at Nüremberg, Bavaria, in 1455; d. there Jan. 7, 1529. His father was a worker in bronze, and he himself, as well as his five sons, adopted the same profession. Of his personal life not much is known (see *Die Nürnberger Künstler, geschildert nach ihrem Leben und Werken*, 1831), but he attained a great fame as an artist and received orders both from Germany and foreign princes. Of his numerous works, the tomb of St. Sebaldus in the church of St. Sebaldus in Nüremberg is the most celebrated (1506–19), containing 72 figures, besides those of the apostles and prophets. Another famous work by him is the monument in the cathedral of Berlin over the elector John Cicero.

Viscon'ti [from the Lat. *vicecomites*, "viscounts"], a Lombard family, said to descend from King Desiderius, and in possession of large estates on Lakes Como and Maggiore, obtained in course of time the sovereignty of Milan and extended its power over the whole of Northern Italy, from Venice to Florence. One member of the family, Ottone, is mentioned in 1078 as viscount of Milan, and another Ottone was appointed archbishop of Milan in 1262 by Pope Urban IV. This appointment by the pope, and not by the chapter, was considered an infringement on the rights of the people, and occasioned a popular rising under the leadership of the family of the Torriani or Della Torre. A civil war ensued, and was not brought to a final close until 1311, when the emperor Henry VII. expelled the Torrianis from the city, and not only confirmed Matteo as viscount of Milan, but also made him imperial vicar in Lombardy. Between Matteo and Pope John XXII. a controversy arose regarding the appointment to the archiepiscopate of Milan. In 1322 the pope excommunicated the Viscontis, and in 1323 a crusade was preached against them. But by the aid of the emperor Louis of Bavaria, Galeazzo I. succeeded in completely defeating the holy army at Vavrio on the Adda in 1324, and the excommunication was annulled. The power of the family now increased rapidly. Its members were conspicuous as shrewd politicians, able generals, and great patrons of literature and art; but they were generally unscrupulous and cruel, and conspiracies, depositions, and assassinations fill the pages of their history. With Gian Galeazzo (1378–1402) the power of the family culminated. He was a son of Galeazzo II., the patron of Petrarca, the founder of the University of Pavia, and the inventor of the famous process of torturing called "Galeazzo's seat;" and the son evinced all the father's virtues and vices on a grand scale. He founded the library at Pavia, re-established the University at Piacenza, commenced the erection of the cathedral of Milan, built the Certosa and the bridge across the Ticino at Pavia, etc. He conquered Padua, Verona, Vicenza, etc., bought the title of duke of Milan from the emperor Wenceslas, and aspired to the royal crown of Italy, when he suddenly died from the plague. His daughter, Valentina, married Louis, duke of Orleans, and was the grandmother of Louis XII., king of France. On the death of his son, Filippo Maria, in 1447, the male line of the family became extinct, but his natural daughter, Bianca, married to Francesco Sforza, retained Milan and a large part of the family inheritance.

Visconti (Giovanni Battista), b. at Sarzana, near Genoa, in 1722; settled in Rome, where he succeeded Winckelmann as superintendent of antiquities; organized the museum Pio-Clementinum in the Vatican, and undertook extensive excavations, by which the tomb of the Scipios was discovered. D. in Rome Sept. 2, 1784.—His son, Ennio Quirino, b. at Rome Nov. 1, 1751, received a careful education, and was appointed sub-librarian of the Vatican in 1771, but lost subsequently this office, as he refused to take holy orders. Meanwhile, his archæological writings made his name famous, and in 1785 he was made director of the Museum Capitolinum. During the French occupation of Rome he was a member of the provisional government, and one of the five consuls during the period of the republic. But on the approach of the Neapolitan army in 1799 he left Rome and sought refuge in France, where he was made director of the collections of the Louvre and professor of archæology at the University of Paris, and d. Feb. 7, 1818. His principal works are—*Monumenti degli Scipioni* (1780), *Museo Pio Clementino* (7 vols., 1782–1807), *Inscrizioni greche Trapez, ora Borghesiane* (1794), *Descriptions des Antiques du Musée national du Louvre* (1801), *Iconographie ancienne* (5 vols., 1808–20), *Illustrazioni di Monumenti scelti Borghesiani*, published after his death (1821). His complete works appeared at Milan in 12 vols. (1818–22).—His son, Louis Tullius Joachim, b. at Rome Feb. 11, 1791; studied at the school of Fine Arts in Paris, and was much employed as practical architect by Louis Philippe and Napoleon III. D. in Paris Dec. 29, 1853. He erected in Paris the fountains of Gaillon, Molière, Louvois, and St. Sulpice; the tomb of Napoleon I. in the Hôtel des Invalides, the Collet Palace on the Quai d'Orsay, and furnished the plans for the completion of the Louvre, which, however, he did not live to see executed.

Viscon'ti-Venos'ta (Emilio), b. at Tirano, in the Valtelline, in 1828. He was carefully educated, wrote for various literary and political periodicals, and until about 1858 was in relation with Mazzini. In 1859, Cavour appointed him royal commissioner at the head-quarters of Garibaldi in Lombardy, and he acted in conjunction with the dictator Farini in measures for the annexation of Central Italy to Piedmont. In 1860 he was associated with Pepoli in a mission to Paris and London; on his return was elected to Parliament and appointed a member of the committee of contenzioso diplomatico in the ministry of foreign affairs; accompanied Farini to Naples, as legal and diplomatic counsellor, on the annexation of that kingdom to Italy; became minister of foreign affairs in 1863; was sent as minister of Italy to Constantinople; resumed the ministry of foreign affairs on his return, and remained in that position until Mar., 1876, when, with his colleagues of the Minghetti ministry, he resigned. In all these important positions he has shown marked ability.

Viscosite, or **Viscosine** [the first name is preferable, as in accordance with Dana's terminology in mineralogical nomenclature], a name conferred by the writer upon one of the constituents of the peculiar carbonaceous mineral *grahamite*. (See Irisite.) Viscosite forms 15 to 20 per cent. of both the West Virginia and Colorado grahamites, also forming a small constituent of *albertite*. It appears to exist also in some crude Pennsylvania petroleums, and probably in coal-tar. Viscosite is obtained by digesting grahamite with ether or petroleum-naphtha—green fluorescent solutions resulting—and distilling off these solvents. It appears then as a translucent, dark-brown, very lustrous substance, of curious balsamic odor, very brittle when cold, and giving a light-brown powder. When warmed, it melts at a very low temperature, acquiring before melting a soft viscosity, like sealing-wax, so that threads of surprising length may be drawn out; hence its name. It has not been analyzed as yet, but appears to be a hydrocarbon free from oxygen, as its solutions in hydrocarbons preserve the lustre of *sodium* indefinitely. Henry Wurtz.

Viscos'ity [Lat. *viscosus*, from *viscum*, "bird-lime"], a quality of liquid bodies, which, in some, causes them to flow with difficulty—an absence of *complete fluidity*. It has been referred to an *intermediate condition* between solidity and liquidity, but this is speculative and conveys no definite idea. At present it can only be said that it is probably a common quality of all liquids, in which they differ only in degree, some being very viscous or viscid, like strong syrup or mucilage, while others have a minimum of viscosity, like ether or chloroform. The chemist Dollfus invented an instrument called a *viscometer* to measure the degree of this quality by the time required for a given quantity of the liquid to pass through a given aperture under the same conditions. The rate of *transpiration* of a liquid is of course a function of its viscosity. (See *Transpiration*, under Liquids, Chemical and Physical Nature and Properties of.) Henry Wurtz.

Vis'count [originally a *vice-count*, or earl's deputy] is at present, in the British peerage, the title of a nobleman higher in rank than a baron and lower than an earl. There is a corresponding title in the nobility of several other European nations.

Viscum. See Mistletoe.

Vi'seu, town of Portugal, province of Beira, is old, ill built, dirty, and hot, but has a fine cathedral, many Roman remains, and a well-attended fair in September. P. 9160.

Vish'nee-Volo'tchok, town of Russia, government of Tver, on the Tsna, carries on an immense transit-trade, especially in grain, as it is situated on the canal which connects the Tsna with the Tvertsa, and thereby the Baltic with the Caspian Sea. P. 13,873.

Vish'nu, the second person of the Hindu Trimûrti. Whilst Brahma is said to create, and Siva to destroy, the chief function of Vishnu is said to be preservation. In tracing the history of the god, it can plainly be seen that the reason for nominating Vishnu as the Supreme Preserver lies in the fact that in his avatars he appears as an almighty Deliverer, the last succor of gods and men. Vaishn'avas consider him to be the greatest of gods, the embodiment of the supremest Supreme. Deriving their idea from the root-meaning of the word *Vishnu*, the Vaishn'ava Brahmans declare him to be the "Encompasser" and the "All-Penetrator." And not only so: as the supreme deity he formed heaven and earth. He is the Indefinable Omnipotent, and is the comrade of the gods of fire and the spacious firmament. It is he who reclines on the lotus; he is as fierce as the long-tusked boar; he is shaded and guarded by the hooded serpent of many heads; he is the lord of innumerable hosts of the monkey-warriors of Hanumân; he is the primal fish of the ocean of births; he is the eternal tortoise, and on his back he can bear all the weight of the universe; he is the man-lion; and he is the fulfiller of all space, who can at will take upon him the form of a dwarf. Brahma, with his four heads, springs into being from his navel. He is the husband of the peerless Sitâ, who is so pure that even the flames of a furnace cannot take effect on her person. He loves dark blue, and dark-blue flowers are used in his worship. He is the hero of the *Râmayana*, and he is the matchless Krishna, with his hyacinthine complexion. He is lauded in the *Mahâbhârata* under a thousand names. He is Narâyana, the rester on the waters. He is the loved of the Gopîs, the thousand shepherdesses whom he divinely seduced. He is the sweet flute-player of heaven, and its nimble dancer. The lovely Laksmî, goddess of prosperity, sits at his feet and fondles her lord. Now he rides on Garuda, a creature partially man, partially bird. Now he wields the axe, or drives the plough, or sits on a throne. In a word, Vishnu is presented to us under almost innumerable aspects. If we are to believe his votaries and those who have written in praise of him, we are bound to confess that he stands alone, as the incomparable chief of the Hindû pantheon. But, unfortunately, zealous advocates of Saivism are as extravagant in the praise of their own pet deity, and declare that he is so potent that he is worshipped by Vishnu. As for Brahma, he is rather a venerated name that is encircled by shadowy awe, and which looms through the mists of tradition, than a living power to whom daily prayers and sacrifices must be offered up.

Vishnu in the *Vedas* is the sun. In the *Rig-Veda* he is represented as "stalking over the seven divisions of the globe with a threefold progression" (*i. e.* he shines everywhere in three ways—from the E., from the zenith, and from the W., at morn, noon, and eve). But at this period the worship of Vishnu was very restricted, and his praise not unboundedly expressed. He was considered but a third-rate power, after all, and inferior to Indra, whom he expressly worships. But when we come to the epic times of Sanskrit, to the *Mahâbhârata* and *Râmâyana*, then at once we find the sun-god of the Vedas leap up into sudden prominence, and become identified with the eternal Prime Essence itself. In the *Mahâbhârata*, however, although treated as one of the Triad, he is now and then spoken of as if he were not of equal honor with Siva. But the *Râmâyana* is wholly devoted to his praise. In that epic he is the chief of the gods, and his supremacy is in every way conspicuous and complete.

The most remarkable thing about Vishnu as a god is his avatars. It is his incarnations which present him to us as he is supposed to be, the champion of gods and men. Take away the idea of incarnations from the Vaishn'ava legends, and only the primal notions of Vedic triads are left. It is because that the grandeur—or at least picturesqueness—of many of the nine past avatars of Vishnu struck the Hindû fancy that Vishnu sprang up to popularity so suddenly, and has maintained his repute as a power so long. In the idea which lies at the root of many of these incarnations we catch a tone of Oriental chivalry much calculated to fire the Asiatic imagination. Then the *Râmâyana* burst on the world of Hinduism, and the obscure god of the sun was raised for all time to be the god of the gods of the East. He could do no evil. He ravished the Gopîs, but did he not create them? May not a potter put the vessels which he makes to any use which he sees fit? Brahmans will ask the Christian in words the latter reverences, "Shall not the Lord of all the earth do right?" Of course the reply is, if put as a query, "Who, then, is that Lord?" It must be acknowledged by any candid man who has read the *Purânas* that Brahma is represented as a liar who lusts after his own daughter, that Siva is an adulterer and abominably vicious and ferocious, and that Vishnu is a fornicator as well as a thief from his cradle. It is difficult for one to choose whom to worship in such a triad. But the Brahman triumphantly asks you to explain the authority by which you judge the gods by any mortal standard. As South Indian poets say—

> "That good and ill's gods' play
> Do not our sages say?
> May they not what they make unmake again?
> Mayhap, in 'sport divine'
> They made your blood and mine;
> May they not shed it, as they shed the rain?"

These lines embody one of the leading thoughts of Purânic philosophy. All mundane matters, good or evil, are only regarded as affording sport to the idle gods, who are, by virtue of their divinity, above all responsibility.

It will be most convenient if we now glance at the avatâras of Vishnu, taking them in the order in which they are generally commented on. First, then, we come to the incarnation in which Vishnu took the form of a fish. This is called the *Matsya avatâr*. In the *Matsya Purâna* we have a full account of it. There are many indications that the history of this avatar has some connection with that of the Hebraic account of the Deluge. With the story of this incarnation, too, is incorporated the name of the lawgiver Manu. In the *Mahâbhârata* the hero of this avatar is regarded to be not Vishnu, but Brahma. Even in the Vaishn'ava traditions Brahma plays an important part in the narrative. The origin of the avatar appears to have been the necessity for avenging the loss of the four *Vedas* which proceeded from Brahma's four mouths. The Vaishn'ava legend, which makes Vishnu to be the avenger of Brahma, necessarily implies the supremacy of Vishnu. Brahma, we are told, fell asleep, and a demon saw him thus unconscious. The demon's name was Hayagrîva, who took the opportunity to steal the *Vedas*. These *Vedas* had proceeded from the four mouths of Brahma. It will be remembered that, according to one legend, Brahma assumed a four-headed form for the purpose of looking to the four quarters of the globe, in order to catch his daughter *Tilôtumei*, whom he desired to ravish. (The reader will remember Milton's lines, "In Saturn's reign such mixture was not held a stain.") Out of the four mouths of the four heads, thus wantonly assumed, issued the holy *Vedas!* Hayagrîva succeeded in robbing Brahma, but was caught in the act and fact by the ever-watchful Vishnu, who determined to slay the doughty devil. But he appears to have taken a long time about it, and gone about his work in the most roundabout manner possible. Nor does it appear why Vishnu—who, when incarnate in his cradle, began to set an example to men by stealing a pot of butter—should be angry at the similar deed of Hayagrîva. Nor can the legends to the effect that Brahma sprang up in the perfection of power and person, four-headed and crowned, from the navel of Nârâyana, be easily reconciled with the tradition of the assumption of those heads in order to see whither his virgin daughter had fled from his incestuous embrace. But the fact is, the sacred books of the Hindûs are, as a whole, a contradictory jumble of wild legends. The Bible of Christendom stands alone as one harmonious whole, composed of many parts—a history written in all ages of the ancient world and by different men, but which, in no part of it, is self-contradictory. But in these legends of the avatars of Vishnu we must take only one and record it, and leave the rest to be recorded by others, whose will. So we learn from the account we follow that Vishnu took the form of a fish. The sage Manu was performing his religious ablutions. The fish slipped into his hands, addressed the pious sage, and claimed protection from the larger fish. Manu consented, and placed it in his pitcher of water. But the fish grew so large that he placed it in a pond. Then the pond was found too small, and the fish was placed in a lake. Then nothing but the sea would contain the enormous creature; whereupon Manu became convinced of the divine character of the fish, although he surely might have become so aware long before when he heard the finny curiosity speak to him. Prof. Goldstücker thus writes: "Satyavrata now understood that the fish was none other than Nârâyana, and after he had paid his adoration to the god, Vishnu revealed to him the imminence of a deluge which would destroy the world, and told him that a large vessel would appear to him, in which he was to embark, together with the seven Rishis, taking with him all the plants and all the seeds of created things. Manu obeyed the behest of the god, and when the water covered the face of the earth, Vishnu again appeared to him in the shape of a golden fish, with a single horn ten thousand miles long, and to this horn Manu attached the vessel, Vishnu's serpent

serving as a cord. While thus floating in the vessel, Manu was instructed by the fish-god in the philosophical doctrines and the science of the Supreme Spirit; and after the deluge had subsided, the fish-god killed Hayagriva, restored the *Vedas* to Brahman, and taught them to the Manu Satyavrata." There are surely in this legend particularly strange allusions to Noah and the ark, and even to the number of persons who escaped from destruction in the flood.

Next comes, in the usual order assigned, the tortoise avatar. This is in one way a remarkable incarnation, as, although the gods afterward fought with them and gained the victory, the demons were at first called into active alliance with all the powers of heaven. And yet they were summoned to aid toward encompassing their own downfall. For the gods had been growing weak; the demons were, if anything, growing stronger and stronger. Even the men on earth, by performing meritorious acts of austerity or by offering up extraordinary sacrifices, were getting stronger, and equal in strength with the gods themselves. So the gods, after solemn consultation, repaired to the omnipotent Vishnu, who directed them to churn the ocean of milk, with the mountain *Mandara* for their churning-stick. This was to be stuck down into the sea, cone downward, and the long serpent of Vishnu, *Vâsuki*, to be coiled round the mountain. The demons were to pull at the head of the snake, and the gods to pull at the tail, each alternately, so that the mountain should revolve in the sea of milk, and churn it. Vishnu himself, taking the form of a tortoise, descended to the bottom of the sea to support the mountain on his back whilst it revolved on the pivot of his scales. All this was done that the nectar of immortality, called *Amrita*, should be obtained for the gods, that their strength might be renewed and perfect invulnerability obtained. The *Amrita* was found of course. Then all kinds of the most miraculous creations suddenly sprang up from out of the milky waves. But the final close of this avatâra was—which is rather usual in these Vaishn'ava legends—a free fight in heaven. The Hindûs like noise and commotion only next to the mysterious and the wonderfully incredible in their divine histories. Any one who has read the *Râmâyana* will remember Hanuman's leap of ninety odd miles. And when gods and demons fight, the Hindû listens with rapture to the tale of how a mountain was used as a club, and a lightning-flash as a javelin!

We now come to the avatar in which Vishnu takes upon himself the form of a boar. As of the other incarnations, so of this, there are innumerable versions. That which the Saiva religionists chiefly patronize in Southern India is by no means flattering to any except Siva; for in that version of the legend—undoubtedly a late one, however—Brahma tries to reach the head of Siva, whilst Vishnu assumes the form of a boar, and, digging to the foundations of the earth, tries to arrive at the feet of the god. But he is the illimitable one. Brahma descends, and tries to make believe he has accomplished the feat he attempted, but is exposed and cursed by Siva. Vishnu ascends crestfallen, his tusks utterly worn out, without having been near the fulfilment of his purpose. But the *Varâha*, or boar-avatar, in the earliest phases of the legend, appears to point to its being an incarnation of one of the Trimûrti with the main object of saving the earth from a deluge which submerged it. But, according to some accounts, it was Brahma who, taking the form of a boar, tried to raise up the earth above the waters. Afterward, when the Varâha avatâra became associated with Vishnu, all kinds of strange symbolisms in connection with the incarnation were invented. The deluge was wickedness; the boar was the power of religious ceremonial. The *Vishnu-Purâna* is the storehouse of such idealization. It is impossible to conceive a greater mass of fanciful folly than that which we owe to Vaishn'avas of the Purânic period, who made this avatar their especial theme.

The *Vâmana-avatâra*, or incarnation in which Vishnu appears as a dwarf, is certainly one of the most poetical and pleasing of his many appearances amongst mortals. To the present day the Hindûs listen to any story about the Lord of Space who took three steps—one on earth, one on air, and one on heaven—and gained these three empires for himself. For it happened that King *Bali* was so powerful a monarch that he overcame *Indra* himself. He was lord of heaven, earth, and hell, and tyrannized over the greatest gods. By excessive austerities and unrivalled sacrifices he became so powerful that it was only by craft that the almighty Vishnu could himself overcome him. So, whilst Bali was performing on an extraordinary scale a sacrifice in honor of the gods, so that thereby he might acquire still more power by his meritorious action, and rule more despotically and supremely than ever, a dwarf approached him and did him reverence. Bali was pleased, and asked the little Brahman what he would like for a gift. The dwarf said, "Only as much ground as I can cover by taking three steps." This comical request was at once granted, when the god leapt up as the mightiest of the host of heaven, and, placing one foot on earth, one on the middle space, and one over heaven, gained to himself the three worlds, leaving only hell to Bali. But, on account of the pious and promise keeping manner in which Bali submitted himself to Vishnu, he was told by the god that after death he should be born again as the eighth of the Manus.

In the next avatar Vishnu appears as a man-lion, and this incarnation is called *Nr'isinha avatâra*. In it the Preserver is represented as saving the gods from the might, acquired by the most rigorous penances, of Hiran-ya-Ka'sipu. This man could not die. He was lord of all the universe.

> "Supreme he stood:
> The merit of his sacrifice
> Was as a monsoon flood;
> His good deeds numberless—
> As in broad plains the laden ears of rice—
> That gods, who fain had shed his heart's red blood,
> Constrained by merit, were compelled to bless!"

He performed the omnipotent, god-overpowering horse-sacrifice. But even in his case the wily Vishnu was too much for him, and again upheld the might and supremacy of heaven.

Before proceeding further in our account of this typical avatar, it would be well to draw the attention of the reader briefly to the Hindus' idea of the peculiar efficacy of sacrifice. So it was an implanted theory in the breasts of every Semitic race. The Aryan imbibed it, or received it as a mental, instinctive axiom. As its alterior object, Fate seemed to stand supreme. The gods were omnipotent, yet not purely and wholly so. A wicked and depraved mortal or inferior spirit could, by the practices of self-abnegation, austerity, sacrifice, and the rest, terrify the whole pantheon. Merit acquired became more potent than deity of the most exalted kind. And then the only remedy was—incarnation! How wonderfully, in a measure, run these grooves of thought collaterally with the later biblical revelations! We find in India the same seeds germinating, uprising, flowering, bearing fruit, and casting new seeds abroad which we find in the soil of sacred Palestine. The same instinctive notions are afloat in the human mind. And the Krishna is found by the Orientalist to be but a lower and more sensual estimation of the Christ.

Hiran'yakas'ipu, in consequence of his prolonged meritorious austerities and sacrifices, forced from Brahma the gift of a life which could not be destroyed by any created being—by neither man nor bird, reptile nor demon nor fish, at any time, or in any mode, or by any weapon. His motive was anger against Vishnu. The moment Hiran'yakas'ipu obtained, through merit, this invulnerability, he began to molest the gods and to persecute the votaries of Vishnu. At length, Vishnu took upon himself to slay this demon without there being any need for Brahma's vow being broken. He came, therefore, *not* in the form of a being which had been "created," but as a new creation, a man-lion, and tore the heart of the demon from out of his breast with his sharp claws. It must be acknowledged that the trickery displayed in this avatar is not at all worthy of divinity. The word of the promise is only kept, not the spirit.

The *Parasu-Râma* avatar of Vishnu is not very interesting, as its glory is overshadowed by that of the great *Ramachandra Avatâra*. It was the liberation of the universe from Arjuna of the thousand arms which was accomplished under this incarnation. Here again, of course, we meet with this strange belief in "merit," for Arjuna acquired his malignant power wholly by deeds of unexampled piety. Arjuna was of the military class of Hindus, a Kshatriya, and Vishnu vowed to extirpate him and his whole caste. Using an axe or a bow, he did this; and it has been supposed that the legend is in essence historical, recording a great struggle in primeval times between Brahmans and Kshatriyas. The Arjuna of this avatar must be carefully distinguished from other heroes of his name.

The avatar of Vishnu as Rama is one of the most remarkable of Oriental myths, and is given in full in that magnificent epic, the *Râmâyana*. To this very day pious Vaishn'avas call out "Râma! Râma!" as the most potent of sacred exclamations or appeals for the immediate intervention of the deity who conquered the hosts of the ten-headed Râvana. And yet Râma was only the incarnation of *half* of the essential divinity of Vishnu. The whole history of this incarnation is one wild fight with demons and powers. It can scarcely be doubted that the myth is intimately connected with the inroad of South Indian Aryans into Ceylon. Such places as Adam's Bridge across the Palk Straits, Ramêswaram, Mahêndragiri, etc., are mentioned and minutely described. The monkey and bear

allies of Râma have been thought to be the Dravidian allies of the Brahman in his descent on Ceylon. The four leading personages in this avatar—which we must analyze in detail—are Râma, Râvana, Sîtâ, and Hanumân. But the whole story is full of clearly-defined characters, who grandly move through the divine drama; and finally all, in some way or other, combine to illustrate the omnipotence of Vishnu. (See RÂMÂYANA.)

The story of Râma's exploits may be thus sketched: Dasaratha, king of Ayodhyâ, had three wives and no sons, and to prolong his race (he was of the line of the Solar dynasty) he invoked the gods after solemnly performing the all-powerful horse-sacrifice. Then Vishnu appeared to him, and passed in the form of nectar into his three wives, one-half of his essence passing into *Kausalyâ*, one-quarter into *Sumitrâ*, and one-quarter into *Kaikeyî*. The result of this imbibing Narâyana was that the god was born in a threefold manner—as Râma (one-half Vishnu, son of Kausalyâ), as Lakshmana (one-quarter Vishnu), and as Bharata (also one-quarter Vishnu). It should also be mentioned that Lakshmana was a twin, and that his brother divided his quarter of divinity with him, but this does not affect the main current of the myth, wherein Lakshmana is more conspicuous than Bharata. At an early age the great sage *Vishwamitra* recognized in Râma the incarnation of Vishnu, and taking him with him to his secluded retreat in the jungle, got him to destroy the troublesome demons of the vicinity, who broke in upon the pious meditations of the sage and destroyed much of his peace of mind. This was the beginning of the war between Râma and the Râkshasas, or demons, which lasted all through the course of his history. They constantly polluted the sacrifices of the holy men, and Râma constantly pursued, fought with, and slew them. Under this head the *Râmâyana* gets to be positively wearisome. Râma always conquers, and is always bespattered with praise, and so on. Râma, in all his adventures, has Lakshmana at his side to share their dangers with him, and the friendship of the brothers is a delightful episode of ancient Hindu poetry. But the fairest creation of the Râma legend is the sweet and pure and loving Sîtâ. She was the daughter of *Janaka*, a potent monarch, who determined to give his daughter to the king most worthy of her, and who could perform the most wonderful martial exploits. A host of royalty presented itself to contend for the prize. Sîtâ was to be the bride of the man who could bend the enormous bow which only Siva, of gods and mortals, had ever bent before. The kings tried their best, but could not do so. Râma bent it like a willow wand, and flung it disdainfully away, and duly became the husband of the beautiful Sîtâ. In ancient Puranic legends, it may be mentioned in passing, we frequently come upon legendary accounts of strength being tested by the bow, and accuracy of aim, together with steadiness of the eye, by the arrow. Râma's first test of strength took place at Mithilâ. Râma's brethren married Sîtâ's sisters. Dasaratha, Râma's father, now grew old and imbecile, and installing Bharata, the third son, as his successor on the throne, banished his son Râma to live in the forests for fourteen years. Râma set out, honoring his father's mandate and preferring exile to disobedience to paternal authority. Soon after, Dasaratha died. Bharata now was proclaimed king of Ayodhyâ. Râma recommenced fighting the fiends. One of these was a she-devil, sister of the almighty demon of Ceylon. At the sight of Râma she became desperately enamored, but he repulsed her embraces. At last she became so importunate that her ears and nose had to be judicially removed, and they were carefully eliminated from her face by Râma's brother! Being naturally rather displeased, she hurried off to her brother Râvana, told him of Râma and his treatment, and then slyly played her trump card by telling the monstrous ogre of Ceylon that Râma possessed a wife who was simply peerless, and who could be easily carried off. Sîtâ was soon followed to the forest *Dandaka*, enticed from the home of Râma in the jungle whilst Râma himself was chasing a visionary deer, and carried away by the hideous Râvana to the central wilds of Ceylon. Râma, after a little lamentation, which forms a poetically touching episode, finds out to whom he owes the loss of his wife, and straightway sets off to make war against the demon of the "island" (*Lanka*). He collects a vast army of monkeys and other animals to aid him in his invasion. The son of the wind, *Hanumân*, leads the animal host. The rocks are torn down from the Himalayas and thrown into the strait between Râmêswaran and Ceylon, so as to form a bridge for the forces of the avenging avatar to cross over. Hanumân, however, crosses over to Ceylon in a more expeditious and agile way. He goes to Mâhêndragiri, a mountain about 5000 and 6000 feet above sea-level in the extreme S. of India, and takes a clear, clean leap from the top to Adam's Peak, the highest mountain in Ceylon. It appears that Hanumân, ere clearing this prodigious jump of 100 miles or so, leapt off with one foot, so as to alight on the other. So on the rocky tops of both the mountains we have alluded to, the traveller is shown by the simple natives the imprint in the hard rock of one huge foot. Râma of course proves victorious, destroys Râvana, and rescues Sîtâ, who is put into a furnace to test her purity after her rape by Râvana. Agni, the fire-god, sustains her through the ordeal, and her chastity is fully vindicated. Râma returns, after the expiration of the fourteen years' exile, to Ayodhyâ, and claims the kingdom from Bharata, who nobly abdicates. Everywhere, throughout Southern India at least, the two favorite names by which Vishnu is known are Râma and Krishna.

It is to the latter avatar that we now must come. It is extremely complex, and we cannot here devote great space to it. The fact is, that Krishna (together with Balarâma) was born a hero and champion of the great Pânduva kings in their wars against the Kurus. He is, as a god, simply the ideal personification of heroism, manliness of every kind, astuteness, and lust. He is of a deep-blue complexion, and is the perfection of manly beauty. He first comes to earth as the opponent of *Kansa*, the fiend-king, who terrorized over gods and men. To accomplish the end he had in view, and to annihilate Kansa, he, with Balarâma, determined to become incarnate, born of the seventh and eighth births of Devakî. Kansa had news of this, and killed every child born as soon as he could. But by means of stratagems and concealment Balarâma and Krishna escaped and grew up. When a few years old, they killed powerful demons and played all kinds of pranks with shepherds, uprooting trees, overturning heavy wagons, etc. But even this was an improvement on Krishna's prime achievements as an infant. He began his earthly career as an incarnate god by stealing butter! When seven years old, he killed a seven-headed snake-demon on the Jumna. A little time afterward he persuaded some votaries of Indra to worship the mountain *Govardhana*, rather than Vishnu himself. This greatly incensed the sky-god, who, to punish the land, sent down for a whole week a deluge of rain on the shepherds who had left off worshipping him; but these were not injured, for Krishna tore up by its roots the mountain Govardhana, and held it up, base upward, like an umbrella, over the heads of those who obeyed his behests! Finally, Indra worshipped Krishna as omnipotent. Vishnu now took to the wildest excesses of carnal lust. His dark-blue face and comely form at once produced an impression on the hearts of susceptible *Gôpis*, or shepherdesses, and led to a thousand of them being ravished by Krishna. Jayadêva, the poet of Kinduvilva, narrates that after a little Krishna became weary of, and penitent for, these worldly excesses, and married as his one wife the pure, saintly, ethereal, and intellectual Radha. However, if this be true, he soon got tired of his monogamy, for we find him marrying shortly afterward sixteen thousand one hundred virgins! Krishna and his brother at length slay their great enemy Kansa, after having killed two of his pugilists before thought to be invincible. Krishna was especially noted for lust and for thieving; so now we read of him stealing a miraculous tree from Indra's heaven. He died by an arrow from a hunter's bow. The hunter thought he was a deer, and wounded him in the sole of his foot. A strangely commonplace ending to the life of a god who had sixteen thousand one hundred wives! Krishna is one of the wildest of the creations of Oriental imagination. But he is thoroughly *typical*. He is dark of face in a land of dark complexions. He is handsome; and the Oriental loves the beautiful as much as most men do. He is deceitful, and wily, and shrewd, and unscrupulous; and the Asiatic has a great regard for these "virtues." He is lustful, but India is a land where wives are bought and sold, and where he that has most money indulges most in the pampering of his sexual passions. He steals; and the Hindû shrugs his shoulders, and only wishes he could steal the whole land, as perhaps some civilized nations have done in their quiet and eminently genteel and respectable way. He is brave; the timid Brahman delights in courage, with a vague sort of admiration for the inconceivable. Then Vishnu redresses wrongs. Never mind his faults, then, say they, if this be true. His wife is *Sri* or *Lakshmi*, the beautiful goddess of prosperity; and prosperity the Hindû fully appreciates. Vishnu is therefore a most popular god. He is not feared like Siva, but he is loved in a dim, fanatical kind of way. His idols—witness those of Srirangam—are covered with robes, and plates, and necklaces, and armlets, and rings, and anklets, and crowns, and overshadowed by umbrellas and seated on thrones, each and all ablaze with jewels of the largest size and first water—diamond, and ruby, and emerald, and topaz, and opal, and sapphire, and pearl. Much

more might be written of Vishnu, but we must conclude our remarks by a passing allusion to the *Buddha* avatar, the ninth. It is evidently a late invention of the Jaina sect, who tried (see JAINAS) to reconcile Brahmanism with Buddhism. The last avatar is yet to come, when the great god with the four hands will accomplish all things in the final *Kalki* avatar. R. C. CALDWELL.

Visible Speech. See DEAF AND DUMB, by HON. H. BARNARD, LL.D.; and VOICE, by PROF. R. R. RAYMOND, A.M.

Visigoths. See GOTHS, by PROF. CLEMENS PETERSEN.

Vision. See APPENDIX.

Vision, Defects of. See SIGHT, DEFECTS IN, in APPENDIX.

Visitation, in law. See CORPORATION (§ iv.), by PROF. T. W. DWIGHT, LL.D.

Visita'tion Nuns, first established in 1610 at Annecy, Savoy, by St. Francis de Sales and St. Jane Frances de Chantal; received papal approbation in 1626; introduced into the U. S. in 1808 by Teresa Lalor. The order has numerous convents in this country and in Europe.

Viswâmitra. *Viswâmitra* was a great sage of the Kshatriya caste. He is said to have lived many thousands of years, and to have performed constant austerities of an astonishing nature. He is represented as of kingly dignity, and the great foe of *Vasishtha*. Between Vasishtha and Viswâmitra there was a constant conflict for supremacy, the former being at first victorious, but finally the latter. The whole legend is in praise of the Brahman caste, in contradistinction to the warrior division of Hindû sects. It is indubitably an extremely ancient myth. Vasishtha seems to have been the personification of Brahmanism, and Viswâmitra the personification of the Kshatriya caste. When, after many thousands of years of austerities, Viswâmitra, by merit, becomes the equal or superior of Vasishtha, this is only accomplished by his becoming a Brahmarshi, or Brâhmana Rishi, a sage of a higher caste than that in which he was born. Thus, the Brahman element in the history of Viswâmitra is clearly traceable. This history is an extremely quaint and interesting one. It extends from the earliest Vedic times, through the epic to the Puranic. Its episodes, as given by various writers, are, however, extremely contradictory. We must give briefly a version or two of the acts of the life of this celebrated sage and ascetic, selecting as best we can the accounts most widely credited.

Viswâmitra traces his origin to the monarch *Purûravas*. His father was *Gâthin* or *Gâdhi*. The well-known character *Jamadagni* was said to be his nephew, who is connected with the *Parasu-râma avatâra* of Vishnu, which we have previously alluded to. Viswâmitra had a hundred sons, and could only be diverted from meritorious austerities and sacrifices by being snared by beautiful women. He wrote several of the hymns of the *Rig-Véda*. The rivalry between Vasishtha and Viswâmitra is said to have begun about a question of sacrificial precedence. Afterward Viswâmitra visited Vasishtha, who had one of those miraculous cows of prosperity and plenty—a kind of living Aladdin's lamp, the owner of which could have pretty much what he liked—which is so frequently met with in Indian legends. Viswâmitra abused the sumptuous hospitality of his host, and tried to seize and carry away the wonderful cow. But the cow asserted its divine origin, and, emitting hosts of warriors, destroyed the hosts of Viswâmitra, who had to fly. He now became convinced of the invincibility of Brahmans when pitted against any other caste. So he determined to become a Brahman. Many thousand years passed before he attained his object, but he did finally become a pure Brahmanic sage. First, after a thousand years or so of penance, meditation, and deeds of holiness, austerity, and sacrificial rites and observances, he became a secular Rishi, then a Rishi pure and simple, then a chief of Rishis, and then, last of all, the goal of his desires, a Brahman Rishi, to whom Vasishtha himself had to yield precedence. So he became the "friend of all the gods," as his name in Sanskrit signifies. But before he attained the summit of his desires, he was often thwarted by the gods themselves, who were afraid that he would become too powerful. They consulted, and found out the weak point in the saint's character—the love of the fair sex. So they sent to him "her of the fish-bright eyes, the flowering tendril of the gods," *Menakâ*. Her dalliance quite turned the head of the sage. Then afterward a beautiful creature called *Rambhâ* did precisely the same thing. Amongst the miracles performed by Viswâmitra was that of causing a king to ascend bodily to heaven, and by an incantation to prevent the sacrificial immolation of a human victim. Whilst he raised himself to a higher caste, he by his power could lower a man's caste, and indeed did so in the case of fifty of his own sons. The splendid hymns in the third mandala of the *Rig-Véda* are in most part ascribed to Viswâmitra. In them he confines his devotion to Agni, the deity of fire. He begins thus: "Render me vigorous, Agni, since thou hast made me the bearer of the Soma to offer it in the sacrifice: honoring the gods who are present, I take hold of the stone (to express the juice); I propitiate them; do thou, Agni, protect my person. We have performed, Agni, a successful sacrifice; may my praise magnify (thee) as worshipping thee with fuel and with reverence: (the gods) from heaven desire the adoration of the pious, who are anxious to praise the adorable and mighty Agni. The gods discovered the graceful Agni concealed amidst the waters of the flowing rivers for the purpose of (sacred) acts—Agni, who is intelligent, of purified vigor, and friendly; who from his birth bestowed happiness on earth and heaven." . . . "Spreading through the firmament with shining limbs, sanctifying the rite with intelligent and purifying energies, and clothed with radiance, he bestows upon the worshipper abundant food and great and undiminished prosperity." . . . "Son of strength, sustained by all, thou shinest, possessing bright and rapid rays. When the vigorous Agni is magnified by praise, then the showers of sweet rain descend." . . . "I, the institutor of the rite, worship thee with oblations. Desirous of thy favor, I implore thy friendship. Grant, together with the gods, protection to him who praises thee. Preserve us with thy well-regulated rays." (See H. H. Wilson's *Rig Veda Sanhitâ*, vol. ii. p. 318, to vol. iii. p. 14.) The above will give a fair idea of the style of the Vedic hymns ascribed to Viswâmitra. R. C. CALDWELL.

Vis'tula [Pol. *Wisla*; Ger. *Weichsel*], river of Europe, rises in Austrian Silesia in the Carpathian Mountains, 2000 feet above the level of the sea, flows with a winding course, but generally in a northern direction, through Poland and East Prussia, and enters the Baltic through several mouths. Its entire course is 616 miles; at its entrance into Poland, after receiving the San, it is navigable for large vessels.

Vita'ceæ [from *Vitis*, the most important genus], a natural order of exogenous and mostly climbing woody plants. There are 260 recognized species, but the grapevines (*Vitis vinifera*, *V. labrusca*) are the only ones of economic value, although several others are planted for ornamental purposes.

Vital (ORDERIC). See ORDERICUS VITALIS.

Vital Statistics. See APPENDIX.

Vitebsk', government of Western Russia, on both sides of the Dwina, comprises an area of 17,336 sq. m., with 888,727 inhabitants. The surface is level, and covered with forests which yield excellent timber and mast; with lakes which are rich with fish; and with marshes which afford good pastures. Though the soil in general is not very fertile, much grain and flax are raised, and cattle and coarse-woolled sheep are reared.

Vitebsk, town of Russia, capital of the government of Vitebsk, on the Dwina, is mostly built of wood, and has no manufactures, but an active trade in corn, flax, hemp, and cattle. P. 28,914.

Vit'elline [Lat. *vitellus*, "yolk of egg"], the albuminoid or proteid constituent of the yolk of eggs. (See ALBUMINOIDS.) It has been ranked as a special compound of this class, but is now rather deemed by some to be merely a mixture of ordinary albumen and caseine. It is obtained by simple treatment of yelk with ether, which dissolves out the oily and coloring matters. H. WURTZ.

Vitel'lius (AULUS), b. in Rome Sept. 21, 15 A. D.; was a great favorite with Tiberius, Caligula, Claudius, and Nero, who bestowed the highest offices and greatest honors on him, although he was a sluggish glutton, generally drunk every day. Galba sent him to Germany in Dec., 68, as commander of the legions there—nobody understood why—and here he was proclaimed emperor by the soldiers Jan. 3, 69. His friends urged him forward, and fortune favored him. Galba was murdered Jan. 15, and Spain and Gallia recognized Vitellius. In Rome, Otho had assumed the imperial dignity, but he was defeated at Bedriacum by Vitellius's generals, and stabbed himself Apr. 15, 69. July 18, Vitellius entered Rome at the head of an army, or rather a loose band, of about 60,000 soldiers. He made very few confiscations or executions; he seemed bent only on eating and drinking, and for these purposes he spent fabulous sums. Meanwhile, VESPASIAN (which see) had been proclaimed emperor by the armies of the East, and his generals approached Italy. Vitellius now found nothing but indifference or treachery. He tried to negotiate, but failed. He offered to resign, but too late. He was found hiding in a corner of the deserted palace, dragged out into the Forum, and put to death by a common soldier Dec. 21, 69.

Vitellus. See EMBRYOLOGY, by PROF. J. C. DALTON, M. D.

Viter'bo [anc. *Viterbium*], a city and commune in the province of Rome, Central Italy, in a region fertile in a great variety of agricultural products, among which hemp

is particularly important, with rich pasturage and many valuable mineral deposits. From these sources is derived a great quantity of raw material, the elaboration of which furnishes employment to many laborers. Viterbo has also several mineral springs, very various in temperature and composition, which are beneficial in many diseases. Among these is the *Bulicame*, a large spring in continual ebullition, mentioned by Dante. With these great natural advantages Viterbo naturally became an important seat of industry and civilization at a very early period. The Etruscan cemeteries of Castel d'Asso, Norchia, and others are very striking testimonials to the wealth and culture of old Etruria, and there are in the town and neighborhood numerous interesting specimens of Roman and mediæval architectural art. It does not appear, however, that Viterbo or its environs was ever the site of any considerable Roman city, and, in fact, the town can scarcely be said to have a history. The cathedral is of early date, and contains a picture by Mantegna, and in the church of the Osservanti del Paradiso is a fresco ascribed to Leonardo da Vinci. The Santuario della Quercia, just without the town, is much admired for its architecture and for its sculptures and terra-cottas, among which latter are renowned works by Luca and Agostino della Robbia. The villa Lante della Rovere and that of Buen Retiro are celebrated, as is also a fountain called Fontana de' Mori. Many civil structures in Viterbo have architectural features of much merit. P. 26,237.

Vitet' (Louis), b. in Paris Oct. 18, 1802; was educated for a teacher, but engaged in journalism and literature; became a contributor to the *Globe*, and published with considerable success the dramatic poems *Les Barricades* (1826), *Les États de Blois* (1827), and *La Mort de Henri III.* (1829). From the revolution of July, 1830, to the *coup d'état*, Dec. 2, 1851, he held various offices in the civil service, but retired then into private life, and devoted himself exclusively to literature. D. in Paris June 5, 1873. His principal works are — *Eustache Lesueur* (1843), *Monographie de l'Église de Notre-Dame de Noyon* (1845), *Fragments et Mélanges* (2 vols., 1846), *Essais historiques et littéraires* (1862), *Études sur l'Histoire de l'Art* (1864), etc.

Viticulture. See Vine-Culture, by E. W. Hilgard.

Viti Islands. See Feejee Islands.

Vitis. See Grape, Vine-Culture, and Vitaceæ.

Vito'ria, town of Spain, capital of the province of Alava, consists of an old town, narrow, gloomy, and dirty, and a new town, open, airy, and elegant, with many fine buildings and beautiful promenades. Articles of brass, iron, and ebony, earthenware, candles, leather, and chocolate, are extensively manufactured, and a brisk trade in oil, wine, fruits, and corn is carried on. On June 21, 1813, the allied English and Spanish army under Wellington gained a victory here over the French under Jourdan. P. 18,700.

Vitre', town of France, department of Ille-et-Vilaine, on the Vilaine, is a curious old place, but interesting and lively. Its manufactures of leather and hosiery are extensive; has a brisk trade in wax, honey, and grain. P. 8900.

Vitrification. See Glass, by C. G. Leland, and Glass, American Manufacture of, by L. P. Brockett.

Vit'rified Forts, a remarkable class of pre-historic fortifications almost peculiar to Scotland and its islands. They are made of silicious stone, and the inside—in some cases the outside, or indeed the whole mass—has been vitrified by the action of fire and of wood-ashes, the stone being transformed into a kind of glass. Whether the vitrification was intentional or not, is a mooted question.

Vitriol, Elixir of. See Mineral Acids, Medicinal Uses of, by Prof. E. Curtis, M. D.

Vitriol, Oil of. See Sulphuric Acid, by H. Wurtz, A. M.

Vit'riols [Lat. *vitrum*, from the glassy character of the crystals], a generic name among the earlier chemists for the *sulphates*, often still applied in common language. Thus, ferrous sulphate is *green vitriol* or iron vitriol, cupric sulphate is *blue vitriol* or copper vitriol, zinc sulphate is *white vitriol* or zinc vitriol, and so on. Sulphuric acid was also called vitriolic acid, as forming vitriols or obtained from them, as in early times it was so obtained. H. Wurtz.

Vitru'vius Pol'lio, a Roman architect and author of a treatise on architecture in ten books, dedicated to the emperor Augustus. The place of his birth is uncertain, but it was Verona, if we may receive the testimony of an inscription found there. His work appears from internal evidence to have been composed about B. C. 14. In respect to its subject it is very important, as it is the only one of the kind that has come down to us, and it is expressly mentioned by Pliny as one of his authorities. Vitruvius discussed his art in its widest sense. In the first seven books he treats of architecture proper, ecclesiastical and private building; in the eighth, of water and aqueducts; in the ninth, of sun-dials; and in the tenth, of machines. His chief sources were Greek writers, but his knowledge of Greek seems deficient. Though he possessed varied learning and a philosophic turn, he appears to have been an unpractised author, and frequently fails to express himself intelligibly. Some things, indeed, are obscure from our own want of information on this complicated subject at this distance from the period of the writer: thus, his *modulus*, or unit employed in giving the proportions of an ancient temple, is maintained by Aurès to be the diameter of the column at its average vertical height, but by Reber to be the diameter of the lower end of the column proper. We have also an abridgment of the work by a very ancient but unknown author, who has preserved the arrangement of the original, but has limited the subject to private buildings. Vitruvius has been translated by Newton in 2 vols. fol., with 47 plates (London, 1771–91), and by Wilkins, also in 2 vols. fol. (London, 1813). Charles Short.

Vitry-le-François', town of France, department of Marne, on the Marne, is fortified, manufactures hats, hosiery, oil, and trades in wood, coal, corn, and iron. P. 7622.

Vitto'ria, town of Sicily, province of Syracuse, about 20 miles N. W. of Modica. In the neighboring plains are raised vast quantities of the soda-plant, the ashes of which are exported to Marseilles for the use of the soap-factories of that city. This town received its name from a victory obtained by Roger over the Arabs in 1092. P. 17,921.

Vittoria Colonna. See Colonna (Vittoria).

Vitus's Dance, Saint. See Saint Vitus's Dance, by A. M. Hamilton, M. D.

Vivarium. See Aquarium.

Viver'ridæ [from *Viverra*—an ancient name—the typical genus], a family of mammals of the order Feræ, containing the civets and allied types. The form is generally more or less elongated, and somewhat similar to that of the weasels; the head is elongate and terminates in a prominent snout; the feet are neither typically digitigrade, as in the cats and dogs, nor plantigrade, as in the bears, but rather intermediate, sometimes tending in one direction and sometimes in another; the toes are mostly well developed, the claws sharp; the tail more or less elongated; the teeth 36 to 40 in number, and moderate in size (M. $\frac{2}{3}$, rarely $\frac{1}{2}$; P. M. $\frac{4}{4}$, exceptionally $\frac{3}{3}$; C. $\frac{1}{1}$; I. $\frac{3}{3} \times 2$); the true molars of the upper and last of the lower jaw tubercular. The skull is of the "æluroid" (cat-like) type, the paroccipital processes being closely applied to the auditory bullæ; the mastoid processes small or obsolete, the external auditory meatus very short or imperfect; the carotid canals minute and superficial or obsolete; the condyloid foramina and foramina lacera postica debouching in common fossæ, and the glenoid foramina minute or null; the auditory bullæ are divided; the intestinal canal is generally provided with a cæcum; no prostate glands are developed; the os penis is rudimentary. These characters define a natural association of genera, and exclude several that have been approximated to the type by different naturalists. As thus limited, the family is peculiar to the Old World, and especially the tropical portions of Asia and Africa. The American genus, *Bassaris*, formerly referred to the family by most authors, is now proved, by the structure of the skull, to be most nearly related to the raccoons, and not at all to the viverrids. The genera and species are numerous, and have been grouped under eleven, or perhaps twelve, sub-families—viz. (1) Viverrinæ, (2) Prionodontinæ, (3) Galidiinæ, (4) Hemigaliinæ, (5) Paradoxurinæ, (6) Arctictidinæ, (7) Cynogalinæ, (8) Herpestinæ, (9) Cynictidinæ, (10) Rhinogalinæ, (11) Crossarchinæ, and perhaps (12) Euplerinæ. These, however, require confirmation, and more exact appreciation of their relations than they have yet received. The species are of small or moderate size, mostly ranging from the dimensions of a weasel to those of a dog. They are all carnivorous, preying on small animals of various kinds or their eggs, some attacking chiefly, by preference, birds, others serpents, others insects, and still others eggs; but they often fail to discriminate in this respect, and may take to either kind in the absence of a choice. The most noteworthy species are the civets (*Viverra civetta*, etc.), genets (*Genetta vulgaris*, etc.), paradoxures (*Paradoxurus typus*, etc.), binturong (*Arctictis binturong*), ichneumons or mungooses (*Herpestes ichneumon*, etc.), and suricate (*Suricata zenick*), the principal of which will be found noticed and illustrated under their respective names in this Cyclopædia. Theodore Gill.

Vives' (Juan Luis), D. C. L., b. at Valencia, Spain, in Mar., 1492; studied at the universities of Paris and Louvain, after which he visited England, and was chosen one of the first fellows of Corpus Christi College, Oxford, 1517;

was employed by Henry VIII. as tutor to the princess Mary (1523), for whose use he wrote his *De Ratione Studii Puerilis* and *De Institutione Feminæ Christianæ*; was disgraced and imprisoned for having argued and written against the divorce of Queen Catharine of Aragon (1528), and afterward settled as a classical teacher at Bruges (1529), where he married and spent the remainder of his life; with his intimate friends, Erasmus and Budæus, formed a triumvirate to which was ascribed the leading part in the revival of literature. D. at Bruges May 6, 1540. His Latin *Works* were printed at Bâle (2 vols., 1555), not including, however, his most noted performance, the commentaries on St. Augustine's *De Civitate Dei*, which had appeared in 1522. Among his works were treatises *On the Truth of the Christian Faith*, *On the Soul and Life*, and *On the Causes of the Decline of the Arts*.

Viv'ian, p.-v. and tp., Waseca co., Minn. P. 305.

Vivia'ni (Vincenzo), b. in Florence Apr. 5, 1622; studied mathematics under Galileo and Torricelli; was member of the Florentine Academy, also of the French Academy after 1669; received a pension from Louis XIV., and d. at Florence Sept. 22, 1703. His principal works are—*Divinatio in quintum Conicorum Apollonii Pergæi* (1659) and *Divinatio in Aristæum* (1701).

Vivisec'tion [literally, the "opening of the living body" (*sectio viri*), in contradistinction to that of the dead body (*sectio cadaveris*)]. The examination of the interior of the dead body, both in animals and in man, is resorted to for purposes of anatomical research, and also to ascertain the changes produced by disease. Vivisection, on the other hand, is employed for investigating, in the lower animals, the action of the organs during life. The term, however, though strictly applicable, in its etymological sense, only to cutting operations, is used to designate all experiments of a scientific nature performed upon living animals, whether they consist of division of the parts by cutting instruments, or their compression by ligatures, or the subjection of the animal to special conditions of food, temperature, or respiration, or to the action of drugs and medicines. In all these cases the object of the experimenter is to ascertain some fact in physiology or pathology which cannot be otherwise investigated.

The necessity for resorting to experiments upon living animals in physiology and the allied sciences depends upon the obvious fact that these sciences have to deal with the actions and phenomena of life; and consequently, in order to study them successfully, the necessary investigations must be made while life is going on. Examination of the dead body reveals the form and structure of the internal parts, but it does not yield a knowledge of their physiological actions, because these actions have ceased and the organs have relapsed into a quiescent condition. The physiologist, therefore, makes the living body the subject of his investigation for the same reason that the chemist experiments upon the reactions of chemical substances, or the student of electricity upon those which exhibit electrical phenomena. Where the necessary steps of an experiment are of a nature to cause pain to the animal, as in cutting operations, this is generally avoided by the use of ether or chloroform, in the same manner as when these anæsthetics are administered for surgical operations upon the human subject.

The results which have been attained by means of experiment upon the living body constitute nearly the whole of the actual knowledge possessed in physiology. The earliest investigator of note who employed this method was Galen, and his discovery of the true function of the *arteries*, about the year 150 of the Christian era, forms a striking illustration of its necessity and usefulness. Previously to that time the arteries were thought, as their name indicates, to be air-tubes for distributing throughout the body the air taken in at the lungs; while the veins were regarded as the only channels for the conveyance of blood. This conclusion was naturally derived from the appearance of the two sets of vessels in the dead body; for at the time of death the blood leaves the arteries in great measure and accumulates in the veins, and when the body is opened and the arteries cut across, they resume their tubular form, owing to the elasticity of their walls. Thus, the dissector of the dead body found the veins containing blood and the arteries containing air. When an artery was accidentally wounded during life and discharged blood, it was thought that it had first emptied itself of the air, and that the blood was afterward drawn into it from other parts. But Galen experimented upon this subject by exposing an artery in the living animal, and including a portion of it between two ligatures placed a certain distance apart. He then opened it between the ligatures, and showed that it discharged no air, but only blood. Consequently, it must have contained blood beforehand. This was the first demonstration of the important fact that the arteries are blood vessels, and that there are in the body two kinds of blood—namely, venous blood in the veins, and arterial blood in the arteries. William Harvey in 1628 completed our fundamental knowledge of the circulation by his discovery that the blood, after passing from the heart outward through the arteries, returns again to the heart by the veins, thus moving in a continuous round through the vascular system. This discovery was also the fruit of experimentation on living animals; and it was by the same means that other eminent physicians of the time, who at first doubted Harvey's doctrine, were finally enabled to convince themselves of its truth. The real action of the *heart* as a propelling organ for the blood, and the true nature of the arterial *pulse*, were both parts of the same discovery, and were ascertained in a similar way.

The knowledge thus gained of the circulation was not only of the highest value in itself, but soon led to other important results, one of which was the possibility of the *transfusion of blood* from one animal to another. This was first demonstrated in 1665 by Richard Lower, who succeeded in transferring blood from the vessels of one dog into those of another, the second dog being allowed to bleed freely at the same time, but being kept alive by the blood received from the first. This showed that death from hæmorrhage might be prevented by the introduction of blood from another animal of the same species. After a variety of successes and failures in applying this operation to the human subject, the matter was again investigated experimentally by Dr. Blundell in 1824, and has been the subject of numerous later researches. They have resulted in improved methods of performing the operation, and in greater knowledge of its proper application as a remedy. It is now a recognized means of preserving life in cases of exhaustion from abundant or long-continued hæmorrhage.

The function of *respiration*, which is immediately essential to life, has come to be understood mainly through experiments upon animals. The first important knowledge in regard to it was obtained in 1670 by the Hon. Robert Boyle, who enclosed animals of various kinds in the receiver of the air-pump, then a recent invention. He demonstrated in this way not only that atmospheric air is necessary in all cases to the maintenance of life, but also that when confined in a limited space it becomes vitiated by continued respiration, and that in order to maintain life the vitiated air must be removed and replaced by a fresh supply. It was soon afterward found by Mayow that the air thus vitiated by the respiration of animals was also diminished in volume; and he concluded, accordingly, that something in it was consumed or used up by the process of respiration. Lavoisier in 1777 discovered, by experimenting with sparrows, that the respirable ingredient of the air could be removed by the calcination or oxidation of mercury; showing that the substance (oxygen) which combined with the metal was the same with that absorbed by animals in the process of breathing. But if he set free the oxygen from its metallic combination, and added it to the irrespirable residue of the air, the mixture again became respirable and capable of supporting life. He further proved that the animals in breathing not only consumed the oxygen of the atmospheric air, but at the same time exhaled another gas—namely, carbonic acid—which could be made to unite with lime-water and form carbonate of lime. In this manner it was ascertained that the process of respiration consists essentially in the absorption of oxygen and the exhalation of carbonic acid. Without the knowledge of such fundamental facts all further discovery in this direction would be impossible; but since the time of Lavoisier many important particulars have been, and are still being, added to physiology, as to the time, place, and quantity of the absorption and discharge of the gases of respiration, their relation to each other, the mode of their consumption and production in the body, and their influence upon the fitness of the air for breathing. The whole subject of ventilation and its practical application for the preservation of health depend upon a distinct knowledge of the composition of the air and its physiological properties in regard to respiration.

The functions of the *nervous system* have been the subject of experimental investigation from very early times. Galen showed that the nerves are the channels through which the commands of the will are conveyed to the muscles, and that the spinal cord is the conductor for voluntary impulses proceeding from the brain to the nerves of the body and limbs. The researches of modern physiologists have been directed to ascertain the special functions residing in particular nerves or nervous centres. The crossed action of the spinal cord in its communication with the brain, the different properties of the anterior and posterior roots of the spinal nerves—of which the former serve for motion and the latter for sensation—the distinction between the motor

and sensitive nerves of the face, the connection of the medulla oblongata with the function of respiration, and the influence of the pneumogastric nerve on the movements of the chest and the action of the heart,—are a few examples among many of the important discoveries effected in this way. A knowledge of these details is essential for the medical practitioner, since it is only by their aid that he can learn from the external nervous symptoms what is the nature of the internal injury or where it is located.

The natural mode of the *reproduction of bone* when a portion of its substance is destroyed or removed was discovered by a series of researches extending from 1740 to 1858, and conducted mainly by Duhamel, Hunter, Syme, and Ollier. When a bone is broken into small pieces, or when it is otherwise so injured that a considerable part of it must be removed, the remnants generally fail to unite with each other by solid tissue, and the limb, remaining permanently flexible at the point of fracture, is accordingly of no value for practical purposes. Formerly, such a limb was often amputated, in preference to leaving it as a useless incumbrance to the patient. But it was discovered by the experiments above mentioned that if the fibrous covering of the bone, or its "periosteum," were left behind in such cases, while the broken fragments were removed, new bony tissue would be produced and a solid union effected. This method of practice was consequently adopted in the treatment of fractures in the human subject, and has been the means of saving many limbs which would otherwise have been left in a state of deformity or wholly sacrificed.

The foregoing illustrations indicate the manner in which experimentation on animals has been rendered serviceable to physiological science and to practical medicine. It has also produced results of value in other directions, among which may be mentioned the practice and usefulness of *artificial respiration* in cases of drowning, hanging, and the suspended animation of newly-born infants; the improved surgical operation for the cure of *aneurism;* the successful study of the various *digestive secretions;* the investigation of *parasitic and contagious diseases;* the best treatment for *venomous wounds,* like those of the rattlesnake; and the action of *poisons, drugs, and medicines,* with their remedies and antidotes. J. C. DALTON.

Vizagapatam', town of British India, presidency of Madras, the capital of a district of the same name, at the entrance of the Veragatam into the Bay of Bengal, in lat. 17° 41′ N., has a good harbor, sheltered by the Dolphin's Nose, a cliff about 1500 feet high, and is a military station, but is considered unhealthy for Europeans. P. 40,000.

Vizier' [Arab., "burden-bearer"], the title of many dignitaries in Mohammedan countries, first bestowed in 750 A. D. by Abul Abbas (Al Saffah), the first Abbaside caliph, upon his prime minister, whose duty it was to bear as far as possible the burdens of his master. At present the grand vizier of Turkey is the chief minister of state, and holds the most important position under the sultan. A great number of inferior dignitaries are called viziers.

Vizzi'ni, town of Sicily, province of Catania, in a healthy position on a hill near the source of the Dirillo. There are some respectable buildings here, and the neighborhood is fruitful and abounds in pasturage. The commune consists of several fractions, with a pop. of 14,942.

Vlaar'dingen, town of the Netherlands, province of South Holland, on the Meuse, has a good harbor and carries on an extensive herring fishery and some shipbuilding and shipping business. P. 8324.

Vladimeer', government of Russia, nearly in the centre of the country, bounded S. W. by Moscow, comprises an area of 18,145 sq. m., with 1,239,051 inhabitants. The surface is level and the soil not fertile; less grain is produced than demanded for home consumption, but hemp is grown with success. Large forests of pine occur; also lakes rich in fish. Iron is found in several places and extensively worked. On account of the poverty of the soil manufacturing industry has been largely developed. Iron, glass, earthenware, cotton and linen goods are extensively manufactured. The iron-foundries alone employ over 6000 hands, and the value of its cotton manufactures amounts annually to about 13,000,000 robles.

Vladimeer, town of Russia, capital of the government of Vladimeer, on the Kliasma, is beautifully situated, well built, and contains many remains from the time when it was the capital of Russia (thirteenth and fourteenth centuries). The inhabitants of the adjacent districts are celebrated as stone-workers, oven-builders, tilers, slaters, shinglers, and carpenters. P. 13,763.

Vladimeer, or Wladimir, town of European Russia, government of Volhynia, has 4 annual fairs and a trade in silk and salt. P. 5500.

Vladimeer the Great. See RUSSIA, by PROF. CLEMENS PETERSEN, A. M.

Vladislaus. See LADISLAS.

Vliessingen. See FLUSHING.

Vocabulary. See LEXICON, by HON. G. P. MARSH.

Vode'na, town of European Turkey, eyalet of Room-Elee, on the Vistritza, manufactures cotton and woollen fabrics. It occupies the site of the ancient EDESSA (which see) of Macedonia. P. 12,264.

Vo'gel (ENDANN), b. at Crefeld, Rhenish Prussia, Mar. 7, 1829; was educated at Leipsic; studied astronomy and natural science there and in Berlin under Encke; assisted Hind for two years in his labors at Bishop's observatory in London, and went in 1853 to Africa, with the support of the English government, to join the expedition of Clapperton, Barth, and Overweg. Feb. 20, 1853, he sailed from England to Tripolis; Aug. 5 he reached Moorzook, and Jan. 13, 1854, Kuka, the capital of Bornoo. From this place he undertook various expeditions to the adjacent countries; met Barth at Bundi Dec. 1, 1854; visited Yacoba, and returned to Kuka Dec. 1, 1855. At this date his own notes stop, but it was afterward ascertained that on Jan. 1, 1856, he started eastward, penetrated to Wara, the capital of Waday, and was assassinated there Feb. 8, 1856. As his fate was uncertain for a long time, several expeditions were fitted out to find him. His notes have been communicated by his sister, Elise Polko, in her *Erinnerungen an einen Verschollenen* (Leipsic, 1853).

Voghe'ra [*Iria*], town of Italy, province of Pavia, in the rich and highly-cultivated plain between the Po and the Apennines. The Via Emilia passes directly through the town, which is also connected by railway with Genoa, Milan, etc. The ancient castle with its four towers is still standing, but the walls and other defences are demolished. Several of the public buildings are noticeable, and the church of San Lorenzo, on the site of an older one of the same name, is a grand specimen of the Tuscan architecture of the seventeenth century. This church contains some curious monuments, relics, and reliquaries. The theatre is worthy of a large city. Public instruction is well cared for, and Voghera has the honor of being one of the first towns of Italy to practise the art of printing. The manufactories here are extensive; hempen, linen, and cotton fabrics are produced, and the hats of Voghera are largely exported, even to America. The agriculture of the vicinity is also very prosperous. Voghera was settled before the Roman period, and was a place of some importance when destroyed by the Northern invaders early in our era. Its mediæval history is closely connected with that of Milan and Genoa. Roman antiquities of interest are found in and near Voghera. P. 15,500.

Vogt (KARL), b. at Giessen, in Hesse-Darmstadt, July 5, 1817; studied medicine at the university of his native city, and worked a year and a half in the laboratory of Liebig; removed in 1835 to Berne, where he studied anatomy and physiology under Valentin; settled in 1839 at Neufchâtel, where for five years he assisted Agassiz in his various investigations; took part in editing the first two volumes of his *Histoire naturelle des Poissons d'Eau douce,* and published independently *Untersuchungen über die Entwickelung der Geburtshelferkröte* (1842) and *Im Gebirg und auf den Gletschern* (1843); resided from 1844 to 1846 in Paris, and published *Lehrbuch der Geologie und Petrefactenkunde* (2 vols., 1846) and *Physiologische Briefe* (1845–46); travelled in Italy, and was in 1847 appointed professor of natural history at Giessen. On account of his participation in the political movements of 1848 as one of the farthest-going radicals, he lost his chair in Giessen, and left Germany, but in 1852 was appointed professor of geology at Geneva, and in 1853 at Berne. Of his numerous writings, strictly scientific, popular, and polemical, the most remarkable are—*Ocean und Mittelmeer* (2 vols., 1848), *Untersuchungen über Thierstaaten* (1851), exceedingly satirical; *Bilder aus dem Thierleben* (1852), *Zoologische Briefe* (1851), one of his principal works; *Köhlerglaube und Wissenschaft* (1852), full of bitter scorn and sarcasm; *Die künstliche Fischzucht* (1859), *Grundriss der Geologie* (1860), *Vorlesungen über den Menschen* (1864), *Ueber die Mikrocephalen oder Affenmenschen* (1866), *Sechs Vorlesungen über die Darwinsche Theorie* (1868), *Politische Briefe an F. Kolb* (1870). As a writer, Karl Vogt is clear, rapid, and very entertaining, but his polemics against what he considers encroachments on the rights of science by superannuated superstitions is often crude.

Vogüé, de (CHARLES JEAN MELCHIOR), COUNT, b. about 1825; travelled in Syria and Palestine 1853–54; published *Les Eglises de la Terre-Sainte* (1859), *Le Temple de Jérusalem* (1864), *L'Architecture civile et religieuse du I. au VII. Siècle dans la Syrie centrale* (1865–68); was sent as ambas-

sador to Constantinople in 1871, and thence transferred to Vienna in 1875.

Voice (in elocution). Voice, in the generic sense, is a property of all living animals which are structurally endowed with a capacity to produce certain sounds uttered from the mouth: articulate voice, the organ of language—which, as the vehicle of thought and feeling, is the divinely-ordered means of social intercourse and intellectual progress—belongs to man alone. The methods by which the intellectual attainments of any one member of the human family may thus become the possession of all are two—viz. *speaking* and *singing*.

These must have been almost coeval in their origin; for, as the deductions of reason assure us that the social necessities of the race must have very early given rise to spoken language, so a universal experience unites with remotest tradition in ascribing to every human being a religious impulse which finds its most adequate expression in song. The least-civilized tribes have always celebrated their festivals of worship with rude rhythmic chants, while the cultivated nations of all time have cherished music as the ethereal medium of poetry and a potent agent in the culture of the soul. For the musical side of vocal art science has already done much by defining its forms and improving its processes. Mathematics and physics have expounded the laws of sound; philosophers have discovered the immutable principles upon which melody, harmony, and rhythm depend; and the definite nature of the work to be accomplished in giving force and expression to the singing voice has made it possible to conduct that work on a well-ascertained scientific basis. But to the cultivation of speech, a faculty normally universal, and hence much more intimate and important in its relations to man—the minister of his highest social welfare and the agent of his noblest progress—its more complicated mechanical processes and the indefinable character of its melodic scale have hitherto presented the most formidable obstacles.

In many respects, however, what has been accomplished for one of these arts enures also to the benefit of the other. In both, the instrument, at least, is the same, though put to somewhat different uses. The important results of recent investigation in the domain of acoustics, though less obviously practical in their application to speaking than to singing, cannot but be, in the end, of great advantage to both, and that æsthetic culture by which all forms of art are inspired to their lofty purpose is essential alike to music and to elocution.

The limitations of this article require that these contributions of science and experience to the culture of the human voice shall be treated with exclusive reference to elocution. This may be done from a physiological, a physical, and a psychological point of view; in other words, we may consider the instrument, its mechanical uses and processes, and those intellectual laws by which it is made to convey thought and emotion to the human soul.

I. Of the physical apparatus employed in the production of voice the merest outline of description must suffice. Any good manual of anatomy will furnish the inquirer with the detailed discussion he may desire. If we begin to construct the mechanism of the voice as we would build an organ (to which it bears some analogy), we find at the base, in the human chest, the lungs, which perform the office of a bellows to furnish air for the instrument above. This air is forced by their action through bronchial tubes, which, extending upward through either lung, gradually converge until they meet in a single tube, called the *trachea*, or windpipe, consisting of incomplete cartilaginous rings lying horizontally one above the other. At the upper end of the trachea is a funnel-shaped piece of mechanism, enlarging upward and composed of various cartilages connected by ligaments, and moved by muscles. This is called the *larynx*. Through its centre, in continuation of the air-tube, runs a hollow passage, which terminates in a wide triangular opening. Across this are stretched two pairs of tense elastic membranes—the *chordæ vocales*—which have the power both of moving together and of playing into each other. Of these, however, only one pair is immediately concerned in the production of tone. These are called, therefore, the *true* vocal cords. Between their fine edges there is a narrow opening or chink, called the *glottis*; and as these cords are at will made more or less tense, the wind that is forced through the opening causes them to vibrate audibly with various degrees of force and pitch.

This is the genesis of voice: from this point the tone here generated undergoes only modifications of fulness and quality and such as combine to effect articulation. It now passes into the *pharynx*, a membranous bag which leads both into the mouth and into the nose, being separated from the former by the curtain of the palate, and from the latter by a very thin osseous partition. This, together with the two *false* vocal cords and the anterior cavity of the mouth, together with the frontal cavities over the eyes and in the cheek bones, constitutes a resonance apparatus, a species of sounding board, by which the voice is modified in respect to fulness and quality. How it is further affected by the teeth, the tongue, the palate, and the other organs of articulation we are yet to consider.

II. Sound comes to our ears in two forms—as *tone* and as *noise*. Tone is sound caused by the regular periodic vibrations of the sounding body, such as is given out by musical instruments. Noise proceeds from irregular movements of the sounding body. The crash of thunder, the rattling of the streets, the discord which results from striking all the keys of a piano at once—these are noises. The sounds which we make in speaking consist of both tones and noises.

Prof. Helmholtz of Heidelberg, in his *Lehre von den Tonempfindungen*, has shown that for the production of every vowel-sound the cavity of the mouth is definitely tuned by the disposition of its various parts—the teeth, the tongue, the lips, the soft palate, the pharynx, etc. The air confined in the cavity of the mouth has, like any other body of confined air, its own rate of vibration, and hence its own pitch, which varies with the variation of the cavity. The vowel-sound, therefore, is independent of the musical tone produced by the larynx, and is always the same, whether in the mouth of a man, a woman, or a child. This is true also of some of the consonant sounds, while others are merely noises produced by the breath vibrating at points of resistance in partly-closed organs. Thus, every element of language has its own peculiar type—or *Klang*, as it is called by the Germans—which distinguishes it from all others. These characteristic sounds may be heard even in whispering. In speaking aloud they are combined with the noises (also formed in the mouth-cavity) and supported by the *tones* of the larynx. Speech thus results from the combined working of two very different actions of the vocal organs. The difference between singing and speaking is, that the first employs pure tones, modified only, *when words are used*, by those rapid and scarcely-observable discords caused by the striking of the air upon the interior parts of the mouth; while in speaking these *noises* predominate, and *tone* asserts itself only or mainly in the occasional prolongation of the vowel-sounds.

Tone has three properties—strength, pitch, and quality, called by the Germans *Klangfarbe* (tone-color), and by the French *timbre* (stamp). The latter term has come into very general use in English works upon the voice and its culture. The strength of a tone depends upon the amplitude, its pitch upon the rapidity, and its timbre upon the form, of the vibrations which produce it. As the strength of the tone depends upon the breadth of the sound-waves, this, in its turn, depends primarily upon the structure, and then upon the voluntary disposition or adjustment, of the vocal organs and of the resonance-apparatus. Much misdirected labor is sometimes expended in attempting to increase the power of the voice by harsh and straining exercise of its muscular organism, with a vague idea of imparting to them toughness and vigor. In view of the delicacy and tenderness of these ligaments, such a process must appear somewhat worse than useless. When once these parts are fully developed, it is not possible in this way to make a strong voice out of a weak one. Its tone may indeed be reinforced—first, by adding to the impulse which produces it through a greater exertion of the diaphragm and abdominal muscles; secondly, by a proper adjustment of the vocal cords and the management of the breath; and, thirdly, by the co-vibration of the chest, the mouth-cavities, and the bony parts of the head, so that whatever tends to give capacity to the one or firmness to the other contributes to this end. But when we come to consider the nature of timbre, and the ways of modifying it, we shall see that the processes which enter into that culture are nearly identical with what is necessary to this, and exactly adapted to impart to the voice not only a sweet and agreeable quality, but also that reach and ring which comprise all the best effects of power.

The pitch of a tone depends upon the number of the vibrations in a given time by which it is produced: the more rapid the vibrations the higher the pitch. The octave of a tone has exactly twice as many vibrations in the same time as the tone itself: the fifth above the first octave, three times; the major third above the second octave, five times; the fifth of the same octave, six times; and the minor seventh of the same, seven times as many. Variations of pitch in the human voice are due exclusively to the action of the glottis and the ligaments of the larynx, and are subject to the uniform laws by which the tones in hollow tubes ascend or descend according to the different lengths of the air-columns they contain, and in stringed instruments according to the greater or less tension, the extent, and the degree of vibrating surface in their strings. By means of

the LARYNGOSCOPE (which see) the various movements of the larynx and vocal cords which combine these two principles in the production of tone have been accurately inspected and recorded. It is found that in giving forth the lowest tones of what is called the *chest-voice* the windpipe is enlarged to its utmost capacity, the vocal cords are moved throughout their whole length with large, loose vibrations, which are communicated to all the interior parts of the larynx, and again, by resonance, to the confined air in the cavity of the chest. When to this is added a peculiar expansion of the pharyngeal cavity, that full, rich quality of the voice is produced to which Dr. Rush gave the name of *orotund* (from the *ore rotundo* of the Latin maxim), and to which the dramatic artist is indebted for some of his finest effects. As the scale is ascended the vocal cords swiftly meet and separate at each new tone, and are shortened and made more tense; as the strings of the violin are controlled by the fingers of the player. The tones of the *head-voice* (as it is usually styled) are produced by vibrations of the fine inner edges only of the *chordæ vocales*. This, however, is but a general and imperfect view of a very complicated process, and makes no account of the expansion and contraction of the trachea, with the consequent rise and fall of the larynx, and some other important modifications. For we are less concerned at present to give an accurate description of the physiological processes than to expound the physical laws relating to them, in obedience to which the phenomena of voice are produced.

The division of the vocal scale into registers (chest-voice, head-voice, falsetto, etc.), their points of transition, and the treatment of the singing voice with regard to them, about which a wide difference of opinion exists, are less important in elocution, because the scale employed is more limited, little beyond the lower and a part of the middle register requiring cultivation, and that of a simpler character. Men speak (normally) an octave lower than women, employing usually only the chest-tones, rarely the head-tones, and never the falsetto. The usual range of the male voice is from the low F to A. Women use mostly the upper part of the chest register and the lower part of the falsetto, ranging from A below the line to B in the treble clef. Little children speak entirely in the falsetto.

The upper part of the chest register—that is, the middle voice—is best adapted to public speaking, being most capable of inflection, farthest of reach, and most easily sustained. If the voice is pitched too high, when excitement supervenes it will tend to break into a scream, while for low-keyed voices it is usually very difficult to rise out of a tedious monotony. The middle voice gets all the advantage from chest-resonance, and at the same time has room to rise when emotion or occasion demands. The accomplished speaker should have full control over the pitch of his voice, and be able to modulate its key at will, so as to adapt it to all external circumstances.

The increase of the compass of the voice is not so important in elocutionary as in musical instruction. A judicious practice of the scale under the guidance of a skilful master will accomplish all that is necessary in this respect, and at the same time tend to improve the voice in flexibility and purity.

But the most important thing to be considered in the culture of the voice is timbre or quality. All bodies and instruments employed for producing musical sounds give forth, besides their fundamental tones, certain other tones due to higher orders of vibration. It is the intermixture of these with the fundamental tone which determines the *quality* of the sound, and distinguishes instruments from each other—a clarionet from a flute (for example), both these from a violin, all of them from the human voice, and different voices from one another. These are the *harmonics* of the fundamental tone—called by the German physicists the *harmonic overtones*. Though feeble in comparison with the primary tone, they may, with a little practice and attention, be heard when, for instance, one of the lower notes is struck upon a pianoforte. Above every tone of a determined pitch may be traced a whole series of "harmonic overtones," rising according to the "acoustic series" before indicated—viz. first, the octave, then the fifth, etc., etc.

The timbre of a tone, as we have said, depends on the *form* of the waves of vibration. As the surface of water is moved into waves of a different form according to the object which agitates it—whether a falling stone, a ruffling wind, or a dividing keel—so the movements of the air take different shapes according to the way in which they are excited, whether by the violin-string under the rasp of the bow, the harp-string plucked by the finger, or the reed of the clarionet vibrated by the breath. These varieties are infinitely numerous, and are distinguished by the different relations which they cause between the fundamental tone and the overtones. The most beautiful timbre is found to result from that form of the vibratory waves which produces the primary and its harmonics in the intervals of the major chord to the sixth above, the former sounding most loudly, and the latter gradually decreasing. As the overtones increase in strength in relation to the fundamental tone, the sound grows shrill; and if the higher overtones, which lie close together and are dissonant, overpower the fundamental, the quality of the sound becomes exceedingly harsh and disagreeable.

The timbre of the voice depends on the manner in which the tone begins, the management of the breath in producing it, the direction given to the column of air which carries it, and the disposition of the anterior cavities by which it is tuned for the various elements of speech. It has been found that the form of vibration most favorable to a pleasing as well as far-reaching quality of voice is a *round* form—*i. e.* one which sends the sound-waves out upon the air in such a way as to allow of their circulation in all directions with the least obstruction; and that this form is best produced by a light, elastic impulse, like that made by the sudden fall of a pebble into the smooth surface of a lake—with the difference that sound spreads out in the air like a sphere, while the waves of water extend only in circles. This is to be accomplished, first, by a careful adjustment of the vocal organs, so as to allow just the quantity of breath to escape which is necessary for the production of the tone. If too little breath is used, the vibrations will be feeble and the sound will lack strength; if too much, the vibrations will be distorted from the form most favorable to an agreeable and effective quality. An excessive pressure of the breath drives the sound-waves forth in a single direction, instead of allowing them to expand, and the low harmonic overtones disappear, while the high dissonant overtones disagreeably assert themselves. Every particle of the column of air expired should vibrate, or of course it is lost to sound; besides that, the escape of unvocalized along with the vibrating air makes itself manifest in a certain wheezing very detrimental to the purity of the tone. The first impulse of the voice, then, should be sudden, light, and made with a moderate expenditure of breath, which may be afterward reinforced. By this method the sound takes on a round and even form, which may be by due precautions maintained and the timbre kept always at its best; while the same process is most favorable also to the reach of the sound, as it is well known that more speed and power can be generated by a quick, elastic blow than by the steadier pressure of a heavy force.

Again, both theory and experience teach that, for purposes of purity in tone, the air-column from the larynx should be directed, both in speaking and singing, to the front of the mouth, and concentrated there above the upper teeth, whence it should rebound to form continuous vibrations in the various resonance-apparatus behind. If this rebound takes place farther back from any portion of the roof of the mouth, it is found that the inharmonic overtones become prominent, and various discordant qualities result. And here it may be remarked that most of those well-known faults of voice—such as nasality, gutturality, huskiness, thinness, strainedness, and excessive metallicity—which have usually been deemed organic and unalterable, may be traced (with the exception of rare instances of structural defect) to some violation of natural law in the use of the vocal apparatus, and may by proper treatment be greatly modified, and often, especially in the case of young children, entirely obviated.

Finally, the form given to the mouth-cavity, by which it is tuned for the elements of articulation, has not a little influence on the timbre of the voice. For, however excellent the tone may be in its origin, the form of the vibrations—on which, as we have seen, the quality depends—must be affected by the passages through which they proceed on their way to the lips. In the case of the vowels, and some of the consonants, the larger proportion of this air is employed in the generation of a proper musical tone with its regular vibrations, while the remainder, encountering various obstacles in its passage, breaks into *noise*, with irregular vibrations and dissonant overtones. With others of the consonants this proportion is reversed, and these derive their peculiar character from the predominance of noises, which cause the proper musical tones to become almost imperceptible. When both consonants and vowels are combined in syllables, the mouth is tuned and untuned for the vowel-sounds with great rapidity, while the swiftly-succeeding movements of its mechanism form the consonants. As a general rule, and one of far wider application than might at first be supposed, these elements should be formed far forward in the mouth; for when the necessary impulse is given farther back the sound is too tardy in striking the external air, and a dull and hollow quality is imparted to the voice. This is contrary to the practice of most teachers of elocution, who constantly inculcate the duty of producing the voice, as much as possible, from the

throat and chest, under a mistaken notion that it will thus acquire strength and fulness. Care must also be taken to give room in the mouth-cavity for the proper formation of the vowel, or the air in the nasal *fossæ* (which, in correct speaking, is mostly shut off by the soft palate) will be moved to vibration, and a nasal quality will be the result. The more room given in the mouth for the vowel sounds, the more will musical tones predominate, and the richer, fuller, and sweeter will be the utterance. So true and so important are these injunctions that it has been said that the quality of a healthy voice has its origin in the mouth-cavities rather than in the vocal cords, as is commonly supposed.

Very careful and minute analyses of all the elements of speech, together with the various arrangement and movements of the organs in producing them, have been made by Helmholtz and others, but the subject can be barely indicated here. It is the office of the intelligent teacher, who would cultivate the human voice by methods in accordance with nature, to acquaint himself first with the physiology of the delicate and complicated instrument with which he assumes to deal, and then with the physical laws which are concerned in the production of the vocal sounds—the proper disposition of the vocal cords, and the management of the breath in originating and sustaining musical tones, the proper way of directing the air-column through the anterior passages, the right disposition of the mouth-cavities that the quality of the tone may not be impaired by improper obstructions, and the due adjustment of the teeth, tongue, lips, and palate to a pure articulation. Possessed of this knowledge, with the added resources of his own experience, he will be able not only to impart to the voices of his pupils those qualities of melody, reach, and resonance which enter into agreeable and effective speech, but to modify, and often completely remedy, vocal defects hitherto regarded as organic, and to treat successfully those widely-prevalent diseases which result from misuse of the sensitive vocal organs.

One of the most wonderful and interesting results of the system here outlined may be seen in what it has accomplished for the instruction of deaf mutes. The occasional attempts hitherto made by these unfortunates to utter speaking sounds have resulted only in discordant tones, entirely uncontrollable in the essential particulars of pitch and quality; but by many years of minute investigation and unwearied experiment, assisted by an ingenious system of diacritic symbols, Prof. A. Graham Bell of Boston has been enabled to teach them not only to produce all the sounds of speech, but to appreciate and to modify the quality of their voices, to sustain or to vary the pitch, and, in short, to fulfil all the conditions of a correct and pleasing utterance. The symbolic system alluded to was invented by Prof. A. Melville Bell, a distinguished elocutionist formerly of London. It is called "visible speech," and consists of a series of signs which indicate by their form (depending for the vowels on the shape of the wind-passages, and for the consonants on the disposition of the tongue and palate) the exact method by which all the sounds possible to human speech must be produced. (For these characters see DEAF AND DUMB.) A system of vocal culture in elocution based upon the best results of scientific investigation is faithfully pursued through a two years' course at the school of oratory of the Boston University, under the direction of Prof. Lewis B. Monroe. Of the faculty of this school Prof. A. Graham Bell also is a member.

III. With this cursory glance over the field of culture as regards the mechanical laws which govern the voice, we come to a still briefer consideration of speech as the medium of expression, the vehicle of thought and emotion. If we view the vocal elements combined in syllables and words and sentences as constituting the *form* of our art, we inquire now after the animating *spirit* which is to imbue that form with beauty and power. This influence is to be found, primarily and comprehensively, in the largest general culture—intellectual, æsthetic, moral. Cicero demanded for the orator the most consummate and various wisdom, and Quintilian contended that he should be also a *good* man; and even for the reader or the actor, who but embodies in his utterance the sentiments of another, it is clear that intelligence and sensibility to appreciate the language he employs is absolutely indispensable to the successful performance of his task. This psychological fitness makes itself immediately felt in an infinite variety of vocal inflections, some of them so minute as to defy analysis and almost to elude observation. These subtle phenomena the elementary writers, under the head of modulation, undertake to classify, and to formulate a system of *rules* by which they may be definitely produced and regulated. Yet, notwithstanding the nearness of the subject to all human interests, it is not to be denied that the formal study of elocution as a branch of education has never been popular except in ages and communities where mellifluous speech has been cultivated for its own sake—as an end rather than as a means. There is a latent suspicion in the common mind that the fine subtleties of thought and emotion, and the innumerable varieties of vocal inflection which are the exponents of these, are incapable, from the nature of the case, of analysis and classification and mechanical production; that they must result from the intuitive agency of the intellect and the heart; and that without this spontaneous energy no artificial system is competent to create them. Hence, there is much talk, even among intelligent advocates of the widest culture in every other department of art, of leaving the whole matter of rhetorical delivery to the spontaneous suggestions of nature.

This question may not be argued here: it is sufficient to say that there is truth on both sides of it. If the culture of delivery, according to the supposition of Archbishop Whately, the eminent formulator of the doctrine of *laissez aller* in this branch alone of rhetorical study, necessarily involved the careful attention of the speaker, *while in the act of speaking*, to rules of tone, emphasis, and inflection, the question would be answered in the statement of it. But the *technique* of this, as of all other arts, is to be taught and wrought into a *habit*, so that the learner comes to conform to its minutest requirements automatically. The test of excellence in this art, more than in any other, is the *celare artem*, and any disclosure by speaker or reader of his technical sub-processes is instantly fatal to success. On the other hand, it is not easy to see why this, more than any art, should be held as entirely independent of technical knowledge and skill. Notwithstanding the elaborate effort of the distinguished critic in question to show a difference between this and the art of composition, it appears to us that the analogy is complete, and that his objection holds equally good against the study of the numerous rules of grammar and rhetoric, which would doubtless prove mere impediments to the orator who should make conscious use of them in the pulpit or on the rostrum.

But, after all, it must be acknowledged that there has been a tendency in elocution, as usually taught, to fix the exclusive attention of the pupil upon a prescribed set of modulations, too apt to become mechanical, and so to shut the avenues of his soul against that infinite variety of delicate suggestions which nature is wont to make to cultured sensibility, and which can never be reduced to system. What distinction of grave, or acute, or circumflex, for example, can inspire the actor to the proper utterance of the *Et tu, Brute?* of the dying Cæsar, adopted from Plutarch by Shakspeare? Here is a single word, the just delivery of which all the systems of all the schools can never define. The *rules* that govern its utterance are indeed the simplest possible, yet the indescribable modulation which should adequately convey its infinite pathos of grief and despair can be generated only in the sympathies of a cultivated mind and heart. From this we may at least infer that no analysis of the voice in delivery can ever be exhaustive, or be allowed to supersede a constant fresh application to the oracles of nature for inspiration to the best utterance. Perhaps, indeed, we should be all the more jealous of systems when they claim to be exact and comprehensive.

Such, for example, are the attempts that have been made at different times, both in this country and in Europe, to define and regulate expression by intervals identical with those which exist in music, and to indicate the modulation by musical notation. One of the most eminent of these theorists was Dr. James Rush of Philadelphia, who published about fifty years ago the *Philosophy of the Human Voice*, and who deserves respectful mention, not only as an original and acute observer, and one of the first in this country to give impulse to the investigation of this subject, but for the many valuable contributions to the art of vocal culture which his work contains. This writer, having observed the diphthongal character of some of the vowels, gave the name of *radical* to the first, and of *vanish* to the latter of the two elements, and asserted that the voice spans the interval of a musical tone in passing from one to the other. From this he proceeded to construct the theory that all the intervals of speech may be determined by musical analogies; and he elaborated a system by which all the variations of the voice, in every phase of expression, may be measured by the degrees of the musical scale and marked by a quasi-musical notation. It is impossible here to discuss, or even more fully describe, this theory. It was advanced before the more thorough investigations of modern science had better explained some of the imperfectly-observed facts on which it rests; and probably its acute author, had he lived to our day, would have found reason to modify the tone of triumphant certainty with which it was introduced to the world. Its practical value may be estimated by the fact that not one of the notated phrases by which it is illustrated can be read by the musical symbols without

first appealing to the independent action of the mind for a key; and to the other fact, that of all the teachers who have professed to base their instruction upon the philosophy of Dr. Rush, not one (so far as we are aware) has ever made a serious and persistent attempt to carry this portion of it into practice. It is but just to add, however, that all through his rather voluminous work are scattered valuable suggestions of a general nature, and that his analysis of the vocal elements has been found useful for the acquisition of a correct and forcible utterance. Among the most conspicuous of his professed followers were Dr. Barber and Prof. Russell, who were eminent teachers in their day. The former published a *Grammar of Elocution*, in which a brief but ineffectual attempt was made to carry out the musico-rhetorical theory, and the latter an admirable selection of passages of English literature for purposes of voice-culture, entitled *Orthophony, or Vocal Culture*, arranged according to Rush's classification of the different qualities and uses of the voice, and distinguished by the employment of his terminology.

There is another system which is less open to the objection of artificiality, and which appears to be founded on correct principles and to be susceptible of a wider application to the multitudinous phases of expression. It is that which derives the law of delivery from the structure of the sentence. This idea was first advanced by Walker in his *Elements of Elocution*, but its fuller development was reserved for Dr. Mandeville of Hamilton College, New York. This gentleman carried out the principle of modulation based upon sentential structure (not forgetting the special influence of emphasis, of which he presents an acute and exhaustive discussion) through a very wide induction of sentences selected from English literature. This method of instruction, in causing the arts of composition and delivery to go hand in hand, restores elocution to its ancient dignified alliance with rhetoric. It obviates, too, the tendency of the learner to subordinate natural to mechanical methods in the vocal expression of his thought, by familiarizing him with the intellectual processes involved in its literary expression.

The result of a survey of the whole field is a conviction that the popular prejudice against this branch of education is not entirely without show of reason. It is quite natural to feel more hopeful in entrusting our youth, in this matter, to the "sure instincts of genius" than to systems which cast them in rigid mannerisms, professing to be founded on nature, but having only the effects of bad art, or to the guidance of instructors destitute of that liberal culture which alone can fit them to inspire a sense of the true and beautiful. Nevertheless, there can be no greater fallacy than to suppose that by declining to submit them to a true artistic training we but elect to leave them to the operation of that pure abstract beneficence which men fondly call "nature." Some one, pleading for the moral instruction of the children of the street, said, "Do not suppose that if we refuse this responsibility they will simply go untaught: if *we* do not teach them, you may be sure *the devil will*." So, in the matter of a right rhetorical delivery, we may undervalue the importance of training Young America into good habits, but the influences which induce bad ones will none the less continue to swarm around him like the motes of the sunbeam, and he will take them in at every pore. Not nature, but *false art*, will he imbibed—by the child from the very family at home, by the youth from the very atmosphere of the school-room, by the adolescent from the hoary abuses of the college and the still more abominable traditions of the stage, and by them all from nearly every pulpit, forum, and hustings in the land.

The whole matter may be summed up in the well-worn maxim of Ovid: "The safest path lies midway of the extremes." The true doctrine is thus well expressed by another: "To be able to act upon the souls of men with an elevating and informing power, it is first of all necessary that an artist should cultivate the form of his art to its greatest possible perfection, and have such perfect command of it that the practical application of it is as natural to him as to breathe. For, empty and dead as all technical knowledge is unless it is animated with a soul, yet no product of art æsthetically beautiful is possible without a perfect *technique*."

The inquirer who desires to pursue this subject in detail may be commended to Helmholtz's *Lehre von den Tonempfindungen*, Dr. Oscar Wolf's *Sprache und Ohr*, Carpenter's *Human Physiology*, and the writings of Max Müller, Czermak, Du Bois Raymond, etc. For popular reading we may refer to Tyndall's *Lectures on Sound*; to Mme. Emma Seiler's *The Voice in Singing* and *The Voice in Speaking*, which present the results of scientific investigation on the subject so far as practically valuable to the ordinary student; and to Dr. Mandeville's *The Elements of Reading and Oratory*.

ROBERT R. RAYMOND.

Void and **Voidable.** These two legal terms are often and very inaccurately used in common by text-writers in their treatises, by courts in their opinions, and even by legislatures in their statutes; but their true meanings are widely distinct and unlike. Much doubt and confusion are caused by the employment of the word "void" when the real thought intended to be conveyed is expressed by the word "voidable." *Void*, in its strict and only correct sense, denotes that a transaction, contract, conveyance, or other instrument is an absolute nullity, so ineffectual that no act or confirmation of the parties can cure it, and so completely nugatory that the defective quality can be asserted by any person at any time and in any proceeding. A marriage between a man and a woman, one of whom has a spouse known to be living, and a marriage between persons within the prohibited degrees, as in England between a man and the sister of his deceased wife, are thus void. No ratification would relate back and make the wedlock good; the children would be illegitimate, and in an action brought at any subsequent time a stranger might establish the illegality if his rights of recovery or of defence depended upon the proof of such fact. *Voidable*, on the other hand, denotes that a transaction, contract, conveyance, or other instrument is so tainted with imperfection or illegality that it may in some manner and by some method be avoided and rendered null, but also that the defect may be cured and the transaction or instrument made valid by the act and confirmation of the one who could interpose the objection. It was a general doctrine of the common law, applicable in most cases, that no person but an immediate party to the voidable transaction or relation, and his personal representatives, could object to its legality and render it, or procure it to be rendered, a nullity. Statutes have in certain instances modified this principle, and have extended the power of nullifying to others who have been made special representatives of the party for that purpose. The following examples will illustrate the nature of voidable transactions: A marriage procured by fraud or force is voidable. The wife whose consent was obtained under duress may annul the tie as soon as she regains her freedom of action, or she may ratify and make it valid from the beginning by voluntarily continuing to cohabit with her husband. Conveyances of land, transfers of personal property, and contracts executed through fraud, mistake, or duress, are voidable; they may be disaffirmed by the injured party, or they may be ratified by him, and thus made completely binding. Conveyances made with intent to defraud creditors, although declared by the statute to be void, are in fact voidable; the defrauded creditors may procure them to be adjudged null, or may certainly ratify and confirm them. The contracts of infants, except those which are essentially binding, are voidable, since the infant when he attains his majority may affirm them. The courts formerly spoke of certain contracts made by an infant as "void," and their number was gradually reduced. It is hardly possible at the present day that a person, after arriving at the age of twenty-one, would be prohibited from confirming, if he knowingly and deliberately chose to do so, any engagement which he had entered into during his minority. These examples are sufficient to exhibit the wide difference between the terms "void" and "voidable" when accurately used, and to show that in many instances where the word "void" is employed by legal writers, judges, and legislators, the word "voidable" should have been substituted in its place.

JOHN NORTON POMEROY.

Voir Dire [Fr., "to say the truth"], in law, is an ancient technical term derived from the Norman French, and denotes the preliminary examination of a witness on a judicial trial in order to ascertain whether he is competent. At the common law no person pecuniarily interested in the event of a suit was eligible as a witness on the side where his interest lay. If an individual was called on a trial and offered as a witness, the other party, suspecting him to be interested, might require that he should be specially sworn and examined touching his interest. This preliminary proceeding was called an examination on his *voir dire*, or simply the *voir dire*. By modern statutes in England and in most of the U. S. the incapacity resulting from interest has been abolished. The *voir dire* examination, therefore, if used at all, must be for the purpose of ascertaining other grounds of incompetency whenever and wherever any such exist.

JOHN NORTON POMEROY.

Voiron', town of France, department of Isère, on the Morge, manufactures hempen cloth, paper, liqueurs, straw hats, gloves, iron and steel goods, and leather. P. 9637.

Voiture' (VINCENT), b. in 1598 at Amiens, department of Somme, France; was a very adroit man; crept into the court circles; received sinecures and pensions from Gaston of Orleans, Richelieu, Mazarin, and Louis XIV.; was one of the original members of the Academy, and one of the

most conspicuous figures of the Hôtel de Rambouillet; wrote the sonnet "Uranie," which was admired and imitated in Europe as much as the palace of Versailles. D. in 1648. His complete works, consisting of letters and poems in French, Latin, Spanish, and Italian, appeared with notes in 1856.

Volatile or **Essential Oils.** See OILS, by PROF. B. SILLIMAN, M. D.

Volcano. See VOLCANOES.

Volcan'no, p.-v. and tp., Amador co., Cal. P. 1357.

Volcano, p.-v., Wood co., West Va.

Volcanoes [Lat. *vulcanus*]. *Nature and Formation of Volcanoes.*—A volcano is a mountain, generally of conical shape, with a circular cup-like opening or basin at its summit, called a *crater*. In the centre of that crater is the mouth of a perpendicular shaft or chimney, which emits clouds of hot vapor, gases, and, at times of greater activity, masses of ashes, hot fragments of rocks, and streams of fiery, liquid rocks, called *lava*, which flow down the slopes of the mountain. The gradual accumulation of these ejected materials around the mouth of the volcano forms a succession of concentric layers, which explains its conical form. These layers are distinctly visible on the inner walls of the crater, and as the same structure is found to exist in all volcanoes and in every part of their mass open to observation by crevices, it is probable that all such mountains are the result of a similar long-protracted accumulation. By this mode of formation and peculiar structure the volcanoes are quite distinct from the other mountains and mountain-chains which constitute the skeleton of the continents and smaller masses of land.

Volcanic activity, though it be continuous, differs very much in degree at different times. Nearly all the active volcanoes have times of relative repose, interrupted, often at great intervals, by periods of increased activity, which terminate in a violent ejection of incandescent matter from the interior. The volcano is then said to be in a state of *eruption*. The phenomena which characterize these various phases of volcanic activity may be best made clear by describing them as actually observed in Vesuvius, one of the more carefully studied and most active volcanoes of modern times. Vesuvius rises solitary from the midst of a highly-cultivated plain bordering the shores of the Bay of Naples to the height of nearly 4000 feet. Though the mountain is of a regular conical shape, two summits, almost equal in height, are visible from Naples—Monte Somma on the N., Vesuvius proper on the S. The first, however, is but the northern half of the crater-rim of the old Vesuvius, the southern half of which was destroyed by the first eruption of that volcano in historical time, in the year 79 after Christ. Vesuvius proper is the new cone, which gradually grew out of the old crater by the accumulation of the materials ejected during the subsequent eruptions to this day.

State of Repose.—After an eruption the energies of the volcano seem to be exhausted. It enters into a state of relative repose. After the great eruption of Oct., 1822, the crater of Vesuvius was emptied to the depth of 700 to 800 feet; its rim was broken and partially sunk on the S. several hundred feet. Of the dense clouds of smoke nothing remained but a few jets of vapor and gases, called *fumaroles* by the Italians, escaping from fissures in the walls and at the bottom of the crater. The lava, deeply sunk into the chimney, had almost disappeared from sight. Gradually, however, the volcano rallies; the fumaroles become again more active and more numerous, and their united vapors form the usual column which rises from the crater. The lava reappears in the chimney. On its boiling surface, exposed to the atmosphere, a crust is formed which bursts under the effort of the captive steam, sending into the air fragments of red-hot and melted lava, which fall back and accumulate around the chimney. This process is repeated every few minutes; a *cone of eruption* is thus built up around the mouth of the chimney—a cone within the main cone, as Vesuvius itself within the crater of the old Monte Somma. Such a one could be seen in the crater of Vesuvius in 1828. This cone grows more and more in dimensions. Occasional overflows of lava, and the materials which fall from the crumbling walls, help to fill the intervals, and the crater is once more full to the edge. The cone of eruption may grow even higher than the rim of the crater. This was the case in 1756. When the crater is thus full and its mouth choked, a great eruption is expected. Under the weight of these masses the expansive forces below accumulate, and the signs of an approaching eruption soon appear.

Forebodings of the Eruption.—In Vesuvius the usual forebodings of a great eruption are the drying up of the wells and springs, probably by the increasing heat of the ground, causing an internal evaporation and numerous fissures in which the underground waters are lost. Loud subterranean noises, like explosions of distant artillery, shocks of earthquake which shake the surroundings of the volcano, and the large increase of the volume of vapors which escape from the boiling lava in the crater, indicate the mighty struggle which is going on within the bowels of the mountain.

Eruption.—At last the eruption begins, generally with a tremendous burst, which seems to shake the mountain to its very foundations, and hurls into the air dense clouds of vapor and of pulverized lava or ashes. The explosions succeed each other with rapidity and increasing violence. Each sends upward a globular cloud of white steam, which is pressed up by the following one. That long array of fleecy clouds, accompanied by dark ashes, volcanic sand, and fragments of hot lava of all sizes, soon assumes the form of a stupendous column. Checked in its ascending motion by gravity, it expands, in a quiet atmosphere, into a dark circular cloud, which, with the pillar beneath, has the shape of an immense umbrella, or of the Italian pine, to which it has been often compared. In the eruption of 1822, remarkable for the abundance of ashes as well as for its violence, the height of the umbrella was estimated at over 7000 feet.

Atmospheric Phenomena accompanying the Eruptions.—The sudden condensation of such an enormous accumulation of hot vapors gives rise to striking atmospheric phenomena. Vivid flashes of lightning start from all parts of the column. Electricity rages also in the cloud above, and a local thunderstorm is often formed in the midst of the clear surrounding sky, and pours a heavy rain of warm water and ashes, running along the slopes of the mountain. These hot, destructive mud-torrents have often been mistaken for lava-streams.

Appearance of the Sky.—The majesty of the spectacle is increased at night. Though flames of burning gases are of rare occurrence, the clouds are strongly illuminated by the reflection of the white-hot lava in the crater. Red-hot fragments of lava, constantly thrown out, give the column the brilliancy of a gigantic piece of fireworks. The sky itself, far and wide, partakes of the same vivid coloring, and the whole scene resembles a vast conflagration.

Emission of Lava.—At last the boiling lava flows over the rim of the crater in fiery torrents along the slope of the cone, or, bursting the mountain itself by its weight, finds vent by some fissure far below on some point of its declivity. After the expulsion of lava, the volcano seems to be relieved, and the eruption is generally near its end.

Period of Eruption.—The eruption, however, does not necessarily terminate here. The alternate phases of outbursting steam, ashes, and lava may continue, with more or less violence, for weeks and months, until the volcano enters again into a slumbering state. A series of such eruptions, separated by short intervals of a few years, during which the signs of activity are still numerous, constitute a period of eruption. A short review of the history of Vesuvius will show a number of similar periods of activity followed by long seasons—nay, centuries—of almost absolute repose, during which the volcano seemed to be extinct.

History of Vesuvius.—At the time of Christ's birth Vesuvius was described by the Roman geographer Strabo as a burnt mountain, but it had never been known to show any sign of activity. Its crater, nearly full, was covered with a dense forest. In the year 63 after Christ several shocks of earthquake startled the numerous cities and villages which covered its delightful surroundings; and sixteen years after, in 79 A. D., during the reign of the emperor Titus, its first eruption took place. That eruption, graphically described by the Younger Pliny, was of fearful violence. The northern half of the mountain, now called Monte Somma, alone remained; the southern half was ground to powder; the rain of hot and wet ashes was so abundant as to cover the whole country with a deep layer of volcanic materials, under which were buried the flourishing cities of Pompeii and Herculaneum, recently exhumed from beneath several yards of consolidated volcanic tufa. No lava, however, is mentioned. From that time to the year 1036 only seven eruptions are recorded, when lava-streams are noticed for the first time. After two more eruptions, in 1049 and 1138, the volcano seemed to enter into a period of profound sleep, which lasted nearly 500 years. During that long interval only two slight eruptions are known to have occurred, in 1306 and 1500; but meanwhile the volcanic forces were finding vent in the neighboring region of the Phlegrean fields and the beautiful island of Ischia. In the latter, Mount Epomeo poured out destructive currents of lava in 1302. In the former, a new crater opened in 1538 on the shore of the Gulf of Baiæ in the Bay of Naples, and in a few days accumulated such a

mass of ashes and volcanic fragments as to raise a hill of 440 feet above the water in the gulf. That new mountain, still called Monte Nuovo, has a crater of over 400 feet in depth. In 1631, however, the whole activity of that volcanic district seemed again to concentrate in Vesuvius. The mountain had been so long dormant that it was forgotten that it had ever been in eruption. The walls of the crater were covered with forests harboring the wild-boar and other game; its bottom had grassy plains in which cattle quietly grazed; the slopes of the mountain were cultivated up to the foot of the cone. Suddenly, in the latter part of December of the same year, to the amazement and dismay of the inhabitants, began one of the most terrific eruptions recorded in the history of Vesuvius. After violent and repeated shocks of earthquakes, the volcano burst out with tremendous noise. The pine-shaped mass of vapors and ashes rose far above the clouds, and, spreading in every direction, covered a portion of Italy with a thick layer of volcanic sand and dust, destroying all vegetation. The rain of ashes extended beyond the Adriatic. Torrents of hot mud and seven streams of liquid lava, rushing with unusual rapidity from the crater and the foot of the cone to the sea, finished the work of destruction. The beautiful city of Torre del Greco, those of Torre del l'Annunziata, Resina, Portici, and others, were overwhelmed and almost entirely destroyed. During nearly three months Vesuvius raged continually, though with variable intensity, and only gradually settled down to a state of comparative repose. This great eruption was followed by a short rest of the volcano. But from the next eruption, in the year 1660, to this day, the eruptions have succeeded each other at intervals rarely exceeding ten years, and usually much shorter. Among the most remarkable by their magnitude are the eruption of 1698, which marks the beginning of an almost incessant activity of Vesuvius; that of 1737, which covered the city of Torre del Greco with torrents of lava; that of 1760, which again threatened the same city; that of 1779, noted for the height of the column of ashes and flames, which was estimated at 10,000 feet. The eruption of 1794 was the most destructive and the most grand since that of 1631. Rivers of lava, flowing from eight mouths, united into one large stream a mile wide, which rolled over Torre del Greco, and left in some of its streets a thickness of forty feet of lava. In 1822 the rain of ashes lasted from Oct. 26 to Nov. 16, ascending often in a majestic column to several times the height of the mountain. The eruptions of 1839, 1850, 1855, 1862 poured out again an unusual amount of lava, accompanied, in the latter year, by enormous quantities of ashes, betokening the unabated activity of that remarkable volcano.

The volcanic phenomena just described in Vesuvius may be considered as typical, for they are more or less common to all the true volcanoes of the earth. Each volcano, however, may differ in the relative abundance of the ashes and broken fragments compared to the liquid lava; in the violence or frequency of the eruptions; in the size and form of the crater; in the greater or less steepness of the cone; in the composition of its lavas, and other secondary circumstances. But, on the whole, the nature and course of the phenomena show everywhere a remarkable coincidence. Even the submarine volcanoes—and many such are known—do not seem to differ materially; only the arrangement of the ejected materials is no doubt modified in the formation of a submarine cone. The most important of these differences may be shown in a few striking examples.

Etna.—If Vesuvius is the most active, Etna, in the N. E. corner of Sicily, is by far the largest volcano of Europe. This noble mountain rises gently from a broad base, estimated at 80 geographical miles in circumference, to a height of nearly 11,000 feet (10,840 feet), into the region of perpetual snow. Its slopes, to an elevation of 2500 feet, are in a high state of cultivation, and are said to harbor 300,000 inhabitants in 65 cities and villages.

Though Etna has been active from an earlier historical date than Vesuvius, its eruptions are less frequent, but no less destructive. About eleven are mentioned or alluded to before Christ's birth, and sixty since, with an interruption of nearly five centuries between the third and eighth after Christ.

Lateral Eruptions and Parasitic Cones.—There is another marked difference between the two volcanoes in the number of the lateral eruptions. In Vesuvius the number of lateral and top eruptions is nearly equal. In Etna the ejection of materials, at least in the present condition of the volcano, takes place mostly along its slopes, forming small cones of ashes and scoriæ, with a crater at the top, from which, in many cases, lava flows abundantly. These are called *parasitic cones*; they are so numerous on Etna (over 200 having been counted) that they form a characteristic feature of the mountain. They are spread all around the main cone, but frequently in series on straight lines radiating from the main crater. It seems that the pressure of the column of lava in the chimney, combined with the expansive force of the gases, active in every eruption, bursts the mountain, causing deep fissures through which the lava and ashes escape. This view is confirmed by the influence that the height of the mountain seems to have upon the eruptions. In small volcanoes, like Stromboli, one of the Lipari Islands, N. of Sicily, less than 3000 feet high, the eruptions are constant, and have been so from the most remote historical times, but all are from the top. In Vesuvius, with 4000 feet of altitude, top and side eruptions are about equal. In Etna, 11,000 feet high, the lateral eruptions outweigh those from the crater. Therefore, the lower a volcano the more easy and frequent are its eruptions. The higher the column of lava the greater is the pressure on the sides of the chimney, and the more frequent the bursting of the mountain, the lateral eruptions, and parasitic cones. In the Andes, in which the altitude of many of the volcanic peaks exceeds 20,000 feet, it would seem that the eruptions should be all lateral; but the broad base of the Andes chain on which they rest is too massive to be burst, and the column of lava, unable to reach the crater, is tossed about in the chimney, and escapes from the top in the shape of ground ashes, but hardly ever of liquid lava.

The volcanoes of Hawaii, in the Sandwich Islands, are remarkable among all volcanoes of the globe by the great size of their craters, the absence of ashes, and the usually quiet overflow of their abundant lava, often unattended by earthquakes or explosive phenomena of any kind. Hawaii, the larger and the most southern of the group of Sandwich Islands, is an assemblage of three volcanic peaks close to each other—Mauna Kea, in the N., the highest, rising to 13,853 feet above the sea; Mauna Loa, in the S., the most active, 13,760 feet high; and Mauna Hualalai, in the W., 7822 feet. The first two probably exceed in altitude every other mountain in the islands of the broad ocean. On the S. E. slope of Mauna Loa, at 3970 feet above the sea and 16 miles from the main crater, another crater, called Kilauea, one of the most gigantic now in activity on our planet, forms a peculiar feature of that group. According to Prof. Dana, the summit crater of Mauna Loa is of elliptic form, measuring 13,000 feet in its longest diameter and 780 feet in depth. That of Kilauea is 16,000 feet in its greatest length, 7½ miles in circuit, nearly 4 square miles in area, and from 600 to 1000 feet deep. Its bottom, viewed from the brim, is a broad plain interspersed with lakes of boiling lava and jets of vapors. Notwithstanding their immense size, the liquid lava gradually fills them to the brim, and overflows, or, bursting their walls, escapes by large fissures on the slope of the mountain. As remarked, the eruptions from these large reservoirs are usually free from the commotions of the ground and the noisy explosions which attend the eruptions of Vesuvius. In 1840 a large eruption in Kilauea began noiselessly, and was first noticed by a fire in the woods, and the lava, breaking out successively at various points on the slope, reached the sea in a large stream nearly 40 miles from the crater. In Jan., 1843, a lava-stream flowed out of a fissure about 700 feet below the summit of Mauna Loa, and continued for 30 miles. Though one of the grandest eruptions, it broke out in silence and progressed without an earthquake. In Feb., 1852, a bright light at the summit, says Dana, announced another eruption; after three days it was continued by means of a second outbreak, 4000 feet lower, or 10,000 feet above the sea, which also was a quiet one. At this second opening, as described by Rev. T. Coan, the most faithful observer of the mountain for a long series of years, a fountain of fiery lavas 1000 feet broad, playing to a height at times of 700 feet, offered a spectacle of indescribable grandeur and brilliancy. There were rumblings and mutterings from the plunging flood, and explosions, but no earthquakes. Mr. Coan attributed the fountain to the hydrostatic pressure of the column of lava above. In Aug., 1855, another great eruption began, without noise and shakings, at an elevation of 12,000 feet, and for a year and a half the flood continued. The whole length of the stream was 60 miles. In Jan., 1859, still another eruption made its appearance near the summit of Mauna Loa in the same quiet manner, Kilauea remaining undisturbed. On the N. W. side of the mountain the lavas were thrown up "like the waters of a geyser" to the height of 400 to 500 feet, transforming the night into broad daylight, and the stream continued its winding way to the sea after a course of over 50 miles. In Mar., 1868, however, a mighty eruption took place, which proved an exception to the usual ways of the volcano. On the 27th, says Mr. T. Coan, a series of earthquakes commenced in the district of Hilo, and became more frequent and startling from day to day, until the succession became so rapid that the island quivered like the lid of a boiling pot. On the 28th, Mauna Loa

was seen to be on fire. Soon the southern slope of the mountain was rent open, and several streams of lava ran off in different directions, filling the valleys in their course. Suddenly all mountain-valves were closed. The fire, the smoke, the stream, disappeared together. But in Kilauea the action was intense. Earthquakes in rapid succession began to shake the ground, and on Apr. 2 culminated in fearful destruction. On the 7th, Mauna Loa was again rent open near its southern base; a great lava-stream poured into the sea, and the mountain, thus relieved, ceased to convulse the island.

Form of the Volcanic Cones.—The lavas of these islands are noted for their great liquidity. This circumstance, combined with the almost complete absence of ashes, explains the flattened form of these volcanic cones and the slight inclination of their slopes. Dana estimates the general slope of Mauna Loa to be only between 6° and 8°. A horizontal section 1800 feet below the summit would be nearly 20 miles broad, and at the top of the cone the traveller is surprised to find a large plain in which the crater is sunk, but so even that from this observatory, nearly 14,000 feet high, his eye cannot perceive the surrounding ocean. In volcanoes where the lavas are less liquid and ashes abound, as in Vesuvius and Etna, the slopes are more inclined, from 20° to 35°, and the form more conical. The volcanic peaks which emit nothing but ashes without lavas, as those of the Andes, are still more sharply pointed, as shown in the cones of Cotopaxi and Chimborazo. In the volcanoes of Iceland, whose lava is viscous and alternating with ashes, the usual shape is more that of a dome. The molecular condition of the ejected materials thus determines the shape of the mountain.

Nature of Volcanic Products.—Ashes.—The microscopic examination and chemical analysis of volcanic ashes prove them to be nothing but the pulverized lava, containing sometimes a large proportion of minute crystals. They bear, therefore, no analogy to the ashes of burnt wood. These fragments of lava are of all sizes. The most minute fragments, forming an impalpable powder suspended in the air, and often transported by the winds to a distance of hundreds of miles, are called ashes. Coarser materials take the name of volcanic sand. Larger fragments are called by the Italians *lapilli*—*i. e.* "small stones"—popularly pronounced *rapilli*. Still larger pieces of melted lava assume by cooling in their descent a pear-shape form. Others, exploding in their ascent, are called volcanic bombs. Irregular fragments of all sizes, large pieces of the walls of the crater, are also thrown out with great violence. Humboldt speaks of a mass of several tons' weight which was thrown to a distance of 7 miles from the crater in an eruption of Cotopaxi in the Andes.

Lavas.—Lavas, like nearly all rocks of undoubted igneous origin, are remarkable for an almost complete absence of quartz, which is so prevalent in most of the crystalline rocks of metamorphic origin. The lava-stream, when flowing from the crater white-hot, is not unlike a jet of melted iron escaping from the furnace. Moving at first with considerable rapidity, it soon cools on the surface, and is covered by a hard, black, and porous crust, the interior remaining in an incandescent state. Innumerable jets of vapor escape and nearly hide the surface. Enclosed, as in a sheath, by that hard covering, the stream rolls slowly upon itself, progressing at a rate which varies according to the slope and the liquidity of the lava. The cooling, though rapid at the surface, is very slow in the interior; if the stream is thick, the lava will be found still warm after ten or twenty years. This slow cooling allows the lava to crystallize into a compact rock much resembling granite or porphyry. Glassy lavas, like obsidian, reduced into foam by the action of hot vapors and cooled, give pumice-stone.

The amount of matter ejected by volcanoes, though an insignificant addition to the earth's crust, is, nevertheless, very great. The whole island of Hawaii seems but a huge accumulation of lava thrown out from the four craters above described. In a single eruption of Kilauea, that of 1823, the mass of lava was sufficient to have formed a cone 3000 feet high, with a still broader base. All the other high islands in the midst of the oceans, excluding the flat coral islands, are of the same nature. Iceland, with an area of 40,000 sq. m., is composed of a vast table-land, from 3000 to 5000 feet thick, of basaltic and trachytic rocks, similar to the lavas ejected by her numerous active volcanoes. One of the last, the Skaptar Jökul, in the south-eastern part of the island, broke out in 1783, and sent forth several streams of lava during more than a year. The main branch, 40 miles in length, filled the valley of the river Skapta to the brim with from 400 to 600 feet of rock, and expanded lower down into a breadth of 15 miles, forming a vast lake of fire 100 feet deep. The other branch, 50 miles in length and 5 miles broad, was no less imposing. Over twenty villages were destroyed and 9000 inhabitants perished. Prof. Bischoff calculated that the amount of liquid rock emitted in that single eruption was equivalent in bulk to Mont Blanc. The formation of the new volcano, Jorullo, in Mexico, in 1759, graphically described by Humboldt, is another example of the occasional magnitude of volcanic eruptions. From a fertile and highly-cultivated plain, surrounded by volcanic hills, over 100 miles from the sea and 2000 feet above it, the ground was rent, and along the fissure volcanic mouths poured out a stupendous amount of basaltic lavas and fragments, which accumulated in six volcanoes. The central one, Jorullo proper, rises to 1600 feet above the plain, and all rest on a sheet of volcanic rock studded with a multitude of small steaming cones and gently swelling toward the centre, where it has a thickness of 500 feet. This region, covering 4 sq. m., bears now the name of *Malpays*, or "bad land." (For the arrangement of volcanoes on the earth's surface, their distribution, the two great volcanic zones, and the heights of volcanoes, see EARTH.) A. GUYOT.

Vole [Fr.], the name given in England to species of the genus *Arvicola*, which is the type of the sub-family Arvicolinæ, belonging to the family Muridæ. The related species found in the U. S. are generally known under the name field-mice, but thus confounded with species of the sub-family Murinæ. (See MURIDÆ.)

Vol'ga, the largest river of Europe, rises in the government of Tver, Russia, in the Valdai Hills, at an elevation of 663 feet above the level of the Caspian Sea, flows southward with a winding and tortuous course, and enters the Caspian Sea through sixty or seventy mouths after a course of 2500 miles. It receives from the right the Oka and the Svora, and from the left the Tvertsa, Mologa, Sheksna, and Kama, and by canals is connected with the Dwina, Neva, and Dnieper, thus communicating with the Baltic and the White and Black seas. Between Nizhnee-Novgorod and Astrakhan it is navigable for the largest vessels; above Nizhnee-Novgorod only smaller crafts can ascend it; and below Astrakhan, and throughout the whole of its mouth, it is very shallow. At Nizhnee-Novgorod its breadth is 2069 feet, and it is immensely rich in fish, especially salmon and sturgeon.

Volga, tp., Clayton co., Ia. P. 1178.

Volhy'nia, government of Western Russia, bounded S. W. by Galicia, from which it is separated by the Bug, comprises an area of 27,742 sq. m., with 1,704,018 inhabitants. The northern and eastern parts of the country are flat, sandy, or marshy, little productive, but often covered with extensive forests of fir; the southern and western parts are hilly, partly occupied by spurs of the Carpathian Mountains, and contain the best agricultural land in Russia. Corn, timber, cattle, tallow, hides, tar, and potash are largely exported from this government. Cap. Zhitomeer.

Voli'nia, p.-v. and tp., Cass co., Mich. P. 1414.

Volk'mann (ALFRED WILHELM), b. in Leipsic July 1, 1801; studied medicine in his native city, in Paris, and in London, and was appointed professor of physiology at Leipsic in 1834, at Dorpat in 1837, and at Halle in 1843. The most remarkable of his writings are—*Anatomia Animalium* (1831–33), *Neue Beiträge zur Physiologie des Gesichtsinnes* (1836), *Die Lehre vom leiblichen Leben* (1837), *Die Selbständigkeit des sympathetischen Nervensystems* (1842), *Physiologische Untersuchungen im Gebiete der Optik* (1863–64). D. Apr. 21, 1877.

Vol'ney, p.-v. and tp., Oswego co., N. Y., upon Oswego River. P. of v. 3507; of tp. 6565.

Volney', de (CONSTANTIN FRANÇOIS CHASSEBŒUF), COUNT, b. at Craon, department of Mayenne, France, Feb. 3, 1757; studied medicine and Oriental languages in Paris; spent subsequently several years in Egypt and Syria, and published after his return to France, *Voyage en Égypte et en Syrie* (2 vols., 1787; translated into English in the same year), which gave him a great reputation. Elected a deputy for Anjou to the States General of 1789, he advocated the ideas of the Revolution; published in 1791 *Les Ruines, ou Méditations sur les Révolutions des Empires* (translated into English, New York, 1796; London, 1827), and *La Loi naturelle, ou Catechisme du Citoyen français* (1793), but was, nevertheless, imprisoned as a royalist, and saved only by the fall of Robespierre. In 1794 he was appointed professor of history at the Normal School; travelled in the U. S. from 1795 to 1798; was made a senator in 1799, and published in 1803 *Tableau du Climat et du Sol des États-Unis d'Amérique* (2 vols.; translated into English by C. B. Brown, Philadelphia, 1804). After the establishment of the Empire, he retired from the senate, but Napoleon nevertheless made him a count in 1808, and Louis XVIII. a peer in 1814. In 1814–15 he published *Recherches nouvelles sur l'Histoire ancienne* (3 vols.; trans-

lated into English by Col. Corbet, London, 1819). His complete works appeared in 8 vols. (Paris, 1820–26). D. at Paris Apr. 25, 1820.

Volog'da, government of Russia, bounded N. W. by Archangel, comprises an area of 155,498 sq. m., with 1,003,039 inhabitants. The eastern part is covered with branches of the Ural Mountains, rising between 3000 and 4000 feet; the rest is an undulating plain. To the S. are some fertile agricultural districts, but the central and northern parts are little productive, and have a sandy or marshy soil, dotted with lakes and covered with almost impenetrable forests of fir and pine, and a very severe climate. The few inhabitants of these regions are of Finnish descent; they have their abodes along the rivers, and live as hunters. For, timber, salt, and iron are the exports.

Vologda, town of Russia, capital of the government of the same name, on the Vologda, has manufactures of soap, potash, candles, leather, cordage, and ropes, and carries on a brisk trade in its manufactures and in timber, tallow, and fur with Archangel and St. Petersburg. P. 18,984.

Vol'sci, an ancient people of Central Italy, inhabitants of the region directly E. of that of the Latini and W. of that of the Samnites. They were the hereditary enemies of the Latini and of the Romans, and allies of the Æqui. There are a few extant remains of their language, which seems to have been of the Oscan stock. The Volsci for many generations harassed Rome in a series of bloody wars, but about 338 B. C. they were finally subdued, and appear to have become *Latini* (in a legal sense), and subsequently full citizens of Rome.

Volsinii, town of Italy. See BOLSENA.

Volsk, town of European Russia, government of Saratov, on the right bank of the Volga, carries on an immense traffic on the river, exporting tallow, skins, and corn, and is celebrated for its gardens and orchards, in which large quantities of fine fruit are produced, which is exported to Nizhnee-Novgorod. Its fisheries are important. P. 26,853.

Volt [from *Volta*], in electrometry, the unit of tension or of electro-motive force. A million volts make one megavolt; one volt contains a million microvolts. A volt is to a daniell (that is, the tension of a Daniell's cell) as .9268 is to 1.079.

Vol'ta (ALESSANDRO), b. at Como Feb. 18, 1745: was first professor of physics at Como, and then in the University of Pavia, where he taught and studied for thirty years. In 1769 he published a dissertation, *De Vi attractivâ Ignis Electrici;* in 1775 invented the perpetual electrophore, in 1777 a lamp for inflammable gas, in 1782 the electric condenser, and finally arrived at the invention of the famous pile which bears his name, and was described by him in a letter to Sir Joseph Banks in the year 1800. Summoned to Paris by Napoleon I., he received the gold medal of the Institute, of which he became a member in 1802. Napoleon conferred upon him the title of count and the senatorship. The works of Volta were published at Florence in 9 vols. in 1816. D. Mar. 5, 1827.

Voltaic Battery and **Voltaic Electricity.** See ELECTRICITY, by PRES. H. MORTON, PH. D.

Voltaire', de (FRANÇOIS-MARIE AROUET), b. at Châtenay Feb. 20, 1694, the most brilliant French author, who by his genius and wit ruled as an absolute monarch in the kingdom of letters during the eighteenth century. He was a master-architect of ruin, and prepared the way for the mighty upheaving of society in France. He received his education in a Jesuit college; studied law; became secretary to the Marquis Châteauneuf (ambassador to the Hague); was dismissed on account of a love-intrigue; imprisoned in the Bastile for a satirical pamphlet on the decease of Louis XIV., which he hailed as a national deliverance; wrote the *Henriade* and *Œdipe*, which created much sensation and procured his liberty; was presented to the regent, who gave him 1000 crowns; changed his name from AROUET to VOLTAIRE; became the idol of fashionable and literary society; fell desperately in love with a lady of high rank, who gave him no encouragement; challenged the Chevalier de Rohan, who had insulted him, to duel; was arrested by the police and again sent to prison. Disgusted with the society and government of France, he accepted an invitation from Lord Bolingbroke to England Aug., 1726, and spent there nearly three years in friendship with the leading deists, whose opinions he adopted. He returned to Paris 1729; published *Brutus*, *Zaïre*, the *History of Charles XII.*, and *Letters on the English* (which gave great offence to the clergy and were condemned to be burnt); formed a *liaison* with Madame Gabrielle Châtelet 1735, which lasted till a year before her death (1749); wrote on the philosophy of Newton (1738), *Mahomet* (1741), and *Merope* (1743). On invitation of Frederick the Great, who admired his genius and sympathized with his infidelity, but after closer personal acquaintance despised his character, he spent three years in Berlin and Potsdam (July, 1750–53), but was dismissed in disgrace, and arrested on his return to Frankfort, and required to give up some of the king's poetry (which he called "a quantity of dirty linen"). He then settled with his niece at Ferney near Geneva 1755, where he spent the most tranquil and useful part of his life. He procured by untiring exertions the restoration of the good name of Jean Calas, who had been unjustly condemned to death at Toulouse by Romish bigotry (1762); composed or finished *La Pucelle* (1755), *Essay on the Manners of Nations*, a sort of philosophy of history (1756), *Candide* (1758), *Tancrède* (1768), and other works; and contributed to the famous *Encyclopédie* of Diderot and D'Alembert. In 1778 he once more visited Paris, and was received with extravagant demonstrations of enthusiasm, but he soon took sick, and died May 30 under great agonies of despair. He was buried with Rousseau in the Panthéon.

Voltaire was a man of sparkling genius, diversified talent, vast reading, untiring industry, quick wit, and unrivalled power of mockery; full of vanity, levity, petulance, avarice, malice, regardless of truth and charity—"half monkey, half tiger;" yet not without generous impulses and noble indignation against oppression, injustice, tyranny, and hypocrisy. His historical works (*Charles XII.* and *Siècle de Louis XIV.*) are models of clear, elegant, and lively narration. His poetic genius excels in tragedy (*Zaïre*) and epic (*Henriade*), but is destitute of heart and real pathos. His critical and satirical power is unsurpassed. He had a keen and bright intellect, a quick perception of defects, and could wield the dangerous weapons of irony and sarcasm with withering effect. "He had," says Carlyle, "the eye of a lynx, saw deeper at the first glance than any other man, but no second glance was given." He displayed his wit and power of ridicule at the expense of truth and justice, and he even uttered the most reckless falsehoods with unblushing assurance. Voltaire stands out as the bitterest enemy of Christianity in the last century, and contributed more than any one man to the French revolution and the temporary overthrow of religion in his native land. Much of his abuse was aimed at the Roman Catholic Church and her crying abuses at that time. He hated intolerance and bigotry which assumed the name of religion, and in the defence of Jean Calas he undoubtedly did good service to the cause of religious toleration. But he hated all forms of religion, Romanism, Jansenism, and Protestantism, alike, and assailed them most unscrupulously, without even taking the trouble to acquaint himself with the facts and arguments. He despised or hated the Bible as a barbarous book, and could not even appreciate its lofty poetry. We need not be surprised at this, for he also called Shakspeare "a great fool" and "an ugly ape." He went so far as to pronounce the fiendish blasphemy, "Crush the wretch!" (*Écrasez l'infâme!*), which refers either to Christ himself or rather (as Strauss explains it) to the Christian religion and Church. In his *Le Dîner du Comte de Boulinvilliers* (1767), which gives the best view of his religious opinions, he heaps contempt and ridicule on Judaism and Christianity alike, and concludes with the advice, "Expel all theologians and priests, who have flooded the earth with blood; throw away all mysteries of faith as useless trash; preach God and morals, and there will be more truth and happiness in the world." His arguments are borrowed from the English deists, and he is original only in his levity, wit, and never-failing power of satire. He was not an atheist, as is often asserted, but a deist. He said, "If there were no God, it would be necessary to invent one, but all nature cries aloud that he exists" (*mais toute la nature nous crie qu'il existe*). His dying confession to Wagnière, his secretary, was, "I die in the adoration of God, in love to my friends, without hatred of my enemies." He also confessed to a Romish priest (Abbé Gaultier), but this was merely an act of accommodation to the rules of society, that he might secure absolution and decent burial. "We must howl a little with the wolves," he said; "if I were on the banks of the Ganges, I would die with a cow's tail in my hand." He was a Mephistopheles who delighted in mischief, in ridicule and denial. Yet he was necessary in France, and had the mission to lay bare the rotten state of society in Church and State, and by destruction to prepare the way for reconstruction. His talents excite admiration, his character contempt. His only claim to our regard are his few acts of generosity and his services to the cause of religious toleration, although he aimed at freedom of infidelity rather than freedom of faith.

Literature.—*Œuvres* (Geneva and Paris, 1768–96, 45 vols.; Paris, 1802, 55 vols.; 1825, 66 vols.; 1827, 72 vols.; 1832, 95 vols.; 1834, by Beuchot, 70 vols. (Brunet calls this "la plus belle, du moins la plus complète et la meilleure edition").) English translation of his works by Smollett, Francklin, and others (London, 1776, 37 vols.). His *Henriade*, *Pucelle d'Orléans*, *Charles XII.*, and *Century of Louis*

XIV. have often been separately printed. Longchamp and Wagnière (his secretaries), *Mémoires sur Voltaire et sur ses Ouvrages* (Paris, 1826, 2 vols.); Villemain, *Tableau de la Littérature du Dix-huitième Siècle*; art. "Voltaire" in the *Nouvelle Biographie générale*; Lord Brougham, *Lives of Men of Letters and Science* (London, 1845); Carlyle's essay on *Voltaire*; Macaulay's essay on *Frederick the Great*; Schlosser's *History of the Eighteenth Century*; Bungener's *Voltaire*; David Friedr. Strauss, *Voltaire* (6 lectures, delivered before and dedicated to Princess Alice of Hesse, daughter of Queen Victoria, Leipsic, 1870); John Morley, *Voltaire* (London and New York, 1872). PHILIP SCHAFF.

Voltameter. See ELECTRICITY, by PROF. H. MORTON.

Voltaype, or **Electrotype.** See PRINTING, by W. S. PATERSON.

Volter'ra, an ancient town in the province of Pisa, in Northern Italy, on the summit of a steep hill at the height of 1800 feet above the sea, about 50 miles S. from Florence. Volterra was the largest of the twelve capital cities of Central Etruria, and sustained a long struggle against Rome, but the time of its final conquest is not known. During the Middle Ages, Volterra was alternately the spoil of popes and emperors. In the latter part of the fourteenth century Volterra fell into the hands of the Florentine republic, and, in spite of several more or less successful attempts at revolt, remained ever after a possession of Tuscany. Volterra still retains some of her ancient gates, and considerable fragments of the old Etruscan wall built of huge blocks of stone without cement, and much more extensive than the mediæval fortifications. The population is thought to be of more unmixed Etruscan blood than that of other old towns of that people, and many of the names read on the ancient sepulchral monuments are those of families still existing in the city and territory of Volterra. Its cemeteries have yielded rich contributions to Etruscan archæology, and the city museum—which, among many other interesting antiques, contains not less than 400 cinerary urns and sarcophagi, chiefly of alabaster enriched with sculptures—is among the most important existing repositories of Etruscan art. In the neighborhood of Volterra are valuable salt springs, called by an Arabic name, *le moje*, yielding annually about 7000 tons of salt. The Volterran quarries of alabaster are among the finest known deposits of that stone, and articles manufactured from it find a market all over the world. The cathedral, enlarged by Andrea Pisano in 1254, is a fine structure and contains good pictures. The pop., comprising the suburbs and some separate hamlets, is 13,702.

Volterra, da (DANIELE), whose true name was RICCIARELLI, b. at Volterra in 1509; was a friend and pupil of Michael Angelo, whose style he adopted with considerable success. His most famous pictures are a *Descent from the Cross*, in the church of Trinitá de' Monti, in Rome, and the *Massacre of the Innocents*, in Florence. D. at Rome about 1566. In the latter part of his life he devoted himself to sculpture, but left unfinished his two largest works, the statue of St. Michael of San Angelo and the equestrian statue of Henri II., king of France. He was generally nicknamed BRAGHETTONE, because he provided some of the naked figures in Michael Angelo's *Last Judgment* with breeches by order of Pope Paul IV.

Vol'tri [Med. Lat. *Ulterium*], town of Italy, province of Genoa, on the sea-shore between the Leira and the Cerusa, about 10 miles W. of the city of Genoa, with which, however, it is connected by an almost continuous line of houses. Voltri is a flourishing manufacturing town, has some fine churches, and near it are charming villas, the most striking of which is the Brignole-Sale, on a hill commanding an exquisite view of this most lovely coast. Voltri contains at least 125 paper-factories, and the sulphurous water employed in its manufacture is believed to protect the paper against the attacks of the *book-worm*, for which reason it is used, by regulation, in many of the public offices in England. It is also largely exported to America. The mechanical power of the two torrents is also further utilized in the manufacture of cotton, wool, hemp, linen, leather, etc. The mineral springs near Voltri, known as Acqua Santa and Acqua della Penna, are now much frequented. P. 13,250. CAROLINE C. MARSH.

Voltum'na, the tutelary goddess of the Etruscan confederation, at whose temple (*Fanum Voltumnæ*) the general meetings of the deputies from the twelve cantons were held, in the same manner as the assemblies of the Latin, Sabine, Hernican, and other leagues were held at the groves or fountains of Feronia or Ferentina, which, as well as Vertumnus or Vortumnus, Volumnus, Volumna, Vulturnus, and the Oscan Herentas (incorrectly represented as the goddess of love), are probably mere variations of the same name, of which the root, under the forms Val, Vel, Fal, Fel, For, Ver, appears in nearly all the tribal or civic names of the Pelasgic nations of Italy. The worship of Voltumna was doubtless anterior to the irruption of the Etruscans proper into the region called by their name. The site of the temple of Voltumna is placed by some at Castel d'Asso, by others at Viterbo, and by Mr. George Dennis (*Etruria*, vol. i. p. 516) at Monte Fiascone. PORTER C. BLISS.

Voltur'no [anc. *Vulturnus*], the principal river of Southern Italy, rises in Monte San Croce, near Castellone; flows first S. E., then W., through the plains of Campania, and enters the Gulf of Gaëta after a course of about 90 miles. Along the Volturno was fought a series of battles between Garibaldi and the royal Neapolitan troops, Sept. 19, 21, and Oct. 1, 1866.

Volumenom'etry [Lat. *volumen*, primarily a "roll"—whence we get our word "volume," meaning "bulk" and *metari*, to "measure"]. A better term possibly is *stereometry* (Gr. στερεός or στερῆός, "solid," and μετρεῖν, "to measure"). The term denotes the art of determining the volumes or spaces occupied by bodies, applied generally, however, only to solids, and not to liquids and gases, which latter are easily measured by means of graduated measures. In the case of solids, however, which have not the fluidity, and consequent homogeneity, of the other two conditions of matter, the measurement of the true volume is not so simple or direct, requiring contrivances and devices of a more or less elaborate kind. Almost all the methods of volumenometry or stereometry are founded upon the original method of Archimedes, who first discovered and made use of this art; which method was to measure the amount of water that flows over when the solid to be measured is plunged into a vessel filled to the brim. The exactitude of modern science requires, however, that several special precautions should be practised to eliminate certain sources of error.

The taking of specific gravities (see GRAVITY, SPECIFIC) involves one mode of volumenometry, the loss of weight in water being virtually the weight of a volume of water equal to the volume of the body, from which the volume of the body itself follows very simply. Instruments have, however, been constructed, known as *volumenometers* or *stereometers*, which indicate the volume of the immersed body directly by the rise of the liquid into a graduated tube. This plan was first used by Bishop Watson in 1770, who tried in this way to determine the increase of volume produced by the solution of salts in water. He used merely a matrass with a long narrow neck, filled with water up to the neck, and dropped the salt down through this neck, noting the rise in the latter. Playfair and Joule, about 1844, used an improved plan of a similar kind, this being a bulb with a long graduated stem, on the side of the bulb being a tubulure with a ground stopper. The bulb and stem, up to a certain mark, being filled with water, oil, or turpentine, or other suitable liquid, the instrument was so inclined that the stopper could be removed without escape of the liquid, and the weighed salt or other body whose volume was to be measured being introduced, the stopper was then replaced. On again placing the stem in vertical position, the new level of the liquid therein showed the increase of volume. The figures given of the work with this instrument by Playfair and Joule do not show very satisfactory accordances, and it seems probable that some important sources of error were not sufficiently eliminated. It would seem practicable so to use such an instrument as to obtain uniform and correct results.

Instruments have also been constructed to show the volume by measuring the *air* displaced, but these are so subject to sources of error as to be of little use. So far, the only reliable method of volumenometry in use is that referred to before—the careful determination of the density or specific gravity of the body, the volume being simply the reciprocal of the density, or 1 divided by the density. If instead of 1, the *equivalent weight* of a chemically homogeneous body be divided by the density, we get the *equivalent volume*. (See VOLUMES, MOLECULAR.)

HENRY WURTZ.

Vol'umes, Molec'ular or **Equivalent,** sometimes called **Atomic Volumes,** a term objectionable for several reasons, especially because it can apply, even hypothetically, only to elementary bodies, and not at all definitely to compounds; also sometimes called **Specific Volumes,** which is a still more mischievous term, as it likens them to *specific gravities*, to which they have no relation justifying a related term. "Equivalent volumes," or "*volumes of chemical equivalents*," is the most definitive term, as it involves no hypothesis whatever. The term "*molecular volume*" need not, however, be regarded as involving hypothesis if "molecule" and "equivalent" be merely viewed as synonymous in a chemical sense.

Under CHEMISTRY have been discussed the laws of *gaseous* combining volumes (called by some *molecular volumes*),

but the vast subject of *liquid* and *solid* combining volumes has there been left untouched. For one gaseous body that is known, however, *thousands* of equally important solids and liquids are known; and the branch of chemistry here to be treated has a commensurate significance, involving, indeed, in an essential manner, the whole future of the science, and the hope of future substantial progress therein. The argument upon which the writer bases this latter assertion is one which may be forcibly presented in but a few words. In the chemistry of solids and liquids the only laws of proportion and combination of elements hitherto successfully investigated and recognized are those which arise out of relations to the *attractive* or *centripetal* force or forces. The relations to the antagonistic *repulsive* or *centrifugal* force or forces (or resultants of forces, or of *motion*, as they may be deemed) which occasion the occupation of space by solids and liquids, are as yet unrecognized in the science. The writer claims—as many others have claimed before him—that these latter relations must be believed to be at least equally important with those that govern combining weights, and that any laws found to rule them must be admitted to have an essentiality comparable with that of the two laws of definite and multiple proportions by weight, or of the multiple volumic law of combination in gases.

Dr. Thomas Thomson of Glasgow first attempted, about 1830, to compute the relative volumes occupied in the solid and liquid states by equivalents of elements and compounds, and showed some striking approximations of volume between equivalents of some of the metals. The arithmetical method of obtaining equivalent volumes is simply to divide the equivalent weight by the specific gravity. (See ISOSTERISM.) Subsequently, and at intervals since, the question has been taken up and studied by many distinguished chemists—with so little satisfactory success, however, that their generalizations are as yet little noticed in the text-books of the science. An *historical* discussion of this matter would go beyond our present scope, which must be limited to the brief setting forth of some *recently-discovered* relations and laws, which, it is believed, are so extensively supported by facts that they will command universal acceptation from all who are free from prejudice. These discoveries were presented by the present writer to the scientific world within the year 1876.*

The writer considered—as has been hinted under a previous head, ISOSTERISM—that the simple *multiple* relations of volume (like those in gases) which have been sought to be established by other investigators between liquid and solid chemical molecules, were, in the nature of the case, not probable, or at least not probably essential, and that a *geometrical* ratio—or rather some simple ratio between geometrical dimensions, as, for example, between the *cube-roots* of the volumes—was much more likely to be found if sought for. He also considered that, whatever a molecule might be in shape or size, in a homogeneous collocation of equal molecules each one must needs occupy, *virtually*, an equal *cubical* space. He therefore directed his labors entirely to the comparison of the *cube-roots* of equivalent volumes at different temperatures. In due time he discovered that by multiplying the equivalent volumes by 1000—which amounts simply to assuming the equivalent weight of hydrogen as 1000 (instead of unity, which is the customary assumption)—these cube-roots of the volumes of equivalents presented, in many cases, close approximations to whole numbers. It was next found that this approximation was closest at the temperature of melting ice, or the Centigrade zero, the equivalent volume of ice itself being almost precisely the even cube of 27. Further, there appeared conclusive reason to believe that if the temperature be taken at which ice *begins* to melt or absorb latent heat, which is about 4° F. below the so-called freezing-point, the cube root of the equivalent volume of ice would become 27, with mathematical exactness. This point of temperature, of initial fusion of ice, is therefore regarded by the writer as a standard temperature in nature; the more so as it is plainly the point at which all life and motion begin on the earth.

The following may be cited as some of the cases in which the probabilities are more or less great—in many of these cases very great—that at this temperature of initial ice-fusion the equivalent volume of the body would become an exact even cube of a whole number. For purposes of a symbolic *notation*, to convey at a glance this new relation, it will be a convenient device to place the number expressing the cube-root of the volume under the chemical symbol of the element. In the case of ice, which is only *one* of the even cubes that water or the compound H_2O has been found to assume in different forms of combination, a new general symbol, Hδ, is used, founded on the Greek name of water, Ὕδωρ or *Hydor*. In all the following tables, when the temperature of the *experimental* density is not stated, it is to be understood that the experiment was made at about the *normal* temperature, 60° F. The *computed* densities are those corresponding to the new law of cubical molecular condensation, as well as to the new standard temperature of *initial* ice-fusion.

To explain the term *diametric*, as used in this table and throughout this article, it is only necessary to mention that the cube-root of any cubical space is its shortest *diameter*.

TABLE I.—*Elemental and Elementoid Molecules of Simplest Forms.*

Bodies.	Diametric symbols.	Computed zero-densities.	Experimental densities.	Experimenters.
Diamond	C 15	3.5555+	3.55	Pelouze, also Brisson.
Boron (adamantoid)	B 16	2.685	2.68	Wöhler and Deville.
Ice	Hδ 27	.9145	.91674	At 0° C., Bunsen.
Water of crystallization	Hδ 24	1.3021	1.3081	Generalized by F. W. Clarke of Cincinnati, in an extended research.
Amorphous brick-red phosphorus	P 25	1.985	1.964	Schrotter.
Orange-yellow phosphorus	P 24	2.243	2.23	Brodie.
Crystallized native sulphur	S 25	2.048	2.05	Karsten.
Selenium, crystallized from bisulphide of carbon	Se 26	4.495	4.46 4.509	Mitscherlich.
Liquid bromine	Br 30	2.963	2.966	Balard.
Liquid cyanogen	Cy 31	.8728	.866	Faraday.
Silicon	Si 21	2.025	2.004	Winkler.
Amorphous arsenic	As 25	4.8	4.716	Bettendorff (compare red phosphorus).
Antimony	Sb 26	6.904	6.86	Muschenbroek.
Bismuth	Bi 28	9.566	9.556	Marchand and Scheerer (compressed).
Columbium	Cb 25	6.016	6.	Marignac.
Tantalum	Ta 26	10.355	10.43	Rose.
Sodium	Na 29	.943	.935	Davy.
Lithium	Li 23	.575	.578	Bunsen.
Silver	Ag 22	10.143	10.1053	Baudrimont (cast and slowly cooled).
Barium	Ba 33	3.812	3.75	Sergius Kern.
Strontium	Sr 33	2.435	2.4	Franz.
Tin	Sn 25	7.552	7.5565	Herapath (cast).
Iron	Fe 19	8.164	8.14	Smith (electrolytic iron).
	Fe 20	7.	6.886 6.9551	Abel (minimum of hot-blast pig). Mallet (minimum of hot-blast pig).
	Fe 21	6.017	6.03	Stahlschmidt's soft allotrope.
Zinc	Zn 21	7.019	6.966 6.975 6.992 7.03	Schiff. " Playfair and Joule. Bolley.
Manganese, hard.	Mn 19	8.018	8.013 8.03	John. Bachmann.
Manganese, soft.	Mn 20	6.875	6.861	Bergmann.
Nickel	Ni 19	8.456	8.402 8.477	Tourte. Baumgartner.
Cobalt	Co 19	8.602	8.558	T. H. Henry.
Platinum	Pt 21	21.272	21.267	Marchand.
Palladium	Pd 21	11.5	11.4	Deville and Debray.
Rhodium	Rd 21	11.262	11.2	Cloud.
Ruthenium	Ru 21	11.251	11.	Deville and Debray.
Osmium	Os 21	21.488	21.4	"
Vanadium	V 21	5.528	5.5	Roscoe.
Tungsten	W 22	17.28	17.2 17.2 17.22 17.3	Wohler. Zettnow. Allen and Aiken. Bernoulli.

A few other known cases may be added of elements which, *at their own points of fusion*, fall into one of these cubical volumes:

Addenda to Table I.

Bodies.	Diametric symbols.	Computed zero-densities.	Experimental densities.	Experimenters.
Melted phosphorus	P 26	1.764	1.763	Gladstone and Dale.
Melted sulphur	S 26	1.821	1.815	Playfair and Joule.
Melted potassium	K 36	.836	.813	" "
Melted lead	Pb 27	10.517	10.513	" "

The above cases are of necessity chiefly confined to elemental bodies, but the next tabulation to be given, of examples of molecules composed of two cubical volumes asso-

* See the *American Chemist* for Mar., 1876, pp. 321-336—"Introductory Memoir on Geometrical Chemistry, by Henry Wurtz"—memoir dated Jan. 1, 1876.

ciated together, having sometimes the same, but oftener *proximate* diameters, will contain both elements and binary compounds. It will be comprehended that the discovery of these double-cube molecules arose naturally out of—in fact, simultaneously with—that of the simpler cubical molecules tabulated above:

TABLE II.

Bodies.	Volumic formulæ.	Computed zero-densities.	Experimental densities.	Experimenters.
Gas carbon	$^{C}_{18}\cdot^{C}_{19}$	1.890	1.885	Mené.
Common cast phosphorus	$^{P}_{24}\cdot^{P}_{25}$	2.165	2.09	Playfair and Joule.
Iodine	$^{I}_{29}\cdot^{I}_{30}$	4.913	4.948	Gay-Lussac.
Soft amorphous sulphur	$^{S}_{25}\cdot^{S}_{26}$	1.928	1.92 1.921 1.926 1.927 1.927 1.928	Weber. Playfair and Joule. Weber. Weber. Bischof. C. Deville.
Arsenic, native metallic	$^{As}_{24}\cdot^{As}_{24}$	5.771	5.763 5.764 5.766 and six others	Stromeyer. Brisson. Mohs.
Selenium, red, precipitated	$^{Se}_{26}\cdot^{Se}_{27}$	4.241	4.245	Schaffgotsch.
Silver, native crystal.	$^{Ag}_{21}\cdot^{Ag}_{22}$	10.849	10.77	Forbes.
Silver, in fusion	$^{Ag}_{22}\cdot^{Ag}_{24}$	9.468	9.4612	Roberts.
Quicksilver	$^{Hg}_{24}\cdot^{Hg}_{25}$	13.583	13.56 13.582 13.5886 13.5886	Karsten. At 5° C., Regnault. Biot and Arago. At 1°, Kupffer.
Cadmium	$^{Cd}_{23}\cdot^{Cd}_{24}$	8.619	8.604	Stromeyer.
Indium	$^{In}_{21}\cdot^{In}_{22}$	7.434	7.121	Winkler's heaviest.
Gold	$^{Au}_{21}\cdot^{Au}_{22}$	19.243	19.207	Elliott (hammered).
Zinc, melted	$^{Zn}_{21}\cdot^{Zn}_{22}$	6.529	6.522	Playfair and Joule.
Iron, native	$^{Fe}_{20}\cdot^{Fe}_{21}$	6.489	6.497	Bahr (found in fossil wood).
Iron, pure	$^{Fe}_{19}\cdot^{Fe}_{20}$	7.537	7.5	Pommarède (reduced by Zn vapor).
Calcium	$^{Ca}_{29}\cdot^{Ca}_{30}$	1.556	1.55	Löw-Bodart and Jobin.
Potassium	$^{K}_{35}\cdot^{K}_{36}$	.871	.87	Sementini.
Chloride of iodine (solid)	$^{Cl}_{24}\cdot^{I}_{33}$	3.266	3.263	At 0° C., Hannay.
Chloride of sulphur (liquid)	$^{Cl}_{28}\cdot^{S}_{26}$	1.708	1.7055	At 0° C., Kopp.
Chloride of thallium	$^{Cl}_{24}\cdot^{Tl}_{27}$	7.118	7.02	Lamy.
Chloride of sodium	$^{Cl}_{24}\cdot^{Na}_{23}$	2.251	2.24 2.26	Filhol. Mohs.
Chloride of silver	$^{Cl}_{24}\cdot^{Ag}_{23}$	5.521	5.517	Schiff (precipitated).
Liquid hydrofluoric acid	$^{F}_{22}\cdot^{H}_{21}$	1.0019	.9922	Gore.
Fluoride of silver	$^{F}_{18}\cdot^{Ag}_{25}$	6.919	5.852	Gore.
Fluoride of potassium	$^{F}_{18}\cdot^{K}_{26}$	2.478	2.451	Bödeker.
Bromide of potassium	$^{Br}_{28}\cdot^{K}_{28}$	2.717	2.69	Schröder.
Bromide of sodium	$^{Br}_{28}\cdot^{Na}_{23}$	3.019	3.011	Tschermak.
Bromide of silver	$^{Br}_{28}\cdot^{Ag}_{21}$	6.023	6.02	Berthier (native).
Bromide of selenium	$^{Br}_{28}\cdot^{Se}_{28}$	3.621	3.604	Schneider.
Iodide of potassium	$^{I}_{28}\cdot^{K}_{33}$	2.867	2.85	Schiff.
Iodide of ammonium	$^{I}_{28}\cdot^{Am}_{33}$	2.505	2.498	Bödeker.
Iodide of silver	$^{I}_{28}\cdot^{Ag}_{27}$	5.644	5.64	Breithaupt (native).
Cyanide of silver	$^{Cy}_{24}\cdot^{Ag}_{27}$	3.999	3.943	Giesecke.
Sulphide of manganese	$^{S}_{24}\cdot^{Mn}_{20}$	3.987	3.95	Leonhard (mineral *alabandite*).
Sulphide of zinc	$^{S}_{24}\cdot^{Zn}_{22}$	3.961	3.9235	Karsten (lightest).
Sulphide of calcium	$^{S}_{24}\cdot^{Ca}_{24}$	2.604	2.58	Maskelyne.
Sulphide of cadmium	$^{S}_{24}\cdot^{Cd}_{25}$	4.889	4.8	Brooke.
Sulphide of mercury	$^{S}_{24}\cdot^{Hg}_{25}$	7.881	7.748	Moore (black allotrope).
Sulphide of lead	$^{S}_{24}\cdot^{Pb}_{26}$	7.611	7.6	Leonhard.
Seleniide of mercury	$^{Se}_{21}\cdot^{Hg}_{29}$	7.301	7.274	Dana's *Mineralogy*.

Three tables are presented below, containing the molecular structures of such haloid salts as have had their densities determined. In many of these cases there is more than one allotropic form, but the one given here is generally that which is supported by the greater number of density-figures, the *dominant* form, as the writer prefers to call it. In several, however, of the bromides, and even of the iodides, there having been but one determination made, it remains in doubt as yet whether the form given is really the dominant one.

As yet these tabulations are far too imperfect—too many wide gaps remaining to be filled up, and too much uncertainty, as said before, regarding the true places of some important electro-positives—to justify much *generalization* from them. Chemists will observe, nevertheless, several striking cases of basic molecules brought into proximity or serial relations (see SERIES IN CHEMISTRY), both according to their *equivalencies*, and also according to certain known chemical parallelisms not depending always upon equivalence. Thus, for example, *lead* bromide with those of *silver* and *cuprosum*; *vanadium* and *chromium* chloride; *hydrogen* with *magnesium* and *cupricum* chlorides; *lead* with *thallosum* and *mercurosum* chlorides; *ammonium* and *thallium* chlorides; and so on.

Diametric Types.—One feature of these tabulations is their illustration of *typical* diametric relations. Six of these types have appeared, marked by their dominant diametric figures forming a series of *multiples of 4*, these being 16, 20, 24, 28, 32, and 36. Higher ones may exist. These types are, provisionally, numbered from 1 to 6. Negative elements fall sharply into typical diameters, while positives usually only approximate thereto. Thus, *solid* chlorides are of Chloride-Type 3; solid bromides and iodides of Type 4; *liquid* chlorides are of Type 4. Similar differences of 4 are unmistakable among the positive elements. Thus, the diameters of the same metal show numerous cases like Ag 19, 23, 27; *cuprosum*, 20, 24, 28; Pb 23, 27, 31; Cd 24, 28, 33; Ca 25, 29; Sr 26, 30; Ba 30, 34; and so on. (See further under WATER OF CRYSTALLIZATION.)

TABLE III.—*Solid Anhydrous Haloid Bromides, arranged in the Order of the Diameters of the Electro-positive Molecules.*

Bromide of—	Volumic formulæ.	Computed zero-densities.	Experimental densities.	Experimenters.
Argenticum	$^{Br}_{28}\cdot^{Ag}_{19}$	6.525	6.425	Schröder (*maximum*).
Cuprosum	$^{Br}_{28}\cdot^{Cu}_{20}$	4.791	4.72	Bödeker.
Lead	$4^{Br}_{28}\cdot\left(^{Pb}_{22}\,^{Pb}_{23}\right)$	6.635	6.6302	"
Sodium	$^{Br}_{28}\cdot^{Na}_{23}$	3.019	3.011	Tschermak.
Cadmium	$4^{Br}_{28}\cdot\left(^{Cd}_{23}\,^{Cd}_{24}\right)$	4.781	4.712	Bödeker and Giesecke.
Calcium	$4^{Br}_{28}\cdot^{Ca}_{25}$	3.359	3.32	Bödeker.
Mercurosum	$^{Br}_{28}\cdot^{Hg}_{25}$	7.451	7.307	Karsten.
Mercuricum	$4^{Br}_{28}\cdot\left(^{Hg}_{25}\,^{Hg}_{26}\right)$	5.95	6.9202	"
Zinc	$4^{Br}_{28}\cdot^{Zn}_{26}$	3.659	3.643	Bödeker.
Strontium	$4^{Br}_{28}\cdot^{Sr}_{26}$	4.025	3.985	Favre and Valson.
Hydrogen	$^{Br}_{28}\cdot^{H}_{27}$	1.9455	.....	Deduced from the hydrates.
Ammonium	$^{Br}_{28}\cdot\left(^{Am}_{28}\,^{Am}_{27}\right)$	2.291	2.266	Bödeker.
Potassium	$^{Br}_{28}\cdot^{K}_{28}$	2.717	2.672 2.69	Playfair and Joule. Schröder.
Barium	$4^{Br}_{28}\cdot\left(^{Ba}_{29}\,^{Ba}_{30}\right)$	4.267	4.23	Schiff.
Aluminum	$^{Br}_{28}\cdot^{Al}_{34}$	2.544	2.54	Deville and Troost.

TABLE IV.—*Solid Anhydrous Haloid Chlorides, arranged in the Order of the Diameters of the Electro-positive Molecules.*

Chloride of—	Volumic formulæ.	Computed zero-densities.	Experimental densities.	Experimenters.
Lithium	$^{Cl}_{24}\cdot\left(^{Li}_{19}\,^{Li}_{20}\right)$	1.999	1.998	Kremers.
Vanadium	$4^{Cl}_{24}\cdot\left(^{V}_{21}\,^{V}_{22}\right)$	3.214	3.23	Roscoe.
Vanadium	$6^{Cl}_{24}\cdot^{V}_{22}$	3.022	3.0	Roscoe.
Chromium	$6^{Cl}_{24}\cdot^{Cr}_{22}$	3.051	3.03	Schafarik (crystallized).
Argenticum	$2^{Cl}_{24}\cdot\left(^{Ag}_{23}\,^{Ag}_{22}\right)$	6.687	5.595	Schröder (*maximum*).
Sodium	$2^{Cl}_{24}\cdot^{Na}_{23}$	2.251	2.24	Filhol.
Cuprosum	$2^{Cl}_{24}\cdot\left(^{Cu}_{23}\,^{Cu}_{24}\right)$	3.692	3.678	Karsten.
Hydrogen	$2^{Cl}_{24}\cdot\left(^{H}_{24}\,^{H}_{25}\right)$	1.2785	1.27	Watts's *Dictionary of Chemistry*.
Magnesium	$4^{Cl}_{24}\cdot^{Mg}_{25}$	2.195	2.179	Playfair and Joule.
Cupricum	$4^{Cl}_{24}\cdot^{Cu}_{25}$	3.108	3.054	"
Platinum	$4^{Cl}_{24}\cdot^{Pt}_{26}$	5.926	5.87	Bödeker.
Mercurosum	$2^{Cl}_{24}\cdot\left(^{Hg}_{26}\,^{Hg}_{27}\right)$	7.256	7.178	Playfair and Joule.
Lead	$4^{Cl}_{24}\cdot^{Pb}_{27}$	5.873	5.805	Stolba.
Thallosum	$2^{Cl}_{24}\cdot^{Tl}_{27}$	7.148	7.02	Lamy.
Zinc	$4^{Cl}_{24}\cdot\left(^{Zn}_{27}\,^{Zn}_{28}\right)$	2.806	2.753	Bödeker.
Ammonium	$2^{Cl}_{24}\cdot\left(^{Am}_{27}\,^{Am}_{28}\right)$	1.544	1.5443	Wattson.
Thallium	$3^{Cl}_{24}\cdot^{Tl}_{28}$	6.026	5.9	Lamy.
Cadmium	$4^{Cl}_{24}\cdot^{Cd}_{28}$	3.689	3.625	Bödeker.
Mercuricum	$4^{Cl}_{24}\cdot^{Hg}_{28}$	5.464	5.448	Schröder.
Ferrosum	$4^{Cl}_{24}\cdot^{Fe}_{28}$	2.56	2.528	Filhol.
Calcium	$4^{Cl}_{24}\cdot\left(^{Ca}_{28}\,^{Ca}_{29}\right)$	2.184	2.16	Favre and Valson.
Potassium	$2^{Cl}_{24}\cdot\left(^{K}_{28}\,^{K}_{29}\right)$	2.014	1.996	Schröder.
Manganese	$4^{Cl}_{24}\cdot\left(^{Mn}_{28}\,^{Mn}_{29}\right)$	2.4791	2.478	"
Barium	$4^{Cl}_{24}\cdot\left(^{Ba}_{29}\,^{Ba}_{30}\right)$	3.899	3.886	"
Strontium	$4^{Cl}_{24}\cdot\left(^{Sr}_{29}\,^{Sr}_{30}\right)$	2.971	2.96	Filhol.
Bismuth	$6^{Cl}_{24}\cdot^{Bi}_{30}$	4.622	4.56	Bödeker.

TABLE V.—*Iodides, arranged in the Order of the Electro-positive Diameters.*

Iodide of—	Volumic formulæ.	Computed zero-densities.	Experimental densities.	Experimenters.
Sodium	$2^{I}_{28}\cdot\left(\begin{smallmatrix}Na & Na\\ 27 & 26\end{smallmatrix}\right)$	3.696	3.654	Favre and Valson (*maximum*).
Argenticum	$2^{I}_{28}\cdot\left(\begin{smallmatrix}Ag & Ag\\ 27 & 26\end{smallmatrix}\right)$	5.791	5.707 5.718 5.807	Pamour (native, *maximum*). Schroder. H. Deville (precipitated, at 0° C.).
Hydrogen	$2^{I}_{28}\cdot 2^{H}_{27}$	3.0743	.....	From its hydrates.
Cuprosum	$2^{I}_{28}\cdot\left(\begin{smallmatrix}Cu & Cu\\ 28 & 27\end{smallmatrix}\right)$	4.454	4.41	Schiff.
Mercurosum	$2^{I}_{28}\cdot\left(\begin{smallmatrix}Hg & Hg\\ 28 & 27\end{smallmatrix}\right)$	7.646	7.6445	Karsten.
Zinc	$4^{I}_{28}\cdot\left(\begin{smallmatrix}Zn & Zn\\ 28 & 29\end{smallmatrix}\right)$	4.756	4.696	Bödeker and Giesecke.
Mercuricum	$4^{I}_{28}\cdot\left(\begin{smallmatrix}Hg & Hg\\ 30 & 31\end{smallmatrix}\right)$	6.279	6.25 6.27	Filhol. Tschermak.
Potassium	$2^{I}_{28}\cdot\left(\begin{smallmatrix}K & K\\ 31 & 32\end{smallmatrix}\right)$	3.118	3.11	Boullay (*maximum*).
Lead	$4^{I}_{28}\cdot\left(\begin{smallmatrix}Pb & Pb\\ 31 & 32\end{smallmatrix}\right)$	6.132	6.11	"
Ferrosum (with crystal-water)	$4^{I}_{28}\cdot 2^{Fe}_{32}$	2.897	2.873	Bödeker.
Strontium	$4^{I}_{28}\cdot 2^{Sr}_{32}$	4.464	4.415	"
Barium	$4^{I}_{28}\cdot 2^{Ba}_{33}$	4.9	4.917	Filhol.
Ammonium	$2^{I}_{28}\cdot 2^{Am}_{33}$	2.505	2.498	Bödeker.
Cadmium	$4^{I}_{28}\cdot 2^{Cd}_{33}$	4.581	4.576	"
Antimony	$6^{I}_{28}\cdot\left(\begin{smallmatrix}Sb & Sb\\ 32 & 33\end{smallmatrix}\right)$	5.019	5.01	"
Bismuth	$6^{I}_{28}\cdot\left(\begin{smallmatrix}Bi & Bi\\ 33 & 34\end{smallmatrix}\right)$	5.711	5.652	"
Arsenic	$6^{I}_{28}\cdot\left(\begin{smallmatrix}As & As\\ 33 & 34\end{smallmatrix}\right)$	4.407	4.39	"
Tin	$8^{I}_{28}\cdot\left(\begin{smallmatrix}Sn & Sn\\ 35 & 36\end{smallmatrix}\right)$	4.722	4.696	"
Potassium (melted)	$2^{I}_{28}\cdot\left(\begin{smallmatrix}K & K\\ 35 & 36\end{smallmatrix}\right)$	2.488	2.497	At 666° C.—Braun.
Aluminum	$6^{I}_{28}\cdot\left(\begin{smallmatrix}Al & Al\\ 44 & 45\end{smallmatrix}\right)$	2.652	2.63	Deville and Troost.

Divers cases of more complex combinations of cubical molecules will appear further on. The discovery of these cubical relations led the writer, through long and laborious researches and generalizations, to the establishment of certain general laws governing the chemical molecular constitution of matter. The chief of these has been expressed as follows: (1) *The Geometric Law of Molecular Condensation.—The volumes of all single chemical molecules, whether of elements or of radicals—with the one sole exception of oxygen—are expressible by quantities having, at the temperature of incipient ice-fusion, the relation of even cubes of a series of whole numbers, of which series the number pertaining to the molecule of ice at this temperature is 27.*

The tendency of further investigations and generalizations, still in progress, has been, however, toward the promise of a wider extension of the principle—to the effect that all definite chemical compounds, at *their own* points of fusion likewise, fall, when liquid, into definite simple or compound cubical volumes, according to the above law. This probable expansion of the law rests as yet, however, on but a limited number of cases.

THE OXYGEN-VOLUME.—It will be observed that a most important exceptional case is excluded from the law—namely, the great dominating element *oxygen*, the most electro-negative and acidic of known bodies. The mode of arriving, by induction, for the first time, at the true combining volume of oxygen in solids and liquids—a point arrived at early in these investigations, and one which was in reality fundamentally necessary to the success of even the earliest steps therein—must next be explained. It was discovered, after long courses of experiment with volumes that have heretofore been assumed, or supposed to be deduced, for oxygen, by previous workers in this field, and with a great number of volumes, either assumed as hypotheses or computed from various sources, that a volume obtained from that of the *peroxide of hydrogen* of Thénard—being merely the difference between the volume of its equivalent and that of the equivalent of water contained in it—yielded results consistent with each other and with those obtained from cases where oxygen was absent. The figure thus obtained, multiplied as in other cases by 1000, was closely 5181, this precise number ($=3\times 12^3$) having been arrived at by a series of experimental approximations covering a great range of compounds; the unavoidable conclusion having been adopted that oxygen has but one *invariable* volume—a conclusion which follows necessarily from the general principle, induced from all the facts, that the tendency to variation of volume is in proportion to the *electro-positive* nature of an element, while oxygen is recognized as being the least electro-positive, or most electro-negative, of all.

Among the several other independent methods which have been discovered by the writer for approximating to the true oxygen-volume of 5181, it may be well to explain one more. Two oxides of nitrogen are known in *liquid* form, N_2O and N_2O_4. Of each of these there is a *maximum* and a *minimum* density on record, differing so much as to make the existence clear of two allotropic modifications of each, the N_2O densities having been determined at 0° C., and those of N_2O_4 at normal temperature. Admitting that an addition of 1 per cent. to the latter will bring the figures about to what they should be at zero, we find for the equivalent volumes at zero,

Of N_2O = 46959 and 48867
Of N_2O_4 = 62777 and 64148
Differences = O_3 = 15818 and 15281

The sum of these differences divided by 6 = 5183.9 for the single oxygen-volume. The *extreme* closeness of this approximation is of course accidental, but this certainly does not detract from its value. It may be well to point out in addition, to those who may not incline to admit the existence of the two parallel modifications here assumed, that the averaging of the two determinations of each compound amounts in this case to the same thing. Other methods of verifying the new oxygen-volume have been found in the comparison of the volumes of certain metals and oxides, sulphides and sulphates, chlorides and chlorates, selenides and selenates, oxychlorides and oxybromides; also among some oxygenated organic compounds.

VOLUMES OF OXIDES.—Uniform geometric relations, even between related groups of compounds, can only be expected to come out *prominently* under *uniform* conditions of condensation and of influences modifying the same. But in no class of bodies is it more difficult to assure ourselves of uniformity of such conditions than in the case of anhydrous oxides. These are mostly solid, very often not crystalline, and only obtainable in crystals with much difficulty and under exceptional and variable temperatures and other conditions. The few which are soluble in water undergo profound transformations in contact with the latter, accompanied by great thermal disturbance, proving new stages of condensation, with the formation of entirely new classes of bodies. In considering, therefore, the following new facts regarding such anhydrous oxides as are known, due allowance should be made for such variations.

(1) *Oxides of Amphigens.—Liquid* SO_2 is $O_4.\left(\begin{smallmatrix}S & S\\ 32 & 33\end{smallmatrix}\right)$ = 1.431 (D'Andreeff, at 0° – 1.433). *Solid* SO_3 is $O_3.^{S}_{29}$ = 2.003 (Buff, at 25° – 1.908; Morveau, at 13° – 1.955; which compute at 0° to 2.005); four diameters below the larger sulphur-molecule in the liquid dioxide. In the combinations of these with bases the sulphur-molecule shrinks to $^{S}_{24}$, which is its diameter in all the sulphites and sulphates, including oil of vitriol and its hydrates. Dithionic oxide, S_2O_5, is not known as anhydrous oxide, but in dithionates we appear to have $\left(\begin{smallmatrix}S & S\\ 24 & 25\end{smallmatrix}\right)$, like the P in orthophosphates (see below). SeO_2 and SeO_3 are only known in their salts, in which we have always $^{Se}_{24}$. TeO_2, anhydrous, is $O_4.\left(\begin{smallmatrix}Te & Te\\ 25 & 26\end{smallmatrix}\right)$ = 5.933 (Schafarik, 5.93).

(2) *Oxides of Metallic Monads.*—Anhydrous soda is $O.\left(\begin{smallmatrix}Na & N\\ 20 & 21\end{smallmatrix}\right)$; anhydrous potash, $O.\left(\begin{smallmatrix}K & K\\ 24 & 25\end{smallmatrix}\right)$, differing four diameters; the sodium being condensed 4×2 diameters, and the potassium 4×3 diameters, below their *elemental* molecules. This difference of four diameters between corresponding sodium and potassium compounds is general, occurring exactly in the sulphates, nitrates, carbonates, chlorates, and other salts. The corresponding *argentosum* oxide, Ag_2O, is $O\left(\begin{smallmatrix}Ag & Ag\\ 22 & 23\end{smallmatrix}\right)$, containing the molecule of *melted silver;* found also in the sulphate, chromate, selenide, one chloride-allotrope, and in other compounds. In this group it is quite appropriate for us to include the *cuprosum* and *mercurosum* oxides: $O.^{Cu}_{21}$ = 6.032 (Haidinger, 5.992) is clearly related closely to the group, but $O.\left(\begin{smallmatrix}Hg & Hg\\ 25 & 26\end{smallmatrix}\right)$ = 10.839 (Herapath, 10.69) not so directly. Of *thallosum* oxide, Tl_2O, the density does not seem to have been yet determined. (See also *plumbosum*-oxide below.)

(3) *Triadic and Pentadic Oxides.*—It happens that the densities of quite a number of these are known. Of the *nitrogen* oxides, previously referred to, we have that of liquid nitrous oxide, which is $O_2.^{N}_{28}$ = .8964 (Wills, *minimum*, at 0° = .9001), and that of liquid nitric oxide, $O_4.^{N}_{28}$ = 1.423 (Mitscherlich, *minimum*, 1.42). In nitric acid and nitrates this diameter of nitrogen shrinks 4×2 units to $O_5.^{N}_{20}$, which is also the ammonia-diameter of N.

"Phosphoric anhydride," P_2O_5, is $O_5.\left(\begin{smallmatrix}P & P\\ 25 & 26\end{smallmatrix}\right)$ = 2.402 (Brisson, 2.387), but in orthophosphates this shrinks to $O_5.\left(\begin{smallmatrix}P & P\\ 24 & 25\end{smallmatrix}\right)$, and in pyrophosphates dilates to $O_5.^{P}_{26}$, the latter containing the molecule of *melted phosphorus.* The form in the

metaphosphates has not yet been discovered. There is another group of phosphates, first identified by this new method of volumic research, in which the P is condensed enormously, to $^{P}_{18}$ (about one third of its volume in the pyrophosphates, and 1×2 diameters below the same); these being certain heavier mineral phosphates, including *dufrenites*, *wavellites*, *vivianites*, *hitchcockite*, *brushite* (of Julien), and several others.

Of *arsenic* we have $O_3.2^{As}_{26} = 3.905$ (Filhol, 3.881), $O_5.2^{As}_{26} = 3.766$ (Karsten, 3.7312), and $O_5.2^{As}_{25} = 4.023$ (Playfair and Joule, 4.023). $^{As}_{26}$ is Bettendorff's amorphous arsenic. In *arsenates* there is a shrinkage to $O_5.2^{As}_{24}$.

Of *vanadium* (which, as an element, is $^{V}_{21}$) we have $O_3.2^{V}_{20} = 4.773$ (Schafarik, 4.72), but in the pentoxide the V is about four diameters higher, $O_5.\left(^{V}_{23}\,^{V}_{24}\right) = 3.518$ (Schafarik, 3.51). The orthovanadates, few only being known, have not yet been thoroughly investigated, but there is a probable parallelism with the orthophosphates.

Of *boron*, placed among the triads by some, boric oxide has the constitution $O_3.2^{B}_{23} = 1.755$ (Breithaupt, 1.75), but in borates it shrinks to $O_3.2^{B}_{20}$, comparable with the $^{N}_{20}$ of the nitrates (but also with the dyadic $^{C}_{20}$ of the carbonates), and four diameters above its elemental molecule $^{B}_{16}$ (diamond-boron).

Of *tantalum* we have two distinct forms of tantalic oxide, $O_5.2^{Ta}_{26} = 7.27$ (H. Rose's highest figure, 7.28), and $O_5.2^{Ta}_{24} = 8.288$, obtained by *ignition* (H. Rose, 8.26). $^{Ta}_{26}$ is the dominant *elemental* molecule.

Of *columbium* we have corresponding to the *minimum* densities, $O_5.2^{Cb}_{26} = 4.388$ (Marignac, 4.37; Kopp, 4.31), $^{Cb}_{25}$ being an elemental molecule of this metal, while among the *maximum* densities we find *ignited* $O_5.2^{Cb}_{20} = 6.393$ (H. Rose, 6.4) and $O_5.2^{Cb}_{19} = 6.761$ (H. Rose, 6.725), these last bringing it into parallelism with $^{N}_{20}$, $^{B}_{20}$, and $^{P}_{18}$, as above.

Of *iodine*, as a pentad, we have of "iodic anhydride" three definite allotropes:

$O_5.\left(^{I}_{29}\,^{I}_{30}\right) = 4.32$ (Filhol, 4.25), containing *elemental iodine*. (See Table II.)

$O_5.2^{I}_{29} = 4.478$ (Ditte, at 0°, 4.487).

$O_5.\left(^{I}_{27}\,^{I}_{28}\right) = 4.796$ (Kämmerer, 4.7987).

In iodates, however, the iodine molecules shrink, as in case of many other acidogenic elements, to $^{I}_{24}$, this being four diameters smaller than its molecule in the iodides, as shown in Table V. The chloric and bromic anhydrides are unknown, but in both chlorates and bromates we find $^{Cl}_{24}$ and $^{Br}_{24}$, corresponding to the iodine-molecule in iodates.

(4) *Oxides of Tetrads and Hexads.*—Of carbon we have liquid carbonic acid, $O_2.^{C}_{33} = .9502$ (D'Andreeff, at 0°, .9471), but in carbonates (also in hydrocarbons) always $^{C}_{20}$, a shrinkage of thirteen (nearly 4×3) diameters. In this connection it will be interesting to note that the *liquid* compound of carbon with sulphur is $4^{S}_{28}\left(^{C}_{24}\,^{C}_{35}\right) = 1.2963$ (Buff, at 0°, 1.29858), both the sulphur and carbon being about four diameters higher than in *solid* sulphur and carbon compounds. The recently-discovered *solid* sulphide of carbon of Sidot has a nearly-related carbon-molecule, associated, however, with the usual *solid* sulphur-molecule $2^{S}_{24}\left(^{C}_{24}\,^{C}_{23}\right) = 1.641$ (Sidot, 1.66).

Of *titanium* we have the trimorphs *rutile*, *brookite*, and *anatase*, the *maximum rutile* being $O_4.2^{Ti}_{20} = 4.461$ (Kopp, 4.42), like CO_2 in carbonates; the commonest *rutile*, however, being $O_4\left(^{Ti}_{20}\,^{Ti}_{21}\right) = 4.316$ (Hautefeuille, 4.3); the dominant *brookite* (*arkansite*) being $O_4.2^{Ti}_{21} = 4.177$ (H. Rose, 4.166; Klaproth, 4.18); the dominant *anatase* being $O_4.2^{Ti}_{22} = 3.902$ (Hautefeuille, artificial crystals, 3.9; H. Rose, native, 3.912); while another *minimum anatase* is $O_4.\left(^{Ti}_{22}\,^{Ti}_{23}\right) = 3.766$ (Boullay, 3.75).

Of *tin* we have also a similar series of *cassiterite* allotropes, ranging through three diametric units, as with titanium, but in a little higher range, beginning with $O_4.2^{Sn}_{22} = 7.017$ (Forbes, black, from Bolivia, 7.021)—the dominant form being $O_4.\left(^{Sn}_{22}\,^{Sn}_{23}\right)$—and closing with an artificial crystalline form described by Leeds, $O_4\left(^{Sn}_{24}\,^{Sn}_{25}\right) = 5.98$ (Leeds, 6.019). $^{Sn}_{25}$ is Herapath's cast tin.

Of *silicon*, of which one *elemental* form is $^{Si}_{21}$, we have quartz $O_2.^{Si}_{23} = 2.662$ (Deville, 2.663, and many others), and other allotropes less common, containing larger silicon molecules, *tridymite* being $O_2.^{Si}_{25}$, and quartz after fusion $O_4.\left(^{Si}_{25}\,^{Si}_{26}\right)$.

[It thus appears that these four closely related "tetrads" furnish us a *progressive series* in the dominant modifications of their oxides—$O_4.2^{C}_{20}$, $O_4\left(^{Ti}_{20}\,^{Ti}_{21}\right)$, $O_4\left(^{Sn}_{22}\,^{Sn}_{23}\right)$, and $O_4.2^{Si}_{23}$. (See SERIES, IN CHEMISTRY.)]

Of *lead* we have several oxides. In Pb_2O (oxide of plumbosum), as well as in *minium*, we find the melted lead molecule $^{Pb}_{27}$, as we found the melted silver molecule in (argentosum-oxide) $Ag_2O : O.2^{Pb}_{27} = 9.652$ (Playfair and Joule, 9.772) : $O_4.3^{Pb}_{27} = 8.586$ (Karsten, 8.62). In one *litharge* (the heaviest) we find the dominant metallic lead molecule : $O_3.\left(2^{Pb}_{26} \cdot {}^{Pb}_{27}\right) = 9.505$ (Boullay, 9.5); while in one peroxide (the heaviest) the lead is condensed to $^{Pb}_{25}$: $O_2.^{Pb}_{25} = 9.195$ (Wernicke, 9.045).

Of *molybdenum* the dioxide gives us a parallelism with the "tetradic" sub-group above : $O_2.^{Mo}_{21} = 5.68$ (Bucholz, 5.67), like quartz; while the trioxide tends toward widely-different molecules, the lightest one being $O_6\left(^{Mo}_{29}\,^{Mo}_{30}\right) = 3.491$ (Berzelius, 3.49).

Of *uranium* the only two oxides of known densities give us uranosum and uranicum molecules corresponding with the two extremes of the carbon-silicon group : $O.^{U}_{20} = 10.315$ (Ebelmen, 10.15), and $O_4.3^{U}_{23} = 7.108$ (Ebelmen, 7.31).

Of *aluminum* we find in the *corundums* a highly-condensed molecule, approaching $^{Al}_{17}$, but in large classes of aluminous silicates, including the *feldspars* and *zeolites*, it takes $^{Al}_{23}$, like silicon itself, and near its own elemental molecule. Curiously, the *kaolinites* and some other clays, derived from the feldspars, give us the Al *condensed* into its smaller corundum-molecule $^{Al}_{17}$, while in the *garnets*, the heavier *kyanites*, and some others it appears to shrink even to $^{Al}_{15}$. In the lighter *andalusites*, as *mycline*, we find $^{Al}_{23}$ and $^{Al}_{24}$, while normal (*dominant*) *andalusites* have $^{Al}_{19}$, and *sillimanite* has $^{Al}_{18}$.

Of *iron* three well-marked modifications of the sesquioxide (*hæmatites*) may be cited, containing molecules of elemental iron (*ferricum*), set forth in previous tables:

$O_3.\left(^{Fe}_{19}\,^{Fe}_{20}\right) = 5.261$ (G. Rose, 5.23; Rammelsberg, 5.241; Mohs, 5.251; Breithaupt, 5.261; and others).

$O_3.2^{Fe}_{20} = 5.071$ (H. Rose, ignited, 5.037; Neumann, 5.079).

$O_3.2^{Fe}_{21} = 4.696$ (Playfair and Joule, 4.679).

Of the magnetic oxide one form is very distinct (curiously, containing *ferricum !*).

$O_4.3^{Fe}_{20} = 5.186$ (Kenngott, 5.168 and 5.18; Rammelsberg, 5.185; and others).

Of *cobalt*, which generally assumes a more condensed molecule than iron in the corresponding iron compounds, we may give a cobaltic oxide which contains the dominant elemental molecule:

$O_3.2^{Co}_{19} = 5.671$ (Boullay, the highest, 5.6).

(5) *Oxides of Dyadic Metals.*—Some of these may be given as follows:

Magnesium forms $O.^{Mg}_{18} = 3.631$ (Ebelmen, artificial crystals, 3.636).

Cuprieum gives us a considerable series of allotropic forms of cupric oxide, three of which contain copper-molecules recognizable among the elemental densities. Cuprieum, it will be observed, tends to a greater condensation than *cuprosum*:

$O_4.\left(3^{Cu}_{19}.^{Cu}_{20}\right) = 6.45$ (Jenszch, artificial crystals, 6.451; and others).

$O_3.\left(2^{Cu}_{19}.^{Cu}_{20}\right) = 6.399$ (Filhol, 6.322; Herapath, 6.4304).

$O_2.\left(^{Cu}_{19}.^{Cu}_{20}\right) = 6.303$ Whitney, native, 6.25).

$O.^{Cu}_{20} = 6.042$ (Playfair and Joule, artificial, 5.9; Joy, native, 5.952).

Zinc forms $O.^{Zn}_{21} = 5.667$ (Boullay, 5.6; Brooks, 5.6067; Filhol, 5.612), this containing the dominant elemental zinc-molecule, found also in the sulphates, arsenates, silicates, and other compounds.

Calcium gives $O.^{Ca}_{23} = 3.222$ (Filhol, the highest, 3.181),

this being a *calcite* molecule, also found in *fluor-spar*, in the lightest *anhydrite*, in the two *gypsum* allotropes, in *scheelite*, in one *wollastonite*, in *bordite*, and other lime-compounds.

Cadmium gives us $O_2\left(\begin{smallmatrix}Cd & Cd\\ 23 & 24\end{smallmatrix}\right) = 7.043$ (Karsten, 6.9502), this being the elemental molecule of cadmium, of Stromeyer.

Mercuricum forms $O.\begin{smallmatrix}Hg\\ 24\end{smallmatrix} = 11.364$ (Playfair and Joule, the highest, 11.344), this being an elemental molecule of *solidified* mercury. *Mercurosum* (see above, under 2) is less condensed, as in the case of copper-oxides.

Strontium gives $O_2\left(\begin{smallmatrix}Sr & Sr\\ 27 & 28\end{smallmatrix}\right) = 3.98$ (Karsten, 3.932), a strontium-molecule found also in the heaviest strontium-chloride crystallized with $6H_2O$; also in the heaviest nitrate.

Barium forms apparently several allotropic protoxides, the lightest one of which approaches closest to (the next diameter below) elemental barium : $O.\begin{smallmatrix}Ba\\ 32\end{smallmatrix} = 4.031$ (Fourcroy, 4.). This is about four diameters above the strontium oxide. In the dioxide barium is more condensed, the heaviest being $O_4.\left(\begin{smallmatrix}Ba & Ba\\ 28 & 29\end{smallmatrix}\right) = 5.032$ (Playfair and Joule, 4.958).

Under Isosterism it was remarked that there is no distinct similarity in the order of condensation of the volumes of compounds in different classes. This will be found confirmed on comparing the order of the above oxides of dyad metals with the order of the chlorides, bromides, and iodides in Tables III., IV., and V. The iodides approximate somewhat closely to the same order as the oxides, but it may not be quite the same.

Volumes of Water and of Hydrogen.—Out of these new researches have arisen several discoveries regarding the true nature and functions of water and hydrogen, which without any doubt must change the present face of the science of chemistry. The most important of these is the new fact that the compound H_2O, instead of performing the part of a metallic oxide, as has heretofore been conjectured, has in reality the function of a *compound radical*, and hence follows directly the law of simple cubical condensation, like an element. This is the reason why ice and crystal-water, as above shown, have the cubical molecules $H\begin{smallmatrix}\delta\\ 27\end{smallmatrix}$ and $H\begin{smallmatrix}\delta\\ 24\end{smallmatrix}$. Under Water of Crystallization this is further explained. When water combines (apparently) with oxides, both acidic and basic, it has been found that it is broken up (as to its *radical* constitution), the H and O becoming detached, and entering into the new compound as elements, the O with its unchanged volume, 5184, but the H in different cubical volumes. Such hydrogen is elemental or metalloidal ("*hydrogenium*"), and is *replaceable* by electro-positive metals in acids, and in bases by acidic oxides or electro-negative elements or radicals. (See further under Water of Crystallization.)

Volumes in Organic Chemistry.—Under this head comes a vast division of the subject, which might be carried far beyond the necessary limits of this article. The new general principles that have been arrived at, however, governing the chemistry of organic compounds, are exceedingly simple, and may be stated within a small space. The most important one of these new generalizations—one whose application is quite revolutionary in this field of science—is this: that all the great number and variety of hydrocarbon radicals, including the so-called "alcohol radicals," are reducible *to a single one*, H_2C, to which the name *Homologen* is given (with the symbol Hm), because its successive addition, in the same or proximate cubical molecules, gives rise to the universal serial relation known as Homology (which see). Under Homology it is shown that the alcohol radicals themselves constitute a series of homologues. The examples given here of such homologues, formulated upon the geometric law of condensation, must be confined to three series—one of coal-tar, and two of petroleum-derivatives:

Table VI.—*The Coal-Tar Hydrocarbons.*

Hydrocarbons.	Volumic formulæ.	Computed densities.	Densities found at 0° C.	Authorities.
Benzenes, or Benzols.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 27\end{smallmatrix}$	.8906	.8957	Warren.
	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 26\end{smallmatrix}$	.9014	.90122	Adriceuz.
Toluene, or Toluol.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.3\begin{smallmatrix}Hm\\ 26\end{smallmatrix}$	.8837	.8824 .8841	Warren. Longuinine.
Xylene, or Xylol.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.5\begin{smallmatrix}Hm\\ 26\end{smallmatrix}$	.8711	.877 .878	Longuinine. Warren.
Cumenes, or Cumols.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.7\begin{smallmatrix}Hm\\ 26\end{smallmatrix}$	.8617	.8643	Warren.
	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.5\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.8797	.87976	Pisati and Paterno.
Cymene, or Cymol.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.8702	.8705 .8707 .8708 .8710 .87224 .87227 .8732 .8732	Longuinine, from oil of cummin. Pisati and Paterno, from oil of wormwood. Beilstein and Kupffer, from oil of cummin. Fittig, Kobrich, and Jilke. Pisati and Paterno, from camphor. " " from "cymyl-alcohol." Longuinine, from camphor and PCl_5. Beilstein and Kupffer, from camphor.
Laurene, or Laurol.....	$C_6.4\begin{smallmatrix}Hm\\ 28\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 27\end{smallmatrix}.\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.8726	.8751	Lippmann and Longuinine's "diethyl-toluol."

The substantiation, by these discoveries, of Kekulé's *six-atom elemental-carbon nucleus* of the "aromatic series," is of extraordinary interest, though most of the hypotheses that have, with so much labor, been built upon this true basis, by the help of graphic atomistic formulation, seem likely to be of little further use.

Table VII.—*Mineral Hydrocarbons: the Alpha-Naphtha Series of Marsh-Gas Homologues.*

Composition.	Pelouze and Cahours, Pennsylvania petroleum-products: densities.		Cahours and Demarçay, artificial naphthas from fatty acids: densities.		Different zero-densities, found for the same hydrocarbons.		Volumic formulæ.	Computed densities, for melting ice.	Excesses of computed densities over means of experimental densities at normal temperatures.
C_4H_{10}	at 0°	.600	at	....	.600	Ronalds....	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 25\end{smallmatrix}$*	.5940	
C_5H_{12}	18°	.628	14°	.628	.640	Warren	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.3\begin{smallmatrix}Hm\\ 25\end{smallmatrix}$	.6356	.0086
C_6H_{14}	16°	.663	13°	.667	.676	Warren	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.3\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.6766	.0086
C_7H_{16}	16°	.699	12°	.693	.7085	Warren and Storer....	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.4\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}.\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7007	.0017
C_8H_{18}	15°	.726	13°	.723	.728	A. Wurtz...	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.4\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7282	.0037
C_9H_{20}	....	.741	13°	.744	.753 .756	A. Wurtz... Warren.....	$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.4\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.3\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7513	.0088
$C_{10}H_{22}$	16°	.757	14°	.758	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.5\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7635	.0060
$C_{11}H_{24}$	....	.766	14°	.770	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.3\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7737	.0057
$C_{12}H_{26}$	20°	.778	14°	.784	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.4\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.7890	.0080
$C_{13}H_{28}$	17°	.796	....	....	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.5\begin{smallmatrix}Hm\\ 24\end{smallmatrix}$	.8025	.0065
$C_{14}H_{30}$	20°	.809	....	....	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 21\end{smallmatrix}$	.8145	.0055
$C_{15}H_{32}$	19°	.825	....	....	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 24\end{smallmatrix}.\begin{smallmatrix}Hm\\ 23\end{smallmatrix}.\begin{smallmatrix}Hm\\ 23\end{smallmatrix}$	.8305	.0055
$C_{16}H_{34}$	....	....	13°	.846	.....		$2\begin{smallmatrix}H\\ 25\end{smallmatrix}.2\begin{smallmatrix}Hm\\ 26\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 25\end{smallmatrix}.6\begin{smallmatrix}Hm\\ 24\end{smallmatrix}.\begin{smallmatrix}Hm\\ 23\end{smallmatrix}.\begin{smallmatrix}Hm\\ 23\end{smallmatrix}.\begin{smallmatrix}Hm\\ 22\end{smallmatrix}$	.8499	.0039

* In the memoir in the *American Chemist*, before referred to, this series was given in a slightly incorrect form, the error having arisen from the supposition that the density-determinations of Pelouze and Cahours were *all* (like their first one) *made at zero*. Reference made since to their original memoir has enabled the writer to recompute the series correctly, as now given. The figures as they stand above have been submitted to a mathematician of high rank, who has applied the Calculus of Probabilities, and finds the chances of the truth of the new law of condensation in this case to be 479,000,000 to 1.

TABLE VIII.—*Warren's Beta Naphtha Series.*

Composition.	Temperatures.	Densities.	Authorities.	Volumic formulæ.	Computed densities for melting ice.	Differences of experimental from computed densities.
C_4H_{10}	0.°	.611	Warren.....	$^{2H}_{2}, ^{2Hm}_{26} \cdot ^{Hm}_{24} \cdot ^{Hm}_{4}$	.6061	.0029 +
C_5H_{12}	11.2° / 0.°	.6113 / .645	Frankland / Warren	$^{2H}_{25} \cdot ^{2Hm}_{26} \cdot ^{2Hm}_{25} \cdot ^{Hm}_{24}$	.6459	.0000
C_6H_{14}	0.°	.689	"	$^{2H}_{25} \cdot ^{2Hm}_{26} \cdot ^{2Hm}_{25} \cdot ^{2Hm}_{24}$	.6863	.0027 +
C_7H_{16}	0.°	.73	"	$^{2H}_{25} \cdot ^{2Hm}_{26} \cdot ^{2Hm}_{25} \cdot ^{2Hm}_{24} \cdot ^{Hm}_{23}$	.7275	.0025 +
C_8H_{18}	0.°	.752	"	$^{2H}_{25} \cdot ^{2Hm}_{26} \cdot ^{2Hm}_{25} \cdot ^{2Hm}_{24} \cdot ^{Hm}_{23}$	.7555	.0015 +

In consequence of the two facts that *zero* determinations of densities have been almost exclusively confined hitherto to *organic* compounds, and that among these also are by far the greater number of definite *liquid* compounds now known, it is necessarily among carbo-hydrogen compounds that *crucial tests* are chiefly to be found of the truth of the new law of molecular condensation. The above several organic series furnish good examples of these. Whenever we shall have, however, multitudes of careful zero-determinations of *inorganic* densities, we shall no doubt find among these correspondences quite as close and quite as great a degree of beauty and order.

Under WOOD SPIRIT some account is given of the application of these new discoveries to the alcohols, etc.; and the reader may also be referred again for a few other series to the article in the *American Chemist* for Mar., 1876. The present article must close with a statement of two more molecular laws, which the writer has endeavored to define, as generalized from these new classes of relations: (2) *The Law of Molecular Engymmetry.**—*A molecule added to a congeries, tends to assume a diameter already present, or a diameter next below or above one, or between two, already present; in such manner that the tendency is more and more toward the formation of a succession of proximate or consecutive diameters, becoming more regular as the compound molecule becomes more complex.* (3) *The Law of Molecular Crutesis.*†—*The tendency of an elemental or elementoid molecule to vary, according to the diametric ratios, in combining with other elemental or elementoid molecules, is in proportion to its degree of basicity, or electro-positive attitude, relative to the other elemental or elementoid molecules present.*

HENRY WURTZ.

Volumet'ric Anal'ysis, a branch of quantitative chemical analysis (see CHEMICAL ANALYSIS), in which the substance to be estimated is subjected to characteristic reactions, solutions of known strength being employed for this purpose, from the quantity of which required, the substance sought can be determined, by aid of the fixed laws of equivalence. Volumetric processes usually require less time and less elaborate apparatus for their execution than the ordinary methods by weight; and as they afford equally, if not more accurate results, they are particularly well adapted for technical purposes, such as the valuation of commercial products. Gay-Lussac, who first suggested this method of analysis, was impressed with the advantage of estimating silver by the use of a solution of common salt (sodium chloride); and this process will serve to illustrate one of the more simple applications of volumetric analysis. In the ordinary method of analysis a known weight of the substance containing silver is first dissolved in nitric acid; then hydrochloric acid is added, whereby insoluble argentic chloride is precipitated, which is separated from the fluid by filtration, washed, dried, fused, and weighed; and as the composition of argentic chloride is known, the amount of silver contained in the precipitate, and therefore in the original substance, can be easily calculated. It is evident that the same result can be obtained by preparing a solution of sodium chloride of known strength, and ascertaining the quantity of this necessary to precipitate the silver completely as chloride from the nitric acid solution. This is done by slowly adding the salt solution to the silver solution, until a point is reached at which the precipitate ceases to form. The process is now stopped, and the exact number of divisions (grains or cubic centimètres) of the salt solution used ascertained by observing the graduated vessel from which it was taken; and as we know that 58.5 parts by weight of sodium chloride are exactly sufficient to convert 108 parts by weight of silver into silver chloride, and the strength of the salt solution is also known, the weight of the precipitated silver can be readily determined. The operation just described can be completed in less than half an hour, while a silver determination by the method first referred to would require at least half a day; while in regard to accuracy of result the volumetric process is also more advantageous. The liquids used in methods of this character are termed "standard solutions." The quantity of these solutions used in a determination can be ascertained either by weighing or by measuring, but the latter is usually resorted to. In order that a reaction may be applicable in volumetric determinations, it must take place quickly, and give rise to some change by which its termination can be readily detected by the eye, such as the appearance or disappearance of a color, a precipitate beginning or ceasing to form, etc. For this reason the number of processes available is limited, although many reactions that are useless in analysis by weight furnish valuable means for volumetric estimations. The apparatus used consists of a good chemical balance and several varieties of graduated glass vessels for the preparation and measuring of the solutions, in the use of which the French or metrical system of weights and measures is most advantageously employed. The measuring apparatus embraces pipettes, flasks, and burettes. The *pipette* is simply a glass tube, having an enlarged body and a narrow stem, on which a mark is placed indicating its capacity. It is used by filling to the mark, and allowing the liquid to escape by a displacement of the finger from the upper end. The flasks used are graduated for the capacity of from $\frac{1}{10}$th litre to 5 litres. The *burette*, which is employed for the measurement of standard solutions, and usually has a capacity of 50 or 100 cubic centimètres, consists of a long glass tube of uniform calibre, having throughout its length equal divisions (cubic centimètres and fractional parts thereof). The burette of Mohr has at its lower end a caoutchouc tube, which can be opened or closed by means of a spring-clamp; but as the rubber is not entirely without influence on some of the solutions used, it is in many instances advantageously replaced by a glass stopcock. In consequence of the curved surface or *meniscus* of the liquid, it is difficult to obtain a distinct level in the fluid to be measured; the best plan is to have the lowest point of the meniscus coincide with the graduation, when the reading will be proportionally correct, or to employ Erdmann's float. The preparation of the standard solutions is best effected on the atomic plan—*i. e.* they are so prepared as to contain in each litre (1000 cubic centimètres) the whole or a fractional part of the atomic weight of the reagent employed, expressed in grammes. For instance, in preparing a standard or normal solution of the bivalent oxalic acid, the composition of which is $C_2O_4H_2 = 126$, one-half of its atomic weight, or 63 grammes, is dissolved in a litre of water; each cubic centimètre of this solution will contain $\frac{1}{2000}$th of the atomic weight of oxalic acid, and will exactly neutralize $\frac{1}{2000}$th of the atomic weight of an alkaline mono-carbonate, or $\frac{1}{1000}$th of the atomic weight of a caustic alkali. In the case of a substance like silver, it is more convenient to take $\frac{1}{10}$th of the atomic weight; that is, 10.8 grammes of silver are dissolved in nitric acid, and the solution is diluted to 1 litre; each c. c. of this liquid will then contain $\frac{1}{10000}$th of the atomic weight of silver (0.0108 gramme), and will precipitate $\frac{1}{10000}$th of the atomic weight of chlorine (0.00355 gramme) in the form of silver chloride. In the same way, normal solutions of the following acids and alkalies contain in a litre one-half or the whole of their atomic weight in grammes:

Sulphuric acid	49.	gr. per litre.
Hydrochloric acid	36.5	" " "
Sodic carbonate	53.	" " "
Sodic hydrate	40.	" " "

A great advantage of the above system is, that the solutions agree with each other, volume for volume; thus, 100 c. c. of any of the above acid solutions will exactly neutralize 100 c. c. of any one of the alkaline solutions. Its convenience will be readily perceived from the following illustration: Suppose it is necessary to determine the purity of a sample of soda-ash (impure sodic carbonate); if it were perfectly pure, 5.3 grammes would require 100 c. c. of one of the above normal acids for neutralization; and if this quantity is weighed out, dissolved in water, and the normal acid gradually added from a 100 c. c. burette until complete saturation takes place, the number of c. c. required will directly indicate the percentage of pure sodic carbonate present in the sample; thus, if 85 c. c. of the acid solution were necessary, the sample contained 85 per cent. of sodic

* *Engymmetry*, from ἐγγύς, "near," and μέτρον, "measure." This word is modelled, of course, after the word *symmetry*.

† From κράτησις, "rule," "sway," "mastery."

carbonate. It is, however, not always practicable to weigh out the substance composing the standard solution; in this case an approximately correct quantity is taken, and the exact strength of the solution determined by actual experiment. Besides the direct methods of volumetric analysis (which include those processes in which the substance is brought into direct contact with the standardized solution of a reagent which combines with or decomposes it, as in the estimations of alkalies by acids, silver by sodium chloride, iron by potassic permanganate, etc., and also those determinations in which the standard solution reacts upon the substance, causing the liberation of an equivalent quantity of a representative body, which is estimated instead of the substance itself—such as the valuation of manganese ores, in which, upon boiling the substance in hydrochloric acid, an amount of chlorine equivalent to the oxygen present is evolved and its quantity determined), *indirect* or *residual* processes are frequently employed, in which the amount of the substance to be analyzed is not directly estimated, but is calculated by using an excess of some agent of fixed strength, which decomposes or combines with it in a known proportion, and subsequently determining the excess used. Thus, if a weighed amount of an impure sample of calcic carbonate be dissolved in a known excess of nitric acid, it is possible, by determining the amount of pure acid remaining by titrating backward with a standard alkaline solution, to ascertain the proportion of pure calcic carbonate contained in the sample examined.

Having referred to the apparatus employed in, and some of the features of, volumetric analysis, it remains to mention more particularly a few of the processes most commonly used. These may be conveniently classified into analyses by saturation, by precipitation, and by oxidation or reduction, although this division fails to embrace all of the volumetric methods resorted to. *Analysis by saturation* includes the processes of alkalimetry and acidimetry.

Alkalimetry, or the determination of the amount of alkali contained in alkaline mixtures, such as the commercial products *potash* and *soda*, etc., by volumetric methods, is based upon the fact that the alkalies and their carbonates readily form neutral salts with the strong acids which do not affect the color of litmus; whereas the smallest excess of either the alkali or the acid imparts to it a blue or red coloration. Sulphuric, oxalic, or hydrochloric acid is usually employed in the preparation of the standard acid solutions, which are best made of the strength previously prescribed. In addition to the remarks already made concerning the determination of an alkali by means of a normal acid solution, a few details of the process should be added. A weighed quantity of the sample of alkali having been dissolved, the solution is distinctly colored blue by the addition of a few drops of solution of litmus. A burette is then filled to the zero-point with the standard acid, and this is allowed to flow into the solution until a red coloration begins to appear. Owing to the carbonic acid liberated, this will occur before all of the alkali is saturated, and it is necessary to boil the solution in order to remove this source of error, when the blue color will reappear. The acid is then cautiously added by drops, heat again applied, and a little more acid added, until a distinct pink-red color, which does not disappear on boiling, is produced. We now know that complete neutralization has taken place, and, as the strength of the acid solution is also known, the amount of real alkali contained in the sample is readily calculated from the number of cubic centimètres used. The inconvenience occasioned by the presence of carbonic acid in the above process can be avoided by adding more acid than is really required to neutralize the alkali, and then ascertaining the excess taken by means of a normal solution of caustic alkali, and deducting it from the amount of acid used. Caustic lime, baryta, and strontia, and their carbonates, can be estimated in the same manner, the standard acid employed being the hydrochloric.

Acidimetry can be accomplished by a method precisely the reverse of that used in alkalimetry, a normal alkaline liquid being added to the solution under examination until a blue color is imparted to the litmus. Caustic soda, either obtained directly in the pure state or prepared by the decomposition of sodic carbonate by means of lime, is usually employed as the normal alkaline solution; but a solution of 53 grms. of pure sodic carbonate in 1 litre of water is also often used. In special cases, as in the estimation of acetic acid (see VINEGAR), the salt formed does not possess a neutral reaction, and it is advisable to first prepare a solution of the acid of known strength, and then determine the quantity of the alkaline solution required to produce the change of color. The quantity of acid contained in numerous neutral salts, if the base is precipitated by an excess of caustic alkali or carbonate, can be estimated by first adding an excess of the standard alkaline solution, and then determining the excess used by titration with a normal acid; the amount of acid contained in many salts, the base of which is precipitated by sulphuretted hydrogen, can also be determined by titrating the filtrate from the precipitate with normal alkali.

Volumetric analysis *by precipitation* includes such determinations as that of silver, referred to in the beginning of this article. The end of reactions of this nature is frequently shown by the precipitate ceasing to form, but indications of greater precision and delicacy are often obtained by aid of a third body, with which a characteristic color is produced; thus, if in the estimation of chlorine or chlorides by a normal silver solution, a little potassic chromate be added, the completion of the process is indicated by the formation of an orange-yellow color, proceeding from argentic chromate produced by the first drop in excess of the silver solution, and in the precipitation of phosphoric acid by uranic nitrate or acetate, the end of the precipitation is indicated by a drop of the mixed solutions producing a brown color with yellow prussiate of potash. As bromine, iodine, and cyanogen likewise form insoluble precipitates with silver solutions, it is evident that they can be volumetrically determined in the same manner as chlorine. In the estimation of cyanogen, however, the process is often executed in the presence of an excess of alkali, and the standard solution added *until* a precipitate forms, as in this case argentic cyanide is not precipitated until all the cyanogen has formed a double salt with the alkali and silver. Mohr has suggested a method whereby alkalies, alkaline earths, or their carbonates, can be indirectly estimated through the precipitation of chlorine by silver, in which these bodies are first converted into chlorides, and the chlorine then determined by a standard silver solution. Owing to the fixed laws of chemical combination, the amount of chlorine found will be a measure of the base with which it was combined.

Analysis by *oxidation or reduction* comprises numerous volumetric methods, which give very accurate results, and have, to a great extent, replaced the older process by weight. In these, substances which readily take up oxygen are titrated with oxidizing agents of known power; or substances which give up oxygen are deoxidized by an excess of a reducing agent, the excess of which is afterward determined by residual titration with a standard oxidizing solution. The oxidizing bodies most employed are potassic permanganate and dichromate, and iodine; the reducing agents being sulphurous acid, sodic hyposulphite, arsenious anhydride, and oxalic acid. One of the most important estimations coming under this head is the volumetric determination of iron, which is based upon the fact that when a solution of potassic permanganate is added to an acid solution of a ferrous (protoxide) salt, the latter is oxidized to a ferric salt, the purple-red color of the permanganate solution being destroyed so long as any of the ferrous salt is present; but as soon as the oxidation is completed, the next additional drop of the solution imparts a distinct red coloration to the liquid. It is necessary first to reduce all iron contained in the substance examined to the ferrous state, which can be done by means of zinc and sulphuric acid. The strength or standard of the permanganate solution is also to be previously determined by reducing a known weight of pure iron to the ferrous state, and ascertaining the number of cubic centimètres of the solution required to oxidize it, the value of 1 c. c. being noted on the bottle in which the solution is preserved. It is then only necessary to multiply the number of c. c. employed in an analysis by the value, or oxidizing power, of 1 c. c., in order to ascertain the quantity of iron present in the substance taken. Potassic dichromate can also be employed as the oxidant, but in this case the termination of the process is not indicated in the liquid itself, but is shown by a drop of the mixture no longer producing a blue color when added to a solution of ferricyanide of potassium. Iodine often serves as an oxidizing agent by combining with the hydrogen of water to form hydriodic acid, while the oxygen liberated acts upon the oxidizable substances present, and, as the slightest excess of iodine imparts a blue color to starch, the reaction can be applied to the volumetric estimation of many bodies that readily take up oxygen, such as arsenious and sulphurous acids, etc. It is evident that these latter compounds can likewise be employed for the determination of free iodine. On the above reaction very accurate and important volumetric processes are based, such as the estimation of oxygen in peroxides, in which, however, an indirect method is employed. Many substances containing oxygen, when boiled with hydrochloric acid, liberate a quantity of chlorine corresponding to a part or all of the oxygen present. Upon conducting the chlorine so evolved into a solution of potassic iodide, an equivalent amount of iodine is set free, which can then be estimated by adding a solution of starch-paste and titrating with a solution of sodic hyposulphite of known

strength. The standard of the hyposulphite solution used is readily ascertained in the same manner by heating a *known quantity* of potassic dichromate with hydrochloric acid, conducting the evolved chlorine into a solution of potassic iodide, and estimating (in presence of starch) the number of cubic centimètres of the hyposulphite solution required to reduce the iodine set free; the termination of the reaction being indicated by the disappearance of the blue color of the iodide of starch. Processes similar to that just described receive frequent practical application in the valuation of numerous articles of commerce, such as manganese, bleaching-powder (see article on HYPOCHLOROUS ANHYDRIDE, by PROF. HENRY WURTZ), etc.

A method more curious than valuable, by which analytical determinations can be accomplished without the use of weights or standardized solutions, consists in taking a certain amount of the impure substance to be tested, balancing it with an equal weight of the pure substance, and submitting both to titration with a solution of unknown strength. It is easy to perceive that the impure substance will require for its decomposition a smaller quantity of the solution than the pure substance, and that the quantity required will be in proportion to its purity. The pure substance can, in some instances, be replaced by another of similar chemical activity (*e. g.* sodic carbonate by calcic carbonate, manganese dioxide by potassic dichromate, etc.). In addition to the examples cited above, volumetric processes, usually based upon the principles already mentioned, receive extensive application in the estimation of several metals (such as copper, zinc, tin, lead, and mercury) and numerous organic compounds (including sugar, tannic acid, alkaloids, the constituents of urine, water, wine, etc.). J. P. BATTERSHALL.

Vol'untary [Lat. *voluntarius*], in music. This term originally signified an extempore performance on the organ, usually before the opening or at the close of divine worship. In the pure voluntary the performer was unrestricted by any set form, rule, or style, but gave free scope to his imagination and to his skill in execution. In the present day the term "voluntary" is also applied to compositions of this class which are not extempore, but premeditated and carefully written. Large collections of them, composed by the best masters, have been published, and are extensively used under the names of organ-pieces, preludes, offertories, postludes, etc. WILLIAM STAUNTON.

Voluntary Conveyance, in law, denotes a deed of conveyance without the adequate consideration which the law deems valuable—that is, something upon which a pecuniary estimate can be placed. It is therefore a gift, and is frequently made to some near relative of the grantor, in which case the consideration is love and affection, which is regarded as "good," though not as "valuable." As such, it is entirely legal and valid as between the parties—except, of course, where obtained by fraud or undue influence—for the law permits gifts to be freely made so long as the creditors of the donor are not thereby defeated or delayed. The term voluntary conveyance is generally applied to such a deed of lands, but the same principles control all similar transfers of chattels and other forms of personal property. The peculiar legal interest connected with voluntary conveyances arises from their effect upon the rights of the creditors of the grantor or transferror, and all the modern law on that subject has practically originated from two statutes passed in the reign of Elizabeth and from subsequent legislation of the same import. The first (13 Eliz. ch. 5, 1570) enacted that every conveyance of lands, chattels, etc., made with intent to defraud creditors or others of their actions, debts, demands, etc., shall be deemed (only as against that person, his heirs, executors, administrators, or assigns, whose actions, debts, etc., are delayed or defrauded) void. The second (27 Eliz. ch. 4, § 2, 1584) enacted that every conveyance of lands made with intent to defraud any person who shall purchase the same shall be deemed (only as against that person, his heirs, etc.) void. These provisions include two distinct cases: (1) deeds and transfers, whatever may be their consideration, made with an intent, either express or which the law requires or permits to be inferred from all the circumstances, to defraud creditors or subsequent purchasers; (2) deeds and transfers made without a valuable and adequate consideration; and the question with regard to the latter class is, whether they are void or valid as against the creditors of the donor. Statutes designed to produce the same effect, and containing substantially the same provisions, but often with a greater amplitude and minuteness of detail, have been passed in all the States of the U. S. At a former time the rule was maintained by high authority that a conveyance made without consideration by a person indebted was absolutely void as against his then existing creditors, whose demands he should not otherwise have discharged. This is no longer the law. The doctrine is now settled, both in England and in a great majority of the States, that there must be an intent to defraud on the part of the grantor or transferror; that the existence of this intent is a question of fact; that the absence of an adequate valuable consideration, while it does not absolutely show the intent, raises a presumption that such fraudulent intent did in fact exist; and, finally, that this presumption is not conclusive, but is rebuttable, and circumstances may show that, notwithstanding the existing indebtedness and the absence of a valuable consideration, the conveyance was not made with intent to hinder, delay, or defraud the donor's creditors. To illustrate this doctrine: If the grantor at the time of executing a voluntary conveyance to his wife or children was somewhat indebted, but still retained in his hands other property amply sufficient to pay all his then existing debts in full, and those creditors delay in enforcing their demands until he becomes insolvent, and then attack the former deed on the ground that it was without consideration and fraudulent as against themselves, all these circumstances would be taken into account, and would show, or at least tend to show, the absence of any intent to defraud on his part. But if the conveyance by way of gift to his wife or children should have left the grantor without sufficient property to pay his then existing indebtedness, these circumstances would indicate the fraudulent intent condemned by the statute. That a conveyance may be void as against subsequent creditors of the grantor, an actual design to cheat them must be clearly shown by other evidence than the mere absence of a valuable consideration. The want of such consideration does not raise any presumption of fraud, although it may undoubtedly be a circumstance, in connection with other and more directly criminative proofs, from which the preconceived intent to defraud subsequent creditors may be inferred as a conclusion of fact. JOHN NORTON POMEROY.

Voluntaryism. See VOLUNTARY SYSTEM.

Voluntary System, in religion. We shall describe it as it appears both in theory and in practice. The theory, as its advocates contend, rests on Scripture, on history, and on considerations of social equity. They maintain that religion, even in the Old Testament, where it is enforced by divine law, presents a voluntary aspect as it respects obedience, willing submission to divine commands being essential to the performance of religious duty. And, turning to the New Testament, they find there that the whole movement of Christianity at the beginning was of the voluntary kind; that it had no state support and no state control; that it was left to its own spiritual power and the protection and blessing of Heaven; that appeal was made by the apostles to the willing hearts and hands of primitive believers; and that Christ's kingdom was declared by himself to be "not of this world," and therefore its being linked on to the secular government of a country, to be enriched and guided thereby, is entirely out of the question. Voluntaries also appeal to history, with the view of showing that Christianity was more truly (*i. e.* more spiritually) prosperous before it was endowed by the state than afterward; that Constantine's was a fatal gift; that the union between the Church and the Empire gave power to persecution; that now orthodoxy, and then heterodoxy, became established, and that each in turn oppressed the other through the enforcement of political laws; that during the Middle Ages the Church became miserably corrupted by its secular relations, and that some of the brightest spiritual lights of that long period are to be found amongst those who protested against the worldliness of the reigning religion, and promoted spiritual truth and life in voluntary ways. They assert that establishments in Europe have been instruments of persecution; that the use of the magistrate's sword in the service of religion has wounded conscience and cut many a good man to the heart; that the wealth of the Church, being in worldly hands, has been necessarily misapplied; that voluntary efforts have been repressed, and that the willinghood of nonconformists has not had fair play. It is further urged that a comprehensive Church supported by the state so as to become truly national is an impossibility, and that, therefore, every establishment is, and must be, more or less sectarian. It is the Church of a party, not of a united people, and hence the unendowed and unpatronized are placed on terms of inequality, and consequently suffer a social wrong. Men ought not to be taxed for the support of creeds and systems in which they do not believe, and all such taxation involves social injustice. It is the duty and the privilege of every Christian to give as the Lord has prospered him: he is a steward of the gifts of God, and is bound to act conscientiously, and all interference with him in this matter on the part of the civil power is unrighteous and impertinent. Civil society being mixed and changeful, the permanent support of par-

ticular religious bodies is a sort of prolonged usurpation, and inflicts an injury, and crosses the opinions, the prejudices, and passions of those unendowed, so as to foster discontent and division and strife. These and a number of other arguments, which we have not space to specify, are presented by voluntaries to the attention of their fellow-citizens with a great variety of illustration and with no little energy and zeal.

The voluntary principle was implied, if not distinctly asserted, in some of Wycliffe's writings; still more clearly by Leonard Busher, a London citizen and Baptist, in a tract published in 1614; but most of all, in his own day, by Roger Williams in his *Bloody Tenet of Persecution* (1644). Not that the voluntary support of religion was prominently maintained in these works, but phases of religious liberty were unfolded which lead to such a conclusion. The Quakers, too, were amongst the pioneers of voluntaryism, and so were all the men who during the Commonwealth asserted extreme views of individual independence of thought and action. The Puritans were not voluntaries in our sense of the word; the Presbyterians were not; many of the Independents and some of the Baptists were not, for they accepted livings and emoluments in the Establishment. The Pilgrim Fathers and the founders of Massachusetts did not avoid state complications. Such nonconformists as Watts and Doddridge based their nonconformity on other grounds than that of opposition to a legal establishment of religion.

The clear enunciation in England of the principle began about half a century ago, and has ever since been gaining ground. Pamphlets, lectures, and public meetings in favor of disestablishment have called public attention to the question, and some who do not care for it in its religious bearings have been drawn toward the cause by affinity to it on its political side. The Anti-State Church Association and the Liberation Society, conducted by earnest men, have been zealous in fighting this battle, and have appealed strongly for support to liberals throughout the kingdom. Of late the educational has become complicated with the voluntary controversy, and many oppose the combination of religious with secular instruction in schools supported by the nation on the same grounds as those adopted in opposing a national Church. Even the enforcement of observance of the Lord's Day as a day of rest has come to meet objections from the extreme wing of the army arrayed under the voluntary flag. The practice is to be distinguished from the theory. Nowhere is the practice exemplified as it is in America. Ever since the war of independence closed, and the U. S. became separated from England, religion has been left for its support to the willing offerings of Christian people. The establishments which once existed have disappeared. There is no established Congregationalism in New England, nor established Presbyterianism or Episcopalianism in New York or Virginia, or anywhere else. Magnificent churches, well-supported ministers, prosperous colleges, and religious societies of all descriptions attest the energy and power of voluntaryism. The ground was cleared for its unfettered action by the previous absence of wealthy endowments, dignified clerical positions, and any long interweaving of secular and spiritual interests, so as to create difficulties in the way of disentanglement.

The voluntary system has been at work in England by the side of the Establishment ever since nonconformity began. The practice preceded the theory. Before any definite ideas on the subject obtained, proscribed sects were, of necessity, thrown upon their internal resources. Tithes and church-rates were beyond their reach, had they wished for them. It is remarkable that practical voluntaries, in a small minority 200 years ago, have so multiplied and increased as now to vie with the endowed Church in activity and influence. The number of places of worship built, the number of ministers supported, and the number of colleges sustained by voluntary communities appear from recent statistics to be very large. Congregational churches in England alone amount to 1960, pastors to 1575, whilst there are 10 colleges for ministerial education. Methodists are far more numerous, and to these are to be added Baptists, Presbyterians, Roman Catholics, and other large bodies. In Wales also voluntaryism is putting forth energetic efforts.

The voluntary system in Scotland has been widely extended since the disruption of 1843. The Free Church, which exists all over Scotland, as well as the United Presbyterian and other unestablished religious bodies, is entirely dependent for support on contributions from members and friends.

Now that the Episcopal Church of Ireland has been disestablished, it is placed, except so far as old associations and distinctions linger around it, on the same footing as other communities, save that it is endowed with revenues arising from funds which were set apart for its support when it ceased to be, as it had been, the national Church. Presbyterian, Methodist, Congregational, and Baptist communities, not to mention others, are working side by side with it in voluntary endeavors, unaided, except in the case of certain Presbyterian ministers, by any reserve made for them out of the old national endowments.

And in estimating the voluntary principle in its practical working, account must be taken of what it does in established churches. In the churches of England, Wales, and Scotland there have been great voluntary exertions for church building and restorations, for the endowment of places of worship, and for the augmentation of poor livings. Whereas in London 50 new churches were built by act of Parliament after the fire of 1666, and 50 more were ordered in the reign of Queen Anne, and not more than 6 were reared under George III., the bishop of London fund in a few years has outstripped the previous operations of a whole century; and when the ecclesiastical commissioners challenged the Church, offering £150,000 to meet equal private benefactions, the result was the free subscription of £300,000 in a single year.

Turning to the colonies of Great Britain in Canada, Australia, New Zealand, and the Cape, not to mention others, we discover a large amount of free Church activity. There are 232 ministers in one colonial church section alone—the Congregationalist—and that by no means the most numerous. Then to all the foregoing indications of free-will effort in the cause of religion must be added the sum-total revenues of Bible, missionary, and other religious societies, Roman Catholic as well as Protestant, in Europe and America—indeed, in all the world. JOHN STOUGHTON.

Volunteers. See MILITIA, by COL. R. N. SCOTT.

Vol'untown, tp., Windham co., Conn. P. 1052.

Volu'sia, county of E. Florida, bordering on the Atlantic and bounded W. by St. John's River; surface level and often swampy. There are many cattle, but little other live-stock. Staples, Indian corn, sweet potatoes, and cotton. Cap. Enterprise. Area, 2196 sq. m. P. 1723.

Volu'tidæ [from *Voluta*, "volute," the generic name of the type], a family of gasteropod mollusks containing some of the most beautiful and esteemed of univalve shells. The animals have the normal gasteropod form: the mantle is often more than usually well developed; the siphonal extension is short and recurved (generally provided with auricle-like appendages at the base); the gills are normally developed; the head is large and proboscidiform; the tentacles mostly (in Volutinæ, etc.) far apart, and connected by a broad "veil" forming a hood over the head, sometimes (in *Volutomitra*) close together; the eyes sessile on the head, near the outer bases of the tentacles; the teeth of the lingual ribbon are in a single longitudinal row, but diversiform in the several groups; the foot is large or moderate; an operculum is sometimes developed, and sometimes wanting; the shell is convolute or turreted, with a linear or narrow aperture and an anterior notch, with the columella obliquely plaited anteriorly, and with an enlarged nucleus. Although the generally-recognized constituents of the family seem at first to be naturally associated in a group of the rank in question, on account of the similarity of the shell; they differ so decidedly in dentition as to render it doubtful whether the association is of the value assigned. (I.) Most of the species (Volutinæ) have broad teeth with three-lobed apices; of these, again, (1) some are ovoviviparous, and have a very large foot, closing over much of the shell in extension, and depositing a thin enamel-like layer over the under side of the shell, and the nucleus of the shell is large and irregular; such is the genus *Yetus*, or the "boat-shells" of some collectors, typifying the sub-family Yetina of Gray; (2) others are oviparous, and have a moderate foot, and the nucleus of the shell is moderate and spiral; these are the typical Volutinæ of Gray, and include the genera *Voluta*, *Lyria*, *Volutella*, etc. (II.) A few of the species (forming the sub-family Volutomitrinæ) have teeth with diverging bases and single acuminate apices; these differ much among themselves, (3) some (like the majority of the family) having the tentacles far apart, and connected by a veil as well as auricled siphons (genus *Scaphella* or *Amoria*), and (4) others having the tentacles close together and simple siphons (genus *Volutomitra*). The representatives of the family are mostly confined to the tropical seas, and there they attain the largest size and exhibit the most beautiful colors. A few, however, are found in the temperate and even cold seas; the most northern species is a small shell, the type of the genus *Volutomitra*, the *V. groenlandica* of authors. In time they have ranged from the Cretaceous period to the present, and in the Miocene epoch typical forms of the family extended much farther N. in both hemispheres than at present. The species are carnivorous. THEODORE GILL.

Volvulus, another name for the Iliac passion. See Ileus.

Vo'mer [Lat., a "ploughshare," from its shape in man], a bone of the face which in the human skeleton forms a part of the nasal septum. In transcendental anatomy it is considered the centrum of the first cephalic vertebra. It affords important characters in the classification of many fishes.

Vom'iting [Lat. *vomere*; see Indigestion]. Vomiting is a reflex contraction of the muscular coats of the stomach, ejecting its contents. It is an involuntary and spasmodic act, but when established may be aided by voluntary effort. The contraction of the stomach and vomiting may be the result of disease of the brain, of the pneumogastric nerve, of the walls of the stomach, of catarrh or inflammation of its mucous lining; it may be the result of indigestible food, bile or mucus in the cavity of the stomach, or a sympathetic reflex result of disease in other organs, as the uterus, ovaries, or liver. The vomiting of pregnancy and of uterine or ovarian disease, the peculiar morning nausea and vomiting of Bright's disease of the kidneys, bilious vomiting, vomiting of gastric catarrh, and the vomiting at the onset of acute fevers and eruptive diseases of children, and vomiting from surgical causes, as fracture at the base of the skull, concussion and inflammation of the brain, are to be distinguished, each from the other, in some instances, by peculiar features of the act of vomiting, but more often by observation of the associated symptoms. (See Stomach, Diseases of.) At the onset of vomiting the face may be deathly pale; the surface becomes cool and bathed with clammy sweat; the pulse small and feeble; and great prostration results. In some instances faintness occurs, or even fatal syncope. An occasional accident during vomiting is the impaction of solid food or artificial teeth in the larynx, causing suffocation. Robust persons, but little depressed by vomiting, become red in the face during the effort, and later are cool and slightly pale. The clothes should be loose when vomiting, fresh air in the room, water at hand for cold affusion to the face if needed. Stimulants may be needed to counteract collapse. Ice, carbonic acid water, creosote, oxalate of cerium, dilute hydrocyanic acid, are useful remedies to allay vomiting.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Von'del, van den (Joost), b. at Cologne Nov. 17, 1587; was educated in Amsterdam, whither his parents removed, being Anabaptists; the son, however, subsequently joined the Arminians, and finally the Roman Catholic Church. His education was very insufficient, but his poetical genius was of superior rank. He translated the Psalms, Virgil, and Ovid into Dutch verses, and wrote satires and tragedies. The most famous of the latter is *Gysbrecht van Aemstel*, which was first brought on the stage Jan. 3, 1638, and is performed every year on the same day. D. Feb. 5, 1679; a statue in his honor was raised in Amsterdam Oct. 18, 1867.

Voor'hees (Daniel W.), b. in Fountain co., Ind., Sept. 26, 1828; graduated at Indiana Asbury University 1849; was admitted to the bar 1851; was U. S. district attorney for Indiana 1858–61; defended John E. Cook for participation in the Harper's Ferry raid 1859; was a Democratic member of Congress 1861–65 and 1869–71. Qualified Nov. 12, 1877, to fill vacancy in U. S. Senate caused by the death of Oliver P. Morton of Indiana.

Vor'men, one of the principal rivers of Norway, rises under the name of Lougen in the Lessö-Verki-Vand, at an elevation of more than 2000 feet, flows through the narrow, wild, but beautiful Gudbrandsdale, forms the Lake of Mjösen, receives then the name of Vormen, and joins the Glommen. Lake Mjösen, about 80 miles long and 8 miles broad, and situated at an elevation of between 500 and 600 feet, is the scene of a very brisk traffic, four steamers traversing it daily in various directions.

Voronetz', government of Southern Russia, on both sides of the Don, comprises an area of 25,878 sq. m., with 2,152,696 inhabitants. The surface is an undulating plain, the soil very fertile, and the climate mild. Large crops of wheat, barley, oats, and tobacco are raised, and fine fruits, melons, and even vines, are cultivated with success. Cattle, sheep, and horses of good breeds are extensively reared. Corn, cattle, tallow, wool, fruit, skins, and horses are the principal articles of export.

Voronetz, town of Russia, capital of the government of Voronetz, on the Vorona near its influx in the Don, contains many fine buildings, among which are two cathedrals; it is the seat of many civil, ecclesiastical, and educational institutions. Its manufactures of tallow, soap, leather, and candles are quite extensive, and its trade brisk. P. 41,592.

Vö'rösmarty (Mihály), b. at Nyék, Hungary, Dec. 1, 1800; studied law in Pesth, but devoted himself subsequently entirely to literature, and wrote some of the finest epics—*Zalán futása* (1825), *Eger* (1827), and dramas, *Kong Salomon* (1821), *Csongor* (1826) of the Hungarian literature. Some of his minor poems also became very celebrated, as, for instance, the patriotic song, *Szózat* (1845). After the unfortunate issue of the Hungarian revolution of 1848–49, Vörösmarty retired broken-hearted to his country seat; pen and ink were not found in his house. Subsequently, he recovered his spirits, and began a translation of Shakspeare, but d. Nov. 9, 1856, before finishing it. A complete edition of his works was published by Paul Gyulai in 10 vols. (1865–66).

Vor'stius (Conrad), b. in Cologne July 19, 1569; studied theology at Heidelberg; lectured in Geneva, and was in 1596 appointed professor of divinity at the gymnasium of Steinfurt. Meanwhile, his treatises, *De Prædestinatione*, *De Sancta Trinitate*, and *De Persona et Officio Christi*, made him suspected of Socinianism, and he was compelled in 1599 to go to Heidelberg and vindicate his orthodoxy. He was acquitted, and in 1610 he succeeded Arminius as professor of theology at Leyden, but here his treatise *De Deo* was attacked most violently by the Gomarists. James I. of England became interested in the case; *De Deo* was burnt by the hangman in London and Oxford; Vorstius was deposed in 1612, and solemnly condemned as a heretic by the Synod of Dort in 1619. He fled from Holland, and lived concealed until 1622, when the duke of Holstein offered the Arminians an asylum, but Vorstius d. shortly after at Tönningen, Sleswick, Sept. 29, 1622.

Vos, de (Martin), b. at Antwerp in 1530; studied painting in his native city under Francis Floris, and in Venice under Tintoretto; formed a school in Antwerp, and d. there in 1603. His best pictures, among which are *The Triumph of Christ*, *Cæsar's Penny*, *St. Luke painting the Portrait of the Virgin*, etc., are in the museum of Antwerp.

Vosges, department of Eastern France, comprises an area of 2266 sq. m., with 392,988 inhabitants. The eastern portion of the department is occupied by the Vosges Mountains, which are partly covered with forests of oak, beech, and fir, and partly afford excellent pastures, where large quantities of cheese of superior quality are produced. In the western portion, the Plaine, wheat, wine, and fruits, are extensively raised. Iron, copper, and silver are mined, and marble is quarried. Education is better cared for here than in any other department of France; of 52,152 children of school age, only 1103 received no school education in 1857.

Vosges Mountains, a range of mountains on the left bank of the Rhine, situated partly in North-eastern France, partly in South-western Germany, and running parallel with the Schwartzwald (or Black Forest) Mountains in Baden, which they resemble very much, not only in direction, but also in form and geological structure. By the depression between Montbéliard and Mühlhausen they are sharply separated from the Jura Mountains, and their eastern slopes toward the plain of the Rhine are steep and abrupt. But to the N. they connect with the Hardt in Rhenish Bavaria, and to the S. W. by the plateau of Langres through the hills of Faucilles. They are generally rounded and of a regular shape, whence they are called *ballons*, covered with forests of oak, beech, and fir on the sides, and affording excellent pastures on their tops during the six months of the year in which they have no snow. Their highest peaks rise between 4000 and 5000 feet. Ballon de Guebwiller, the highest peak, reaches 4700 feet; Ballon d'Alsace and Ballon de Servance are not much lower. Mineral and thermal springs are numerous, and copper, iron, lead, and rock-salt abound. The Meurthe, Moselle, Saar, Ill, and Ognon descend from them.

Vös'lau, village of Lower Austria, has a palace with a beautiful park, a warm sulphur spring much used for bathing, and numerous elegant villas. The place is most famous, however, for its wine, the so-called *Vöslauer-Wein*, one of the finest wines of Austria, produced from a vine transplanted hither from Burgundy.

Voss (Johann Heinrich), b. at Sommersdorf, Mecklenburg, Feb. 20, 1751; had to struggle with many difficulties in order to finish his education, but was nevertheless possessed of comprehensive knowledge in classical and modern languages and literatures, and had formed valuable connections with many of the more prominent men in the German literature, when in 1778 he was appointed rector of the gymnasium at Ottendorf in Hanover. In 1782 he removed to Eutin, near Lubeck, as rector of the gymnasium there. From 1802 to 1805 he resided in Jena, where he enjoyed a pension from the grand duke of Saxe Weimar. In 1805 he accepted a chair in classical literature at the University of Heidelberg, and here he d. Mar. 29, 1826.

He had an uncommon mastership of the German language and a fine sense for the formal correctness of verses. His translation of Homer (4 vols., 1793) is fluent and elegant, and exercised considerable influence. His translation of Virgil's *Eclogæ* and *Georgica*, of Ovid's *Metamorphoses*, of Hesiod, Theocritus, Bion, Moschus, etc., were also much appreciated. But his power of imagination and emotion was not great. His translation of Shakspeare, finished by his son (9 vols., 1818–29), is unimpressive, and so are his own poems, collected in 4 vols. (1825), though one of them, the idyl *Luise*, became very popular. His critical works show the same character—his attack on Heyne, his polemics against Creuzer, *Mythologische Briefe* (2 vols., 1794), *Antisymbolik* (2 vols., 1824–26), etc. They are clear, and rest on solid knowledge, but they lack elevation and are singularly unsuggestive. A striking picture of the man's noble and open but somewhat circumscribed character is given in his *Wie ward Fritz Stolberg ein Unfreier* (1819), which he wrote when his friend Friedrich Stolberg was converted to Roman Catholicism. His letters were published by his son in 3 vols. (1829–33).

Vos'sius (Gerard Johannes), b. near Heidelberg in 1577 of Dutch descent; studied classical languages and literatures at Leyden and Dort, and was appointed professor of rhetoric at Leyden in 1618, but became entangled in the controversies between the Arminians and Gomarists by his *Historiæ Pelagianæ Libri IV.* (1618), and was for many years prohibited from teaching, though he was acknowledged to be one of the finest scholars of his age. Through Archbishop Laud he received a prebend in the cathedral of Canterbury, and in 1629 went to England, and was installed, but in 1633 returned to Holland, and was made professor of history at the College of Amsterdam, where he d. Mar. 17, 1649. The most remarkable of his works are—*Aristarchus sive de Arte Grammatica* (1635), *Etymologicum Linguæ Latinæ* (1662), *Commentariorum Rhetoricorum sive Oratoriarum Institutionum Libri VI.* (1606), *Ars Rhetorica* (1623), *De Historicis Græcis Libri IV.* (1624), *De Historicis Latinis Libri III.* (1627), etc. His complete works appeared at Amsterdam in 6 vols. (1695–1701). His letters were published in two collections (London, 1690, and Augsburg, 1691).—His six sons were all prominent men, but only the youngest, Isaac Vossius, survived him. He was born at Leyden in 1618, and received the instruction of his father. In 1648 he went to Stockholm on the invitation of Queen Christina, but fell out with Salmasius, and returned to Holland in 1658. In 1670 he removed to England, was made canon of Windsor in 1673 by Charles II., and d. there Feb. 21, 1689. His principal works are—*De Septuaginta Interpretibus eorumque Translatione et Chronologia* (1661), *De Poematum Cantu et Viribus Rhythmi* (1673), *Variarum Observationum Liber* (1685).

Vote [Lat. *votum*]. This term, both in the private and in the public law, denotes a suffrage—a statement of a choice by each individual among many having a like power, given and counted in order to express and obtain an opinion and decision upon some pending question in which all are interested, or to make a selection of a person for some representative or official position. Although "voting" and "votes" are frequently used in matters connected with the private law—as, for example, by the stockholders and directors of corporations—the terms are most frequently and significantly employed to describe the means and instruments by which many officials are chosen at public elections and measures are passed in legislative bodies. In England the voting for members of the House of Commons was for a long time *viva voce*. Each voter came up to the polling-place or booth, and cast his vote by naming aloud the candidate or candidates of his choice; and the names thus announced were immediately registered in the polling-book. This method was long upheld as being peculiarly in harmony with the English character, but it plainly subjected the lower classes, and especially the tenantry, to an enormous political pressure from their superiors and landlords. Parliament finally abolished the whole system, and introduced the ballot by the recent statute of 35 and 36 Vict. ch. 33, § 2 (1872), which goes to the very opposite extreme, and prescribes very minute and careful provisions for rendering the votes absolutely secret. At an early day after the adoption of the U. S. Constitution the *viva voce* vote existed in a few of the States, but the ballot has long been established as a part of the American system, and now prevails in all elections, national, State, and municipal. While the statutes always require that the ballots shall be deposited unopened in the box by an inspector of the election, and often that they shall be printed upon plain white paper without any external marks except the name or title of the offices, no further safeguards are generally furnished for preserving the absolute secrecy which is obtained by the English statute. In one or two States, however, the law has permitted the vote to be enclosed in an envelope. Another common and important species of vote is that used for the determination of questions—and especially for the passage of bills—in legislative assemblies. In the British House of Commons, in the U. S. Congress, and in all the State legislatures the votes must be given by the members personally while present at a session, but in the British House of Lords votes by proxy are permitted. There are three forms of the legislative vote—by a rising and count, by a collective and simultaneous utterance of the *ay* or *no*, and by a call of the roll, each member responding "ay" or "no" when called, so that his name and response may be entered on the records. The American constitutions, statutes, and parliamentary rules contain special provisions by which the latter form may or must be resorted to in the decision of certain classes of questions, and especially in the final passage of bills. Stockholders of corporations are generally permitted to vote by proxy in the election of trustees or directors and in the determination of other matters left to them by the charters. (See also Proportional Representation.) John Norton Pomeroy.

Vouch'er [Law Fr. *vocher*; Lat. *vocatio*, "calling"]. (1) In the ancient common law the term denoted a peculiar proceeding in an action brought to recover land, whereby the defendant "vouched" or summoned his own grantor or lessor, who had warranted the title, to appear and defend his title against the attacks of the plaintiff. The defendant thus calling in his predecessor to defend the suit was also named the "voucher," while the party summoned was styled the "vouchee." This special process and the names belonging to it have been abrogated by the modern amendments made in the system of legal procedure. (2) The term also denotes—and this is now its ordinary signification—any written memorandum, receipt, discharge, or evidence of the payment of money, and also the books of account in which are entered such payments and receipts, used in actions or other proceedings for the judicial settlement of accounts. Every writing showing the payment of money by the person whose accounts are investigated, and which thereby strengthens or even supplies the place of the oral testimony, is a voucher.
John Norton Pomeroy.

Vouet' (Simon), b. in Paris Jan. 9, 1590; studied painting under his father, and afterward in Italy, where he formed his style principally after Paul Veronese and Caravaggio; acquired a great reputation, and was made president of the Academy of St. Luke at Rome in 1624; returned to Paris in 1627; received a pension from Louis XIII. and rooms in the Louvre, and d. there June 30, 1649. He is largely represented in the gallery of the Louvre, where, among others of his works, the celebrated *Presentation in the Temple* is found. Among his pupils were Eustache le Sueur, Pierre Mignard, and Charles Lebrun.

Vourla, or Urghula, town of Asia Minor, on the southern shore of the Gulf of Smyrna, occupies two hills, of which one is inhabited by the Turks, the other by the Greeks. The excellent harbor is formed by a row of islands in front of it, and is generally the station of the European men-of-war which visit Smyrna. The site of the city was in ancient times occupied by Clazomenæ, and the causeway which was built from the mainland to one of the islands when, on the approach of Alexander the Great, the city was removed to this island, is still extant. Between Vourla and Smyrna are numerous warm springs which are much used for bathing.

Vow'el, a vocal element composed of uninterrupted voice, varied by modifications chiefly of the mouth and pharynx. The ordinary *pure* vowels may be made *nasal*, of which examples exist in French, Portuguese, and Polish; they may be *whispered*, as in some of the North American languages; they occur *independent* (of expiration, inspiration, and voice), being vowel-effects succeeding a click; and they are *glottal* when a vowel is accompanied by a scraping effect at the glottis, as in the Hebrew and Arabic *ain*. (See Haldeman, *Analytic Orthography*, 1860, p. 38.) The final element of diphthongs is usually accounted a vowel, but improperly, because two vowels must form two syllables. The final of a diphthong is a *way*-sound (as in *now*, *round*), or a *yay*-sound (as as *boy*, *aisle*), with less closure of the organs than these liquid consonants require, but more than the vowels of *ooze* and *eel*, forming intermediate *coalescents*, while they remain true consonants. In a succession like *by-you* or *bâyou*, the coalescent of *by* glides into the consonant of *you*. S. S. Haldeman.

Voy'sey (Charles), b. in London, England, Mar. 18, 1828; educated at Stockwell Grammar School; graduated at St. Edmund's Hall, Oxford, 1851; took orders in the Church of England; was curate of Hessle, near Hull, 1852–59, of Cruigton, Jamaica, 1860–61; became incumbent of

St. Mark's, Whitechapel, London, 1861; was ejected in consequence of having preached a sermon against the doctrine of endless punishment; held for a short time the curacy of Victoria Dock parish, London, and became vicar of Healaugh, Yorkshire, 1861. He began in 1865 the publication of *The Sling and the Stone* in monthly parts, each consisting of two sermons, and continued the series until 1871. In consequence of these sermons containing sundry opinions upon the doctrines of atonement, justification, incarnation, and inspiration which were held to be inconsistent with the Thirty-nine Articles, Mr. Voysey was prosecuted in the chancery court of York minster by the secretary of the archbishop of York. Decision having been pronounced against him Dec. 1, 1869, he appealed to the judicial committee of the privy council, which confirmed the decision and sentenced the appellant to be deprived of his living and to pay the costs (Feb. 11, 1871), giving him, however, a week in which to retract his opinions. Since that date Mr. Voysey has preached and lectured upon his own responsibility in St. George's Hall, London, being supported by the "Voysey Establishment Fund," to which there were numerous and wealthy subscribers. His sermons, which are increasingly "heretical" in their tone, have been regularly printed every week in the *Eastern Post*. He has published some controversial pamphlets, and conducted for a few months in 1876 the *Langham Magazine*, an organ of free religious thought which had but a brief existence.

Vra'na, village of Dalmatia, formerly a strongly-fortified place belonging to the Knights of St. John, is on the shore of the Lake of Vrana, famous for its rich eel fisheries.

Vukovar', town of Austria, in Slavonia, at the influx of the Vuko in the Danube, has 6782 inhabitants, mostly engaged in silk-culture and silk manufactures.

Vul'can [Lat. *Vulcanus*], a planet supposed to be revolving around the sun, within the orbit of Mercury. About twenty years ago, Leverrier announced that certain perturbations in the orbit of Mercury could only be accounted for by the existence of another planet still nearer the sun, even as the perturbations of Saturn had enabled him to discover the planet Neptune. Within three years after Leverrier's announcement, Dr. Lescarbault detected the supposed planet in its transit across the sun's disk, but it has not been seen since. At the observatory in Paris, MM. Porro and Wolf of Zurich believe they found the stray planet during its transit in 1876. It is not known whether their observations are sufficient for the precise calculation of the elements of the planet. Kepler's law, however, would reduce the time of its revolution around the sun to about a month. It was not discovered during the watching for its transit in Oct., 1876.

Vulcan, in Roman mythology, the god of fire and of those arts which depend on the use of fire, became in course of time completely identified with the Greek Hephæstus, and was, like him, imagined to have his earthly abodes, his workshops, in the volcanoes, where he was served by the Cyclops. Numberless myths were formed in connection with Hephæstus and transferred to Vulcan, but most of them were of a humorous turn. He was a son of Zeus and Hera; but he was born lame, and so weak and feeble that Hera, disgusted with him, dropped him from Olympus. But Thetis caught him when falling, and brought him to a grotto, where he lived for nine years, kindly attended to by the Oceanides. During this period he made a magnificent throne-chair of gold, but so constructed that any person who sat down on it was held fast, and could not get free unless liberated by the workman himself. The chair was sent to Olympus; Hera sat down on it, and was entrapped. At first, all the summons of Zeus and all the supplications of Hera and the other gods were fruitless; the mother sat chained in Olympus, and the son lay laughing in his grotto. But finally a stratagem succeeded. Dionysus went to the grotto, and soon Hephæstus became tipsy. Crowning himself with flowers and wreaths, the lame and homely man joined the wild chorus of the satyrs, and without noticing what was going on he came dancing into Olympus, where the laughing gods took him captive and coaxed him to release Hera. He was married to Aphrodite, but his marriage was not altogether without troubles. (See *Od.*, viii. 266–358.) He was nevertheless fervently worshipped both in Athens and Rome, and festivals to his honor, the *Hephæstia* in Athens and the *Volcanalia* in Rome, were celebrated with great splendor.

Vulcanite and **Vulcanization.** See INDIA-RUBBER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Vulca'no, or **Volcano,** the southernmost of the Lipari or Æolian Islands, in the Mediterranean Sea, in lat. 38° 22′ N., lon. 14° 55′ E., 12 miles off the northern coast of Sicily, is 7 miles long and 3 miles broad, and contains nearly in the centre a crater over 1200 feet high and about one-fourth of a mile in circumference, which constantly emits smoke and vapors charged with sulphur, ammonia, vitriol, and alum. The southern part of the island is very fertile, and produces excellent corn, grapes, fruit, and flax. The interior is sterile, and on the northern side the island is connected by a row of low rocks with the Vulcanello, a minor crater, likewise emitting smoke and vapors.

Vul'gate, The. Latin translations of the Bible. The Latin is one of the three oldest versions of the Old Testament, the Greek, the Syriac, and the Latin, and one of the two oldest of the New Testament, the Syriac and the Latin. The history of its origin is lost, but it is certain that it was made in Africa, and in the second century. It would naturally be assumed that it was made in Rome, but at that period the Church in Rome was essentially Greek, the Roman bishops bore Greek names, the earliest Roman liturgy was Greek, and the few remains of Roman Christian literature are Greek. The same statements hold true of Gaul. The Church in Africa, however, seems to have spoken Latin from the first. At what exact time this Church was founded we know not, but at the close of the second century Christians were found there in all places and in every rank. Tertullian of Carthage, the first of the Latin Fathers, directly cites or alludes to every part of the New Testament which we now have, except the second and third Epistles of St. John, the second of St. Peter, and St. James. This version, the *Vetus Latina*, or *Old Latin*, was preserved generally unchanged in Northern Africa, but when introduced into cultured Italy its provincial rudeness would offend, and the familiarity of the leading bishops there with Greek would make the revision, so likely to take place, easy of accomplishment. Hence, in the fourth century a revision of the Gospels seems to have been made in Northern Italy, and to have been distinguished by the name *Itala, Italian*. This version St. Augustine recommends for its accuracy and perspicuity (*De Doctr. Christ.*, 15), and the text of the Gospels as quoted by him, on occasion, in his works bears out his representation; but in the other books the difference cannot be traced with exactness. The Latin version of the New Testament appears to have arisen from individual and successive efforts: for St. Augustine says that any one in the first ages of Christianity who gained possession of a Greek MS., and thought he had a fair knowledge of Greek and Latin, ventured to translate it. And as the LXX. about B. C. 250 furnished the mould in which the thoughts and expressions of the Greek Testament are cast, so the LXX. may have taken a Latin form for the Latin-speaking Jews, and thus may have made ready a dialect for the Latin version of the New Testament. But, however this may have been, there is found, in fact, a substantial similarity between the character of the Old Testament and the New Testament in Latin, and this justifies the belief that there was one Latin version of the Bible current in Africa in the last quarter of the second century.

The name Vulgate—that is *Vulgata editio*, the current text of Holy Scripture—originally answered to the designation of the Greek version of the Old Testament, the κοινὴ ἔκδοσις. As the *vetus versio* of the Old Testament was made from the LXX., and in substance identified with it, St. Jerome introduces Latin quotations from the Old Testament under the name of LXX. or *Vulgata editio* indifferently, and thus this term was transferred from the current Greek to the current Latin of the Old Testament. This use of the expression *Vulgata editio* continued to later times. It is found in St. Augustine, Ado of Vienne, and in Roger Bacon, and it is recognized even by Bellarmin. The Council of Trent, therefore, historically erred in styling St. Jerome's Bible *Vulgata editio*. The Latin Fathers themselves commonly spoke of St. Jerome's version as *nostra versio*, "our version," or *nostri codices*, "our books;" but the Tridentine prelates, like many later scholars, were misled by the associations of their own period, and gave this designation a wider range than it ever had in early times.

After the translation received a definite shape in Africa, it was jealously guarded by ecclesiastical use, and was retained there even when St. Jerome's version was almost universally received elsewhere; and the disturbance caused by an African bishop's attempt to introduce one of the changes of St. Jerome shows how carefully intentional alterations were avoided. But at the same time the text suffered by the natural corruptions of copying and by the interpolation of glosses, especially in the Gospels, and thus the different forms of the text became almost as numerous as the copies. The one remedy for this confusion was to go back to the first form in Greek.

St. Jerome had not long been in Rome (A. D. 383), when Pope Damasus consulted him on points of scriptural criticism. The answers the pope received may well have encouraged him to seek for greater services, and, apparently

in the same year, he applied to St. Jerome for a revision of the current Latin version of the New Testament by means of the Greek original. St. Jerome undertook it, and confined himself strictly to the labors of a reviser, and therefore when St. Augustine spoke of him as *translating the Gospel*, St. Jerome corrected him, saying that he had simply *emended it*. In the prosecution of his work he collated early Greek MSS. and introduced the necessary changes, but he preserved the old renderings where the sense was not injured by it. Some of his alterations were made purely on linguistic grounds, but it is impossible to ascertain on what rules he proceeded; others involved questions of interpretation; the greater number, however, consisted in the removal of the interpolations by which the first three Gospels especially were corrupted. These interpolations must have been far more numerous than are found in existing copies, but instances still occur to show the service he rendered in checking the perpetuation of apocryphal glosses and additions.

St. Jerome's Preface, addressed to Damasus, speaks only of a revision of *the Gospels*: and St. Augustine, writing to St. Jerome, alludes to *the Gospel*, and there is no preface to any other book such as is elsewhere found before St. Jerome's versions or editions. But this omission is probably due to the fact that the rest of the New Testament was preserved comparatively pure. For St. Jerome enumerates among his works his *Restoration of the New Testament to Harmony with the Greek*, using this general expression, and in writing to Marcella on the charges brought against him for introducing changes in the Gospels, he quotes three passages from the Epistles to show the superiority of his revision over the old version.

The old version of the Old Testament was made from the unrevised form of the LXX., and thus included many false readings and other imperfections. Therefore, about the same period in which St. Jerome revised the New Testament he put his hand to the Old Testament. He first undertook and accomplished a revision of the Psalter. This was done with the aid of the LXX., but not very thoroughly. It was called the *Roman Psalter*, probably because made for the use of the Church in Rome at the request of Damasus. Afterwards, urged by Paula and Eustochium, he made a new and more careful version, which became very popular, and which Gregory of Tours is said to have introduced into France, hence called the *Gallican Psalter*. From this work he proceeded to a revision of the rest of the Old Testament by means of the LXX., which he appears to have completed in four or five years. About the year 374 he began the study of Hebrew, which he zealously pursued for some years, and about 389 published several treatises connected with this study. These paved the way for his new version of the Old Testament direct from the Hebrew, which he now undertook and in 392 seems to have completed. Portions of this, as the books of Solomon, Judith, and Tobit, were done in great haste, but the greater part was accomplished successfully. This stupendous work is an enduring monument of his piety, his genius, and his learning, and has made his name as illustrious in the Western as the great Hexapla made the name of Origen in the Eastern Church.

The critical labors of St. Jerome were received with an outburst of reproach. He was accused, as other such laborers have been, of disturbing the peace of the Church and of undermining the foundations of the ancient faith. Acknowledged errors were looked upon as hallowed by usage, and few had either interest or courage to seek the purest text of Holy Scripture. Even St. Augustine was carried away by popular prejudice and endeavored to discourage St. Jerome from his presumptuous work, as it appeared to him; and to the last he himself adhered, as we have noticed above, to the *Versio Itala*, which he had first employed. But the improved translation gradually came into use side by side with the old, and at length supplanted it; and this it did without any direct ecclesiastical authority.

But the Latin Bible, which thus became current under the name of St. Jerome, was a composite work, containing elements that belonged to every period and form of the Latin version: (1) *Unrevised Old Latin*, Wisdom, Ecclus., 1 and 2 Maccabees, and Baruch; (2) *Old Latin revised from the LXX.*, the Psalter; (3) *St. Jerome's Translation from the original Greek*, Judith, Tobit; (4) *St. Jerome's translation from the original Hebrew*, the Old Testament except the Psalter; (5) *Old Latin revised from the Greek original*, the Gospels; (6) *Old Latin thus revised cursorily*, the rest of the New Testament.

The MS. remains of the *Old Latin text* of the Old Testament are very scanty. There still exist important MSS. of the New Testament: of the *African text*, *Codex Vercellensis*, at Vercelli, of the fourth century; *Cod. Claromontanus*, in the Vatican, of the fourth or fifth century; *Cod. Bobbiensis*, at Turin, of the fifth century, a remarkable revision of this text; of the *Italic text*, *Cod. Brixianus*, of the sixth century. Of *St. Jerome's text* we have *Cod. Amiatinus*, at Florence, of the sixth century; *Cod. Toletanus*, at Toledo, in Gothic letter, of about the eighth century; and *Cod. Fuldensis*, containing the New Testament merely.

At the invention of the art of printing, St. Jerome's Bible was the first book produced from movable types, about 1455. It was printed again and again by various hands and in various forms, but it was not until the heat of controversy in the sixteenth century exaggerated the differences in the text and in the interpretation that an authorized edition was determined on for the Church of Rome. This was undertaken by Pope Sixtus Quintus, and put forth in 1590. Though declared by the pontiff *authentical and in a manner absolutely perfect*, it contained such typographical and other errors as to compel the publication of a second and revised edition in 1592, of another in 1593, and still another in 1598, with a triple list of *errata*, one for each of the preceding editions. This is the standard of the *Vulgate*, or Roman Catholic Bible, of the present day.

The MS. form of St. Jerome's Bible—which, upon the whole, stands highest in the estimation of scholars—is the *Codex Amiatinus*, mentioned above. The editors employed by Pope Sixtus rightly valued this MS., and in some passages solely or chiefly followed its authority. The portion containing the New Testament has been repeatedly published, and is easily accessible, as ed. by Fleck (1840, 12mo), common text with the Amiatine variations; by Tischendorf (1854, roy. 8vo), Amiatine text with learned prolegomena.

We subjoin a specimen of the diction of the Vulgate, under different heads, extending over the first six or ten chapters of St. Matthew, employing the Greek and the Latin text of Prof. Tischendorf in his *N. T. Triglottum*, published in 1854: (1) *It preserves the exact order of the original in very many instances*. At the opening of the Gospel we find, *Liber generationis Jesu Christi filii David, filii Abraham. Abraham genuit Isaac, Isaac autem genuit Jacob*. This follows the Greek word by word: Βίβλος γενέσεως Ἰησοῦ Χριστοῦ υἱοῦ Δαυὶδ υἱοῦ Ἀβραάμ. Ἀβραὰμ ἐγέννησεν τὸν Ἰσαάκ, Ισαὰκ δὲ ἐγέννησεν τὸν Ἰακώβ. So in clauses and phrases: vi. 6, Σὺ δὲ ὅταν προσεύχῃ, *Tu autem cum orabis*; iv. 22, οἱ δέ, *illi autem*. The advantage of following the order of the Greek sometimes appears conspicuously, as in iv. 10, *Dominum Deum tuum adorabis et illi soli servies*—an order preserved in English only by the Rheims version, and far more forcible than the common order. In iii. 1. Ἐν δὲ ταῖς ἡμέραις ἐκείναις is given by *In diebus autem illis*: here (*a*) the postpositive particle *autem* stands for the postpositive δέ, but the Vulgate, faithful to Latin usage, puts it after the noun, not after the preposition, as in the Greek; and (*b*) the demonstrative follows its noun like the Greek; now, common as this order is in Greek, it is comparatively rare in Latin, though found in the best writers (Cicero, Livy). In τὸ σκότος πόσον, vi. 23, we find the interrogative (exclamatory) after its noun, and this position adopted by the Latin, *tenebræ quantæ erunt!* This secondary position of an interrogative is rather uncommon, but found both in prose and poetry (Cic., *Ad Fam.*, xvi. 18; Cæs., *B. G.*, vii. 4; Hor., *Sat.*, i. 5, 43). But we meet here and there with a departure from the arrangement of the Greek without apparent reason: in i. 12, Μετὰ δὲ τὴν μετοικεσίαν is given by *Et post transmigrationem*, instead of *Post transmigrationem autem*; and in ii. 5 and iv. 20, οἱ δέ is given by *At illi*, instead of *Illi autem*; and this is the more strange, as the stricter form is common in the Vulgate.

(2) *Many of its renderings are peculiarly exact in sense or form, or both, in reference to the Greek*. In i. 11, ἐπὶ τῆς μετοικεσίας Βαβυλῶνος, is given by *in transmigratione Babylonis*, which, though unclassical, as we shall presently see, preserves the euphemism of the Greek Testament and of the LXX. for "captivity," and of all our versions, Wycliffe and the Rheims alone have retained it. In ii. 19, Τελευτήσαντος δὲ τοῦ Ἡρώδου, the gen. abs. is exactly given by the abl. abs., *Defuncto autem Herode*, and so in vi. 3. In iii. 2, Μετανοεῖτε is given by *Pœnitentiam agite*, and this Latin was rendered by Wycliffe "Do penance," which the Rheims followed; but, though this English phrase has now, even to the Roman communion, come to mean rather mortification of the body than sorrow of mind, yet the Latin is a good classical equivalent of the Greek, and is actually found in Petronius, *Sat.*, 132, in Tacitus, *De Orat.*, 15, in Pliny, *Ep.*, vii. 10, and has the express sanction of Quintilian in a critical observation in ix. 3, 12. In iii. 9, μὴ δόξητε is given in form by *ne velitis*, and so in v. 42; vi. 13; vi. 25, while, as we shall see below, the freer and quite classic *noli* and *nolite* with the inf. prevails in the Vulgate. In iii. 15, Ἄφες ἄρτι is ingeniously rendered by *Sine modo*, and in iv.

17, Ἀπὸ τότε by *Exinde* (Plaut., Cic., Verg.), and vi. 25, Διὰ τοῦτο by *Ideo*. In iv. 16, ὁ λαὸς ὁ καθήμενος is nicely given by *qui sedebat*, "who were sitting," and viii. 21, ὥστε τὸ πλοῖον καλύπτεσθαι by *ita ut navicula operiretur*, "was being covered," while the A. V. has "sat," and "was covered." In viii. 16, δαιμονιζομένους is rightly rendered *daemonia habentes*, "possessed with demons," while all our versions have here "devils," as if it were the plural of ὁ Διάβολος, "the devil;" but the plural in this sense nowhere occurs in Holy Scripture; and though "devils" is found also four times in our version of the Old Testament, the Vulgate has likewise *daemonia* uniformly there.

(3) *Certain of its renderings seem more or less inexact or faulty.* In i. 20, Ταῦτα δὲ αὐτοῦ ἐνθυμηθέντος is given by *Hae autem ea cogitante*, but this would be the proper rendering of the pres. participle, as is given by the Vulgate in Acts x. 19, while here the proper rendering would have been, *Cum autem hae cogitaviset*; we also find the nor. part. of the Greek given by the pres. part. in the Vulgate in i. 24; ii. 3, 4, 8, 9, 10, 11 *bis*, 16 *bis*, 21, 22, 23; iii. 7; iv. 3, 9, 21; v. 1, 2, 21. These instances are enumerated in full, because there is an impression, even among scholars, that our loose use in English of the pres. part. is largely due to the influence of the A. V.; yet against these twenty cases of such loose use in the Vulgate only four can be adduced from the same portion of the A. V., and one of these (iii. 15) is logically right: Ἀποκριθεὶς δὲ ὁ Ἰησοῦς εἶπεν, "And Jesus answering said." In ii. 8 the diminutive παιδίον is given by *puer*, instead of the dim. *puellam*, by which the Vulgate always renders this elsewhere, except in Tobit i. 8, where it uses *puerulus*. In iv. 21, αὐτῶν—αὐτῶν, both reflexive, are rendered *eorum—suis* for *suis—suis*. In vi. 19, διορύσσουσιν is rendered *effodiunt* for *perfodiunt*, which the Vulgate rightly uses in xxiv. 13 and in Ezek. xii. 12. In vi. 24, ἑνὸς ἀνθέξεται is given by *unum sustinebit* instead of *unt adhaerebit*, which the Vulgate employs in the parallel passage, Luke xvi. 13. In viii. 4, Ὅρα μηδενὶ εἴπῃς is given by *Vide nemini dixeris* for *Vide ne cui dixeris*.

(4) *Many of its renderings are strictly in accordance with Latin usage, even when this differs from the Greek.* We have the Greek part. given by *cum* and the subj.: (*a*) the aor. part., i. 18, Μνηστευθείσης γὰρ τῆς μητρός, *Cum esset desponsata mater*, and so ii. 1, 9, 13, 19; iv. 2, 12; v. 1; (*b*) the pres. part., i. 19, δίκαιος ὤν, *cum esset justus*. We have the Greek aor. part. given by the abl. abs.: καλέσας τοὺς μάγους, *vocatis magis*; so ii. 11, 12; iv. 13, 22; vi. 6. In i. 20, μὴ φοβηθῇς is given by the idiomatic *noli timere*; so v. 17; vi. 2, 7, 8, 19, 31, 34, but in iii. 9, as we have seen, and elsewhere, we find the Greek form imitated, *ne velitis*. In iv. 1 we have πειρασθῆναι, denoting a purpose, rendered by *ut temptaretur*, and in iii. 13, τοῦ βαπτισθῆναι by *ut baptizaretur*, though, as we shall see, the Greek inf. of purpose the Vulgate commonly gives by an inf., simply to preserve the form of expression.

(5) *It not unfrequently gives literal renderings from the Greek in violation of the Latin idiom.* In i. 11, ἐπὶ τῆς μετοικεσίας Βαβυλῶνος is given by *in transmigratione Babylonis*, for *cum Babylona commigrassent* (Liv.); iii. 8, ποιήσατε—καρπόν, *facite fructum*, for *edere, ferre fructum* (Cic., Quint.); iii. 12, συνάξει—εἰς τὴν ἀποθήκην, *congregabit—in horreum*, for *percipere, horreo condere* (Cic., Hor.); iii. 17, ἐν ᾧ εὐδόκησα, *in quo mihi complacui*, for *qui mihi complacuit* (this Greek was rendered literally only by the Vulgate and Wycliffe—"in whiche I have plesid to me"—and no one of our versions but Wycliffe's has here retained the past tense of the original); iv. 4, οὐκ ἐπ' ἄρτῳ μόνῳ—ἀλλ' ἐν παντὶ ῥήματι, *non in pane solo—sed in omni verbo*, for the simple abl., *pane—verbo*; so v. 13, 28; vi. 7; iv. 19, Δεῦτε ὀπίσω μου, *Venite post me*, for *Sequimini me*; iv. 24, ἀπῆλθεν ἡ ἀκοή, *abiit opinio*, for *exiit opinio* (Suet.); vi. 16, ἀφανίζουσιν τὰ πρόσωπα αὐτῶν, *exterminant facies suas*, for *vultus deformare, turpare*, or *fedare* (Verg., Ov.); vi. 34, μεριμνήσει ἑαυτῆς, *sollicitus erit sibi*, for *pro se* (Cic.), or *de se* (Cic. and St. Jerome himself, *Adv. Jov.*, 113).

(6) *It employs some words, forms, and phrases of very unusual, but still of authorized Latin.* In i. 19 αὐτὴν δειγματίσαι, *eam traducere*: this verb is so used by Livy and Martial; ib. ἀπολῦσαι αὐτήν, *dimittere eam*: this is an early and late phrase, being found in Plautus and Suetonius; ii. 16, ἀπὸ διετοῦς, *a bimatu*: this noun is used by Varro and Pliny; v. 13, ἐὰν δὲ τὸ ἅλας μωρανθῇ, *si sal evanuerit*: Cic., in *Div.*, ii. 17, says, *salsamentum* (the brine) *vetustate evanuit*; v. 43, μισήσεις τὸν ἐχθρόν σου, *odia habebis inimicum tuum*: an early phrase used by Plautus; v. 45, ὅπως γένησθε, *ut sitis*, for *ut fiatis*: *esse* is found so used in Cic., *De Off.* i. 11, and elsewhere; vi. 12, ἄφες ἡμῖν τὰ ὀφειλήματα ἡμῶν, *dimittite nobis debita nostra*: compare *alicui tributa dimittere*, "to remit," Tac., *Hist.*, iii. 55.

(7) *It employs some words and phrases quite unexampled in Early or Classical Latin, and found only in Ecclesiastical and Later Latin.* In iii. 12, διακαθαριεῖ, *permundabit*: only Later Latin for *purgabit*; iv. 2, νηστεύσας, *cum jejunasset*; only ecclesiastical for *cum jejunus fuisset*; iv. 10, Ὕπαγε, *Vade*: only poetic and used in the sense of "Go" for *Apage, Abi hinc*; v. 5, παρακληθήσονται, *consolabuntur*: here used as passive, a later usage (Justinian); v. 16, δοξάσωσιν, *glorificent*: only eccl. for *laude afficere, laudibus efferre*; vi. 9, ἁγιασθήτω, *sanctificetur*; only eccl. and later for *sanctus sit*; vi. 11, ἐπιούσιον, *supersubstantialem*: a word coined by St. Jerome for this place.

(8) *In the use of Particles it commonly follows classical usage, even in nice points.* In iii. 11, μὲν—δὲ, *quidem—autem*: employed by Cicero occasionally, and as if in imitation of the Greek formula; v. 13, ἐὰν δὲ, *quod si*: used by the purest writers; δὲ is regularly given by *autem*, and καὶ by *et*, but δὲ, *resumptive*, in ii. 1 is well given by *ergo*.

(9) *Some of its uses of Particles are uncommon, others unexampled.* In v. 29, συμφέρει—σοι ἵνα—καὶ μὴ, *expedit tibi ut—quam*, as now and then in Tacitus, for *magis quam*; vi. 11, ἐὰν—ἐὰν δὲ, *si—si autem* for *si—sin* or *sin autem*; v. 12, Χαίρετε—ὅτι, *Gaudete—quoniam*, for *quod, quia, or cum*; vi. 29, οὐδὲ Σολομῶν, *nec Salamon*, for *ne Salamon quidem*; nor is the familiar classical *ne—quidem* known to the Vulgate New Testament any more than our familiar *not even* is known to the Authorized Version of the New Testament, except once in a question (1 Cor. xi. 14); *nec—quidem*, however, is found in 1 Cor. iii. 2, and *ne—quidem* in the Vulgate Old Testament. One of the most remarkable peculiarities of the diction of the Vulgate remains to be noticed under this head. It is well known that verbs of hearing, saying, thinking, etc., are construed in Greek sometimes with ὅτι, "that," and a finite verb, and sometimes with the acc. and the inf.; while in Latin the latter is the regular construction. But besides its objective meaning, "that," ὅτι has, according to its context, a causal force, "because." Now, the Vulgate, to preserve the exact form of the Greek, commonly construes these verbs with a particle, but, as if taking the wrong meaning of ὅτι, renders, for example, in ii. 22, ἀκούσας ὅτι by *audiens quia*; so v. 21, 27, 33, 38, 43; in ii. 16, ἰδὼν ὅτι by *videns quoniam*; in vi. 32, οἴδεν—ὅτι by *novit quia*; in iii. 9, λέγω ὅτι by *dico quoniam*, and so v. 20, 28; vi. 29; and by *dico quia* in v. 22, 32; in ii. 23, τὸ ῥηθὲν—ὅτι by *quod dictum est—quoniam*; in iv. 6, γέγραπται ὅτι by *scriptum est quia*, and so v. 20, 22; in v. 23, μνησθῇς ὅτι by *recordatus fueris quia*; in v. 17, μὴ νομίσητε ὅτι by *nolite putare quoniam*; in vi. 7, δοκοῦσιν ὅτι by *putant quia*; in vi. 26, ἐμβλέψατε ὅτι by *respicite quoniam*. And in all this portion we find *quod* used only once in this relation, though at certain periods of the language and in certain cases this particle alone stood in such relation; that one instance is in iv. 12, where Ἀκούσας δὲ ὅτι is rendered *Cum audisset quod*.

(10) *In the use of the moods it generally conforms to classical usage.* Omitting illustrations of this conformity, we give the exceptions, which are as follows: in ii. 2, ἤλθομεν προσκυνῆσαι αὐτῷ, *venimus adorare eum*: only a poetic construction for *ut adoremus*, and so v. 17; viii. 29; ix. 13; x. 34, 35; in iii. 11, εἰμὶ ἱκανὸς—βαστάσαι, *cum dignus portare*: also poetic for *cum dignus qui portem*; in iv. 19, ποιήσω ὑμᾶς ἁλιεῖς ἀνθρώπων, *faciam vos fieri piscatores hominum*: rare, but found in Varro and Sallust for *faciam ut*, etc.; in a few instances, only three, the subjunctive is strangely used after certain particles: ii. 16, *videns quoniam illusus esset*; ii. 22, *audiens quia regnaret*; and iv. 12, *Cum audisset quod Johannes traditus esset*. In vi. 28 we find the indicative in an indirect question: *Considerate lilia agri quomodo crescunt*, for *crescant*; but this usage is often found in Plautus and Terence, in a few instances in Cicero, and here and there in the later poets.

Such are some of the characteristics of the Vulgate appearing from an examination of a portion of one of the Gospels. Its excellences are great and marvellous, and even its defects, generally arising from a scrupulous desire to keep close to the side of the sacred original, often suggest or confirm points of the gravest importance. Prof. Lachmann, Prof. Tischendorf, and Dr. Tregelles, the three greatest names connected with the textual criticism of the Greek Testament in recent times, adopting the view of the learned Bentley, regarded the Latin in the purest and most ancient forms as the most important witness to the integrity of the New Testament next to the Greek MSS., nor did they fail to observe that the Latin, in some phases, goes back to a period which no Greek MS. now extant represents.

The Vulgate is, to a degree not generally understood, the venerable parent of our own translation, the Authorized Version. The history of our English Bible begins with Wycliffe, and the Wycliffite version, as it is now more strictly called, was made directly from the Vulgate. But while this great work was completed by Wycliffe and his coadjutors, a certain preparatory work had, in God's providence, already been done. Cædmon embodied the entire

history of the Bible in the alliterative Anglo-Saxon poetry; Aldhelm, bishop of Sherborne in the seventh century, translated the Psalter; Venerable Bede translated the Gospel of St. John; Alfred the Great translated the four chapters of Exodus xx.–xxiv. as the basis of his laws, rendered some of the Psalms and other portions of the Bible for the use of his own children, and an old tradition—though we cannot substantiate it now—makes him the translator of the entire Bible; there is an Anglo-Saxon version of the Gospels, interlinear with the Vulgate, the *Durham Book*, which belongs to the ninth or tenth century; there is another, called the *Rushworth Gloss*, of the same period in the Bodleian Library; there is another of a somewhat later date in the Bodleian and in Christ Church College, Cambridge; we have the famous *Ormulum*, a metrical paraphrase of the Gospels, assigned to the latter half of the twelfth century; there is a prose translation into Norman French of about 1260, which shows that there must have been a demand for the Holy Scriptures among the rich and refined, and perhaps in the court itself; three versions of the Psalms, that portion of the Bible which has always been most dear to the hearts of the English people, were made in these early days—one toward the close of the thirteenth century, another by Schorham about 1320, and the third by Rollo of Hampole about 1349. All these partial and preliminary versions also, it is to be remembered, were made directly from copies of the Vulgate.

The influence of the Wycliffite version, representing the whole Vulgate, has been great and constant on all the subsequent English versions and revisions, furnishing apt and established words and phrases, which the new translators and revisers were neither willing nor able to lay aside. When the Roman Catholic exiles in the reign of Elizabeth produced at Rheims an English version for their own brethren, it was professed, of course, to be made out of *the authentical Latin*, but the translators in innumerable cases, and most wisely, followed the previous English versions; and though the Rheims has defects which time has brought to light, yet it has such and so many good points, chiefly by exactly representing the original Greek in adhering closely to the faithful Latin forms, that any new and excellent revision of our English Bible must often follow in its steps, as the Rheims did in those of the Reformers.

We have spoken in general of our indebtedness to the Vulgate. To be more particular, when the Vulgate was turned into its earliest English form, the Anglo-Saxon version, it was hardly possible that this act should not have greatly modified our language by introducing new words, mostly religious, and by giving us new forms of construction; and again, this work would be carried further by the Wycliffite version, and was perhaps nearly consummated in the Rheims, the last great version that preceded our own. Our Christian nomenclature itself has thus in great measure been furnished to us by the Vulgate, and many of these precious words were either invented in Latin or there first used in their higher and spiritual sense; such as *regeneration, conversion, justification, sanctification, predestination, election, propitiation, reconciliation, Savior, salvation, Redeemer, redemption, Mediator, Spirit, cross, faith, grace, revelation, inspiration, Scripture, Testament, communion, orders, congregation;* some words are Greek, but given to us through the Latin, as *baptism, Paraclete,* and *presbyter* or *priest;* while some were coined in Latin to copy the Greek, as *transgress* from *transgredior*, in imitation of παραβαίνω.

If we say, as we may with truth, that Christianity in the first instance was received in the Greek language and through Greek thought, we may surely say that it was adopted in Europe chiefly in Latin forms; and the influence of the Vulgate upon the religious language, thought, and culture of Europe, and so also upon our own, can hardly be overestimated. (*The Vulgate*, Canon Westcott, in Smith's *Dictionary; Horne's Introduction to the Scriptures*, vol. iv., Dr. Tregelles; *N. T. Lat.*, Fleck (1840); *N. T. ex Cod. Amiatino*, Prof. Tischendorf (1854); *Two Letters on 1 John v. 7* (Discussion of N. African Latin), Card. Wiseman, *Essays* (vol. i., 1853); *Geschichte der Vulgata*, Kaulen (1868); *Itala und Vulgata*, Rönsch (1875); *Itala-fragmente*, Ziegler (1876).) CHARLES SHORT.

Vulkoj, town of Transylvania, circle of Carlsburg, forms the centre of several rich gold, silver, copper, and quicksilver mines, and is the seat of a considerable mining industry. Its mines form one of the very few places in which *tellurium* has been found in its elementary state. P. about 3000.

Vul'pius (CHRISTIAN AUGUST), b. at Weimar Jan. 23, 1762; studied at Jena and Erlangen; received an appointment at the library in Weimar in 1797, and d. there June 26, 1827. He wrote a great multitude of operas, romantic dramas, romances, tales, etc., and edited *Curiositäten der physisch-litterarisch-artistisch-historische Vor- und Mitwelt* (10 vols., 1810–23), and *Die Vorzeit* (4 vols., 1817–21), which contain some interesting materials. One of his original works became very famous—*Rinaldo Rinaldini, der Räuberhauptmann* (1797). It was republished over and over again, translated into many foreign languages, and imitated by all the scribblers of Europe. It is still of interest to the student, showing whither the imagination of that age liked to wander when it was unoccupied by real business and uncultivated by true art.—His sister, JOHANNA CHRISTIANA SOPHIE VULPIUS, born at Weimar June 1, 1765, met Goethe for the first time in the summer of 1788, when she addressed him in the park of Weimar in order to present a petition to him; removed shortly after into his house as a kind of stewardess; bore him a son, August von Goethe, Dec. 25, 1789, and was married to him Oct. 19, 1806, a few days after the battle of Jena. Goethe chose this time in order to attract as little attention to the affair as possible. She continued to address him as *Herr Geheimerath*, and he would sometimes say with a smile: "*Die Kleine kann gar keine Verse verstehen.*" Nevertheless, when she d. (June 6, 1816) Goethe mourned her sincerely, and she was spoken of with kindness and with respect by all his friends.

Vul'ture [from Lat. *Vultur*], a name applied to certain representatives of the group or sub-order (generally called order) Raptores or Ætomorphæ.

I. By almost all ornithologists until recently, and even by the latest monographer of the Raptores (Sharpe, in *Catalogue of the Accipitres or Diurnal Birds of Prey*, in 1874), the name, under its Latin form, Vulturidæ, was employed as a family name for all the diurnal raptorial birds distinguished by the "head naked or clothed with down; no *true feathers on crown* of head." The group thus defined embraced the typical vultures and allied forms of the Old World and the condor, turkey-buzzards, etc., of the New. But the researches of several modern authors—but first and especially of Prof. Huxley—have amply demonstrated that under this term two very distinct types of structure have been confounded, and that the superficial agreement between those types is a simple analogical one, and the absence of cephalic feathers has doubtless reference to their habits of feeding. It has been also shown, on the one hand, that the vultures of the Old World are closely related to the true Falconidæ, especially the buteonine forms, and that their separation from the latter as a distinct family can scarcely be justified; and, on the other hand, that the analogues of the New World are very distinct in several points of structure, and should therefore be isolated as an independent family. The two forms will, then, be considered under separate heads: (1) Falconidæ vulturinæ and (2) Cathartidæ.

(1) *Falconidæ vulturinæ, or Old-World Vultures.*—It is very doubtful whether even sub-family rank should be attributed to the group of Old-World vultures, and it is only in deference to general usage that the heading is preserved. The forms in question are simply Falconidæ without true feathers on the crown of the head, and, so far as known, have no other co-ordinated characters. Like the typical Falconidæ, the nostrils are not perforate. According to Sharpe, the group is divisible into six genera—viz. (1) *Vultur*, with 1 species; (2) *Gyps*, with 6; (3) *Pseudogyps*, with 2; (4) *Otogyps*, with 2; (5) *Lophogyps*, with 1; and (6) *Neophron*, with 4; to which some (*e. g.* G. R. Gray) add others—*Gypohierax* and *Gypoëtus*. These essentially agree in habits, living for the most part on dead animal matter, and even appearing to prefer that which is putrescent, although not confining themselves to such. When an animal has died the carcass is soon discovered by these birds, and they fly from all points of the compass, and in company share the banquet. They alight for this purpose, and stalk to the animal, pulling at the flesh and swallowing the torn piece, unless, indeed, it is pulled away by a neighbor, contests for possession of the dainty bits constantly going on. After eating to satiety, they rest in a lethargic manner near the remains of the carcass, and are scarcely able to fly, and when disturbed generally vomit their ingesta before they are able to take to wing. They are birds of bold flight, and soar high in the air, scanning the ground in search of food. This they seem to find as much by the sense of sight, if not more than by that of smell. The species, as might naturally be supposed, are mostly inhabitants of warm countries, especially Asia and Africa; several, however, inhabit Southern Europe, they being *Vultur monachus* (the typical vulture), *Gyps fulvus*, and *Otogyps auricularis*.

(2) *Cathartidæ, or New-World Vultures.*—These differ in many respects from their Old-World analogues, and contrast with them especially in the perforate internasal membrane, through which anything can be seen on the opposite side. These essentially agree in habits with the typical vultures. Their characteristics will be found under the head CATHARTIDÆ in APPENDIX. THEODORE GILL.

W.

W, a letter composed of two V's or two U's, the U and V having been once interchangeable. W is either a vowel with the sound of *oo*, or more frequently it is a consonant, having almost the same vowel-sound, but partly suppressed by the closure of the lips, and on this account it is freely interchangeable with *b* and *v*. The English *w*-sound was represented by Latin V-consonant and a form of it in Anglo-Saxon, where it is often improperly written with *w*. W is the proper representative of a sound allied to English and French *v*, but made with the lips alone, and its earliest occurrence is said to be in the year 536 on coins, in the name *Witiges*. The corresponding voiceless sound is the Greek *phi*. W in chemistry designates tungsten (or wolfram). It is an abbreviation for west, and in martyrologies stands for *widow*.

Waa'gen (Gustav Friedrich), b. at Hamburg Feb. 11, 1791; was educated in Silesia, whither his father, a painter of some reputation, removed in 1807; made the campaigns of 1813–14 as a volunteer; studied art subsequently under the influence of Ludwig Tieck, a relative of his, at Breslau, Dresden, Heidelberg, and Munich; was appointed director of the picture-gallery of the Museum of Berlin in 1830; visited England and France; became professor of the history of art at the University of Berlin in 1844; visited Spain, St. Petersburg, etc. D. at Copenhagen July 15, 1868. His principal works are—*Kunstwerke und Künstler in England und Paris* (3 vols., 1837–39), of which a much enlarged edition of the English part, *Treasures of Art in Great Britain*, appeared in 3 vols. in 1854, and was followed by a supplement in 1857; *Kunstwerke und Künstler in Deutschland* (2 vols., 1843–45), *Die Gemäldesammlung in der kaiserlichen Eremitage in St. Petersburg* (1864), *Die vornehmsten Kunstdenkmäler in Wien* (2 vols., 1866–67).

Waal, The, river of the Netherlands, is one of the principal arms of the Rhine, joins the Maas, and receives the name of *Merwede*.

Wa'bash, county of S. E. Illinois, bordering on Indiana, watered by Wabash River and Bonpas Creek, and traversed by Cairo and Vincennes and Louisville New Albany and St. Louis R. Rs.; surface generally level, varied by forest and prairie; soil fertile. There are saw-mills, flour-mills, and manufactories of carriages, furniture, and sash, doors, and blinds. Sheep and swine are numerous. Staples, Indian corn, wheat, oats, hay, and dairy products. Cap. Mount Carmel. Area, 110 sq. m. P. 8841.

Wabash, county of N. E. Indiana, drained by Wabash, Salamonie, and Eel rivers, and traversed by Wabash and Erie Canal and Toledo Wabash and Western R. R.; surface varied and partly covered with forests, soil fertile. There are saw-mills, planing-mills, woollen-mills, tanneries, carrying establishments, and manufactories of iron castings and linseed oil. Horses, cattle, sheep, and swine are numerous. Staples, wheat, Indian corn, flaxseed, tobacco, wool, hay, lumber, and dairy products. Cap. Wabash. Area, 420 sq. m. P. 21,305.

Wabash, tp., Clarke co., Ill. P. 2945.

Wabash, tp., Wabash co., Ill. P. 1120.

Wabash, tp., Adams co., Ind. P. 957.

Wabash, tp., Fountain co., Ind. P. 1284.

Wabash, tp., Gibson co., Ind. P. 412.

Wabash, tp., Jay co., Ind. P. 933.

Wabash, tp., Parke co., Ind. P. 781.

Wabash, tp., Tippecanoe co., Ind. P. 2129.

Wabash, p.-v., cap. of Wabash co., Ind., on Wabash River, at the junction of Toledo Wabash and Western and Cincinnati Wabash and Michigan R. Rs., 136 miles S. W. of Toledo, has 5 churches, an excellent high school, 2 weekly newspapers, repair and machine shops of Cincinnati Wabash and Michigan Railway, woollen, flouring, and oil mills, 2 furniture, 1 carriage, and 1 spoke factory, 2 banks, 2 hotels, 3 planing-mills, and 1 machine-shop. P. 4200.
John L. Knight, Ed. "Plain Dealer."

Wabash, tp., Darke co., O. P. 824.

Wa'basha, p.-v. and tp., cap. of Wabashaw co., Minn., on Milwaukee and St. Paul, Minnesota Midland, and a branch of Green Bay and Minnesota R. Rs., and upon the W. bank of Mississippi River, has 5 churches, fine high school, a foundry and machine-shops, 1 newspaper, 1 furniture-factory, a court house, and several hotels. P. 1739. W. S. Walton, Ed. "Herald."

Wa'bashaw, county of S. E. Minnesota, bounded E. by Mississippi River, which separates it from Wisconsin, intersected by Zumbro River, and having Lake Pepin on the E. border; surface undulatory, partly prairie; soil fertile. There are manufactories of carriages, agricultural implements, furniture, and lime. Horses, cattle, and sheep are numerous. Staples, wheat, oats, Indian corn, potatoes, hay, and dairy products. Cap. Wabasha. Area, about 570 sq. m. P. 15,859.

Wabash City, Wabash co., Ind. P. 2881.

Wa'bash College, an institution of learning at Crawfordsville, Ind., founded 1833 under Presbyterian management, has four college edifices, a cabinet of 30,000 specimens, and libraries of 30,000 volumes, and an average of nearly 100 students in the regular college course. The president from 1841 to 1861 was Rev. Charles White, D. D., who was succeeded by the present incumbent, Rev. Joseph F. Tuttle, D. D.

Wabash River rises in Mercer co., O., flows at first N. to Wabash City, where it receives Big Beaver River; turning N. W., it sweeps in a devious course across Indiana, and during the last 120 miles of its course forms the boundary between that State and Illinois. It is the largest northern tributary of the Ohio. It has been navigated at high water by steamboats as far as Lafayette, Ind.; and from Terre Haute to Huntington, Ind., it is followed by Wabash and Erie Canal. Length, 550 miles.

Wabaun'see, county of N. E. Kansas, drained by Kansas and other rivers; surface undulating, soil fertile. Cattle form the principal live-stock. Staples, Indian corn, wheat, and hay. Cap. Alma. Area, 801 sq. m. P. 3362.

Wabaunsee, p.-v. and tp., Wabaunsee co., Kan. P. 517.

Wac'camaw, tp., Brunswick co., N. C. P. 452.

Waccamaw, tp., Georgetown co., S. C. P. 4310.

Waccamaw River rises in Waccamaw Lake and in the marshes of Bladen, Columbus, and Brunswick cos., N. C., flows into South Carolina in a direction nearly parallel to the coast, and at Mount Gilead, S. C., unites with the Great Pedee, which indeed is usually called Waccamaw below the junction. It finally flows into Winyaw Bay. The Waccamaw proper is navigable to Conwayboro', S. C.

Wace (Richard or Robert), usually known as Master Wace, the name being a corruption of the Latin *Eustorius*, and otherwise written *Waice*, *Gace*, and *Gasse*, b. in the island of Jersey about 1115; was taken to Caen, Normandy, in childhood, and there educated; afterward resided in France, but returned to Caen; became a priest and reading-clerk in the royal chapel; was made canon of Bayeux by Henry II. of England about 1160. D. in England about 1180. He wrote while at Caen, and dedicated to Henry II. (about 1155), *Brut d'Angleterre*, a rhyming paraphrase, in Romance verse of above 15,000 lines, of Geoffrey of Monmouth's *British History*, and *Le Roman de Rou, et des Ducs de Normandie* (about 1170), a poem of nearly 17,000 lines, partly in alexandrine, partly in octosyllabic verse, forming a chronicle of the Norman dukes to his own time, including the conquest of England, and extremely valuable as the best monument of the Norman French language of that period. The latter work was printed for the first time in a complete form by Frédéric Pluquet (Rouen, 2 vols., 1827), and the former by Le Roux de Lincy (Rouen, 2 vols., 1836–38). The portion of the *Roman de Rou* relating to the conquest of England was translated into English prose by Edgar Taylor, with notes and illustrations, *Master Wace, his Chronicle of the Norman Conquest* (1837), and by Sir Alexander Malet, Bart., *The Conquest of England, from Wace's Poem, now first translated into English Rhyme* (London, 1860), including also the text, illustrated by photographs from the Bayeux tapestry. Four shorter poems are doubtfully attributed to Wace—a shorter chronicle of the dukes of Normandy (Caen, 1824), *L'Établissement de la Conception Notre Dame, dite la Fête aux Normands* (Caen, 1842), *La Vie de St. Nicholas* (Paris, 1820–34), and a romance about the Virgin, still in MS. Porter C. Bliss.

Wachu'sett Mountain, in the N. part of Princeton, Worcester co., Mass., reaches an elevation of 2016 feet. It is a detached peak, from whose top there is a wide and picturesque view.

Wa'co, city, cap. of McLennan co., Tex., on the W. bank of Brazos River, and at the W. terminus of the N. W. branch of Texas Central R. R., contains 10 churches, 1 university, a female college, 1 convent, and 4 select schools, 1 extensive cotton and woollen factory, 2 daily, 3 weekly, and 2 monthly newspapers, 2 iron and brass foundries, an ice manufactory, 2 flouring-mills, 1 lumber-mill, and various other industries. A wire suspension bridge (24 by 472 feet) spans the river at this place. P. about 10,000.

J. W. Downs, Prop. "Daily Examiner."

Waco'nia, p.-v. and tp., Carver co., Minn. P. 1097.

Waco'chee, tp., Lee co., Ala. P. 1179.

Waco'ta, p.-v. and tp., Goodhue co., Minn. P. 88.

Wacous'ta, tp., Humboldt co., Ia. P. 93.

Wa'day, country in the interior of Africa, and, next to Bornoo and Darfoor, the most powerful empire of Soodan, is bounded W. by Bagirmi, N. by Sahara, and E. by Darfoor. Its surface is a somewhat elevated plain, with a general inclination from E. to W., broken now and then by isolated groups of mountains, and traversed in its whole extent by two broad valleys. Copious streams flow through these valleys, and form in the eastern part of the country the large inland sea of Fittre, which is remarkably rich in fish. The soil is on the outskirts sandy and barren, but of a more productive quality in the central part; and as the land is reached by the tropical rains, its vegetation is luxuriant, especially in the southern regions. Rice, maize, durra, and all kinds of tropical fruits are raised; different kinds of palm, ebony, and sandal trees abound. The principal occupation, however, is not agriculture, but rearing of cattle and horses, of which latter the country possesses a very fine breed. In trading, horses or strips of cotton cloth are used as money. The inhabitants consist of Arabs and different tribes of negroes: no less than thirty different languages are in use. The ruling tribe and the Arabs are Mohammedans; the rest are pagans. The capital is Warra, but neither this nor any other town of the country has over 1000 houses. Manufacturing industry is almost unknown, or confined to articles of the coarsest kind, but the commerce of the country is quite considerable. Gums, ivory, ostrich-feathers, tamarinds, and skins are exchanged for armor, arms, cotton fabrics, and tobacco, and of late the sultan of Waday has succeeded in establishing a direct communication with Egypt, thus escaping the extortions of the Darfoorians.

Wad'dams, tp., Stephenson co., Ill. P. 1359.

Waddell' (James), D. D., b. at Newry, Ireland, in July, 1739; was brought to America in infancy by his parents, who settled on Whiteclay Creek, Pa.; studied under Dr. Finley at Nottingham; was an assistant to Pres. Smith at Hampden-Sidney College; studied theology under Samuel Davies; was licensed as a Presbyterian preacher 1761; ordained pastor of a church in Lancaster co. 1762; removed to Augusta co., Va., 1776, and to Hopewell 1785; lost his sight while there, but continued to preach, and became renowned for his oratory, which was graphically described by William Wirt in the *British Spy*. D. in Louisa co., Va., Sept. 17, 1805. A daughter married Rev. Dr. Archibald Alexander of New Jersey.

Wad'dell (James Iredell), b. July 13, 1824, at Pittsboro', Chatham co., N. C. Some of his ancestors settled in this State at its first colonization, and the family has always occupied a prominent position, socially and otherwise. One of his ancestors, Maj.-Gen. Hugh Waddell, was the ranking officer of the colony of North Carolina before the Revolution, at the beginning of which he died, and was the same person who with Gen. John Ashe resisted the landing of the British stamps at Old Brunswick in 1766, several years before the "Boston tea-party." Another paternal ancestor was Gen. Francis Nash, who was killed at the battle of Germantown in 1778. Another in the maternal line was Alfred Moore, one of the justices of the Supreme Court of the U. S. at the beginning of the present century. Capt. Waddell was educated at the Bingham School, Hillsboro', N. C., and entered the U. S. navy Sept. 10, 1841; became a passed midshipman in 1847 and a lieutenant in 1855. For his conduct during the time when the officers and crew of the supply-ship *Release* were all stricken down (except a man and a boy) by the Chagres fever, in relieving the vessel and taking her to Matanzas, Cuba, he was most honorably mentioned in a special report made by his commanding officer to the navy department. For his successful conduct of an expedition into the interior of China, while on that station in 1860, he was honorably mentioned in general orders, and was again commendably reported to the navy department. At the breaking out of the war in 1861, he resigned his commission and returned to his native State. He entered the Confederate navy as lieutenant Mar. 27, 1862; in April was ordered to burn the unfinished ram Mississippi at New Orleans; served as ordnance-officer at Drury's Bluff on James River, Va., where the Federal iron-clad fleet was repulsed; was sent to Europe on special service in 1863, and took charge of the Shenandoah on Oct. 19, 1864, on the N. side of the islands called Deserters near the island of Madeira. The name Shenandoah was given to this steamer on his taking command of her; the Sea-King was her previous name. She had been built at Glasgow in 1863 by a London firm for the China trade. In the fall of 1863 she set out on her first voyage, taking government troops to New Zealand, and returned with a cargo of tea in 1864. In September of this year she was sold by her owners to a merchant of Liverpool, and on Oct. 8 following she again left London on another voyage with British papers, but in the mean time was sold to an agent of the Confederate government, and turned over to the command of Lieut. Waddell at the time and place stated, where under her new name she set out on a cruise against the commerce of the U. S., with which the Confederate States were then at war. She first went to Melbourne, Australia, where she was detained for twenty odd days for repairs, the only port she visited in a cruise of thirteen months. During this cruise she was actively in service only eight months out of the thirteen. During this time she made 38 captures, valued at $1,152,000, though the demands of claimants amounted in the aggregate to $6,200,000. She destroyed 32 vessels, and released 6 on bonds. She visited every ocean except the Antarctic. She was the only vessel that carried the Confederate flag around the world, and bore it afloat, her commander not knowing the fact, six months after the surrender at Appomattox Court-house. The last gun fired from her deck was on June 22, 1865. She ran a distance in all of 58,000 statute miles, and met with no injury, although amidst icebergs a fourth part of her active service. Her anchors were on her bows for eight months. She never lost a chase. Com. Waddell having been informed at sea in Aug., 1865, by the master of the British bark Barracouta, of events in this country, desisted from all further belligerent acts, and proceeded to Liverpool with the Shenandoah, where by formal letter to the ministry on Nov. 5, 1865, she was turned over to the British government. After three days' detention, the British authorities took charge of the vessel, and Lieut. Waddell, after spending some time in Europe, returned to his native land. For the last few years (Mar., 1875) he has been engaged in the U. S. Pacific Mail Co.'s service as captain. A. H. Stephens.

Waddell (James Pleasants), A. M., oldest son of Rev. Moses, b. in Willington, S. C., Jan. 5, 1801; educated at Nassau Hall and University of Georgia; graduated at the latter institution 1822, and in which he was tutor of Latin for two years; resigned to take charge, as principal, of the Richmond Academy; in 1836 elected professor of belles lettres and oratory in the University of Georgia; in 1840 transferred to the chair of Greek; in 1846 chosen professor of Latin and Greek in that university, which office he filled for ten years. D. at Athens, Ga., May 28, 1867. Alexander H. Stephens.

Waddell (John Newton), D. D., LL.D., youngest son of Rev. Moses, b. Apr. 2, 1812, at Willington, S. C.; graduated at the University of Georgia 1829; entered the Presbyterian ministry in 1841; was chosen professor of Latin and Greek in the University of Mississippi in 1848; resigned in 1857 to occupy the like chair in La Grange College, Tenn.; was elected president of that college in 1860, which position he held till the place was occupied by the Federal army in 1862; then accepted the appointment of general superintendent of Presbyterian missions in the Western Confederate army; was chiefly instrumental in founding the charity for the benefit of orphans at Tuskegee, Ala.; in 1865 elected chancellor of the University of Mississippi; held that position nearly ten years, when he resigned to accept the appointment of secretary to the board of ministerial education of the Southern Presbyterian Church, the duties of which he still discharges.

Alexander H. Stephens.

Waddell (Rev. Moses), D. D., b. July 29, 1770, in that part of Rowan now cut off into Iredell co., N. C.; graduated at Hampden-Sidney College, Va., 1791; was ordained a Presbyterian minister in 1792, and soon became distinguished for his eloquence and theological learning. The degree of D. D. was conferred upon him by the College of South Carolina in 1807. His fame, however, rests more upon the extraordinary qualities exhibited by him in his eminent success as a teacher, instructor, and educator of youth than upon his displays in the pulpit. In his insight into the character of boys, the constitution of their minds,

and their capacities and aptitudes, and in drawing out and developing their faculties by proper training, discipline, and government, he had few if any superiors in the U. S. In this respect he is entitled to rank with Dr. Nott of Union College, Schenectady, N. Y., and Dr. Witherspoon of Princeton, N. J. In 1804 he established his classical boarding-school at Willington, S. C., from which he sent forth such men as Hugh S. Legaré, James L. Petigru, Augustus B. Longstreet, George McDuffie, and John C. Calhoun, William H. Crawford, and many prominent jurists, legislators, and divines. In 1819 he was called to the presidency of the University of Georgia at Athens, which office he held until 1829, when he was compelled to resign in consequence of failing health. D. July 21, 1840. ALEXANDER H. STEPHENS.

Wad'ding (LUKE), b. at Waterford, Ireland, Oct. 16, 1588; studied theology in the Jesuit seminary at Lisbon and elsewhere in Portugal; joined the Franciscan order 1605; became professor of divinity at the University of Salamanca; accompanied as chaplain an embassy to Rome in 1618 for the settlement of the controversy relating to the doctrine of the Immaculate Conception, and wrote the history of the mission in Latin; remained at Rome; founded in 1625 the College of St. Isidore for Irish Franciscans; is said to have encouraged the Irish rebellion of 1641; was one of the papal councillors appointed in the settlement of the Jansenist controversy, in which his own opinions coincided with those of Jansen, but he retracted them upon the publication of the papal bull of condemnation; was procurator of his order at Rome 1630–34, and vice-commissary 1645–48, and refused a cardinal's hat. D. at Rome Nov. 18, 1657. He edited from the MS. the posthumous *Concordantiæ Bibliorum* of Marius de Calasio (4 vols. folio, 1621) and the works of Duns Scotus (12 vols., 1639), and wrote the history and bibliography of his order in the elaborate Latin works *Annales Ordinis Minorum* (Lyons, 8 vols. folio, 1625–40), of which a new edition, edited by J. M. Fonseca, appeared in 22 vols. (Rome, 1731–47), and *Scriptores Ordinis Minorum* (Rome, 1660; new ed. 1806).

Wad'dington, p.-v. and tp., St. Lawrence co., N. Y. P. of v. 710; of tp. 2599.

Waddington (GEORGE), D. D., b. in England in 1793; educated at the Charter-house and at Trinity College, Cambridge, where he obtained a fellowship; spent several years in Oriental travels; took orders in the Church of England; became vicar of Masham, Yorkshire, dean of Durham 1840, and warden of Durham University 1841. D. at Durham July 20, 1869. Author of *A Visit to Greece* (1825), *The Present Condition and Prospects of the Greek or Oriental Church* (1829), *History of the Church from the Earliest Ages to the Reformation* (1833), *History of the Reformation on the Continent* (3 vols., 1841), and *Lectures on National Education* (1845), and joint author with Barnard Hanbury of a *Journal of a Visit to some Parts of Ethiopia* (1822).

Waddington (WILLIAM HENRY), b. in Paris, France, in 1826, of English parentage; graduated at the University of Cambridge 1849; was naturalized in France; spent some time in archæological explorations in Asia Minor and Palestine; became in 1865 a member of the Academy of Inscriptions, and was elected to the Chamber of Deputies; was chosen to the National Assembly 1871 and 1876; was minister of public instruction under Thiers for a few days in May, 1873, and again filled that post under MacMahon in 1876, distinguishing himself by his projects for the reformation of national education by depriving the Roman Catholic Church of its commanding influence in the schools and universities. He married in 1875, as his second wife, Miss King of New York. Author of *Voyage en Asie mineure au Point de Vue numismatique* (1850), *Mélanges de Numismatique et de Philologie* (1861), *Édit de Dioclétien* (1861), and *Fastes des Provinces asiatiques de l'Empire romain depuis leur Origine jusqu'au Règne de Dioclétien* (1872 *seq.*), and edited the Greek and Roman inscriptions in Le Bas's *Voyage archéologique* (1868).

Wade, tp., Jasper co., Ill. P. 1861.

Wade (BENJAMIN FRANKLIN), b. at Springfield, Mass., Oct. 27, 1800; worked on a farm during his early manhood, teaching district schools during the winters; settled in Ashtabula co., O., 1821; studied law; was admitted to the bar 1828; was elected prosecuting attorney 1835, to which post he was twice re-elected; State senator 1837; president judge of the third judicial district 1857; was U. S. Senator 1851–69; was a firm opponent of slavery, and voted in 1852 against the Fugitive Slave law; ardently opposed the Nebraska bill, the Lecompton constitution, the appropriation of $30,000,000 for the purchase of Cuba; and subsequent to Mr. Lincoln's election in 1860, on the question of compromise between the North and the South, he strongly opposed any concessions. The Homestead bill, which he had for many years advocated, finally passed the Senate in 1862; as chairman of the joint committee on the conduct of the war, he advocated the vigorous prosecution of the war, and favored the confiscation of property in slaves, and reported the bill for the abolition of slavery in the District of Columbia; became president of the Senate *pro tempore* and acting Vice-President of the U. S. on the assassination of Pres. Lincoln; and was one of the commission sent in 1871 to Santo Domingo to report upon the proposed acquisition of that island. D. at Jefferson, O., Mar. 2, 1878.

Wade (JOHN), b. in England about 1809; received a classical and legal education; practiced at the bar in London; wrote largely in favor of reform 1829–32; became vice-president of the French Institut d'Afrique, and has received since 1862 a pension for valuable services to literature. Author of *A History of the Middle and Working Classes* (1833), *The Cabinet Lawyer* (24th ed. 1868), *British History chronologically arranged* (1839), *Unforeseen Abuses in Church and State* (1849), and other works; revised Archdeacon Coxe's *Memoirs of the Duke of Marlborough* (3 vols., with atlas, 1848), and supervised a standard edition of *Junius's Letters* (2 vols., 1850).

Wade'na, county of Central Minnesota, drained by Crow Wing River; surface rolling, chiefly prairie-land. Cap. Wadena. Area, 540 sq. m. P. 6.

Wadena, p.-v., cap. of Wadena co., Minn.

Wä'denswei, town of Switzerland, canton of Zurich, on the southern shore of Lake Zurich, has the largest tanneries in Switzerland and important manufactures of silk and cotton fabrics, wax candles, soap, chemicals, and tobacco. P. 5980.

Wade Plantation, tp., Aroostook co., Me. P. 76.

Wa'ders (*Grallatores*), a group of birds distinguished by elongated legs and the exsertion of the inferior part of the crus (tibia and fibula) and its nakedness. It is an artificial physiological group, constituted by the groups (sub-orders or super-families) called (1) Limicolæ or Charadriomorphæ, (2) Alectorides or Geranomorphæ, (3) Phœnicopteri or Amphimorphæ, and (4) Herodiones or Pelargomorphæ. (See also GRALLATORES.) THEODORE GILL.

Wades'boro', p.-v. and tp., cap. of Anson co., N. C., on Carolina Central and Cheraw and Wadesboro' R. Rs., has 6 churches, 1 college, 1 bank, 3 newspapers, and 2 hotels. P. of v. 480; of tp. 2337.

JOHN T. PATRICK, PROP. "PEE DEE HERALD."

Wad'leigh (G. H.), U. S. N., b. Sept. 28, 1842, in New Hampshire; graduated at the Naval Academy in 1863; became lieutenant in 1866, lieutenant-commander in 1868; served in the Lackawanna at the battle of Mobile Bay, and commended for "undaunted bravery."

FOXHALL A. PARKER.

Wad'malaw Island, tp., Charleston co., S. C. P. 3826.

Wads'worth, p.-v. and tp., Washoe co., Nev. P. 253.

Wadsworth, p.-v. and tp., Medina co., O., on Atlantic and Great Western R. R., 37 miles S. of Cleveland, contains 4 churches, a Mennonite college, excellent schools, 1 bank, 3 newspapers, and several manufactories. P. of v. 949; of tp. 2283.

JOHN A. CLARK, PROP. "YOUNG FOLK'S GEM."

Wadsworth (BENJAMIN), D. D., son of Capt. Samuel, b. at Milton, Mass., 1669; graduated at Harvard 1690; was colleague with Mr. Foxcroft as pastor of the First church, Boston, from Feb. 8, 1696, until July 7, 1725, when he was inducted president of Harvard College. D. at Cambridge Mar. 16, 1737. He published many sermons and theological treatises.

Wadsworth (JAMES), b. at Durham, Conn., July 6, 1730; graduated at Yale College 1748; during the war of the Revolution was a member of the committee of safety and major-general of the State militia; was a judge of common pleas for New Haven county, a delegate to the Continental Congress 1783–86, and a member of the State council 1785–90, and was thirty years town-clerk of Durham, where he d. Sept. 22, 1817.

Wadsworth (JAMES), nephew of Gen. James, b. at Durham, Conn., Apr. 20, 1768; graduated at Yale College 1787; removed with his brother William to the Genesee country of Western New York 1790, purchasing a large tract of land in that valley; became by the rise of value of landed estates one of the richest proprietors in the State; took a very active interest in promoting common-school education, printing pamphlets on the subject, employing lecturers, and offering premiums to the towns that should first establish school libraries; advocated as early as 1811 the establishment of normal schools; procured in 1838 the enactment of the school-library law; stipulated in the titles to the lands he sold, for two tracts of land of 125 acres

each in every township, for the maintenance of schools and churches; founded and endowed a library and scientific institution at Geneseo, and disbursed in all nearly $100,000 for the promotion of the cause of popular education. D. at Geneseo June 8, 1844.

Wadsworth (James Samuel), b. at Geneseo, N. Y., Oct. 30, 1807; studied at Hamilton College and at Harvard University, but without graduating; studied law at Yale and in the office of Daniel Webster; was admitted to the bar, but never practised law as a profession, devoting his attention to assisting his father in the care of the large family estates, which, as increased by the property of William, who died in 1833, amounted to 15,000 acres of land, to the sole charge of the greater part of which he succeeded on the death of his father. Applying himself with enthusiasm and success to agricultural affairs, he was in 1842 elected president of the State society, in the prosperity of which he always manifested a lively interest. The cause of education and the interests of the community in which he lived were objects which he strove by every means to promote. In politics he took a special interest in the questions which affected his State and the nation. Of Federalist stock, he was a Democrat by conviction, but in the agitation of the slavery question in 1848 he supported the Free-Soil party, and thenceforward his efforts were in the same direction. In 1856 he was nominated a State elector by the Republicans, and in 1860 was chosen a district elector for Lincoln and Hamlin. In the events which succeeded he took an open and decided stand for the Union, and under appointment of the legislature of New York attended the Peace Conference in Feb., 1861, where he firmly opposed all measures tending to jeopardize the honor and independence of the Union. Upon the outbreak of war and interruption of railroad communication with the national capital, Wadsworth provisioned two vessels at New York, which he accompanied to Annapolis, where he superintended the delivery of the supplies. At the battle of Bull Run he served as volunteer aide to Gen. McDowell, displaying conspicuous bravery and rendering efficient aid. Commissioned a brigadier-general of volunteers in Aug., 1861, he commanded a brigade in front of Washington until Mar., 1862, when appointed military governor of Washington. While holding this command he received the Republican nomination for governor of New York, but was defeated by Horatio Seymour. Applying for service in the field, he was assigned to the 1st corps in Dec., 1862, participating in the battle of Fredericksburg. At Chancellorsville his corps was not engaged, but at Gettysburg, Wadsworth's division was the first to engage the enemy on the morning of July 1, 1863, and in the struggle that ensued that day his division lost 2400 out of 4000. During the second and third days' fighting he rendered conspicuous service in maintaining the heights on the right of the line, and also during the subsequent operations in the campaign of that year. Early in 1864 he made an extended tour on special service through the South and South-west. In Gen. Grant's Richmond campaign of 1864, Wadsworth commanded the 4th division of the 5th corps, composed in part of his old command, which crossed the Rapidan May 5. On the evening of the 5th he was engaged for several hours, sustaining severe loss. In the fighting which was renewed early next morning Wadsworth was at once engaged with the 2d corps, and the enemy was defeated; but at noon, after a lull in battle, the enemy, being reinforced, took up the offensive, and though Wadsworth made the most heroic efforts to stay the onset, his men finally gave way, and while endeavoring to rally them he was struck in the head by a bullet, and before he could be removed the enemy had gained possession of the ground where he lay. Although unconscious, his death did not occur until Sunday morning, May 8, 1864. It was said of him by a distinguished general that "in all these combats he literally *led* his men, who, inspired by his heroic bearing, continually renewed the contest which but for him they would have yielded."

George C. Simmons.

Wadsworth (Peleg), b. at Duxbury, Mass., May 6, 1748; graduated at Harvard 1769; taught school, and afterward went into commercial business at Plymouth, Mass.; entered the army at Roxbury Apr., 1775, as captain of minutemen; became aide to Gen. Ward and adjutant-general for Massachusetts; was present at the battle of Long Island, Aug., 1776; became brigadier-general of militia 1777; was second in command in the Penobscot expedition 1779; was taken prisoner Feb., 1781; escaped from the fort at Castine in June; settled at Portland, Me., 1784, as a land-surveyor; was elected a State senator 1792; sat in Congress 1793–1807; received in the latter year a large grant of land in Oxford co., Me., as a recognition of his Revolutionary services; settled upon it, and spent the remainder of his life in developing the resources of that region, enjoying the rank of major-general of Maine militia. D. at Hiram, Me., Nov. 18, 1829.

Wae'reghem, town of Belgium, province of West Flanders, has 7217 inhabitants, mostly engaged in flax cultivation and lace manufactures.

Waes'münster, town of Belgium, province of East Flanders, on the Darme, manufactures oil and pack cloth, and has 5192 inhabitants.

Wa'fer [O. Fr. *waufre*], the small circular disk of unleavened bread employed in the celebration of the Eucharist in the Roman Catholic Church. It is usually marked with emblematical figures.—Wafer, a disk of dried paste used for sealing letters. The paste is mixed with some non-poisonous coloring-matter. The wafer is formed in a hot wafer-iron shaped like a pair of pincers. This iron dries the wafer, and partly converts its starch into dextrine.

Wafer (Lionel), b. in London about 1645; made several voyages to the Pacific as surgeon; visited Bantam in the Malay Archipelago 1677; went to Jamaica 1679; practised his profession there for some years; became surgeon to two buccaneers, Cook and Lynch, and subsequently to Capt. William Dampier on his expedition across the Isthmus of Darien; quarrelled with Dampier, and was left in a wounded condition among the Indians of the Isthmus; sailed again with Dampier and Cook; was one of the first settlers of Philadelphia, Pa., and returned to England 1690. Author of *A New Voyage and Description of the Isthmus of America* (1699).

Wa'geningen, town of the Netherlands, province of Gelderland, on the Rhine, has many good educational institutions, some shipbuilding and manufactures of tiles and bricks, and a considerable trade in cattle. It has four well-attended fairs annually. P. 5326.

Wa'ger, an agreement between two or more persons that a specified sum of money or other thing of value shall be paid or transferred by one to the other upon the happening or not of a designated contingency *in which neither has any legal interest.* It implies at least two parties, and that each puts something at risk, which constitutes the stakes, which are to be delivered to the winner. These stakes are often, though not necessarily, deposited with a third person as the stakeholder to await the final decision. If the uncertain event is one in which the parties have a legal interest, the agreement belongs to the class of business contracts sometimes termed "aleatory," of which the insurance policy is the most familiar example. At the common law, wagers in general were valid and binding promises, and were enforced by the courts. Indeed, certain special judicial proceedings for the determination of disputed facts were anciently put into the form of actions upon fictitious bets. If, however, the subject-matter of a wager, or the contingency on which it turned, was illegal, or indecent, or opposed to public policy, or otherwise *contra bonos mores*, it was held to be improper and incapable of enforcement. By statutes of England and of the various States of the U. S. this common-law doctrine has been abrogated, and all wagers have been declared void. There is much diversity in the extent and effect of this legislation. The statute of New York may be taken as an example of the most sweeping and destructive. All wagers, bets, or stakes laid upon any game or upon any chance or unknown contingency are unlawful. All contracts for or on account of money or other property staked, lost, or won are null and void, even though the contracts are negotiable paper in the hands of *bona-fide* holders. Each party can recover his stake from the stakeholder; the loser who has paid can recover the sum back from the winner; and even when the stakeholder has surrendered up the stakes to the winner, he is still liable to the loser for the latter's portion of the deposit. These statutory rules are in direct opposition to the common-law doctrine concerning voluntary payments. The legislation of other States is of a somewhat milder type. It declares all wagers unlawful, and all contracts based upon them incapable of being enforced; but if the loser has voluntarily parted with his money to the winner, it does not empower him to recover it again. Of course, legitimate business agreements which depend upon contingent events, such as contracts of insurance, are excepted from the prohibitions of these statutes. Wagers upon the results of an election have generally been made the subject of special enactment; the penalty of forfeiting their right to vote at such election is visited upon the parties, while in some States their act is made a misdemeanor.

John Norton Pomeroy.

Wa'ger-Policy, in law, is an instrument having the form of a policy of insurance, but without any legal interest held by the assured in the subject-matter of the contract or in the risk insured against. It is, therefore, merely a

wager, according to the nature of the instrument, between the insurer and the assured that the contingent event referred to will or will not happen—that the ship will or will not perform her voyage, that the house will or will not burn, or that the person will or will not die, as the case may be. The assured puts at risk or stakes the premium paid, and bets that the uncertain event will take place, while the insurer puts at risk or stakes the sum insured, and bets that such event will not happen. Thus, a policy of marine insurance, where the assured has no interest in the ship, cargo, or freight, is nothing but a bet between him and the insurer upon the safety of the vessel, the premium and the sum insured being the stakes; a similar policy of fire insurance is merely a bet upon the safety of the house, one party risking his premium upon the chance that it does not burn within a year, the other risking the sum insured upon the chance that it does burn within the same period; finally, a policy of life insurance taken upon a life in which the assured has no interest is a bet by him that the person thus designated will die, and by the insurer that he will not die. Such bargains are plainly within the statute against wagers, and even at the common law they are against public policy, since they create a strong interest in the assured that the ship should be lost, the house should be burned, or the life should be ended. In order that a policy of insurance shall be a legal contract, and not a wager, the assured must have some legal interest in the subject-matter, and this interest must be shown upon the face of the instrument. It is not necessary that he should be the absolute owner of the ship, cargo, freight, or building, but he must at least hold some equitable or other inferior estate in them, or some specific claim upon them, as a mortgage, lien, or charge, whereby he would be pecuniarily damnified in case of their loss or injury. Every one has an interest in his own life, so that he may procure it to be insured. Creditors also have a legal interest in the lives of their debtors, and statutes have created an insurable interest in the lives of certain near relatives, as between husband and wife, parent and child. It is now a settled rule in reference to life policies that if they are valid in their inception, they may be assigned to parties who have no interest in the life assured, and they will continue to be valid in the hands of such assignees. This important distinction between life and other policies arises from the fact that they are not contracts of indemnity. Wager-policies are universally void, either by virtue of special statutes enacted against them or because the courts have held them to be within the general statutes concerning wagers. JOHN NORTON POMEROY.

Wa'ges [Lat. *vas, vadis*, "security"]. The theory of wages accepted by most political economists a generation ago was that the normal price of labor depends on the cost of the laborer's subsistence. In the words of David Ricardo, "The natural price of labor depends on the price of the food, necessaries, and conveniences required for the support of the laborer. With a rise in the price of food and necessaries the price of labor will rise; with a fall in their price the natural price of labor will fall." The acceptance of this doctrine by the majority of English economists is the more surprising that Adam Smith had clearly shown that the quantity and quality of the food and other commodities obtained by the laboring classes are the consequence, not the cause, of the amount of their wages. The food of the laborer in Scotland, he observed, was much inferior to that of his fellow in England—adding, "This difference, however, in the mode of their subsistence is not the cause, but the effect, of the difference in their wages, though by a strange misapprehension I have frequently heard it represented as the cause. It is not because one man keeps a coach, while his neighbor walks afoot, that the one is rich and the other poor; but because the one is rich he keeps a coach, and because the other is poor he walks afoot." Ricardo's doctrine, nevertheless, was generally accepted, not only by theoretical economists, but also by practical legislators and statesmen, and it led to the English corn laws; for the inference was that wages must rise with the price of food, so that taxes on corn cannot fall on the laborer; and down to the Irish famine Sir Robert Peel supported the duty on foreign corn under this conviction. It is singular that at the same time it was part of Ricardo's theory of wages, and of the general creed of economists, that the price of labor varies in different employments with the nature of the work. But if it adjusts itself to a certain standard of subsistence, and depends on the cost of the articles which laborers commonly consume, it is hard to see how it can also depend on the nature of their employment. Nor was this the only inconsistency in the received theory. It was likewise held that there is in each country a certain aggregate amount of wages, or "wages fund," formed by the accumulations of capitalists, the proportion of which to the number of laborers determines the general or average rate of wages, the rates in particular employments varying according to their difficulty, severity, etc. Here a new element—namely, the accumulation of capital—becomes the dominant factor; and it is evident that the rates of wages resulting from the amount of capital accumulated may have little or no relation to the cost of the laborer's living.

The foregoing doctrines were not only inconsistent with each other, but also with the actual rates of wages in every civilized country during the last 100 years, especially with the extraordinary diversity in the rates in different parts of the same country. A century ago Adam Smith drew attention to "the sudden and unaccountable differences in the wages of neighboring places in England;" and several generations later these differences, instead of disappearing, had greatly increased. Soon after the publication of the *Wealth of Nations*, Arthur Young collected statistics of agricultural wages in 26 English counties, and found that the highest rate then was 8*s.* 6*d.*, the lowest 6*s.* In 1850, Mr. Caird traversed the same counties, and found that agricultural wages then varied from 6*s.* to 16*s.* In 1870 it was found that they varied from 7*s.* in Dorsetshire to 18*s.* and 20*s.* in Northumberland. Was the Dorsetshire or the Northumberland rate, then, it might be asked of Ricardo's followers, "the natural price of labor"? Or how could the general rate depend on the proportion between the total accumulation of capital and the total number of laborers in the country when such different rates prevailed in different parts of it? Again, if wages varied in accordance with the nature of the employment, how was it that they varied so widely in the same employment?

The truth is, that the doctrines of Ricardo and his followers are applicable only to a past state of society, or to what may be called the mediæval as distinguished from the modern industrial system. In the Middle Ages the laborer was commonly paid in commodities, or, if in money, the sum was adjusted to the cost of his subsistence, and the wages of common labor varied but little throughout each country. Scotland was much behind England in the seventeenth century, and this state of things still continued in the former in the time of Adam Smith. "In the last century," he says (the *Wealth of Nations* was published in 1776), "the most usual day-wages of common labor through the greater part of Scotland were sixpence in summer and fourpence in winter. Three shillings a week, the same price very nearly, still continues to be paid in the Highlands. Through the greater part of the low country the most usual wages of common labor are now eightpence a day; tenpence, sometimes a shilling, in the counties which border upon England, and in a few other places where there has lately been a considerable rise in the demand for labor, about Glasgow, etc." He adds that wages were considerably higher in England than in Scotland, and that they varied also considerably more from place to place, and remarks: "In England the improvement of agriculture, manufactures, and commerce began much earlier than in Scotland. The demand for labor, and consequently its price, must necessarily have increased with those improvements." In the same chapter Adam Smith states that wages were much higher in North America than in any part of England, although the price of provisions was everywhere in North America much lower. We have in these facts the principal key to the true law of wages in modern times. The natural sources of wealth, the fountains of wages and profits—mines, soils of uncommon fertility, sites especially adapted for manufactures and trade, natural resources and advantages—are unequally distributed, not only among the different countries, but also among the different parts of each country. Their development, too, has been unequal. Hence the rate of production, the returns to capital and labor together, and the demand for labor have varied in different countries, and in different localities in the same country. In the south-western counties of England, for example, agriculture has been the only employment, the landlord and the farmer the only employers, and land is neither plentiful nor very fertile; in the N. of England rich mines and flourishing manufactures have competed with farming for labor. Hence the rates of wages in the northern and southern counties have been very unequal, and the inferiority of the laborer in the latter is more the effect than the cause of inferior wages. In the American States, again, extraordinary natural resources have been developed with extraordinary enterprise and skill, and all the chief causes of high wages—a high rate of production, great demand for labor, and abundance of fertile land within the laborer's reach, diminishing the supply—have concurred. The value of the joint produce of capital and labor together determines the maximum price of the labor, and this maximum varies with the local resources and powers of production of different regions, as well as with the energy and skill of both capitalist and laborer. Given the maximum, the actual partition between employers and

laborers will depend on a variety of conditions which cannot be stated in a single proposition, although they are all consistent with the formula that wages depend on demand and supply. In one place, for instance, the laborers may have the choice of several employments on the spot, may have the means of removing easily to several other places, and may know all the circumstances of the market. In another place they may be tied to one spot by ignorance and poverty, and may compete with each other desperately for a bare living, although their employers could afford a much higher remuneration. Sometimes we find employers combining and laborers competing; sometimes employers compete and laborers combine. In some cases machinery, animals, and natural agents co-operate with labor, compete for it, and in both ways add to its value; in other cases they compete with it and supersede it. In some cases there is antagonism between labor and capital, each striving to diminish the share of the other; while elsewhere they co-operate amicably, and aim at augmenting the returns to both. So various being the conditions which determine the rates of wages in particular cases, it is evident that the aggregate amount of wages, instead of being the general cause which determines the rates in particular cases, is merely the result or arithmetical sum of the particular rates added together. In looking to the particular rates, both employers and workmen too often think too much of their respective shares, and too little of the total amount to be shared. A doctrine which has contributed to this error is laid down in some celebrated treatises of political economy—namely, that profit depends on wages, and therefore the lower the wages the higher the profit. But not only is the efficiency of labor a variable quantity, dependent in part upon the rate of its remuneration, but capitalists themselves have productive powers, as also have the instruments, the animal, and the natural agents they employ; and it is an error alike for laborers to assume that an increase of profit can be had only at their cost or by their exertions, and for capitalists to look only to keeping down wages for profit.

Another reflection which the subject calls for is, that the economic system of modern times must be admitted to have introduced two conditions unfavorable to labor, in the great uncertainty and fluctuations in trade, prices, demand for labor, and wages, on the one hand, and the disappearance of production on a small scale with the openings it afforded to the majority of workingmen to rise to the rank of small capitalists and masters, on the other hand. These drawbacks add greatly to the value of the avenue to independence which the facility of acquiring landed property offers to labor in America. (See LABOR, STRIKES, TRADES-UNIONS.) T. E. CLIFFE LESLIE.

Waggoner, tp., Mason co., West Va. P. 3324.

Wag'horn (THOMAS), b. at Chatham, England, in 1800; entered the navy as midshipman 1812; served many years in the East Indies, taking part in several campaigns by land and sea, and from about 1827 devoted himself to promoting steam communication between England and India *viâ* the Isthmus of Suez, in the interest of which project he made at his own expense elaborate surveys. He met with ill-success for many years, and exhausted his fortune in the undertaking. D. in London Jan. 7, 1850. His statue now occupies a conspicuous position on the route of the Suez Canal.

Wag'ner, p.-v. and tp., Clayton co., Ia. P. 988.

Wagner (JOHN), M. D., the first professor of pathological and surgical anatomy in the U. S., b. about the close of the last century; graduated A. B. in Yale College, Conn., 1812, and was made A. M. in the same institution 1815; went abroad that year, and through his preceptor, Dr. Post of New York, became a pupil of the celebrated Sir Astley Cooper for three years; on his return settled in Charleston, S. C., where he soon rose to eminence as a surgeon. He was elected professor of pathological and surgical anatomy in the South Carolina Medical College, said to have been the first of that department ever established in this country; in 1832 became Dr. Ramsey's successor in the chair of surgery. D. in Charleston, S. C., the scene of his great promise of usefulness, after a protracted and painful illness, May 22, 1841. PAUL F. EVE.

Wagner (RUDOLF), b. at Baireuth, Bavaria, June 30, 1805; studied medicine at Erlangen and Würzburg, and comparative anatomy in Paris under Cuvier; undertook various scientific journeys in France and Sardinia, and was appointed professor of zoology at the University of Erlangen in 1829, and in 1840 at the University of Göttingen, where he d. May 13, 1864. His principal works are —*Lehrbuch der vergleichenden Anatomie* (2 vols., 1834–35), *Icones physiologicæ* (1839), *Lehrbuch der Physiologie* (1839), *Handwörterbuch der Physiologie* (4 vols., 1842–53), *Neurologische Untersuchungen* (1854), which brought him into conflict with Karl Vogt and the materialistic school of scientists; *Vorstudien zu einer wissenschaftlichen Morphologie und Physiologie des menschlichen Gehirns als Seelenorgans* (2 vols., 1860–62).—His younger brother, MORITZ FRIEDRICH WAGNER, b. at Baireuth Oct. 3, 1813, was educated for business, but left this career in 1834; studied natural science at Erlangen and Munich; accompanied the French army in Algeria 1837–38 as a member of the scientific commission, and wrote *Reisen in der Regentschaft Algier* (3 vols., 1841); studied geology at Göttingen; undertook 1842–45, with the support of the Academy of Berlin, explorations in the regions of the Black Sea, Caucasus, Armenia, Koordistan, and Persia, and wrote—*Der Kaukasus und das Land der Kosacken* (2 vols., 1847), *Reise nach Kolchis* (1850), *Reise nach dem Ararat und dem Hochlande Armeniens* (1850), *Reise nach Persien und dem Lande der Kurden* (2 vols., 1852); travelled 1852–55, with Scherzer, extensively in North and Central America, and wrote, in connection with him, *Reisen in Nordamerika* (3 vols., 1854), *Die Republik Costa-Rica* (1856); undertook 1857–58, with the support of King Maximilian II. of Bavaria, explorations in Panama and Ecuador, the results of which were published in Petermann's *Mittheilungen*, and was appointed professor at the University of Munich in 1860. His *Travels in Persia, Georgia, and Koordistan* were translated into English in 3 vols. (London, 1854).

Wagner (RUDOLF JOHANNES), b. at Leipsic Feb. 13, 1823; studied chemistry and technology in his native city and at Paris; was appointed professor of chemistry at the Polytechnic School of Nuremberg in 1851, and in 1856 professor of technology at the University of Würzburg. In 1858 he was made inspector-general of technical studies in Bavaria. His principal works are—*Lehrbuch der Chemie* (1850), *Lehrbuch der chemischen Technologie* (1850), *Geschichte der Chemie* (1854), *Handbuch der Technologie* (4 vols., 1856–63), *Theorie und Praxis der Gewerbe* (5 vols., 1857–61), etc., most of which have gone through several editions and been translated into other languages. He is also the editor of *Jahresberichte über die Leistungen der chemischen Technologie* (started in 1856).

Wagner (WILHELM RICHARD), b. in Leipsic May 22, 1813, son of a police actuary, who died six months after his birth. His step-father, who was an actor and painter, wished to make a painter of him, but for that he showed no aptitude. The boy played tunes on the piano at the age of seven; at nine he entered the Dresden Kreutzschule, and studied hard—not music, which he cared little for, but Greek, Latin, ancient history, and mythology. He made verses, longed to be a poet, translated twelve books of the *Odyssey*, took up English, in his enthusiasm for Shakspeare projected a tragedy which was a compound of *Hamlet* and *Lear*. His passion for music was awakened by hearing Beethoven's music in Leipsic; he studied then in order to adapt his great tragedy for the lyric stage, but in a desultory and fitful way, which resulted in no solid attainment. He had no systematic instruction until his sixteenth year, and then his impetuous genius disdained rules; he preferred composing music to studying it. One of his boyish overtures was played in the Leipsic theatre. Less than six months with Theodor Weinlig, spent in the study of counterpoint, was his first equipment for his extraordinary career. He was then nineteen. An overture composed at this time, after the model of Beethoven, was played and well received, he tells us, at one of the Gewandhaus concerts; a symphony, composed after Beethoven and Mozart, was performed at the Conservatory in Vienna, and later at the Gewandhaus in Leipsic. At this period Wagner visited Vienna, Prague, Wurtzburg, making the acquaintance of music and musicians, all the while undergoing the intellectual fermentation which introduced his musical reform. At twenty-one he abandoned his model, Beethoven, and felt that a new era in music was about to dawn. In 1834 he accepted the position of musical director at the theatre of Magdeburg; completed and on ten days' notice presented an opera, *Das Liebesverbot*, and was not disheartened by its failure; went to Berlin with the *Liebesverbot*, but met with no practical encouragement at the royal opera; asked for and received the position of musical director at Königsberg; in Dresden was moved by reading Bulwer's *Rienzi* to write an opera with that title, which, after some delay, was brought out in Dresden in 1842; visited London, and, being driven by a storm into a Norwegian port, caught the legend of the "Flying Dutchman;" went to Paris, but found no welcome; in 1839–40 composed an overture to the first part of Goethe's *Faust* and several songs; suffered from want to the degree that he was compelled to arrange music for all sorts of instruments. In 1842 the success of *Rienzi* at Dresden secured his appointment to the post of Kapellmeister at the Dresden opera-house. Here he finished the *Flying Dutchman*, and composed *Tanhäuser*. In

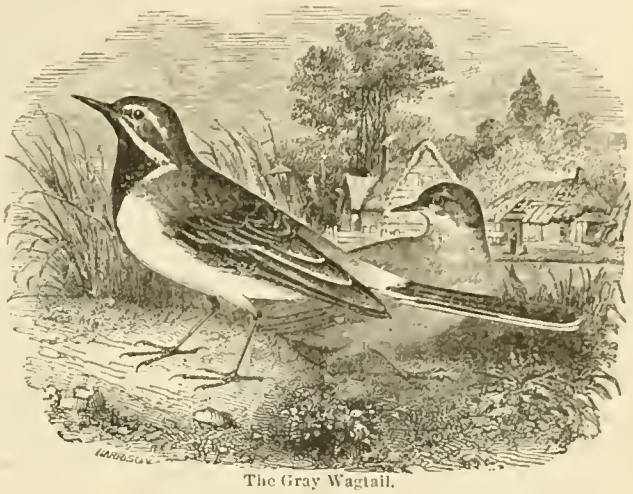
1849 his revolutionary enthusiasm forced him to take refuge in Zurich. There he became director of the musical society and of the orchestra of the theatre; composed *Lohengrin*, and began the composition of the *Nibelungen*; in 1858 left Zurich, and resided for short periods in Italy, Paris, Vienna, Carlsruhe; attracted the attention of Ludwig, king of Bavaria; established himself in Munich, and entered on his fame. *Tristan und Isolde* appeared in 1865, *Die Meistersinger von Nürnberg* in 1868, and *Reingold*, the prelude to the *Nibelungen*, in 1869. At Munich was laid the plan, so brilliantly carried out at Baireuth in the summer of 1876, where, in a theatre of his own design, with an orchestra composed of the best material Germany could furnish, and singers he had himself selected, was produced, under royal patronage and imperial countenance, with the moral support of a large and distinguished public, the threefold opera of the *Nibelungen Ring*, in which his musical theories first found full expression. Wagner's musical reform is not technical; it embraces the whole field of conception and expression. Disgusted with the Italian and French school of opera, while persuaded more and more that opera was the highest form of musical expression, loathing the silly *libretti* and disdaining the practice of making music subservient to the convenience of pet singers, he contended that the theme of opera should be poetic in the purest, deepest sense; that the poetry should be married to fitting music, vocal and instrumental; and that the whole should be associated with the convictions and sympathies of humanity. Hence he took his themes from romance, legend, and popular myths, arranged his *libretti* himself and in his musical adaptations consulted the intellectual demands of his theme, neglecting and even scorning the popular arts of song and melody which delight the ears of the opera-loving public. The phrase "music of the future," which is applied to his work, was bestowed in derision, though it was warranted by the title of one of his own essays. *The Flying Dutchman*, *Tanhäuser*, and *Lohengrin* were written, composed, and the two first performed, before the composition of his theoretical pieces, the first characteristic example whereof, the *Tristan und Isolde*, did not long precede the *Nibelungen*. In this opera he fully expressed himself, and by it is willing to be judged. Here, he says, "I moved with entire freedom and disregard of all theoretic scruples." Wagner resents the charge that his music is destitute of melody. "The one true form of music," he says, "is melody. Music that has no melody has no inspiration, no power over the feelings, no originality. But melody is something more than the fixed and narrow form that belongs to the childish stage of musical art—the dance form." "The wanderer in the wood becomes every moment more distinctly aware of endlessly-varied voices that are audible in the forest. They grow louder and louder, and the voices, the separate tunes, he hears are so many that the whole music seems to him one grand forest melody. Yet he cannot hum it over to himself; and to hear it again he must again go to the woods." Wagner is a copious writer; his collected works, critical, expository, controversial, fill nine octavo volumes, and abound in vigorous, ingenious, original ideas. His musical compositions are numerous. Besides the operas and overtures mentioned, there are overtures, songs, marches, poems with pianoforte accompaniment, a polonaise, a sonata, a mourning symphony for the funeral of C. M. von Weber, and smaller pieces that have not been catalogued. A complete list of his works, so far as known, may be found in *Art Life and Theories*, by E. L. Burlingame (New York, 1875). The same volume, which is devoted entirely to Wagner, contains a good sketch of his musical system, taken from his own writings. In Germany, where his works are known, Wagner has numerous and devoted disciples, in spite of bitter opposition. Out of Germany he is comparatively unknown and unappreciated. In America he is to the general public scarcely more than a name. *Lohengrin* has been handsomely presented in New York; *Tanhäuser* has been tolerably well produced. His characteristic pieces are brought out in fragments at concerts. Still, his admirers are neither few nor uninfluential. Some of the ablest critics are on his side. The most popular leader of orchestra is his adherent. Those that are best acquainted with him give him most praise. His home is in Baireuth, where he lives in a house of his own designing. His wife is a daughter of Franz Liszt, who is a believer in the genius and the mission of his son-in-law. Wagner calls himself a *pessimist*, but derives from that belief the privilege of enjoying the more heartily the good things that unexpectedly fall to his lot. Optimism, he says, made him complaining because he received so little; pessimism allows him to be grateful for small favors and patient under heavy trials. His ardor in the cause of human rights made him cheerfully consent to write the grand march for the American Centennial celebration of 1876. O. B. FROTHINGHAM.

Wag'oner, tp., Oconee co., S. C. P. 1982.

Wagons. See CARRIAGES, by L. P. BROCKETT, A. M.

Wu'gram, village of Lower Austria, 12 miles N. E. of Vienna, and on the opposite or northern side of the Danube, famous for the victory which Napoleon gained here over the Austrians July 6, 1809.

Wag'tail, the name conferred in England on the species of passerine birds constituting the genera *Motacilla* and *Budytes*; these have the bill slender and conical, with the upper mandible slightly notched at the tip, and the culmen somewhat concave above the front of the nostrils; the wings are long and pointed, and have each nine primaries; the tail is longer than, or equal to, the wings, and the two central feathers are rather longer than the lateral; the feathers are mostly broadest at the middle, and thence taper to the tips; the tarsi are rather long, and scutellate in front only; of the toes, the inner is free almost to the base, and the outer adherent by the basal joint only; the hind claw is more or less curved. The name is given in allusion



The Gray Wagtail.

to their habit of "wagging" their tail in a fan-like manner. They are active birds, at home equally in the air and on land; they fly by short undulating courses, and frequently emit, while on the wing, chirping notes; on the ground they run by a rapid succession of steps. The species are quite numerous; according to Gray, there are 16 species of *Motacilla*, 14 of *Budytes*, 2 of *Calobates*, and 1 of *Limonidromus*. These are all naturally peculiar to the Old World and Australia, but the *Motacilla alba* and *Budytes flava* have been known to wander into North America. THEODORE GILL.

Wah. See AILURUS FULGENS.

Waha'bees, or **Wahabites,** the name of a modern Mohammedan sect prevailing in Central and Eastern Arabia, but hardly known outside of the peninsula. It was founded in the middle of the eighteenth century by Abd-el-Wahab, who converted Saoud, the sultan of Nedjed, and from Deraijeh, the capital of Nedjed, in which Abd-el-Wahab lived and preached, his ideas spread so rapidly that before his death, in 1787, they predominated in the larger part of the peninsula. It was a moral reformation rather than a religious revival which Abd-el-Wahab preached, and with politics he did not interfere. The differences between the doctrines of the Wahabees and those of the orthodox Mohammedans are comparatively very small, though the Wahabees deny the inspiration of the Koran and the justness of worshipping Mohammed's tomb. A strict observance of all the precepts of the Koran, which had fallen into neglect throughout the whole Mohammedan world, and become very much mixed up with pagan practices among the Bedouins; a return to the old Arab frugality and chastity; a total abstinence from wine, opium, and tobacco; a strict administration of justice; and the renewal of the war against all other religions, were the points most characteristic of the new sect. The immediate result of these ideas was a revival of the old Mohammedan fanaticism, and Saoud used this circumstance to subdue his neighbors and extend his empire. His son, Abd-ul-

Aziz, took Mecca in 1803, and his grandson, Saoud II., Medina in 1804. The Wahabite cultus was introduced in the holy cities, and pilgrimages were stopped, partly because the pilgrims belonged to the Persian or Turkish rites, and consequently were considered heretics, partly because of the gross vices and crimes which these pilgrimages occasioned. The prevention of the pilgrimages to the holy cities caused a great commotion in the Mohammedan world, and in 1804 the sultan of Constantinople ordered Mehemet Ali to punish the Wahabees. After seven years' preparation, Mehemet Ali was ready to execute the order, and in 1811, Mecca and Medina were reconquered. In 1818, Ibrahim Pasha took and destroyed Deraijeh, and the power of the Wahabees seemed completely broken. Soon, however, other and more important affairs occupied the attention of the Egyptian rulers. The Egyptian governors were repeatedly expelled from Nedjed, the Wahabite kingdom was reorganized, and after the death of Mehemet Ali in 1849, Egypt retired altogether from the contest, and the Wahabees spread undisturbed. In 1863 they held 316 towns and villages and numbered 1,219,000. (See Corancez, *Histoire des Wahabites depuis leur Origine jusqu'à l'an 1809* (Paris, 1810); W. G. Palgrave, *Narrative of a Year's Journey through Central and Eastern Arabia* (London, 1865); Burckhardt, *Notes on the Bedouins and the Wahabys* (London, 1830).)

Wahee, tp., Marion co., S. C. P. 1429.

Wahkiak'um, county of S. E. Washington Territory, bounded S. by Columbia River; surface rugged and mountainous, generally covered with dense forests. Lumber is the principal product. Cap. Cathlamet. Area, 225 sq. m. P. 270.

Wahkon'sa, tp., Webster co., Iowa. P. 921.

Wahoo'. (1) The *Euonymus atropurpureus*, a fine ornamental shrub of the U. S. belonging to the order Sapindaceæ, and often called burning bush and spindle tree. Its bark has considerable use in medicine as a diuretic, tonic, and alterative, with cathartic powers. (2) The winged elm, *Ulmus alata*, a small tree of the Southern U. S. Its wood is much valued for timber. Its branches have singular corky wings.

Wahoo, p.-v., cap. of Saunders co., Neb.

Wahsatch Mountains. See UTAH.

Wain'wright (JONATHAN MAYHEW), D. D., D. C. L., b. at Liverpool, England, Feb. 24, 1792, of American parents, his mother being a daughter of Rev. Dr. Jonathan Mayhew of Boston; came with his parents to the U. S. 1803; graduated at Harvard 1812; was tutor there in rhetoric and oratory 1815–17; took orders in the Protestant Episcopal Church 1816; became rector of Christ church, Hartford, Conn., 1816; assistant minister of Trinity church, New York, 1819; rector of Grace church, New York, 1821, of Trinity church, Boston, Mass., 1834, and again assistant minister of Trinity church, New York, 1838, having especial charge of St. John's chapel; visited Europe and the East 1848–49, and Europe again in 1852, when the University of Oxford conferred upon him the doctorate of law; was many years secretary to the House of Bishops; was chosen provisional bishop of New York in October, and consecrated Nov. 10, 1852; was a ripe scholar, a fine musician, and an admired pulpit-orator. D. in New York City Sept. 21, 1854. He published a volume of chants (1819), *Music of the Church* (1823), *The Pathways and Abiding-places of our Lord* (illustrated, 1851), *The Land of Bondage, a Journal of a Tour in Egypt* (1852), several liturgical compilations, and, with Dr. W. A. Muhlenberg, *The Choir and Family Psalter* (1851), and edited the *Life of Bishop Heber, by his Widow* (2 vols., 1830), and the magnificently illustrated volume, *Our Saviour with Prophets and Apostles* (1850). A controversy between him and Rev. Dr. Potts on the possibility of "a Church without a bishop" was issued in a volume 1841. A *Memorial Volume* appeared in 1856, with a memoir by Bishop Doane, and another *Life*, by Rev. John N. Norton, in 1858.

Waite (CARLOS A.), b. in New York City in 1800; entered the U. S. army as lieutenant of infantry 1820; became major of 8th Infantry Feb. 16, 1847; commanded that regiment in the Valley of Mexico; was brevetted for the battles of Churubusco and Molino del Rey; became full colonel of 1st Infantry June 3, 1860; served in that rank through the war of the rebellion until Feb., 1864, when he was retired, and was brevetted brigadier-general Mar. 13, 1865. D. at Plattsburg, N. Y., May 7, 1866.

Waite (HENRY MATSON), LL.D., b. at Lyme, Conn., Feb. 9, 1787; graduated at Yale College 1809; was admitted to the bar Dec., 1812; practised law at Lyme; was elected to the lower house of the legislature 1815; was a member of the State senate 1832–33, judge of the superior court and of the supreme court of errors 1834–54, and chief-justice 1854–57. D. at Lyme Dec. 14, 1869.

Waite (HENRY RANDALL), PH. D., b. at Copenhagen, N. Y., Dec. 16, 1846; graduated at Hamilton College 1868; became in that year literary editor of the Utica *Daily Herald*; subsequently studied theology at Union Seminary, N. Y., editing at the same time the *University Quarterly Review* and contributing to the press; resided in Europe in 1871–74; organized American (Union Evangelical) chapels at Rome and Geneva, and was chaplain at Rome; became in 1874 editor of the New Haven *Daily Evening Journal*; became in 1875 associate editor of the *International Review* at New York, and lecturer on political science to the University of Syracuse, and is president of the Political Science Association and of the National Reform League, both of which owe their existence to his efforts. Author of *Carmina Collegensia* (1868) and *Sermons from the Life of St. Paul in Rome* (1873); is preparing works upon *The History and Scenery of the St. Lawrence River* and upon *Higher Education*, the latter in conjunction with Dr. Karl M. Therdin of the University of Upsala, Sweden.

Waite (MONRISON REMICH), LL.D., son of Henry Matson, b. at Lyme, Conn., Nov. 29, 1816; graduated at Yale College 1837, in the same class with William M. Evarts and Edwards Pierrepont; studied law at Lyme with his father, then a judge of the supreme court of errors; settled at Maumee City, O.; was elected to the Ohio legislature 1849; removed to Toledo 1850; took a prominent place at the Ohio bar; declined repeated nominations to Congress and also a seat on the supreme bench of Ohio; distinguished himself as U. S. counsel at the Geneva tribunal of arbitration on the Alabama claims 1871; was president of the Ohio constitutional convention 1873, and became chief-justice of the Supreme Court of the U. S. Mar. 4, 1874.

Waite Plantation, tp., Washington co., Me. P. 122.

Waites'burg, p.-v., Walla Walla co., Wash. Ter.

Waits [Scottish *wate*; Ger. *Wacht*, a "watch"], a former class of watchmen in English and Scotch towns, who at certain fixed hours of the night played upon the pipe and other instruments. In London and many other places the waits were officially recognized until quite recently, if indeed they are not so at present in some places. At London there are still companies of men called waits who during the Advent season frequently serenade the citizens, and on Christmas morning call for a Christmas-box.

Wait'sen, town of Hungary, on the right bank of the Danube, is well built, and beautifully situated in a fertile district celebrated for its excellent wine. It has educational institutions and a large trade in cattle. P. 12,894.

Waits'field, p.-v. and tp., Washington co., Vt. P. 948.

Waitz (GEORG), b. at Flensburg, duchy of Sleswick, Oct. 9, 1813; studied law and history at the universities of Kiel and Berlin; visited numerous cities in Germany, France, and Scandinavia, investigating their archives; was appointed professor of history at Kiel in 1842, at Göttingen in 1849, and removed in 1875 to Berlin as editor of the *Monumenta Germaniæ Historica*. His principal works are—*Deutsche Verfassungsgeschichte* (4 vols., 1843–61), *Die Schleswig-holsteinische Geschichte* (2 vols., 1851–54), *Lübeck unter Jürgen Wullenweber* (3 vols., 1855–56), *Grundzüge der Politik* (1862), besides numerous minor essays, monographs, and editions of documents relating to the history of Germany.

Waitz (THEODOR), b. at Gotha, duchy of Saxe-Weimar, Mar. 17, 1821; studied philosophy and mathematics at Leipsic and Jena; travelled in 1842–43 in France and Italy; published in 1844–46 a critical edition of Aristotle's *Organon* in 2 vols., and was appointed professor of philosophy in 1848 at the University of Marburg, where he d. May 21, 1864. He wrote—*Grundlegung der Psychologie* (1846), *Lehrbuch der Psychologie als Naturwissenschaft* (1849), *Allgemeine Pädagogik* (1852); but his principal work is his *Die Anthropologie der Naturvölker* (5 vols., 1860–67; last volume edited by Gerland), vol. i. giving a general introduction; ii., treating of the negroes of Africa; iii.–iv., the aboriginal inhabitants of America; v., the Malayo-Polynesian nations. He also wrote *Die Indianer Nordamerikas* (1864).

Waiv'er [from *waif*]. This term, in its most comprehensive sense as a word of legal nomenclature, denotes the passing by, declining, or refusing by a person to accept of rights which may avail to him, or to take advantage of privileges which may exist in his favor, or to interpose objections which might be raised to the regularity or suffi-

ciency of proceedings instituted or pending against him. As a general principle, a person may thus waive all rights and privileges which affect him individually, so that no other one would be damnified by the act. When, however, the right or privilege is of a public nature, or grows out of circumstances which are required to be strictly regular and legal from considerations of public policy, a private person is not permitted to waive such right, and thus to derange or defeat a policy which affects large classes or perhaps the entire people of a State. A waiver may either be intentional and done in a direct and formal manner, or it may be unintentional and the consequence of negligence or a disregard of established methods. In the first case the intention to surrender a right must be clearly and unequivocally expressed; and in order both to remove all doubt and to furnish the highest evidence of the party's design, the law sometimes requires the act to be in writing. The second case furnishes the greatest variety of practical questions. In all judicial proceedings, criminal or civil, the law prescribes a greater or less number of steps to be taken in a certain manner, by certain forms, and at certain times; and if this established order is not accurately complied with, the adverse party may object to the irregularity; but if he, in turn, does not interpose his objection at the proper time or by the proper mode, he is considered as having waived it, and cannot be heard to urge it afterward, unless, indeed, the original fault was vital to the whole proceedings, and so tainted them with imperfection that a proper notice of it given at an earlier stage would not have enabled the opposite party to make a sufficient correction without actually commencing anew. The particular instances of this waiver through *laches* are almost as numerous as the possible irregularities which may happen and the possible objections which may be taken to them. Another common species of waiver is intentional, and is shown in the choice of legal remedies. On the occurrence of certain delicts or wrongs a double remedial right is given to the injured party for his election. For example, when the wrongdoer has taken and carried away or converted the goods of another, the owner may either treat the act as a tort, and may sue for the damages resulting therefrom, or he may waive the tort and the right of action springing from the tortious act, which often includes the power to have the defendant arrested, and may simply regard the transaction as a sale of the goods and bring an action on the contract for their price. Also, when a buyer has procured a sale to himself on credit by means of false and fraudulent representations, so that the vendor might rescind the contract and either retake the goods or recover damages for their wrongful conversion, he may waive the fraud and all of its remedial consequences, and sue directly for the price. In these and all similar cases the intention to waive is shown by the kind of action which the plaintiff commences. Another example is the waiver of the forfeiture arising from the breach of a condition in a lease or other conveyance. Such forfeitures are deemed harsh and inequitable, and the law requires great strictness and regularity in their enforcement. If, therefore, the lessor or other person claiming by virtue of the forfeiture does any act subsequent to the breach of the condition which recognizes the estate and the rights conferred by it as still continuing to exist, he thereby, as a general rule, waives the forfeiture, although that result may not have been intended by him. JOHN NORTON POMEROY.

Wakan'da, tp., Carroll co., Mo. P. 5342.

Wakarusa, p.-v., Elkhart co., Ind., about 58 miles N. W. of Fort Wayne; has good schools, 1 weekly newspaper, 1 machine-shop, 1 grist and 2 saw mills, and 5 stove-shops. P. 245. J. H. BRUBAKER, ED. "SUN."

Wakaru'sa, tp., Douglas co., Kan. P. 2401.

Wake, in old English usage, is the equivalent of VIGIL (which see), and in most instances where the term occurs in old books it is to be understood in this sense. In many English parishes the term and custom still survive in the "country wakes," ancient festivities which are kept up on the eves of certain saints' days. The *lyke-wake*, in which the neighbors of a deceased person hold a watch over the dead body, is a custom of entirely different character. It is found among the lower classes in several countries, notably among the Irish.

Wake, county of Central North Carolina, drained by Neuse and Little rivers, and traversed by North Carolina Raleigh and Gaston and Augusta R. Rs.; surface hilly, soil moderately fertile. Granite and plumbago are found. There are flour-mills, saw-mills, and manufactures of carriages, railway cars, iron castings, machinery, and paper. Cattle, sheep, and swine are the principal live-stock. Staples, cotton, Indian corn, sweet potatoes, and tobacco. Cap. Raleigh, which is also the capital of the State. Area, 1010 sq. m. P. 35,617.

Wake (WILLIAM), D. D., b. at Blandford, Dorsetshire, England, in 1657; graduated at Christ Church, Oxford, 1676; took orders in the Church of England; became chaplain to the English embassy in France; had a theological controversy with Bossuet, arising from what he claimed to be a misrepresentation of the doctrine of the Church of England, 1686–88; became preacher to Gray's Inn, canon of Christ Church 1689, chaplain to King William, rector of St. James, Westminster, 1693, dean of Exeter 1701, bishop of Lincoln 1705, archbishop of Canterbury 1716, and discussed with Dupin a project for the union of the English and Gallican churches 1718. D. Jan. 24, 1737. Author of several controversial publications against Bishop Atterbury, three volumes of *Sermons*, and a translation of the *Apostolical Fathers* (1693).

Wake'field, town of England, county of York, on the Calder, is well built, and has many educational and benevolent institutions. Its manufactures of cloth and yarn have declined, but its trade in corn, cattle, and coal is very considerable. P. 28,069.

Wakefield, p.-v., Clay co., Kan.

Wakefield, p.-v. and tp., Middlesex co., Mass., on Boston and Maine, Newburyport and Georgetown, and South Reading branch of Eastern R. Rs., 10 miles N. of Boston, contains 4 churches, a public library containing about 1500 volumes, a town-hall, 2 banks, 1 newspaper, and manufactories of rattan, stoves, and boots and shoes. P. 4135.
W. H. TWOMBLY, ED. "CITIZEN AND BANNER."

Wakefield, tp., Stearns co., Minn. P. 613.

Wakefield, p.-v. and tp., Carroll co., N. H. P. 1185.

Wakefield, p.-v., Washington co., R. I.

Wakefield, tp., Rappahannock co., Va. P. 1362.

Wakefield, tp., Sussex co., Va. P. 1063.

Wakefield (EDWARD GIBBON), b. in England about 1796; educated to the business of a land-surveyor; was brought into public notice in 1826 from having eloped to Gretna Green and there married a young heiress of fifteen; was tried and convicted of forcible abduction, the marriage being declared null by special act of Parliament, and imprisoned three years in Newgate; turned his experience to advantage by writing a book upon prison management; subsequently made minute inquiries upon the system of colonization by convicts in Australia, writing a volume of *Letters from Sydney* so full of local knowledge as to be generally accepted as a genuine book of travel; published *Tracts relating to the Punishment of Death in the Metropolis* (1831), and a careful work on *England and America, a Comparison of the Social and Political State of the Two Nations* (2 vols., 1833), and *A View of the Art of Colonization* (1833), in which he promulgated the "new colonization system," on which he gave evidence before a committee of the House of Commons; was a director of an association formed upon his system for the colonization of New Zealand and of South Australia; attacked the system of penal transportation, to which he gave the first effective blows, aided by Robert S. Rentoul and Sir William Molesworth; accompanied the earl of Durham to Canada as his private secretary, and rendered valuable service in the introduction of the new form of government; resided for some years in the S. of France, but subsequently removed to New Zealand, a colony which owed its existence largely to his efforts, and where his brother, Col. William, and his son, Edward Jerningham, had been (1839) pioneer settlers. D. at Wellington, New Zealand, May 16, 1862. The distinctive principle of the "Wakefield system" much resembles that of the American homestead and pre-emption legislation, consisting in selling the lands in small lots and at low prices to actual settlers, and employing the proceeds as a fund for the transportation of fresh emigrants. PORTER C. BLISS.

Wakefield (GILBERT), b. at Nottingham, England, Feb. 22, 1756; graduated at and became fellow of Jesus College, Cambridge, 1776; took orders; appointed curate of Stockport, Cheshire, and of St. Peter's, Liverpool, 1778; classical tutor in the dissenting academy at Warrington 1779–83; formally abandoned the Church of England 1786, becoming a "Socinian" or Unitarian, though without any church connection; was classical tutor at Hackney Academy 1790–91; published *Silva Critica* (5 parts, 8vo, Camb. and Lond., 1789–95) and a *Translation of the New Testament* (3 vols., 1791); attacked the practice of public worship in a pamphlet entitled *An Enquiry into the Expediency and Propriety of Social Worship* (1791); wrote his own *Memoirs* (1792), a volume of *Evidences of Christianity* (1793); edited several of the classics, especially *Lucretius* (3 vols., 1796–97); engaged in controversy with Porson and others on points of classical learning, on which subjects he corresponded at length with Charles James Fox; was imprisoned in Dorchester jail 1799–1801 for a "seditious libel" he had published in reply to Bishop Watson's *Address to the Peo-*

ple of Great Britain. His political friends presented him with £5000 as a token of their sympathy and esteem. D. at Hackney Sept. 7, 1801.

Wakefield (Priscilla **Trewman**), b. at Tottenham, near London, England, in 1751, of Quaker parents, was a descendant of Robert Barclay, the celebrated Quaker apologist; married Edward Wakefield 1771; wrote numerous works for the young, and established at Tottenham in 1798 the "Frugality Bank," which in 1804 was reorganized as the first savings bank in Great Britain. D. at Ipswich Sept. 12, 1832.

Wakefield (Robert), b. in the N. of England about 1480; educated at the University of Cambridge and on the Continent; became "the greatest linguist of his time;" taught Greek, Hebrew, Chaldaic, and Syriac in France and Germany; was for some years professor of Hebrew at the University of Louvain; returned to England 1519, and became chaplain to Dr. Richard Pace; rendered assistance to Henry VIII. in the matter of his divorce from Queen Catharine of Aragon; became lecturer in Greek at Cambridge 1524, professor of Hebrew at Oxford 1530; was a canon of Wolsey's new college 1532, and saved many Hebrew and Greek MSS. from destruction at the dissolution of the lesser monasteries 1536. D. in London Oct. 8, 1537. His *Oratio de Laudibus et Utilitate trium Linguarum Arabicæ, Chaldaicæ, et Hebraicæ*, etc. (London, 1524), printed by Wynkin de Worde, was the first book issued in London in which Hebrew and Arabic characters were employed, they having been specially cut in wood. Among his other works were a Latin paraphrase of *Koheleth* (Ecclesiastes) and a *Syntagma de Hebræorum Codicum Incorruptione*, the latter (*s. l. et a.* 4to) an extremely rare specimen from the press of De Worde.

Wake Forest, p.-v. and tp., Wake co., N. C. P. 3135.

Wake'man, p.-v. and tp., Huron co., O., beautifully situated on the banks of Vermilion River, 12 miles S. of Lake Erie, 45 miles W. of Cleveland, and 68 miles E. of Toledo, on Lake Shore and Michigan Southern R. R. The business of the village is in farm produce and the manufacture of oil barrels, pumps, flour, etc. It contains 4 churches, good schools, and 1 weekly newspaper. P. of v. about 500; of tp. 1216. F. M. Lewis, Ed. "Free Press."

Wake-Robin, a plant. See Arum.

Wakesh'ma, tp., Kalamazoo co., Mich. P. 1401.

Wak'ley (Thomas), M. D., b. at Membury, Devonshire, England, in 1795; studied medicine and surgery in London, attending the lectures of Sir Astley Cooper 1815; practised some years as a surgeon in London; retired from active practice in 1823, when he founded the *Lancet*, a weekly medical journal, which he edited nearly forty years, and which was instrumental in promoting many reforms in surgery and medicine. Dr. Wakley was coroner for Middlesex 1839–62, and sat in Parliament 1835–52. D. in the island of Madeira May 2, 1862.

Waknafi, a tribe of East African nomads, inhabiting a territory near the coast and traversed by the equator. They are heathens, but practise circumcision, and by their language seem to be of Arabian stock. Their manner of life is much like that of the Tartars. They are a warlike people, but are low in the scale of civilization.

Wakul'la, county of N. Florida, bordering on Appalachee Bay, bounded W. by Ocklockonee River, and E. by the St. Mark's, and traversed by a branch of Jacksonville Pensacola and Mobile R. R.; surface level, soil fertile. Live-stock, principally cattle and swine. Staples, Indian corn and a little cotton and sugar. Cap. Crawfordville. Area, 504 sq. m. P. 2506.

Wal'bridge (Hiram), b. at Ithaca, N. Y., Feb. 22, 1821; graduated at Ohio University 1841; studied law at Toledo, O.; was admitted to the bar 1843; became brigadier-general of Ohio militia 1844; settled in New York City as a merchant 1847; was a Democratic member of Congress 1853–55; was a fluent speaker, an effective promoter of internal improvements, and an earnest supporter of the war for the Union, advocating early in 1861 the calling out of 600,000 volunteers; declined a seat in Mr. Lincoln's cabinet; was vice-president of the national commercial convention at Chicago, and president of similar bodies convened at Detroit and Louisville, and in 1869 was a national commissioner to examine and report on the Pacific R. R. D. in New York City Dec. 6, 1870.

Walch (Christian Wilhelm Franz), b. at Jena Dec. 25, 1726; studied theology and philosophy at the university of his native city, where his father was a professor of theology; travelled through Germany, Holland, France, Switzerland, and Italy, and was appointed professor of philosophy in 1750 at Jena, and in 1753 at Göttingen, where he subsequently became professor of theology, developed a great activity as a teacher, and d. in 1784. Of his works, which mostly relate to ecclesiastical history, the most remarkable are—*Historia Adoptianorum* (1755), *Historia Patropaschitarum* (1760), and *Entwurf einer vollständigen Historie der Ketzereien* (11 vols., 1762 *seq.*).

Walch (Johann Georg), b. at Meiningen in 1693; studied at Jena, and was appointed professor there, first in eloquence in 1719, then in theology in 1724. D. in 1775. The most remarkable of his writings are—*Philosophisches Lexicon* (2 vols., 1726), *Bibliotheca Theologia Selecta* (4 vols., 1757–65), and *Theologia Patristica* (1770; revised ed. 1831). He had three sons—Johann E. I. (1725–78), professor and writer on theology and mineralogy; Christian W. F. (which see); and Karl F. (1734–99), professor and writer on law.

Wal'cheren, island of the Netherlands, forming part of the province of Zealand, between the East and West Scheldt and the North Sea. It is 11 miles long and 10 miles broad, and has 45,000 inhabitants. It is low, and is protected against inundation partly by natural downs, partly by immense dykes, the rupture of which has on more than one occasion been most disastrous, but it is very fertile, and contains fine tracts both of meadow and arable land. The northern part of the island is well wooded. Walcheren is somewhat famous in military history for the disastrous expedition of the English under Lord Chatham and Admiral Strachan in 1809.

Wal'ckenaër (Charles Athanase), Baron, b. in Paris Dec. 25, 1771; was drafted into the army in 1793, and held some administrative position; attempted literature, both the philosophical essay and the romance; entered the civil service during the Restoration, and was appointed prefect of the department of Nièvre in 1824 and of that of Aisne in 1826; retired from public life in 1830, and devoted himself exclusively to science; was chosen perpetual secretary of the Academy of Inscriptions in 1840. D. at Paris Apr. 27, 1852. His most remarkable works are—*Faune parisienne des Insectes* (1805), *Tableau des Aranéides* (1805), *Histoire naturelle des Insectes aptères* (1837), *Le Monde maritime* (1819), *Géographie historique et comparée des Gaules* (1839), *Mémoires touchant la Vie et les Écrits de Mme. de Sévigné* (5 vols., 1842); he also published *Nouvelle Collection de Voyages* (21 vols., 1826–31).

Wal'cott, tp., Rice co., Minn. P. 599.

Walcott (Mackenzie Edward Charles), F. S. A., b. in England in 1822; educated at Winchester School; graduated at Exeter College, Oxford, 1844; took orders in the Church of England; was for some years curate of St. Margaret's, and subsequently of St. James's, Westminster; became precentor and prebendary of Chichester cathedral 1863; was minister of Berkeley chapel, Westminster, 1866–69; is a member of many learned societies, a distinguished authority upon archæology and architecture, and a contributor to numerous magazines and other periodicals. Author of *The History of St. Margaret's Church, Westminster* (1847), *Memorials of Westminster* (1849), *William of Wykeham and his Colleges* (1852), *The Cathedrals of the United Kingdom* (1859), *The Minsters and Abbey Ruins of the United Kingdom* (1859), *The South Coast of England* (1859), *The East Coast of England* (1861), *Guide to the Lakes, Mountains, and North-west Coast of England* (1860), *Cathedral Cities of England and Wales* (London, 6 vols., 1866), *Memorials of Canterbury* (1868), similar *Memorials* of Stamford, Carlisle, Exeter, Chichester, Worcester, and other cities (1865), *Sacred Archæology, a Popular Dictionary of Ecclesiastical Arts and Institutions* (1868), and numerous other works, including sermons and poems.

Wald, town of Rhenish Prussia, manufactures articles of brass, copper, iron, and steel. P. 5775.

Wal'deck-Pyr'mont, principality of North-western Germany, consists of two parts—Waldeck, situated between Rhenish Prussia and Hesse-Cassel, and comprising an area of 407 sq. m., with 51,824 inhabitants; and Pyrmont, situated between Hanover and Brunswick, and comprising an area of 25 sq. m., with 7319 inhabitants. Both districts are hilly, but fertile and well cultivated, rich in salt, iron, marble, and sandstone, and covered with fine forests. Agriculture and breeding of cattle are the principal occupations, and timber and mineral waters from the celebrated springs of Pyrmont form the two chief items of export.

Wal'den, p.-v., Montgomery tp., Orange co., N. Y., on Walkill Valley R. R., 73 miles N. of New York City, has 3 churches, excellent schools, 2 banks, 1 newspaper, foundry and machine-shops, 2 cutlery-works, a woollen-mill, soap-works, and 2 hotels. P. 1254.

Chauncey A. Reed, Ed. "Herald and Recorder."

Walden, p.-v. and tp., Caledonia co., Vt. P. 992.

Wal'den, or **Waldensis** (Thomas), whose family name was Netter, b. at Saffron-Walden, Essex, England, about 1380; educated at Oxford; entered the Carmelite order in

London, and was ordained sub-deacon 1395; was sent by Henry V. as his representative at the Council of Pisa 1409; became provincial of the English Carmelites 1414; attended in that capacity the Council of Constance 1415; went to Lithuania 1419; founded there several houses of his order, and negotiated a peace between the king of Poland and the Teutonic Knights; was confessor to Henry V., whom he attended on his deathbed 1422; took a prominent part in the persecution of the Lollards; accompanied Henry VI. to France, and d. at Rouen Nov. 2, 1430. Author of treatises, *Doctrinale antiquum Fidei Ecclesiæ Catholicæ* and *De Sacramentis*, and supposed to have been the writer of the series of tracts entitled *Fasciculi Zizaniorum Johannis Wycliff* ("Bundles of Wycliffe's Tares"), first edited by Dr. W. W. Shirley in the "Rolls Series" (1858).

Walden's, tp., Calhoun co., Ala. P. 1070.

Walden'ses, called also **Vallenses** or **Valdenses** [from *vallis*, "valley"], and **Vaudois** ["men of the valleys"], a Protestant sect and community in Italy, numbering in 1839 about 20,000, now numbering about 25,000, most of whom are in Piedmont, on the eastern slope of the Cottian Alps, from 25 to 40 or more miles S. W. of Turin, occupying a romantic district of about 22 by 18 miles. From 1686 to 1829 there were thirteen parishes—there are now sixteen—in the three valleys of Lucerna, Perosa, and San Martino. In 1814 the territory was reannexed to Sardinia. The original language of the people was a dialect of the old Provençal, which gave way largely to the French in consequence of the introduction, after the plague of 1630, of fifteen pastors from Geneva. But Italian is also spoken, and is now steadily gaining ground. Of four journals published in 1873, three were in Italian and one in French. The people are remarkably intelligent, industrious, honest, and hospitable. For 600 years they have claimed descent from a race which peopled the same valleys and professed the same faith in the first centuries of the Christian era. This claim, once generally allowed by Protestant historians, and still maintained by some, is no longer tenable. Vigilantius of the fourth century, and Claudius of Turin of the ninth, were not Waldenses. The name is probably derived from that of a wealthy merchant of Lyons in France, who is called Waldo, Waldus, Waldius, and even Waldensis. The earliest authority for Peter Waldo or Petrus Waldus is a manuscript of 1404 A. D.; the date of his birth is not known. The sudden death of one of his friends, an eminent citizen of Lyons, turned his attention to spiritual things. Two ecclesiastics were employed to prepare for him vernacular translations of the Gospels, with other portions of Scripture, and some passages of the Fathers topically arranged. About 1170—some say in 1173—he distributed his property to the poor, and, with several associates of both sexes who had joined him, began to preach in the streets of Lyons and of other places in the neighborhood. His aim was to revive the fervent, simple, self-denying piety of the early Church. He emphasized the right and duty of every Christian to study the Scriptures for himself, and held that laymen, if only truly regenerate, might properly preach and administer the sacraments. His followers styled themselves *Humiliati* ("the Poor"). Others called them *Leonistæ* (from *Leona* = Lyons) or *Sabotati* (from *sabot*, "wooden shoe"). The name *Waldenses* first occurs in 1194 in an edict of Ildephonsus, king of Aragon. Waldo was excommunicated by the archbishop of Lyons, but appealed to the pope (Alexander III.), and the third Lateran Council, then (1179) in session, failed to brand him as a heretic. Afterward, at Verona, under Lucius III., in 1184, he was condemned and driven into exile. He died in 1197, possibly in Bohemia, but probably in Northern Italy. His followers multiplied rapidly in several countries, but especially in Southern France, Northern Spain, and Northern Italy, whence, from the latter part of the thirteenth century, they gradually came together in the valleys of Piedmont and Savoy, and have remained there ever since, in spite of thirty-three bloody persecutions, some of which are among the bloodiest in history. One of these massacres (in 1655) called forth Milton's immortal sonnet beginning—

> "Avenge, O Lord! thy slaughtered saints, whose bones
> Lie scattered on the Alpine mountains cold."

Setting aside their claim to a high antiquity, recent writers recognize three periods in the history of the Waldenses: (1) When they differed but very little from the Roman Catholics except in regard to purity of life and the use of Scripture; (2) when they denounced Rome as Babylon and the pope as Antichrist; (3) since their reformation in doctrine, which began in the time of Huss of Bohemia (d. 1415), and was completed in the time of Luther and Calvin. As late, apparently, as 1520 or 1524 their form of government was still episcopal. They are now Presbyterians, each congregation having a pastor, elders, and deacons. The churches are all under a consistory called "The Table." Their present standard of doctrine is a confession (of 33 articles) dating from 1655, and probably composed by Jean Leger, then their moderator, afterward (1669) their historian. This confession is Calvinistic—indeed, is borrowed largely from the Gallic Confession of 1559, which, if not composed by Calvin himself, had both his inspiration and his approval. Their more ancient summary of doctrine, *The Noble Lesson*, which was formerly supposed to have come down from the twelfth century, is now assigned to the fifteenth. Great injustice is done them by those Roman Catholic writers who confound them with the Albigenses and Cathari. They were never tainted with the Manichæan heresy. Between them, however, and the Bohemian Brethren the connection was very close, although it is impossible to determine exactly the indebtedness of each to the other. A new era in their history dates from the visit of Dr. Gilly, canon of Durham, in 1823, whose *Narrative of an Excursion to the Mountains of Piedmont* (1824) recalled the attention of the Protestant world to this interesting people. Moved by this book, which he chanced to see in the library of the duke of Wellington, Col. Beckwith, who had lost a leg under Wellington at Waterloo, went among the Waldenses in 1827, and remained there, laboring earnestly for their improvement, with only occasional interruptions, till he died in 1862. A *Memoir* of Col. Beckwith, by J. P. Meille, Waldensian pastor at Turin, was published in 1873. Since 1848, when for the first time in all their heroic history full liberty of worship was granted them, the Waldenses have greatly flourished. In Turin they number 1500, have removed their theological seminary to Florence, are sending forth missionaries, and have established congregations in all parts of the Italian peninsula. They have hospitals and colleges (at La Tour and Pomaret) and excellent schools.

The literature of the subject is copious. Perrin, *Histoire des Vaudois* (1619); Morland, *History of the Evangelical Churches of the Valleys of Piedmont* (1658); Leger, *Histoire générale des Eglises évangéliques des Vallées de Piemont ou Vaudoises* (1669); and Allix, *Some Remarks upon the Ecclesiastical History of the Ancient Churches of Piedmont* (1690; new ed. 1821); Maitland, *Tracts and Documents illustrative of the Doctrines and Rites of the Ancient Albigenses and Waldenses* (1832); Muston, *Histoire des Vaudois* (1834) and *L'Israël des Alpes* (1851, 4 vols.); Monastier, *Histoire de l'Eglise vaudoise* (1847, 2 vols.); Hahn, *Geschichte der Waldenser* (1847); Dieckhoff, *Die Waldenser im Mittelalter* (1851); Herzog, *Die romanischen Waldenser* (1853); Todd, *Books of the Vaudois* (1865); Palacky, *Verhältniss der Waldenser zu den böhmischen Secten* (1869); Schaff, *Creeds of Christendom* (1877, 3 vols.). R. D. Hitchcock.

Wal'do, county of S. Maine, bounded E. by Penobscot River and Bay, drained by St. George and Marsh rivers and affluents of the Sebasticook, and traversed by Maine Central R. R.; surface undulating, with considerable productive soil. It has a large export-trade in timber, staves, lime, etc., and a considerable cod and mackerel fishery. Principal live-stock, cattle and sheep. Staples, manufactured articles, lumber, potatoes, oats, hay, wool, and dairy products. Cap. Belfast. Area, 812 sq. m. P. 34,522.

Waldo, tp., Livingston co., Ill. P. 1051.

Waldo, p.-v. and tp., Waldo co., Me. P. 618.

Waldo, p.-v. and tp., Marion co., O. P. of v. 247; of tp. 1029.

Waldo (Daniel), b. at Windham, Conn., Sept. 10, 1762; was a soldier in the Revolution: taken prisoner at Horseneck and confined in the Sugar-house prison, New York; graduated at Yale College 1788; was a Congregational pastor at West Suffolk, Conn., 1792–1809; was afterward settled at Cambridgeport and Harvard, Mass., and at Exeter, R. I.; was a home missionary in Pennsylvania, New York, and Rhode Island; resided in New York: became chaplain to the House of Representatives 1855. D. at Syracuse, N. Y., July 30, 1864, at the age of 102 years.

Waldo (Peter). See Waldenses.

Waldo (Samuel), b. at Boston, Mass., in 1696: engaged in commerce at Falmouth, Me.; acquired a large fortune; crossed the ocean fifteen times: was an intimate friend of Sir William Pepperell, with whom he served in the Massachusetts council, and as brigadier-general and commander of a regiment at the capture of Louisburg, 1745, and spent a year with him in England upon public service. D. on Penobscot River, Me., May 23, 1759.

Waldo (Samuel), b. at Windham, Conn., in 1783; studied painting at Hartford, Conn.; went to London 1806: was there associated with Benjamin West, J. S. Copley, and Robert Fulton, and became a successful portrait-painter, which profession he exercised in New York City fifty-two years, from Jan., 1809, to his death, Feb. 16, 1861.

Waldo (Samuel Putnam), grandson of Gen. Israel Putnam, b. in Connecticut in 1780; author of *Lives* of Jackson, Decatur, Nicholas Biddle, Paul Jones, E. Preble, and A. Murray; of *Tour of James Monroe* (1818); prepared for publication Archibald Robbins's *Journal of the Loss of the Brig Commerce upon the Western Coast of Africa.* (See Riley, James.) D. at Hartford, Conn., Mar., 1826.

Wal'doboro', p.-v. and tp., Lincoln co., Me., on Knox and Lincoln R. R., at the head of tidewater on Medomak River, has 6 churches, good schools, 2 circulating libraries, 1 newspaper, and 2 banks; seat of U. S. customs district; incorporated 1773. Principal business, shipbuilding. P. 4174. S. L. Miller, Ed. "Lincoln County News."

Wal'dron, p.-v., cap. of Scott co., Ark., has good schools, 2 silversmiths, 2 furniture manufactories, 1 newspaper, 2 gins, 2 hotels, and 1 mill. P. 162.
R. A. Allison, Ed. "Reformer."

Wald'wick, tp., Iowa co., Wis. P. 935.

Wales was inhabited by the Cymries, a people of Celtic descent, at the time when the Romans first came to Britain. Conflicts soon arose between the Cymries and the Romans, and the latter repeatedly invaded Wales, though without conquering it. Against the Anglo-Saxons the Cymries succeeded also in vindicating their independence, but at the time of the Danish conquest of England, Wales had become divided between several princes who warred against each other, and the Cymries were finally compelled to pay tribute. The tribute, however, was refused to William the Conqueror, and he accordingly invaded the country and conquered it. The Welsh retained their own native princes, but they had to pay tribute, and their independence was gone. Rebellions and wars ensued, until, in 1282, Llewellyn ap Griffith (which see) was defeated and slain, and Edward I. united the country with England by the statute of Rhuddlan (1284), and gave his son, afterward Edward II., who was born in the castle of Carnarvon Apr. 25, 1284, the title of prince of Wales. The country, however, still retained a kind of political independence, but as this gave rise to frequent controversies and new insurrections (see Glendower), Henry VIII. finally merged the country completely into England in 1536. (For its geography, statistics, language, and literature see Great Britain and Welsh Language and Literature.)

Wales, p.-v. and tp., Androscoggin co., Me. P. 556.

Wales, p.-v. and tp., Hampden co., Mass. P. 831.

Wales, p.-v. and tp., St. Clair co., Mich. P. 1358.

Wales, p.-v. and tp., Erie co., N. Y. P. 1416.

Wales, New South. See New South Wales.

Wales, Prince of. See Albert Edward.

Wales'ville, p.-v., Whitestown tp., Oneida co., N. Y. P. 115.

Walew'ski (Alexandre Florian Joseph Colonna), Count and Duke, b. at Walewice, Poland, May 4, 1810, a son of Napoleon I. and the countess Walewska; was educated at Geneva; fought in the ranks of the Polish patriot army in 1830, and was sent in the same year to London to solicit an English intervention; went to France after the fall of Warsaw; entered the army as a captain, and was naturalized as a French citizen; gave up subsequently the military career and devoted himself to politics and literature; wrote *Un Mot sur la Question d'Afrique* (1837), *L'Alliance anglaise* (1838), also a drama, *L'École du Monde* (1840), and founded the *Messager*, which he sold in 1840 to Thiers; entered the diplomatic service, and was chargé d'affaires to Buenos Ayres at the outbreak of the Revolution of 1848; was sent in 1849 as ambassador to Florence, and in 1854 to London; was minister of foreign affairs May 7, 1855–Jan. 4, 1860, minister of state Nov. 24, 1860–June 23, 1863, and president of the Legislative Assembly Sept. 1, 1865–Apr. 2, 1867. D. at Strasbourg Oct. 27, 1868.

Wal'ford (Edward), b. at Hatfield Peverell, Essex, England, in 1823, is a great-grandson of Sir William Pepperell, Bart.; was educated at the Charter-house; graduated at Baliol College, Oxford, 1845; took orders in the Church of England, but being in sympathy with the "Tractarian" movement, soon seceded to the Roman Catholic Church; became assistant master of Tunbridge School 1846; afterward became a private tutor in preparing pupils for Oxford, and has written or edited numerous educational, biographical, genealogical, and literary works, and translated several volumes of the Greek ecclesiastical historians in "Bohn's Library." He was editor and proprietor of the *Court Circular* 1858–59, sub-editor of *Once a Week* from its beginning to 1863, editor of the *Gentleman's Magazine* 1865–68, and of the *Register* from July, 1869. Among his publications were the annual *Shilling Peerage*, *Shilling Baronetage*, etc. (1857 *seq.*), *Men of the Time* (1862), and *Representative Men in Literature, Science, and the Arts, with Photographic Portraits* (1867). He has written many biographies in Knight's *Cyclopædia*, and furnished for many years the obituaries of distinguished men to the *Times*, *Illustrated London News*, and other leading periodicals.

Walhal'la, in Northern mythology, the name of the magnificent palace, resting on spears and covered with shields, to which the warriors repaired when they fell on the battlefield fighting bravely. Those who were cowards and died in their beds from sickness or old age were sent to Niflheim, and that place was as dark and gloomy, as silent and shadowy, as Walhalla was bright, resplendent, and stirring with life. Every morning the Einheriars, the inhabitants of Walhalla, marched out at cock's crow from its 540 doors, through each of which 800 men could walk abreast. The day they spent to their hearts' delight in fighting furiously against each other, but toward sunset all the wounds healed up, and home they went to the banquet in Odin's hall, where roast pork, the favorite dish of the old Norsemen, was served, cut fresh every morning from the wild boar Sæhrimner, while Freya's maids handed round the strong mead in golden horns. The idea of a future life was much more vivid in the Scandinavian mythology than in any other pagan religion, and it had a direct bearing on man's conduct in this life, as his future state was wholly dependent on the deeds he achieved during his life on earth. But his moral ideas were extremely narrow, nearly confined to a mere distinction between bravery and cowardice, and his ideas of moral reward and punishment were extremely coarse, simply an exaggerated image of his earthly delights.

After the wars between Germany and France, which ended with the downfall of Napoleon I. in 1815, King Louis I. of Bavaria conceived the idea of erecting a temple of fame which should be called Walhalla, and in which busts and statues should be placed of all the great men Germany had produced. The temple was built 1830–42, and it is certainly one of the most remarkable edifices in Germany. It is a copy of the Parthenon, 232 feet long, 110 feet broad, and 63 feet high, built of a fine reddish marble, and situated at Donaustauf, on a hill on the Danube 250 feet above the river. The substructure and the surroundings are magnificent, and contribute largely to set off the building itself. The design was made by Leo von Klenze, the bas-reliefs, statues, and groups which adorn the edifice by Rauch, Schwanthaler, and I. M. Wagner. It is singular, however, that a German temple of fame should be a Greek building with a Scandinavian name; and German critics say that a similar confusion reigns with respect to the Einheriars who are selected for this Walhalla.
Clemens Petersen.

Walhalla, p.-v., cap. of Oconee co., S. C., the present terminus of Blue Ridge R. R., contains 4 churches, a college, 1 bank, 1 newspaper, 1 brewery, and 2 hotels. P. 716.
Thompson & Keith, Eds. "Keowee Courier."

Walhon'ding River, called also **White Woman's River** and **Mohican River,** is formed by several forks which unite in Ashland co., O. At Coshocton, O., the stream joins the Tuscarawas, and forms Muskingum River.

Walke (Henry), U. S. N., b. in Virginia in 1809; entered the navy as midshipman Feb. 1, 1827; became lieutenant in 1839, commander in 1855, captain in 1862, commodore in 1866, rear-admiral in 1870; retired in 1871. Served with great gallantry during the civil war at Fort Henry, Fort Donelson, Island No. 10, Vicksburg, Grand Gulf, Memphis, and various other places on the Western waters, and was complimented in official despatches by the secretary of the navy, the general of the army, and Rear-Admirals Foote, Porter, and Davis. Foxhall A. Parker.

Walk'er, county of N. W. Alabama, drained by Blackwater and Gipsy rivers and affluents of the Black Warrior; surface hilly, soil in the valleys fertile. Bituminous coal is found, and timber is abundant. Live-stock, principally cattle and sheep. Staples, cotton, rye, sweet potatoes, and wool. Cap. Jasper. Area, 828 sq. m. P. 6543.

Walker, county of N. W. Georgia, drained by Chatooga and Chickamauga rivers, traversed by Taylor's ridge, and containing Lookout, White Oak, and Pigeon mountains; surface broken, soil rich along the streams. Bituminous coal, marble, limestone, and lead abound, and there are several fine mineral springs. Live-stock, principally cattle, sheep, and swine. Staples, cotton, Indian corn, wheat, wool, a little tobacco, and dairy products. Cap. Lafayette. Area, about 500 sq. m. P. 9925.

Walker, county of E. Texas, bounded N. E. by Trinity River and traversed by Houston and Great Northern R. R.; surface level, soil a rich alluvium. There are saw-mills and some manufactures of cotton and woollen. Principal live-stock, cattle and swine. Staples, cotton, Indian corn, and

sweet potatoes. Cap. Huntsville. Area, 854 sq. m. P. 9776.

Walker, tp., Conway co., Ark. P. 222.

Walker, tp., Hancock co., Ill. P. 1474.

Walker, tp., Jasper co., Ind. P. 281.

Walker, tp., Rush co., Ind. P. 1081.

Walker, tp., Anderson co., Kan. P. 891.

Walker, tp., Kent co., Mich. P. 1675.

Walker, tp., Moniteau co., Mo. P. 3492.

Walker, p.-v. and tp., Centre co., Pa. P. 1356.

Walker, tp., Huntingdon co., Pa. P. 978.

Walker, tp., Juniata co., Pa. P. 1608.

Walker, tp., Wise co., Va. P. 1036.

Walker, p.-v. and tp., Wood co., West Va. P. 1205.

Walker (Abraham Joseph), b. in 1818 near Nashville, Tenn.; graduated at Nashville University 1838; was admitted to legal practice 1841; settled at Jacksonville, Ala., 1842; became a successful lawyer and Democratic legislator; removed in 1852 to Talladega, and in 1854 became one of the State chancellors; was 1856–59 a judge of the State supreme court; chief-justice 1859–68. D. at Montgomery Apr. 25, 1872.

Walker (Amasa), LL.D., b. at Woodstock, Conn., May 4, 1799; educated in the common school at North Brookfield, Mass.; became a merchant at Boston 1825; was a prominent advocate of the construction of the Western R. R., an influential member of the early anti-slavery circles, and a leader in the cause of temperance; visited Europe 1843 and 1849 as delegate to peace conventions; was professor of political economy at Oberlin College, O., 1842–49; was a representative in the Massachusetts legislature 1848, member of the State senate 1849, secretary of state 1851–52; was chosen to the State constitutional convention 1853; was member of Congress 1862–63, and of the Philadelphia loyalists' convention 1866, and lecturer on political economy at Amherst College from 1861–66. D. at North Brookfield Oct. 29, 1875. Author of *The Science of Wealth* (1866; 7th ed. 1874), and one of the editors of the *Transactions* of the Agricultural Society of Massachusetts (7 vols., 1848–54).

Walker (Benjamin), b. in England in 1753; settled in New York at an early age; became a merchant; served in the Revolution as aide-de-camp to Gen. Steuben and to Washington 1781–82; was subsequently secretary to the governor of New York and a broker in New York City, where he was naval officer in Washington's administration; was a member of Congress 1801–03; became in 1797 agent for the vast landed estates of the earl of Bute in Central New York, and was identified with the growth and prosperity of Utica, where he d. Jan. 13, 1818.

Walker (Clement), b. at Cliffe, Dorsetshire, England, about 1595; educated at Christ Church, Oxford, but left without a degree; became usher to the exchequer; was originally a royalist and churchman, but having been chosen to the Long Parliament for Wells 1640, distinguished himself by his violence as a Presbyterian and promoter of the "Solemn League and Covenant," and by his hostility to the Independents, against whom he wrote his *Complete History of Independency* (1646–50), a work of great value for the annals of that stormy period; was imprisoned by Cromwell in the Tower 1649, where he d. Oct., 1651. He wrote there *The High Court of Justice, or Cromwell's New Slaughter-house.*

Walker (Dawson A.), b. in Grainger co., Tenn., Dec. 7, 1819; graduated at East Tennessee University at Knoxville in Aug., 1843; studied law and was admitted to the bar in Feb., 1845; moved to Georgia, and located at Spring Place in Mar., 1845; was appointed by the governor to fill a vacancy on the bench of the superior courts of the Cherokee circuit in Feb., 1860; was elected to the same place in Jan., 1861; was again appointed to the same position in Mar., 1865; in 1866 was elected by the legislature judge of the supreme court for six years, but lost this position under the reconstruction laws in 1868, as he was not renominated by Gov. Bullock. He was appointed by Pres. Grant one of the members of the civil service commission in 1871; in 1872 was the candidate of the Republican party for governor of the State. He is a lawyer of great distinction, and resides at Dalton. Alexander H. Stephens.

Walker (Francis Amasa), son of Amasa, b. at Boston, Mass., July 2, 1840; graduated at Amherst 1860; studied law under Judges Devens and Hoar at Worcester; entered the army 1861 as sergeant-major of Devens's regiment; became assistant adjutant-general of Couch's brigade Sept. 14, 1861, adjutant-general of Couch's division Aug. 11, 1862, colonel on the staff of the 2d army corps Dec. 23, 1863, and brevet brigadier-general 1865; was wounded at Chancellorsville; taken prisoner at Reams's Station, and confined in Libby prison, where his health was shattered; was a teacher at Williston Seminary, Easthampton, Mass., 1866–68; an editor of the Springfield *Republican* 1868–69; became chief of the bureau of statistics of the treasury department at Washington 1869; was superintendent of the ninth census of the U. S. 1870–71; commissioner of Indian affairs 1871–72, and has been since 1872 professor of political economy and history in the Sheffield Scientific School of Yale College. He edited three 4to volumes of *Census Reports*, compiled a *Statistical Atlas of the U. S.* (1874), and has published *The Indian Question* (Boston, 1873) and *The Wages Question* (New York, 1876).

Walker (Frederick), b. in London, England, in 1840; studied art at the Royal Academy; became a distinguished member of the Society of Painters in Water-Colors, and in 1871 an associate of the Academy. D. in London in 1876. Both his water-color and his oil paintings were deemed of great merit, and a collection of 200 of them was exhibited in London in 1876.

Walker (Freeman), b. Oct. 25, 1780, in Charles City co., Va.; went to Georgia in 1797, where, after a course of study, he was admitted to the bar, and commenced the practice of law in the city of Augusta in 1802; soon rose to eminence in his profession; in 1807 was a member of the State legislature, and in 1819 was elected a Senator of the U. S. In this body his talents shone with rare splendor. His speech on the Missouri question, it is said, "will ever remain a monument of his genius and patriotism." Richard Henry Wilde said of him that he was "generous, hospitable, and humane, of cheerful temper and familiar manners, idolized by his family, beloved by his friends, and admired by his countrymen." D. at his residence, in Richmond co., Ga., Sept. 23, 1827. Alex. H. Stephens.

Walker (George), D. D., b. in county Tyrone, Ireland, about 1650; educated at the University of Glasgow; took orders in the Church of England; was rector of Donoughmore, near Londonderry, Ireland, when James II. laid siege to that city 1689; raised a regiment, with which he gallantly defended Londonderry after it had been abandoned by its governor, and held out until the siege was raised, July 30, 1689. He received the thanks of the House of Commons, was nominated to the bishopric of Derry by William III., and was killed at the battle of the Boyne, July 1, 1690, "while exhorting the colonists of Ulster to play the man." He published *A True Account of the Siege of Londonderry* (1689) and a *Vindication.* His statue surmounts a lofty pillar at Londonderry.

Walker (Sir Hovenden), b. in Somersetshire, England, about 1660; entered the navy at an early age; became a captain 1692, rear-admiral of the red 1709, and of the white 1710; was knighted by Queen Anne 1711; commanded in that year the unfortunate naval expedition which sailed from Boston against Canada; lost half his vessels by shipwreck on the Isle aux Œufs, and had to abandon the enterprise; suffered the loss of his ship, the Edgar, which blew up at Spithead 1715, when he was dismissed the service; subsequently settled in South Carolina as a planter, and published *A Journal or Full Account of the Late Expedition to Canada* (London, 1720). D. at Dublin, Ireland, in Jan., 1726.

Walker (James), D. D., b. at Burlington (then Woburn), Mass., Aug. 16, 1794; graduated at Harvard College 1814; studied theology at Cambridge; was pastor of the Unitarian church in Charlestown, Mass. 1818–38; editor of the *Christian Examiner* 1831–39; Alford professor of moral and intellectual philosophy at Harvard 1838–53, and president of Harvard University 1853–60. D. at Cambridge Dec. 23, 1874. He left his valuable library and $15,000 in money to the university. Author of *Sermons preached in the Chapel of Harvard College* (1861), *A Memoir of Daniel Appleton White* (1863), *A Memoir of Josiah Quincy* (1867), and a posthumous volume of *Discourses* (1876); delivered three series of *Lectures on Natural Religion* and a course of Lowell lectures on the *Philosophy of Religion*; published a number of occasional sermons and addresses, and edited as college textbooks Dugald Stewart's *Philosophy of the Active and Moral Powers of Man* (Cambridge, 1849) and Dr. Thomas Reid's *Essays on the Intellectual Powers, abridged, with Notes and Illustrations from Sir William Hamilton and others* (Cambridge, 1850).

Walker (James Barr), D. D., b. at Philadelphia, Pa., July 29, 1805; became an operative in a factory at Pittsburg, and subsequently a printer; was clerk to Mordecai M. Noah in New York City, and principal of an academy at New Durham, N. J.; studied law at Ravenna, O.; graduated at Western Reserve College, Hudson, O., 1831; edited successively the *Ohio Observer* at Hudson, the *Watchman of the Valley* at Cincinnati, and the *Watchman of the Prairies* at Chicago, all religious newspapers; was also engaged in

the book-trade; studied theology, and was licensed to preach 1841, since which time he has resided at Mansfield, O., conducting a private orphan asylum and lecturing on the harmony between science and revealed religion at Oberlin College and Chicago Theological Seminary. Author of *The Philosophy of the Plan of Salvation* (Boston, 1855); a work published anonymously under the editorship of Prof. C. E. Stowe, but of which many thousands were quickly sold in the U. S. and in England, it being translated into five languages, including Hindostanee, *God Revealed in Nature and in Christ* (1855), intended as a refutation of the "development theory;" *Philosophy of Scepticism and Ultraism* (1857); *The Philosophy of the Divine Operation in the Redemption of Man* (London, 1862); and *The Living Questions of the Age* (Chicago, 1869).

Walker (John), b. at Colney-Hatch, near London, England, Mar. 18, 1732; was in early life engaged in mercantile pursuits, and was subsequently an actor; established in 1767 a school at Kensington, and from 1769 devoted himself to lecturing on elocution in England, Scotland, and Ireland, a profession in which he achieved great success. Author of several works on grammar and elocution, and of a *Critical Pronouncing Dictionary and Expositor of the English Language* (1791; 36th ed. 1862), which was long the standard work of its class, and still retains considerable value.

Walker (John G.), U. S. N., b. Nov. 20, 1835, in New Hampshire; graduated at the Naval Academy in 1856; became lieutenant in 1859, commander in 1866; served with distinguished gallantry at the taking of New Orleans and Vicksburg, and in almost all the battles on the Mississippi River and its tributaries during the years 1862 and 1863, and commanded the gunboat Saco at the taking of Wilmington, N. C., in 1865. Always commended for "coolness, sound judgment, and intrepidity."

Foxhall A. Parker.

Walker (Leroy Pope), b. in Alabama; early entered public life; was Speaker of the Alabama house 1847–50; a judge of the State circuit court 1850–53; became a prominent advocate of the internal improvement of the State and of the policy of secession; was Confederate secretary of war 1861–62; served afterward as a Confederate brigadier-general, and after the war resumed legal practice at Huntsville, Ala.

Walker (Robert James), b. at Northumberland, Pa., July 19, 1801, and was the youngest son of Judge Jonathan Hoge Walker, a learned jurist and an ardent philanthropist. Educated under his father's direction, Mr. Walker graduated at the University of Pennsylvania in 1819 with the highest honors, and in 1821 was admitted to the bar at Pittsburg; entered upon political life as a Democrat, and in 1823 first proposed Gen. Jackson as a candidate for the Presidency; in 1825 was married to Mary Bache, a great-granddaughter of Benjamin Franklin and a granddaughter of A. J. Dallas; in 1826 removed to Natchez, Miss., and entered into a successful law-partnership with his brother, Duncan S. Walker. He opposed the nullification movements of South Carolina (1833), and, heading the opposition to Hon. George Poindexter, was in 1836 elected to the U. S. Senate; and in that year brought forward, without success, the first Homestead bill. In the Senate he at once took a prominent position, which he thenceforth maintained, gaining rapidly a brilliant reputation in this country and abroad; in 1837 brought forward a bill for the recognition of the independence of Texas. His bust in marble, by Powers, was placed in the Texan capitol as a testimonial to his services to the young republic. In 1837 he ably advocated the Independent treasury bill; in 1841 originated the Pre-emption act, still unrepealed; in 1843 declined a nomination for the Vice-Presidency of the U. S. He exercised great influence during the Tyler administration, and in 1844 secured the nomination and election of James K. Polk to the Presidency. In 1844 he published a cogent letter in favor of the "reannexation" of Texas; in 1845 was appointed secretary of the treasury, an office which he filled with distinguished ability until 1849. The revenue tariff of 1846, the warehouse-system, the Independent treasury, and the establishment of the department of the interior were measures proposed by him. In Great Britain his opinions touching questions of political economy had great weight, and his report on free trade was reprinted by the British House of Commons. In 1853 he was appointed commissioner to open trade with Japan and China, but resigned the position; in 1857–58 he was, by appointment of Pres. Buchanan, governor of Kansas at a most difficult crisis. Here his management of public affairs reflected the greatest credit upon him as a patriot and statesman, though it lost him the friendship and esteem of a large number of lifelong political and social followers. On the breaking out of the civil war, he most efficiently sustained the Federal government, and in 1862–64 was financial agent of the U. S. in Europe, negotiating the sale of $250,000,000 in government bonds, and preventing the second $75,000,000 loan to the Confederacy. He afterward advocated the purchase of Alaska and the Danish West Indies, and opposed the radical party during the reconstruction measures of Congress under Pres. Johnson's administration. Mr. Walker was profoundly versed in civil and common law, a skilful advocate, an enthusiastic student of political economy, an earnest believer in free trade, in popular sovereignty, and in the American federal system. State rights and the Union of the States were to him equally dear. His knowledge of facts and his industry were alike wonderful. Full of generous, ardent, and kindly sympathies, he was himself tenderly loved by a large circle of friends; yet such was his strength and manliness that he repeatedly sacrificed many long-continued and highly-valued friendships by his devotion to what he regarded as the right. During a part of the war he conducted a monthly magazine with much ability, called *The Continental*, though at a heavy pecuniary loss. In 1867 he was counsel for the State of Mississippi, and made a masterly argument before the Supreme Court in a case brought to restrain the execution of the reconstruction acts. In the latter part of his life he was successfully engaged in the practice of law at Washington, D. C., where he d. Nov. 11, 1869.

Martha Walker Cook.

Walker (Sears Cook), b. at Wilmington, Mass., Mar. 28, 1805; graduated at Harvard 1825; taught school in Boston and Philadelphia 1828–36; built an observatory at the Philadelphia High School 1837; was actuary to an insurance company in Philadelphia 1836–45; was employed at the Washington Observatory 1845–47; identified the planet Neptune with a star discovered by Lalande in May, 1795, and had charge of the longitude department of the Coast Survey from 1847 to his death, at Cincinnati Jan. 30, 1853. His parallactic tables for computing the phases of an occultation (1834), his method of determining differences of longitude by telegraph (1849), and his various astronomical and mathematical papers exhibit great powers of mind.

Walker (Timothy), b. at Rumford (now Concord), N. H., June 26, 1737; graduated at Harvard 1756; studied theology, but was never ordained; became a lawyer in New Hampshire; commanded a regiment of minutemen at the siege of Boston 1775; was a member of the committee of safety 1776; served in the war as paymaster; was a member of the State constitutional convention and of both houses of the legislature, judge of the court of common pleas 1777–1804, and chief-justice of that court 1804–09. D. at Concord, N. H., May 5, 1822.

Walker (Timothy), LL.D., brother of Sears C., b. at Wilmington, Mass., Dec. 1, 1802; graduated at Harvard 1826; was a teacher of mathematics at Messrs. Bancroft & Cogswell's celebrated Round Hill School at Northampton 1826–29; studied at the Dane Law School 1829–30; went to Cincinnati, O., 1830; was there admitted to the bar 1831; established in 1833, in connection with Judge John C. Wright, the Cincinnati Law School, which in 1835 was united with Cincinnati College; was professor of law until 1844, having for some years the exclusive charge of the school; was president judge of Hamilton county court of common pleas 1842–43, and founded the *Western Law Journal* 1843, which he continued to edit for several years while practising at the Cincinnati bar. D. at Cincinnati Jan. 15, 1856. He translated Fischer's *Elements of Natural Philosophy* (Boston, 1827); wrote for the *North American Review*; published *Elements of Geometry* (1828) and an *Introduction to American Law, designed as a First Book for Students* (Philadelphia, 1837; 5th ed., revised by J. Bryant Walker, 1869), and delivered several admired discourses on anniversary occasions, among which were those *On the Dignity of the Law as a Profession* (1837), *On the History and General Character of the State of Ohio* (1838), *On the Reform Spirit of the Day* (1850) before the Phi Beta Kappa Society of Harvard, and memorial orations on John Quincy Adams (1848) and Daniel Webster (1852).

Walker (William), b. at Nashville, Tenn., May 8, 1824; studied medicine in Paris; travelled in Italy and Germany; was admitted to the bar at Nashville; resided several years at New Orleans, where he was connected with the *Crescent* newspaper; went to California 1850; became one of the editors of the San Francisco *Herald*; afterward practised law at Marysville; organized in July, 1853, an expedition for the conquest of Northern Mexico; set sail from San Francisco Oct. 15; landed at La Paz, Lower California, with a handful of followers; proclaimed himself president and made a liberal distribution of high offices; occupied two or three small towns; issued a proclamation annexing

Sonora to his dominions; received early in 1851 a reinforcement under Col. Watkins, raising his numbers to 100 men, with whom he set out for Sonora overland. The party, having suffered great privations on its march from want of food, gradually melted away, and Walker thought it expedient on nearing the U. S. frontier to surrender to the officials at San Diego, Cal.; was tried at San Francisco for violation of the neutrality laws, but acquitted May 15, 1851; was induced soon afterward by liberal offers from one of the parties to a civil war in Nicaragua to proceed thither, landing at Realejo with 62 followers June 11, 1855; was joined by 100 natives of the "liberal" party; won two sharp battles at Rivas (June 29) and at Virgin Bay, in consequence of which he augmented his forces, and after a short siege obtained possession of the city of Granada Oct. 15; made a treaty with Gen. Corral, designating Rivas as president and himself as minister of war and general-in-chief; quickly discovered, or alleged, a treacherous plot on the part of Corral, whom he tried by court-martial and caused to be shot Nov. 8; received numerous recruits from California; had to wage a war with Costa Rica; was defeated near Guanacaste Mar. 20, 1856, but won a battle at Rivas Apr. 11; engaged in a quarrel with the management of the (Vanderbilt) Transit Co., then in full operation in Southern Nicaragua; revoked the charter and confiscated its property for non-payment of his demands for money; went through the farce of ordering a presidential election June 25; took possession of the presidency; issued great quantities of worthless currency; re-established slavery by a decree of Sept. 25, and was recognized by the American minister resident and by the government of Pres. Pierce, but succumbed in the following spring to a general insurrection fomented by the agents of the steamship company and aided by forces of Costa Rica and Honduras. After having lost several desperate battles and burned the city of Granada, he surrendered at the port of San Juan del Sur, May 1, 1857, to Com. (afterward Admiral) Charles H. Davis of the U. S. sloop-of-war St. Mary's; was taken to Panama; went thence to New Orleans; was put under bonds to keep the peace, but soon organized another party, with which he sailed in the steamer Fashion and landed Nov. 25 at Punta Arenas, Nicaragua; was compelled, with 132 men, to surrender as a prisoner to Com. Paulding of the U. S. navy Dec. 8, and taken to New York; was liberated by order of Pres. Buchanan Jan., 1858; made another attempt in Oct., 1858, but was seized on board his steamer at the mouth of the Mississippi River; tried and acquitted in the U. S. court at New Orleans; spent the next few months in preparing a work entitled *The War in Nicaragua* (1860); professed himself a Roman Catholic; succeeded in fitting out another expedition, with which he landed at Truxillo, Honduras, June 27, 1860; held that town until Aug. 23, when an English man-of-war intervened, ordering him to evacuate the place; marched southward with 80 men; was captured Sept. 3; carried back to Truxillo, tried by court-martial, and shot Sept. 12, 1860. Walker was known as "the gray-eyed man of destiny;" he had a profound conviction of ultimate success, to which, though not deliberately cruel, he was prepared to sacrifice every other consideration. PORTER C. BLISS.

Walker (WILLIAM H. T.), b. in Georgia in 1817; graduated at the U. S. Military Academy July 1, 1837, when appointed brevet second lieutenant 6th Infantry, and second lieutenant July 31; ordered at once to the seat of war in Florida, was engaged in the battle of Okeechobee, Dec. 25, 1837, and three times wounded; brevetted first lieutenant, promoted to that rank Feb. 1, 1838, but resigned Oct. 31; in Nov., 1840, was reappointed; promoted to be captain Nov., 1845, he served in the war with Mexico in Gen. Scott's army from Vera Cruz to the battle of Molino del Rey, where so severely wounded as to compel him to remain absent from the army on sick leave for two years. For gallantry at Churubusco and Contreras he was brevetted major, and lieutenant-colonel for Molino del Rey. Returning to duty in 1849, he was forced again to go on sick leave 1850–51. In Dec., 1852, he was appointed deputy governor of the East Pascagoula Branch Military Asylum; transferred to West Point in July, 1854, as commandant of cadets. Promoted to a majority in the 10th Infantry in Mar., 1855, he was in 1856 relieved from duty at West Point and ordered to a Northern frontier post, but soon after, in the same year, went on sick leave, and remained absent until Dec. 20, 1860, when he resigned from the army. Entering the Confederate army, he rose to the rank of major-general, serving mostly in the South and West. In the sortie from Atlanta, Ga., he was killed July 22, 1864.

Walker (WILLIAM JOHNSON), M. D., b. at Charlestown, Mass., Mar. 15, 1790; graduated at Harvard 1810; became a skilful and highly-successful surgeon at Charlestown, and accumulated a large fortune. D. at Newport, R. I., Apr. 2, 1865. During his lifetime he distributed some $400,000 to objects of public utility, and by his will left nearly $1,000,000 to various institutions of learning.

Walker (WILLIAM SIDNEY), b. at Pembroke, Wales, Dec. 4, 1795; educated at Eton School; graduated at Trinity College, Cambridge, 1819; contributed to Charles Knight's *Quarterly Magazine*; was fellow there 1822–29, during which period he became blind; afterward gained a scanty subsistence by his pen in London, where, after years of suffering from strange hallucinations due to a painful disease, he d. Oct. 15, 1846. He enjoyed at college an immense reputation for talent and literary ability, scarcely justified by his desultory performances, and was well known as the intimate college friend of Praed, Derwent Coleridge, and John Moultrie, of whom the latter edited his *Poetical Remains with a Memoir* (1852). At the age of seventeen he published an epic poem, *Gustavus Vasa* (1813), translated while an undergraduate *Poems from the Danish* (1816), subsequently edited a *Corpus Poetarum Latinorum* (Cambridge and London, 1827; new ed. 1851), and left in MS. *Shakspeare's Versification and its Apparent Irregularities, explained by Examples from Early and Late English Writers* (1852; 3d ed. 1859), and *A Critical Examination of the Text of Shakspeare, etc.* (3 vols., 1859), both edited by W. N. Lettsom.

Walker Creek, tp., Lafayette co., Ark. P. 520.

Walker Creek, tp., Ellis co., Kan. P. 23.

Walker's, tp., Etowah co., Ala. P. 524.

Walker's Creek, tp., Rockbridge co., Va. P. 2467.

Walker's Lake, in Esmeralda co., Nev., is 45 miles long and 20 miles wide, and has an elevation of 4000 feet. It receives the waters of Walker's River, and has no outlet. Its waters afford fine trout, but are brackish and alkaline.

Walker's River rises in the Sierra Nevada of California by the E. and W. forks. The waters flow into Walker's Lake, Nev.

Walk'erton, p.-v., cap. of Bruce co., Ont., Canada, on Saugeen River, 30 miles from Saugeen (Southampton), and on Wellington Grey and Bruce Railway. It has 3 weekly newspapers. P. about 1200.

Walkerton, p.-v., St. Joseph co., Ind.

Walk'erville, tp., Greene co., Ill. P. 800.

Walk'ing-Leaf, the usual name of *Camptosorus rhizophyllus*, formerly classified in the genus *Asplenium*, a curious North American fern found in the Northern and Middle States of the U. S., derives both its common and its scientific name from the peculiarity of propagating by striking the tips of its leaves into the ground, where they take root and give origin to new plants.

Walking-Stick, a name given to insects of the family Phasmidæ, which belongs to the order Orthoptera. The body is elongated and often linear, and in some resembles a twig or dried stick, whence the name; the head is small and oblong; the antennæ filiform and moderate; the legs are long, slender, and gressorial, none being adapted for grasping or for leaping; the wings are rudimentary or wanting. The species are sluggish animals, chiefly found on twigs and leaves, and their resemblance to such parts is doubtless an adaptation for protective purposes. A species (*Diaphemora femorata*) is not uncommon in portions of the U. S.; its average size is between three and four inches. THEODORE GILL.

Walky'ries [Icelandic, *Valkyrjur*; Ang.-Sax. *Wälcyrigear*, from *val*, the "battlefield," and *kjora*, to "choose"], one of the most sublime, but also one of the most terrible, creations of the Scandinavian mythology. They were beautiful young maids in the service of Odin; Hrist and Mist were his two cup-bearers, the former name signifying a black cloud, the latter a watery, floating, and trembling vapor, as, in general, ideas abstracted by observation of nature seem to be most curiously mixed in the conceptions of these superhuman beings. Clad in radiant armor, surrounded with the subdued brightness of an aurora borealis, and with light streaming from the points of their lances, they ride through the air, three and three, sent by Odin to attend to battles. In Njals Saga they sit on a hill overlooking the battle between Sigtryg with the silken beard and King Brian of Ireland, and while they sing their weird songs they weave the battle web, allotting death and victory according to the orders of Odin. Generally, however, they are imagined as hovering over battles, sometimes even as participating in the fight, marking with the point of their lance the heroes who shall die and whom they shall conduct to Walhalla. In some respects the idea of the Walkyries resembles that of the Norns or Destinies, though they never attain that lofty, stern, and inapproachable dignity which characterizes those mysterious deities, to whom Odin himself must bow. The Walkyries, although superhuman beings, are not goddesses. They fall in love

with men, and then they distribute death and victory in battle according to their own passions. Then Odin expels them from Walhalla, dooms them to marriage, or touches them with his magic rod, and drives them into a trance, in which they lie sleeping till the warrior comes who understands bow to break the spell. This is the story of Brynhild and Sigurd, and in such cases the Walkyries of the Scandinavian mythology resemble the German swan-maidens, though they never show that tame sentimentality or that exaggerated wildness which characterizes the German fiction.

CLEMENS PETERSEN.

Wall, tp., Ford co., Ill. P. 588.

Wall, tp., Monmouth co., N. J. P. 2671.

Wall (GARRET D.), b. in Monmouth co., N. J., Mar. 10, 1783; was admitted to the bar 1807; was clerk of the supreme court 1812–17; quartermaster-general 1815–37; was appointed U. S. district attorney, and elected governor by the legislature 1829, but declined the latter office; was U. S. Senator 1835–41, and judge of the court of errors and appeals 1848–50. D. at Burlington Nov. 22, 1850.

Wall (CHARLES WILLIAM), D. D., b. early in the nineteenth century; educated at, and senior fellow of, Trinity College, Dublin; took orders in the Church of England, and became professor of Hebrew in the University of Dublin and vice-provost of Trinity College. Author of *An Examination of the Ancient Orthography of the Jews and the Original State of the Text of the Hebrew Bible* (1835) and *Proofs of the Interpolation of the Vowel Letters in the Text of the Hebrew Bible* (1857).

Wall (JAMES W.), son of Garret D., b. at Trenton, N. J., in 1820; graduated at Princeton 1839; became a lawyer at Trenton, and subsequently (1847) at Burlington; filled the posts of commissioner of bankruptcy and of mayor of Burlington; visited Europe 1854; wrote against the restrictions imposed upon the press at the outbreak of the civil war, for which he was imprisoned some weeks in Fort Lafayette as a sympathizer with the rebellion; was welcomed with demonstrations of enthusiasm by his political friends on his release; was elected U. S. Senator to fill an unexpired term Jan., 1863, and removed to Elizabeth 1869. D. at Elizabeth June 9, 1872. Author of various literary essays and addresses, and of *Foreign Etchings, or Outline Sketches of the Old World's Pleasant Places* (Burlington, 1855).

Wall (WILLIAM), D. D., b. in England in 1646; was for fifty-two years (1676–1728) vicar of Shoreham, Kent, where he d. in 1728. Author of a *History of Infant Baptism* (1705), which is considered the standard work in favor of such baptism, and was translated into Latin: of a *Defence* (1720) of that book, *Critical Notes on the Old Testament* (2 vols., 1734), and other theological writings.

Wal'labout Bay, in Brooklyn, N. Y., is a bight in the East River, opposite the S. E. angle of Manhattan Island. The Wallabout is separated by an island from the East River. The island and all the land abutting on the bay is the property of the U. S. government, and the whole constitutes the Brooklyn navy-yard. The Wallabout was the mooring-ground of the Jersey and other British prison-ships during the Revolution.

Wallaby, a kangaroo. See APPENDIX.

Wal'lace, county of W. Kansas, bordering on Colorado, drained by Smoky Hill River and its affluents, and traversed by Kansas Pacific R. R.; surface mostly elevated table-land. Cap. Wallace. Area, about 2000 sq. m. P. 538.

Wallace, tp., Independence co., Ark. P. 308.

Wallace, tp., La Salle co., Ill. P. 734.

Wallace, p.-v. and tp., cap. of Wallace co., Kan., on Kansas Pacific R. R., includes Fort Wallace, an important military post.

Wallace, p.-v. and tp., Chester co., Pa. P. 746.

Wallace (ALFRED RUSSEL), b. at Usk, Monmouthshire, England, Jan. 8, 1822; educated at the grammar school of Hertford; was articled to an elder brother as land-surveyor and architect; abandoned that profession to devote himself to natural history; undertook in 1848, with Mr. H. W. Bates, an exploration of Northern Brazil; resided some months at Pará; explored the Amazon and Negro rivers; obtained numerous vocabularies of Indian tribes; made extensive collections in ornithology and botany, which were mostly lost at sea; returned to England 1852; published *Travels on the Amazon and Rio Negro, with Remarks on the Vocabularies of the Amazonian Languages* (1853), aided in the linguistic part by Robert G. Latham, and *Palm Trees of the Amazon, and their Uses* (1853); spent eight years in exploring the vast islands of the East Indies, especially the Moluccas, Celebes, and New Guinea; arrived, independently of Mr. Darwin's researches, at a theory of natural selection, which he embodied in a paper sent to Sir Charles Lyell, *On the Tendency of Varieties to depart indefinitely from the Original Type*, and read before the Linnæan Society July 1, 1858, simultaneously with Mr. Darwin's paper *On the Tendency of Species to form Varieties*, etc., being the first public announcement of the so-called "Darwinian theory;" brought from the East Indies in 1862 more than 8000 birds and more than 100,000 entomological specimens; was occupied for several years in the study and classification of his vast collections; published *The Malay Archipelago, the Land of the Orang-utan and the Bird of Paradise, a Narrative of Travel 1854–62, with Studies of Man and Nature* (2 vols., 1869), accompanied by 9 maps and 50 illustrations; presented many papers to the *Transactions* of the Linnæan, Zoological, Ethnological, Anthropological, and Entomological societies, some of which were collected in a volume, *Contributions to the Theory of Natural Selection* (1870); was awarded in 1868 the royal medal of the Royal Society, and in 1870 the gold medal of the Geographical Society of Paris; has become noted for his investigations of spiritualism, in which he is a believer, as shown by his volume on *Miracles and Modern Spiritualism* (1875), and has lately issued, simultaneously in English, French, and German, an elaborate and important work, *On the Geographical Distribution of Animals* (2 vols., 1876). PORTER C. BLISS.

Wallace (DAVID), b. at Philadelphia, Pa., Apr. 4, 1799; graduated at West Point 1821; studied law in Brookville, Ind., where his family had settled in 1817; was several times elected to the State legislature; was a member of the Indiana constitutional convention; lieutenant-governor 1834–37, governor 1837–40, member of Congress 1841–43, and judge of common pleas for Marion co. 1856–59. D. at Indianapolis Sept. 4, 1859.

Wallace (HORACE BINNEY), b. at Philadelphia, Pa., Feb. 26, 1817, was the youngest son of John Bradford Wallace; studied for two years at the University of Pennsylvania; graduated at Princeton 1835; studied medicine, chemistry, and law, but never adopted a profession; contributed largely to literary periodicals; published anonymously a novel, *Stanley, or the Recollections of a Man of the World* (1838); edited, in conjunction with Judge Hare, *American Leading Cases in Law* (2 vols., 1847; 3d ed. 1852), *Smith's Leading Cases* (4th Amer. ed., 2 vols., 1852), and White and Tudor's *Leading Cases in Equity* (2d Amer. ed., 3 vols., 1852), all copiously annotated; aided R. W. Griswold in his *Napoleon and the Marshals of the Empire* (2 vols., 1847); travelled in Europe 1849–50, and again 1852, giving assiduous study to philosophical problems, and d. by his own hand at Paris, in consequence of an attack of brain disease, Dec. 16, 1852. Two posthumous volumes of his miscellaneous writings were published—*Art and Scenery in Europe, with other Papers* (1855), and *Literary Criticisms and other Papers* (1856).

Wallace (Sir JAMES), b. in Great Britain about 1730; became post-captain in the navy 1771, commanded the fleet on the Newport station 1775, and conducted the naval expedition up the Hudson River Oct., 1777, when Kingston was destroyed and several other towns laid waste; was captured in the Experiment by D'Estaing Sept. 24, 1779; commanded the Warrior in Rodney's victory over De Grasse, Apr. 12, 1782; was governor of Newfoundland 1793–95; became rear-admiral 1794, vice-admiral 1795, and rear-admiral of the blue Jan. 1, 1801. D. in London Mar. 6, 1803.

Wallace (JOHN BRADFORD), b. in Somerset co., N. J., Aug. 17, 1778; graduated at Princeton 1794; was admitted to the Pennsylvania bar 1797; wrote in defence of the Federal party, and practised with distinguished success in Philadelphia, where he d. Jan. 7, 1837. He edited *Reports of Cases Third Circuit Court* (1801), Abbot on *Shipping* (1802), and wrote *Remarks upon the Law of Bailment* (1840). A *Memoir* by his widow was privately printed (1848).

Wallace (JOHN WILLIAM), b. at Philadelphia, Pa., Feb. 17, 1815, son of John Bradford (1778–1837); graduated at the University of Pennsylvania 1833; studied law in Philadelphia and in London at the Inns; became master in chancery of the Pennsylvania supreme court; was reporter to the third circuit U. S. circuit court 1842–53; has been reporter of the U. S. Supreme Court since Mar. 21, 1864, and is president of the Historical Society of Pennsylvania. Author of *The Reporters, chronologically arranged, with Occasional Remarks upon their Respective Merits* (1843), and of several legal and historical discourses; editor of *Cases in U. S. Circuit Court* (2 vols., 1842–53) and *Cases argued and adjudged in the U. S. Supreme Court, etc.* (1864 *seq.*), *British Crown Cases Reserved* (6 vols., 1839–53), and *American Leading Cases* (2 vols., 1857), and after the death of his brother, Horace B., revised the 4th ed. of John William Smith's *Leading Cases in Law* (2 vols., 1857).

Wallace (Lewis), b. in Fountain co., Ind., about 1828; studied law and was admitted to the bar, but during the war with Mexico served as second lieutenant 1st Indiana Vols. Returning to Indiana and his profession, he was for one term a member of the State senate; early in 1861 became adjutant-general of Indiana, but in April took command of the 11th Indiana (3 months') Vols., which served in West Virginia, being engaged in the capture of Romney, etc. On the expiration of its term the regiment was reorganized in Aug., 1861, with Wallace again at its head, but Sept. 3 he was commissioned brigadier-general of volunteers, and stationed for a time in Kentucky. At the capture of Fort Donelson, where he commanded a division and the centre of the Union lines, he displayed such ability and courage that his commission as major-general of volunteers followed, Mar. 21, 1862. In the succeeding battle of Shiloh (which see), though not engaged the first day, he rendered efficient aid in the second day's fighting and subsequent advance upon Corinth; in Nov., 1862, was president of the court to inquire into the conduct of Gen. Buell; commanded Middle department and 8th corps 1864; defeated at Monocacy. Member of commission for trial of persons implicated in the murder of Pres. Lincoln and attempted assassination of Mr. Seward.

Wallace (Robert), D. D., b. in Perthshire, Scotland, in 1697; educated at the University of Edinburgh; became minister of Moffat 1723, and of Greyfriars' church, Edinburgh, 1733. D. in 1771. Author of *A Dissertation on the Numbers of Mankind in Ancient and Modern Times* (1753), *Characteristics of the Present Political State of Great Britain* (1758), and *Various Prospects of Mankind, Nature, and Providence* (1761).

Wallace (Robert), b. in Scotland about 1810; graduated at the University of Glasgow, and became collegiate tutor to the University of London. D. in London Nov. 16, 1858. Author of numerous geographical, mathematical, and mechanical textbooks, of *A Dissertation on the True Age of the World* (1844), *Anti-Trinitarian Biography* (3 vols., 1850), and *A History of the Steam-Engine* (new ed. 1859); was editor of the *Public Instructor* and other periodicals, and co-editor (with Profs. De Lolme and H. Bridgeman) of Cassell's *French Dictionary* (new ed. 1859).

Wallace (Robert), D. D., b. in the parish of St. Andrew's, Fifeshire, Scotland, June 24, 1831; educated at the universities of St. Andrew's and Edinburgh; took orders in the Scottish Church; became minister of Newton-upon-Ayr 1857, of Trinity College church, Edinburgh, 1860, and of Old Greyfriars, Edinburgh, 1868; examiner in philosophy at the University of St. Andrew's 1866, professor of divinity and church history at the University of Edinburgh 1872, and on the death of Alexander Russel in July, 1876, succeeded him as editor of the *Scotsman*, the leading daily newspaper of North Britain.

Wallace (R. R.), U. S. N., b. Nov. 7, 1835, in Tennessee; graduated at the Naval Academy in 1856; became lieutenant in 1861, commander in 1870; served in the Fort Jackson at both the Fort Fisher fights, and highly commended in the report of her commanding officer of Jan. 16, 1865. Foxhall A. Parker.

Wallace, or Walleys (William, usually but improperly called Sir William), b. in Scotland about 1270. Most of the events of his career are involved in great uncertainty, his true history being largely falsified by the rhyming chroniclers of the next generation. He appears to have been the younger son of Sir Malcolm Wallace of Ellerslie, Renfrewshire. According to one account, having quarrelled with the son of the English governor of Dundee Castle while a student at the high school of that city, he stabbed his antagonist, and fled to the Southern Highlands; according to another version, the event is represented as a duel which took place in 1295. He first appears in authentic history in 1297 as leader of a large band of insurgents against the authority of the English king, Edward I., who then attempted the conquest of Scotland. Emboldened by the success of several preliminary skirmishes, he attacked the town of Scone, where an English justiciary was holding court, killing or taking prisoners many of the English, while Sir William Douglas about the same time captured two of the English strongholds. Edward thereupon sent into Scotland a considerable force under the command of Sir Henry Percy and Sir Robert Clifford, who successfully repulsed a night-attack made by Wallace near Lochmaber, and drove him back into Ayrshire, and received, by a treaty at Irvine, the submission of most of the Scottish leaders. Wallace and Murray of Bothwell alone refused to lay down their arms, and withdrew to the Northern Highlands, where they organized large forces and captured the English garrisons at Aberdeen, Forfar, and Montrose. Wallace then advanced to the siege of Dundee, being now recognized as commander-in-chief of the national insurrection. Edward I. was at this time in Flanders, but his general, John de Warrenne, earl of Warrenne and Surrey, who in the previous year had been appointed guardian of Scotland, having gathered a powerful army and advanced toward Stirling, Wallace abandoned the siege and marched against him. After a vain attempt at negotiation, Earl Surrey was completely defeated at Cambuskenneth (or Stirling Bridge) Sept. 10, 1297, and pursued to Berwick. Wallace passed the border and ravaged Cumberland and Northumberland. The forces engaged are traditionally stated as respectively 50,000 English and 40,000 Scots, but these numbers are evidently exaggerated. On his return, Wallace was recognized in Scotland as guardian of the realm in the name of John Baliol, then a prisoner in the Tower of London. In the following year Edward proceeded to Scotland with a force numbering, according to Scottish accounts, 80,000 infantry and 7000 cavalry, and gained over Wallace a decisive victory at Falkirk July 22, by which the English rule in Scotland was re-established. The career of Wallace is involved in great obscurity for several years, but it is certain that he refused to submit, and carried on a guerilla warfare on a small scale for several years. At one time he went to France with a few followers to seek the aid of King Philip, and was thrown into prison by that monarch, but soon liberated and recommended to the pope, who vainly summoned Edward to evacuate Scotland in May, 1301. Wallace took part in the Scottish revolt of 1303, though not in any conspicuous capacity; was declared an outlaw on account of his refusal to respect the treaty between Edward and John Comyn, earl of Badenoch (Feb. 4, 1304), large rewards being offered for his capture; was betrayed by Sir John Menteith into the hands of the English near Glasgow early in 1305; was taken to London, tried for treason in Westminster Hall, condemned Aug. 23, 1305, and hanged, drawn, and quartered at West Smithfield the following day. His head was placed above London Bridge and his limbs sent to Newcastle, Berwick, Perth, and Stirling. (See the *Lives* by Carrick (1830), J. S. Watson (1862), Paterson, and Tytler, the *Histories of Scotland* of Tytler and Burton, and for the English version William Longman's *History of the Life and Times of Edward I.* (2 vols., 1869).) Porter C. Bliss.

Wallace (William), LL.D., b. at Dysart, Fifeshire, Scotland, Sept. 23, 1768; taught himself French, Latin, and mathematics while acting as bookbinder and shopman; obtained the post of assistant professor of mathematics at Perth Academy 1794; became mathematical master in the Royal Military College at Great Marlow, afterward at Sandhurst; lecturer on astronomy 1818, and was professor of mathematics in the University of Edinburgh 1819–38. D. at Edinburgh Apr. 28, 1843. He wrote largely on mathematics for scientific periodicals and for the *Encyclopædia Britannica*; prepared textbooks on conic sections and geometry; edited Playfair's *Elements*, and was author of a *New Book of Interest* (1794).

Wallace (William H. L.), b. at Urbana, O., July 8, 1821; removed to Illinois with his father in 1833; studied law, and was admitted to the bar in 1816, but the war with Mexico occurring, he enlisted in Col. Hardin's 1st Illinois Vols., of which he became adjutant, and was engaged in the battle of Buena Vista. Resuming his profession, he was in 1853 chosen district attorney for the ninth Illinois district. In May, 1861, he was appointed colonel 11th Illinois Vols., and at Fort Donelson (Feb., 1862) commanded a brigade in McClernand's division with conspicuous gallantry and ability, which led to his appointment as brigadier-general of volunteers in March. In the succeeding battle of Shiloh (which see) Wallace commanded Smith's old division, which withstood for nearly six hours the furious assaults of the enemy, and was the last to leave the field, Wallace falling mortally wounded in an ineffectual attempt to resist the overwhelming onslaught. D. at Savannah, Tenn., Apr. 10, 1862.

Wallace (William Ross), b. at Lexington, Ky., in 1819; educated in collegiate institutions at Bloomington and South Hanover, Ind.; studied law at Lexington; settled in New York City 1841, and has since resided there, chiefly engaged in literary pursuits. Author of several volumes of poems.

Wallace (William Vincent), b. at Waterford, Ireland, in 1814, son of a military band-master, from whom he inherited a genius for music and a taste for roving; obtained at the age of eighteen considerable reputation as a pianist and violinist; visited Australia, New Zealand, and the islands of Oceanica, where he is said to have had some very romantic adventures; also India, South America, and the U. S.; brought out at Drury Lane his successful opera, *Maritana* (1846), which was followed by *Matilda of Hungary*, *Lurline*, *The Amber Witch*, *The Maid of Zurich*,

Love's Triumph, Gulnare, Olga, The Desert Flower, and others, and was author of marches, polkas, fantasias, etc., and of many songs which have become popular favorites. D. at Château de Bayen (Haute-Garonne), France, Oct. 12, 1865. His remains were buried in Kensal Green Cemetery, near London. *Memoirs* were published (in French) by M. A. Pougin (Paris, 1866).

Wal'laceburg, p.-v., Kent co., Ont., Canada, on the navigable river Sydenham, 17 miles N. W. of Chatham. It has a weekly newspaper. P. about 600.

Walla'chia, the largest of the two Danubian principalities which form Romania, is bounded N. by Hungary, Transylvania, and Moldavia, and E., S., and W. by Turkey, from which it is separated by the Danube, and comprises an area of 27,930 sq. m., with 3,421,000 inhabitants. The surface is a large, unbroken plain sloping from the Carpathian Mountains to the Danube, along which are found large tracts of swamps and marshes. The climate is extreme; the winter is severe and long, snow covering the ground often for four months, and the summer is extremely hot and subject to long droughts. The whole plain is almost treeless, but the soil is very fertile, even rich, and though agriculture, the main occupation of the inhabitants, is in a very backward state, rich crops of wheat, maize, millet, wine, and fruits are gathered, and immense herds of cattle and horses reared. The inhabitants belong to the Greek Church and speak the Romanian language, a spoiled Latin, mixed with Gothic, Greek, Turkish, and Slavonian elements. The lower classes live in very abject circumstances, and a middle-class does not exist, as the country has no manufactures, and its trade is carried on by the Jews, who by the natives are considered as an inferior, and even as an odious, race. Cap. Bucharest. (See MOLDAVIA and ROMANIA.)

Wal'lack (JAMES WILLIAM), b. in London, England, Aug. 24, 1795, son of William, a comedian and vocalist, and of Elizabeth Field, who for several years played leading female characters with Garrick; made his first appearance on the London stage at the age of seven years; was engaged by Sheridan at Drury Lane; played with Edmund Kean in Shakspearean dramas; came to the U. S. 1818; appeared as Macbeth at the Park Theatre, New York, Sept. 7, 1818; became stage-manager at Drury Lane 1820; alternated between England and the U. S. for several years; opened in 1837 the National Theatre, New York, burned down in 1839; established in 1852 Wallack's Lyceum, afterward Wallack's Theatre, on the corner of Broadway and Broome street, rebuilt in 1861 at the corner of Broadway and Thirteenth street, and still a favorite place of amusement. He was a superior comedian and manager, owing much of his success to his care in the selection of competent supporters in his companies and to his regard for artistic proprieties in the details of stage costumes and scenery. D. in New York Dec. 25, 1864.—His son, JOHN LESTER, b. in New York Jan. 1, 1818, known for some time as J. W. LESTER, is now (1876) proprietor of the theatre, maintaining its reputation with success, and has adapted some French comedies to the American stage.

Wal'lagrass Plantation, tp., Aroostook co., Me. P. 297.

Wallaroo, a kangaroo. See APPENDIX.

Wal'la Wal'la, S. E. county of Washington Territory, bounded, in 1870, N. by Snake River, E. by Idaho, S. by Oregon, and W. by Columbia River, but in 1875 the new county of Columbia was formed from the E. portion of this county; surface variegated, usually well timbered, with many broad valleys and fertile plains. There are flour-mills, saw-mills, and breweries, and some manufactures of saddlery, sash, doors, and blinds, bagging, and tin, copper, and iron ware. Principal live-stock, cattle, horses, sheep, and swine. Staples, wheat, oats, wool, and lumber. Cap. Walla Walla. Former area, about 3500 sq. m. P. 5300.

Walla Walla, p.-v., cap. of Walla Walla co., Wash. Ter., on Walla Walla and Columbia River R. R., in the midst of a rich agricultural region, has 8 churches, 7 schools, 2 banks, 3 newspapers, 1 foundry and machine-shop, 3 flouring-mills, and 4 hotels. Principal business, farming and stock-raising. P. about 2500.

W. I. MAYFIELD, ED. "SPIRIT OF THE WEST."

Walla Walla River, a small stream of Washington Territory which flows into the Columbia at Wallulu, near old Fort Walla Walla.

Wal'lenstein, or **Waldstein, von** (ALBRECHT WENZEL EUSEBIUS), b. on the family estate of Hermanitz, Bohemia, Sept. 14, 1583; was educated in the Protestant faith, but came after the death of his parents under the guardianship of his uncle, Albrecht von Slavata, who sent him to the Jesuit academy of Olmütz, where he was converted to Romanism. After studying at the universities of Padua and Bologna, and travelling through Italy, Spain, France, and Holland, he served in Hungary against the Turks in the army of the emperor Rudolf, under Gen. Basta, and married in 1606 an old widow, by whose death in 1614 he inherited very extensive estates in Moravia. His uncle bequeathed to him fourteen estates in Bohemia, and he thus became one of the largest landed proprietors in Moravia and Bohemia. In 1616 he organized a regiment of dragoons at his own expense, and hastened to the rescue of the city of Gradisca, which was besieged by the Venetians. The emperor now made him a count, and by his marriage with the daughter of Count Harrach he obtained connections and influence at the court of Vienna. When the revolution which opened the Thirty Years' war broke out in Bohemia in 1618, he sided with the emperor, saved the imperial treasury containing a large sum from falling into the hands of the insurgents, equipped a new regiment of dragoons, and when, after the battle of the White Mountain—in which, however, he was not present—enormous confiscations took place in Bohemia, he bought of the emperor estates to the value of 7,290,228 florins. In 1623 the emperor created him prince, and in the following year hereditary duke of Friedland. With his success his ambition increased. In 1625, when the Protestant princes of Northern Germany, under the leadership of Christian IV. of Denmark, and in alliance with Bethlen Gabor of Transylvania, arose against the emperor, Wallenstein offered to organize an army of 50,000 men and lead it according to the orders of the emperor. After some negotiations the offer was accepted, and in an incredibly short time he actually created an effective army of about 40,000 men. Apr. 25, 1626, he defeated Count Mansfeld, one of the most famous generals of the time, at Dessau, and pursued him through Silesia into Hungary, where this part of the war ended by the dissolution of Mansfeld's army and an advantageous peace with Bethlen Gabor. Returning through Silesia, Wallenstein occupied Brandenburg and Pomerania, expelled the refractory dukes of Mecklenburg, penetrated through Holstein and Sleswick into Jutland, and compelled Christian IV. to conclude peace. In reward the emperor created him duke of Mecklenburg in 1629, and thus the obscure Bohemian nobleman had become a prince of the German empire. But at this moment his career received a severe check. He was haughty in his bearing and exacting in his demands. Many people complained of him, and his army, now numbering about 100,000 men and stationed at various points of Northern Germany, was felt as a very heavy burden. Moreover, there was something mystical in his character, which, while it attracted people below him, made him suspicious to the eyes of people above him, and the emperor could not fail to observe that such a man at the head of such an army was a great danger. In Sept., 1630, he was dismissed and his army dissolved. He retired to his estates in Bohemia, where he lived in royal splendor, occupied with the administration of his vast property, with astrological studies, and with schemes of the most daring ambition. When Gustavus Adolphus appeared successful in Germany, Wallenstein proposed to raise an army and attack the emperor in joint operation with him, but the Swedish king had no confidence in him, and dropped the negotiations. Meanwhile, after the defeat of Tilly and the annihilation of his army, when the Saxons invaded Bohemia and the Swedes penetrated into Bavaria, the situation of the emperor became almost desperate, and the reinstatement of Wallenstein in power seemed almost the only means of escape. The emperor made the humblest approaches and consented to the most humiliating conditions. Wallenstein received the supreme military authority in Germany, the right of appointing his own officers, the rights of confiscation, amnesty, and pardon—yea, even the right of negotiating peace. But two months after his appointment there was a new army ready for battle. In the spring of 1632 the Saxons were expelled from Bohemia, and Wallenstein occupied a strongly-fortified position at Nuremberg in front of the army of Gustavus Adolphus. The attempt of the Swedes at dislodging him (Sept. 3) failed. Both the armies moved into Saxony, and on Nov. 16, 1632, the battle of Lutzen took place. Gustavus Adolphus fell, but Wallenstein was defeated. He retreated into Bohemia, and here he remained inactive for over a year, in spite of the entreaties and positive orders of the emperor. He opened negotiations with the Swedes, the Saxon princes, and Richelieu. His plan was, by an alliance with these powers to compel the emperor to accept such a peace as they would grant him, and the special goal of his personal ambition seems to have been the acquisition of the Bohemian crown. He failed, however. Although he succeeded in concealing his schemes from the emperor, he failed to detect the intrigues of the court in his own army, and while he still hesitated, and had made no decisive step, some of his most important generals—Gallas, Piccolomini, Altringer, Marradas, and Colloredo—fell from him, and with

them the army. On Feb. 23, 1634, he fled from his head quarters at Pilsen to seek rescue and support by the Swedish corps which approached under Duke Bernhard, but two days afterward he was assassinated at Eger by one of his own followers, Col. Butler. His *Letters* have been published by F. Förster in 3 vols. (1828–29), and monographs on his life and character have been written by Förster (1831 and 1844), Aretin (1846), Hurter (1855), Dudik (1858), Fiedler (1860), Ranke (1869), Gindely (1875). The picture of Wallenstein in Schiller's tragedy is generally considered as striking as it is vivid and impressive.

Wal'ler, county of S. E. Texas, formed since the census of 1870, bounded E. by Brazos River, and traversed by Houston and Texas Central R. R.; surface undulating, soil productive. Cap. Hempstead. Area, 350 sq. m.

Waller (Edmund), b. at Coleshill, Hertfordshire, England, Mar. 3, 1606, of an ancient and wealthy family, was first cousin, through his mother, of John Hampden, and distantly related to Cromwell; educated at Eton and at King's College, Cambridge; inherited in boyhood an estate of £3,500 a year; was chosen to Parliament for Agmondesham at the age of nineteen, on the accession of Charles I. (1625), and sat in that body much of the time for sixty years; married in 1631 a London heiress, who soon died; became noted as a writer of elegant and rhythmical verses, most of which were in praise of Sacharissa (Lady Dorothy Sidney) and Amoret (Lady Sophia Murray), to whom he unsuccessfully paid court; married Miss Mary Bresse, by whom he had thirteen children; was appointed after the battle of Edgehill (1642) one of the Parliamentary commissioners to negotiate with the king at Oxford; was gained over by the royalists, and entered into a conspiracy known as "Waller's plot" for the restoration of royal authority; but the plot having been discovered May 31, 1643, he was imprisoned for a year, fined £10,000, and banished the kingdom, only saving his life by abject humiliation before the House of Commons, confessing his guilt and incriminating his companions, three of whom were hanged; spent eight years of exile in France and Italy; was allowed to return about 1653, when he became a favorite with Cromwell, who several times visited his mother (a determined royalist), at Beaconsfield, where Waller now took up his abode; celebrated the praises of Cromwell in *A Panegyric to my Lord Protector* (1654), which contains some of his most effective stanzas; lamented his death in another poem, but welcomed the return of Charles II. by some indifferent verses *To the King upon his Majesty's Happy Return* (1660); was a general favorite with all parties on account of his wit and eminent social qualities; published a volume of his poems 1645, and again 1664, which ran through many editions, were highly admired and imitated. D. at Beaconsfield Oct. 21, 1687. Of the twenty-five or more editions of his poems, the most valued are that of 1711, edited by Bishop Atterbury, and containing two portraits of the poet, one in his twenty-third and one in his seventy-sixth year, and that of 1729, with a *Life* by Fenton and a portrait by Vertue. Some of the editions contain a number of Waller's parliamentary speeches. There are modern *Lives* by Bell (1853) and Gilfillan (1857) accompanying the latest editions of the *Poems*. Porter C. Bliss.

Waller (Edwin), b. in Spottsylvania co., Va., in 1800; became an alcalde in Texas; was the owner of the Sabine, a vessel which in 1832 sailed past the Mexican post of Velasco, the Mexican authorities having determined to levy a duty on the exportation of cotton, then a new branch of Texan commerce. This was the first overt act of resistance to the Mexican exactions in Texas. Mr. Waller was for some time imprisoned. His vessel brought back two cannon, which afterward did duty in the Texan navy. Waller became a leading spirit in the following war; was wounded at the capture of Velasco; helped form the provisional government; was a member of the convention of 1836, and assisted in framing the constitution of that year; selected Austin as the capital 1839; was president of the board of land commissioners; was the first mayor of Austin; postmaster-general of Texas; was long chief-justice of Austin co.; was the first to sign the ordinance of secession in 1861, his last political act.

Waller (John Francis), LL.D., b. in Limerick, Ireland, in 1810; graduated at Trinity College, Dublin, 1831; was called to the Irish bar 1833; became vice-president of the Royal Irish Academy 1864; was for many years editor of the *Dublin University Magazine*; editor of William Mackenzie's *Imperial Dictionary of Universal Biography* (Glasgow, 6 vols. imp. 8vo, 1866); contributed to Cassell's *Biographical Dictionary* (1869); edited the *Works* of Goldsmith, with a *Life* (1864), and is author of *The Slingsby Papers* (1852), *Poems* (1851), *The Dead Bridal* (1856), and other works.

Waller (Sir William), b. in Kent, England, in 1597; educated at Magdalen College and Hart Hall, Oxford, and at Paris; served in Germany during the early part of the Thirty Years' war as a volunteer in the army of the Protestant princes; was knighted by Charles I. on his return; was elected by the town of Andover to the Long Parliament (1640), in which he was a zealous member of the Presbyterian party; was appointed general and second in command of the Parliamentary forces under the earl of Essex 1642; took a leading part in the reduction of Portsmouth in that year; was defeated by the royalists at Lansdowne, near Bath, July 5, 1643, and again at Roundway Down, near Devizes, July 13, but gained a signal victory over Sir Ralph Hopton at Cheriton (or Cherrytown) Down, Alresford, near Winchester, Mar. 29, 1644; was defeated by Charles I. in person at Cropredy Bridge, near Banbury, Oxfordshire, July 29; joined the earl of Manchester in his march against Oxford, and took part in the indecisive engagement at Newbury, Berkshire, Oct. 27; was deprived of his military command by the "Self-denying Ordinance" Apr., 1645, but continued to be a leader of the Presbyterians in Parliament; was one of the eleven members of Parliament who were impeached of high treason by the army, June, 1647, and expelled and twice imprisoned, but was soon readmitted to his seat; was a second time expelled, together with all the Presbyterians, by Col. Pride, Dec., 1648; remained in retirement until the Restoration, when he sat as a member of the council of state Feb., 1660, and of the Convention Parliament Apr. to Dec., 1660. D. at Osterley Park, Middlesex, Sept. 19, 1688. Some of his immediate descendants settled in Maryland and Virginia. He left in MS. a *Vindication*, published in 1793, and *Divine Meditations*, printed in 1680. Porter C. Bliss.

Wallette', county of N. W. Dakota, bordering on Montana and British America, bounded on the S. by Missouri River and drained by its affluents; surface rolling, most of it constituting the Plateau du Couteau du Missouri. Area, about 3350 sq. m.

Wall'-Flower, the *Cheiranthus cheiri*, a European half-shrubby cruciferous plant, often growing on old walls, whence the name. It is a popular garden-flower, having blossoms single or double, of varied colors and of a rich fragrance. The Western wall-flower, or "yellow phlox" of the U. S., is *Erysimum asperum*, var. *Arkansanum*, a fine cruciferous plant.

Wal'lich (Nathaniel), M. D., b. at Copenhagen, Denmark, June 28, 1786; studied medicine; went to India 1807 in the employment of the Danish government at Serampore; devoted himself to botany, and after the transfer of the Danish possessions to England transferred his services to the East India Company, and was superintendent of the Calcutta botanic garden from 1815 to 1847, when he returned to Europe and settled in London; was elected vice-president of the Linnæan Society 1849, and d. in London Apr. 28, 1854. He contributed to the *Transactions* of the Asiatic Society of Calcutta and of the Linnæan Society, and to Sir W. J. Hooker's *Journal of Botany*; added a copious supplement to Drs. Roxburgh and Carey's *Flora Indica* (3 vols., 1832), and was author of *Tentamen Floræ Nepalensis Illustratæ* (Calcutta and Serampore, 1824–26), *A Numerical List of Dried Specimens of Plants in the East India Company's Museum* (1828), and *Plantæ Asiaticæ Rariores* (3 vols., 1830–32), with 300 colored plates.

Wal'lingford, p.-v. and tp., New Haven co., Conn., on Hartford and New Haven R. R., 12 miles from New Haven, contains 4 churches, excellent schools, 1 hotel, manufactories of britannia and silver ware, 1 newspaper, a book-making establishment, public Turkish bath, and a machine-shop. P. 3676. The Wallingford Community, a branch of the Oneida Community, founded in 1850 by John H. Noyes and Henry Allen, the original proprietor, is located here. The whole property is held by three persons in trust; the religion, social life, and government are the same as those of its head and parent community. The domain comprises 340 acres, 150 of which are covered by a valuable water-power belonging to the society. The principal business is agriculture, horticulture, job printing, and book-making in all its branches. The society numbers 60 members. (See Oneida Community.) Alfred Barron.

Wallingford, p.-v. and tp., Rutland co., Vt. P. 2023.

Wallis, Switzerland. See Valais.

Wal'lis (John), D. D., F. R. S., b. at Ashford, Kent, England, Nov. 23, 1616; educated at Felsted School and at Emmanuel College, Cambridge, where he graduated about 1636; became a fellow of Queen's College; took orders in the Church of England 1640; was chaplain to Sir Richard Darley and to Lady Vere; became an expert in discovering the keys to MSS. written in cipher, and was employed for that purpose by the Long Parliament; obtained the living

of St. Gabriel, Fenchurch street, London, which he exchanged for St. Martin's 1643; was secretary to the Westminster Assembly of Divines 1644; became Savilian professor of geometry at Oxford 1648, and keeper of the archives at Oxford 1658; was confirmed in those posts and made one of the royal chaplains at the Restoration 1660; was one of the founders of the Royal Society 1662; had a controversy with Hobbes, who pretended to have discovered the quadrature of the circle 1655–63; attracted notice by his success in teaching a deaf and dumb child to speak; was one of the revisers of the Book of Common Prayer 1661; edited the posthumous works of Jeremiah Horrox (1673), and maintained theological controversies with the Arians, Baptists, and Sabbatarians. D. at Oxford Oct. 28, 1703. Author of *Grammatica Linguæ Anglicanæ* (1653), *Arithmetica Infinitorum* (1655), *Mathesis Universalis* (1657), *De Æstu Maris Hypothesis Nova* (1668), *Mechanica, sive de Motu Tractatus Geometricus* (3 vols., 1669–71), *Observations concerning the Swiftness of Sound* (1673), *Claudii Ptolemæi Opus Harmonicum* (1680), *A Treatise of Algebra* (1685), *Institutio Logicæ ad Communes Usus accommodata* (1687), *Theological Discourses* (1692), and other minor works, which were collectively published as *Opera Mathematica et Miscellanea* (Oxford, 3 vols. folio, 1695–99), and a volume of his *Sermons, now first Printed from the Original MSS.*, appeared in 1791, with a *Memoir and Introduction* by Rev. C. E. de Coetlogon. His work on the *Arithmetic of Infinities* was of great service to (Sir) Isaac Newton in his mathematical studies, as suggesting new views in geometry, especially by foreshadowing Newton's brilliant discoveries of the binomial theorem and the method of fluxions.

Wallis (Severn Teackle), b. at Baltimore, Md., Sept. 8, 1816; graduated at St. Mary's College 1832; studied law with William Wirt; was admitted to the Baltimore bar 1837; published numerous pamphlets on legal and miscellaneous subjects; travelled in Europe 1847; served in the Maryland legislature; is a trustee of the Peabody Institute at Baltimore, and since 1870 provost of the University of Maryland. Author of *Glimpses of Spain* (1849), *Spain, her Institutions, Politics, and Public Men* (1853), and a *Discourse on the Life and Character of George Peabody* (1870).

Wal'lisville, p.-v., cap. of Chambers co., Tex. P. 27.

Wall'kill, tp., Orange co., N. Y., contains several villages, the largest of which is Middletown. P. 9477.

Wallkill River rises in Sussex co., N. J., and flows N. N. E. through Orange and Ulster cos., N. Y., its waters flowing into the Rondout. It furnishes considerable water-power. The Wallkill Valley is a famous dairy region.

Wall Lake, tp., Wright co., Ia. P. 199.

Wallon' (Henri Alexandre), b. at Valenciennes, department of Nord, France, Dec. 23, 1812; was educated in the Normal School of Paris, and became professor of modern history and geography at the Sorbonne in 1840; was elected a member of the Legislative Assembly of 1849, but resigned his seat in 1850 on account of the restrictions under which the Assembly placed the suffrage; was again elected a member of the National Assembly of 1871, and contributed much to the final establishment of the Republic; became minister of public education in 1875, and member of the senate in 1876. His principal works are—*De l'Esclavage de la Colonie* (1847), *Histoire de l'Esclavage dans l'Antiquité* (3 vols., 1847–48), *Jeanne d'Arc* (2 vols., 1860), *La Vie de Jésus et son nouvel Historien* (1864), against Renan; *Richard II., Épisode de la Rivalité de la France et de l'Angleterre* (2 vols., 1864), *La Terreur, Étude critique sur l'Histoire de la Révolution française* (1872).

Walloom'scoik River rises in Bennington co., Vt., flows past Bennington, and empties into the Hoosac in Rensselaer co., N. Y. It is also known as the Walloomsac River.

Walloons' [Dutch, *Walen*], a name applied to the inhabitants of certain provinces of Belgium and Holland—viz. Artois, Hainault, Namur, a portion of Flanders, Brabant, the country of Liege, Limburg, and Luxemburg. These speak the Walloon language or ancient French, which has Gaulish, Latin, and Teutonic elements. (See J. Sigart, *Dictionnaire du Wallon de Mons*, Bruxelles, 1870.) The Walloons are distinguished from the other Flemings and Brabançons not only by their idiom, but by their stature and fine bearing. The etymology of their name is the old German word *Wahle* (signifying "stranger," or, in the most restricted sense, *Gaul*), in Dutch, *Vaal*. Hence the appellation *Walschland*, applied to the N. of Italy (*Gallia Cisalpina*). A line beginning at Menin on the Lys (where the French and Belgian boundaries meet), running easterly, bending northward toward Brussels and Louvain, and then southward until it terminates on the Meuse between Maestricht and Liege, divides the Flemings to the N. from the Walloons to the S.

J. W. De Peyster.

Walloostook River. See St. John River (Maine and New Brunswick).

Wall'pack, tp., Sussex co., N. J. P. 647.

Wall-Papers. See Paper-Hangings.

Wall'-Piece, an arm having its stock like that for the musket, of larger calibre, and too heavy to be fired without a fixed support. It is therefore usually provided with a pivot-bolt which may rest in a socket on top of a wall or in the sole of an embrasure, and checks recoil while permitting free aiming. The earliest small-arms were wall-pieces. (See Small-Arms.)

Wall'send, a small town of England, county of Northumberland, is famous for the excellent coal which is raised in its collieries. P. 5721.

Waln (Robert), b. in Philadelphia, Pa., in 1797; received a liberal education, and devoted himself to literature; wrote *The Hermit in America on a Visit to Philadelphia* (1819), *American Bards, a Satire* (1820), a poem of nearly 1000 lines, praising Clifton and Dwight, and condemning the verses of Barlow, Humphreys, and L. M. Sargent; *Sisyphi Opus, or Touches at the Times, with other Poems* (1820), and *The Hermit in Philadelphia, Second Series* (1821); made a voyage to China as supercargo; published in quarto numbers a *History of China* and a *Life of La Fayette* (1825), and edited after the third volume Sanderson's *Biography of the Signers of the Declaration of Independence* (7 vols., 1820–27), for which he wrote several of the lives. D. at Philadelphia July 4, 1825.

Wal'nut [signifying "foreign nut;" it was introduced into Europe from the East], the common name of trees and their fruit of the genus *Juglans* (order Juglandaceæ). In some localities the name is locally extended to the hickories, which are of an allied genus. The English walnut or madeira-nut of the shops is the fruit of *Juglans regia*, a stately tree producing excellent timber. The nuts are very good eating, and the kernels yield a fixed drying-oil much prized by artists and makers of choice varnishes. In the U. S. we have the black walnut, *J. nigra*, which produces a very valuable dark-colored timber, much used for furniture, joinery, gun-stocks, etc. The black walnut produces a strong and very oily nut, much relished by some persons. The white walnut, *J. cinerea*, called also oilnut and butternut, produces a useful timber. Its nuts are more palatable than those of the black walnut, and its inspissated sap, or a decoction of the bark of the root, is a useful cathartic.

Walnut, p.-v. and tp., Bureau co., Ill. P. 1187.

Walnut, p.-v. and tp., Marshall co., Ind. P. 1972.

Walnut, tp., Montgomery co., Ind. P. 1449.

Walnut, tp., Adair co., Ia. P. 213.

Walnut, p.-v. and tp., Appanoose co., Ia. P. 778.

Walnut, tp., Dallas co., Ia. P. 489.

Walnut, tp., Jefferson co., Ia. P. 1199.

Walnut, tp., Madison co., Ia. P. 869.

Walnut, tp., Polk co., Ia. P. 1231.

Walnut, tp., Wayne co., Ia. P. 674.

Walnut, tp., Atchison co., Kan. P. 1374.

Walnut, tp., Bourbon co., Kan. P. 289.

Walnut, p.-v. and tp., Butler co., Kan. P. 849.

Walnut, tp., Crawford co., Kan. P. 568.

Walnut, tp., Adair co., Mo. P. 495.

Walnut, tp., Fairfield co., O. P. 2072.

Walnut, tp., Gallia co., O. P. 1732.

Walnut, tp., Pickaway co., O. P. 1636.

Walnut Creek, p.-v. and tp., Pottawattamie co., Ia. P. 382.

Walnut Creek, tp., Brown co., Kan. P. 1561.

Walnut Creek, p.-v. and tp., Bates co., Mo. P. 1070.

Walnut Creek, tp., Macon co., Mo. P. 1304.

Walnut Creek, tp., Edgecombe co., N. C. P. 1008.

Walnut Creek, tp., Holmes co., O. P. 1321.

Walnut Grove, tp., Crittenden co., Ark. P. 160.

Walnut Grove, tp., Knox co., Ill. P. 1960.

Walnut Grove, p.-v. and tp., McDonough co., Ill. P. 1128.

Walnut Grove, tp., Neosho co., Kan. P. 686.

Walnut Grove, tp., Saline co., Kan. P. 912.

Walnut Grove, tp., Granville co., N. C. P. 1698.

Walnut Grove, tp., Wilkes co., N. C. P. 1005.

Walnut Hill, p.-v. and tp., Tallapoosa co., Ala. P. 762.

Walnut Hill, tp., Marion co., Ill. P. 721.

Walnut Lake, p.-v. and tp., Faribault co., Minn. P. 500.

Wal'pole, p.-v. and tp., Norfolk co., Mass. P. 2137.

Walpole, p.-v. and tp., Cheshire co., N. H. P. 1830.

Walpole (Horace), fourth Earl of **Orford,** third son of Sir Robert, b. in London, England, Oct. 5, 1717; educated at Eton and at King's College, Cambridge; received from his father several lucrative sinecures, which produced him about £4000 per annum; travelled on the Continent 1739–41, accompanied by the poet Gray, with whom he quarrelled at Reggio; had a seat in Parliament 1741–68, but took little part in politics; purchased an estate near Twickenham 1747; was occupied for many years in the erection and decoration of a strange, irregular Gothic mansion, which he called Strawberry Hill, and which he filled with a library and a museum of pictures, armor, antiquities, and miscellaneous objects; set up a private press 1757, on which, among others, he printed several of his own works, and succeeded his nephew as fourth earl of Orford 1791, but never took his seat in the House of Lords. D. in London Mar. 2, 1797. He was never married. Author of *A Catalogue of the Royal and Noble Authors of England* (1758), *The Castle of Otranto* (1765), a romance, *Historic Doubts on the Life and Reign of Richard III.* (1768), *Memoirs of the Last Ten Years of the Reign of George II.* (1822), and other works, but will be best remembered by his voluminous and interesting letters. His *Entire Correspondence* (9 vols., 1857–59) was edited by Peter Cunningham.

Walpole (Sir Robert), Earl of **Orford,** b. at Houghton, Norfolk, England, Aug. 26, 1676; educated at Eton and at King's College, Cambridge; was elected to Parliament for Castle Rising 1700, and for King's Lynn 1702; became secretary at war 1707, and treasurer of the navy 1709; managed as leader of the Whigs the parliamentary proceedings against Dr. Sacheverell 1710; was found guilty by the House of Commons of "a high breach of trust and notorious corruption;" was expelled the House and sent to the Tower Jan. 17, 1712, the condemnation being probably due to partisan animosity; was soon released and re-elected to Parliament, but not permitted to take his seat until the following year; became a privy councillor on the accession of George I.; procured the impeachment of Bolingbroke and the late Tory ministers; was appointed paymaster-general of the forces Sept., 1714, chancellor of the exchequer and first lord of the treasury, with the rank of prime minister, Oct. 10, 1715; resigned office in consequence of the intrigues of Sunderland Apr. 10, 1717; was the determined enemy of the South Sea scheme; became again paymaster-general June, 1720; returned to power as prime minister and first lord of the treasury Apr. 4, 1721, and was the virtual ruler of England for the ensuing twenty-one years, until Feb., 1742, when he resigned, having been created earl of Orford two days before. D. in London Mar. 18, 1745. The popular impression so long prevalent that he ruled by means of bribery was doubtless much exaggerated.

Walpole (Spencer Horatio), D. C. L., b. in Surrey, England, in 1806, is a great-grandson of Sir Robert; was educated at Eton and at Trinity College, Cambridge, where he obtained two first prizes for declamation and essay-writing; was called to the bar at Lincoln's Inn 1831; became a bencher there, a successful practitioner in the chancery courts, and a queen's counsel 1846; married a daughter of the premier, Spencer Perceval, 1835; sat in Parliament for Midhurst as a Conservative 1846–56; has represented the University of Cambridge since 1856; was secretary of state for the home department in Lord Derby's three administrations, 1852, 1858–59, and 1866–67; is chairman of the Great Western Railway; and was for some years commissioner of church estates, and is an excellent classical scholar.

Walpur'gis-Night, the evening before the first of May, the vigil of the old festival of St. Walpurgis, or Walburga, who died in 778, and is properly commemorated on Feb. 25. She was an Englishwoman of the royal blood of Wessex, the first abbess of Heidenheim, and a sister of SS. Willibald and Wunnibald. Walpurgis-Night is celebrated as the season of the supposed annual celebration of the "witches' sabbath" on Blocksberg in the Hartz. St. Walpurgis had no connection with this ancient superstition, except a partly accidental one. In fact, the old May-day festival was a heathen one, like midsummer (which became the feast of St. John), and the traditions with regard to Walpurgis-Night have a dim reference to the old heathen practices. (See Halloween.)

Wal'rus [*Norse, hval,* "whale," and *ros,* "horse"], the common English name of the species of *Rosmarus.* (See Morse and Rosmaridæ.)

Wal'sall, town of England, county of Stafford, on the Tame, has large brass and iron foundries and manufactures of cutlery and hardware. Its tanneries, malt houses, and manufactures of harness and saddlery are also extensive. P. 46,152.

Wal'senburg, p.-v., cap. of Huerfano co., Col.

Walsh (Robert), LL.D., b. at Baltimore, Md., in 1784; educated in the Roman Catholic college at Baltimore and the Jesuit college at Georgetown, D. C.; spent several years in Europe, returning 1805; studied law under Robert Goodloe Harper, but abandoned that profession on account of deafness; became a writer for Dennie's *Portfolio;* published *A Letter on the Genius and Disposition of the French Government, including a View of the Taxation of the French Empire* (1810), which in six weeks ran through 12 editions in London, and contained much information new to English readers; conducted from 1811 to 1813 the first quarterly attempted in America, *The American Review of History and Politics,* in which most of the articles were from his pen; issued *Correspondence respecting Russia between R. G. Harper and Robert Walsh, Jr.* (1813), and an *Essay on the Future State of Europe* (1813); wrote biographical prefaces to an edition of the English poets in 50 small volumes, and *An Appeal from the Judgments of Great Britain respecting the United States of America* (1819); conducted *The American Register* (1817–18), a valuable statistical publication, *The Museum of Foreign Literature and Science* (1 vol., 1822), and *The American Quarterly Review* (22 vols., 1827–37), a resuscitation of his original *Review;* wrote biographical sketches for Delaplaine's *Repository* and for the *Encyclopædia Americana;* brought out the *Select Speeches* of George Canning (1835), William Windham, and William Huskisson (1841); and edited from 1821 to 1837 the *National Gazette,* a small daily newspaper, in which much attention was given to literature, and published *Didactics, Social, Literary, and Political* (2 vols., 1836), a selection of aphorisms from his newspaper articles and MSS. In 1837 he became U. S. consul at Paris, where he resided until his death, Feb. 7, 1859, acting as correspondent of the *National Intelligencer,* and subsequently of the *Journal of Commerce.*

Walsh (Robert), LL.D., b. in Ireland about 1785; educated at Dublin University; took orders in the Church of England; was joint author with John Warburton and Rev. James Whitelaw of a *History of the City of Dublin* (2 vols., 1818), and became chaplain to the British legations in Constantinople and Rio Janeiro. Author of *A Brief Notice of some Ancient Coins and Medals as illustrating the Progress of Christianity in the Early Ages* (1828; 3d ed. 1830), *Notices of Brazil* (2 vols., 1830), and *A Residence at Constantinople* (2 vols., 1836).

Walsh'ville, p.-v. and tp., Montgomery co., Ill. P. 1740.

Wal'singham (Sir Francis), b. at Chiselhurst, Kent, England, about 1536; studied at King's College, Cambridge; travelled on the Continent, and remained there during the reign of Mary; acquired the favor of Cecil, Lord Burleigh, by his political abilities and his knowledge of foreign languages; was sent three times on missions to the court of France, where he resided 1570–73; was on Cecil's recommendation knighted, sworn of the privy council, and made one of the principal secretaries of state 1573; was sent on important embassies to the Netherlands 1578, to France 1581, and to Scotland 1583; was a man of strict morals and undoubted integrity, addicted to religious meditation and to the Puritanic party in the state, but displayed as a statesman a consummate craftiness, bordering on duplicity; was said to have had in his pay in foreign countries 53 agents and 18 spies, through whom he was quickly informed of the secrets even of hostile courts; was an uncompromising political adversary, if not a personal enemy, of Mary Queen of Scots, whom for years he surrounded with spies and informers, who endeavored to inveigle her into real or pretended plots and conspiracies in order to intercept her letters; had in his pay a servant of the French ambassador Castelnau, and Gray, the envoy of the duke of Guise to the Scottish court, who was employed in managing the correspondence of Mary and James with their friends in France, thus discovering the so-called "Babington's plot" 1586; was a member of the commission for the trial of the queen of Scots at Fotheringay Oct., 1586; was charged by her with having forged the correspondence produced against her—a charge which he of course solemnly denied. About this time he was made chancellor of the duchy of Lancaster, and soon afterward withdrew from the management of public affairs. D. at Barn-Elms, near Lon-

don, Apr. 6, 1590, and was buried in St. Paul's cathedral. He was kept poor all his life by the niggardly policy of Elizabeth, and died in debt.—His daughter FRANCES was successively the wife of Sir Philip Sidney, of Robert Devereux, earl of Essex, and of Richard de Burgh, earl of Clanricarde. A tolerably full account of Walsingham's French embassy (1570–73) is given in Sir Dudley Digges's *Compleat Ambassador* (folio, 1655), and many of his letters may be found in the various collections of state papers. He was the chief patron of Richard Hakluyt in his colossal enterprise of collecting and publishing the voyages and discoveries of the sixteenth century. No biography of Walsingham seems ever to have been written, though the careers of few statesmen better deserve a detailed examination. PORTER C. BLISS.

Wal'singham (THOMAS), a native of Walsingham, Norfolk, England, was about the year 1440 a monk of the Benedictine abbey of St. Alban's, and, as Bishop Nicolson suggests, "very probably regius professor of history in that monastery," and was afterward prior of Wymondham, Norfolk. He was author of two valuable Latin chronicles, *Historia Brevis, ab Edwardo Primo ad Henricum Quintum*, and *Ypodigma Neustriæ vel Normanniæ, ab Irruptione Normannorum usque ad Annum sextum Regni Henrici Quinti*, the former work being a continuation of that of Matthew Paris. Both were edited by Archbishop Parker in the same volume with Asser's *Ælfridi Regis Res Gestæ* (1574), and in Camden's *Anglica, etc., a Veteribus Scripta* (Frankfort, 1603). The *Historia Brevis* has recently been edited by H. T. Riley for the "Rolls Series" under the title *Chronica Monasterii S. Albani, Historia Anglicana* (2 vols., 1863–64).

Wal'ter (JOHN), b. in England in 1739; became a printer in London; bought in 1780 two patents issued to Henry Johnson for "logography, or the art of using entire words, their radices, and terminations, instead of single letters, in arranging and composing for printing;" endeavored to introduce that invention by the establishment of a newspaper, *The London Daily Universal Register*, of which the first number appeared Jan. 18, 1785. Though the system of printing proved a comparative failure, the newspaper itself prospered, especially after a change of title was made to *The Times* (Jan. 1, 1788), and it gradually rose to the rank it now holds of the leading periodical of the world. Mr. Walter acquired a considerable fortune, and d. at Teddington, Middlesex, Nov. 16, 1812.

Walter (JOHN), son of the above, b. in London, England, in 1784; became joint proprietor and sole manager of the *Times* 1803; raised its circulation in ten years from 1000 to 5000 copies; introduced improvements in the printing-press (see PRINTING), including the use of steam-power, first practically employed Nov. 27, 1814; sat in Parliament for Berkshire 1832–37, and was elected for Nottingham 1841. D. in London July 28, 1847. He left a large personal estate, and built and endowed a handsome church near his country-seat at Bearwood, near Reading, Berkshire.

Walter (JOHN), son of the above, b. in London, England, Oct. 8, 1818; educated at Eton and at Exeter College, Oxford; studied law; was called to the bar at Lincoln's Inn 1847; was an unsuccessful candidate for Parliament in the so-called "Liberal-Conservative interest" 1843, but was returned for that borough Aug., 1847; represented it until 1859, when he was elected for the county of Berkshire; was defeated in the general election of July, 1865, but again chosen for that county in 1868 and 1874. He became proprietor of the *Times* at his father's death, and has conducted that great exponent of English public opinion with great success, and is a deputy lieutenant for London and Berkshire. His name is attached to a "web-perfecting" printing-press. (See PRINTING.)

Walter (THOMAS USTICK), LL.D., b. at Philadelphia, Pa., Sept. 4, 1804; received a good education; became professor of architecture in the Franklin Institute, Philadelphia; designed the Philadelphia county prison (1831), Girard College (1833), the U. S. Capitol extension (1851–65), the new treasury building and the government hospital for the insane at Washington, and was one of the founders of the American Institute of Architects.

Walter'borough, p.-v., cap. of Colleton co., S. C., 50 miles S. W. of Charleston, has 6 churches, good schools, 3 hotels, and 1 newspaper. It is a resort for invalids during the winter months. P. about 1000.
A. C. SHAFFER, ED. "NEWS."

Wal'tham, tp., La Salle co., Ill. P. 1115.

Waltham, p.-v. and tp., Hancock co., Me. P. 366.

Waltham, p.-v. and tp., Middlesex co., Mass., on Boston and Fitchburg R. R. and on both sides of Charles River, about 9 miles W. of Boston, contains 7 churches, a free public library, excellent schools, 2 banks, 2 newspapers, a farmers' club, post of the Grand Army, with literary and Masonic organizations. The first cotton-mill on an extensive scale was erected here in 1814, and with its later additions of a bleachery and hosiery department is still in successful operation. The American Watch Co.'s factory situated here is the largest of the kind in the country, and it was here that watchmaking by machinery was first thoroughly introduced. It has abundant water-power. Waltham is connected with the city of Newton by a street railway. P. 9065. GEO. PHINNEY, ED. "FREE PRESS."

Waltham, tp., Mower co., Minn. P. 179.

Waltham, tp., Addison co., Vt. P. 249.

Waltham Abbey, or **Holy Cross,** town of Essex, England, on the river Lea and the Great Eastern Railway, 12 miles N. of London. It has government powder and flour mills, and Enfield Lock, where the royal small-arms factories are situated, is in the immediate vicinity of the town. The town took its name from the ancient monastery founded here by Harold Harefoot. P. 5197.

Wal'thamville, p.-v. and cap. of Liberty co., Ga.

Wal'ther von der Vogelweide, b. between 1165 and 1170 in Franconia or Austria, of a noble but poor family; learned the art of poetry from the elder Reinmar, and became a wandering minstrel; visited successively the courts of most of the German princes, charming people by his songs in praise of love and valor, and influencing them by his poems on political, social, and even religious subjects; received in 1215 a small fief from Frederick II. near Würzburg, where he d. about 1230, and was buried near the cathedral; a new monument was raised on his tomb in 1843. His poems have been edited by Lachmann (1827), Wackernagel and Rieger (1862), and Pfeiffer (1864). His *Life* was written by Uhland (1822) and Menzel (1865).

Walthall, p.-v., cap. of Sumner co., Miss.

Walthourville, p.-v., cap. of Liberty co., Ga., on Atlantic and Gulf R. R.

Wal'ton, county of N. W. Florida, bordering on Alabama, and intersected by Yellow Water River; surface level and partly covered by pine forests; soil fertile in the N. part, and poor in the S. Principal live-stock, cattle and swine. Staples, cotton, wool, Indian corn, and sweet potatoes. Cap. Euchee Anna. Area, 1480 sq. m. P. 3041.

Walton, county of N. Georgia, bounded N. E. by Appalachee River, drained by the head streams of the Ocmulgee and Oconee, and traversed by Georgia R. R.; surface elevated and undulating, soil moderately fertile. Iron ore and granite are abundant, and some gold has been found. Principal live-stock, cattle, sheep, and swine. Staples, cotton, Indian corn, and wool. Cap. Monroe. Area, 320 sq. m. P. 11,038.

Walton, tp., Lahette co., Kan. P. 477.

Walton, tp., Eaton co., Mich. P. 1645.

Walton, p.-v. and tp., Delaware co., N. Y., on New York and Oswego R. R. at the junction of the Delhi branch, 17 miles W. of the latter place, contains 9 churches, a union school with academic department, 1 bank with savings department, 1 newspaper, 1 tannery, 2 grist-mills, a sash and door factory, and 1 hotel. Principal business, farming and dairying. P. of v. 866; of tp. 3216.
WM. A. WHITE, PROP. "CHRONICLE."

Walton, tp., Charlotte co., Va. P. 2778.

Walton, p.-v. and tp., Roane co., West Va. P. 1371.

Walton (BRIAN), D. D., b. at Seymour, in Cleveland, Yorkshire, England; educated at Magdalen College and Peterhouse, Cambridge, where he graduated 1619; took orders in the Church of England; was a curate in Suffolk and in London; was successively rector of St. Martin's, Ongar, London, of Sandon, Essex, and of St. Giles-in-the Fields, London; became prebendary of St. Paul's and chaplain to Charles I. 1639; espoused the side of the clergy in the London tithe dispute, publishing a *Treatise on the Payment of Tithes and Oblations in London* (1641); became thereby obnoxious to the Puritans, during whose ascendency he was summoned before Parliament, placed in custody, and his livings sequestrated (1642). He was forced to flee to Oxford, where he devoted himself for ten years during the civil war and the Protectorate to the preparation of his great work, the *Biblia Sacra Polyglotta* (London, 6 vols. folio, 1657), including the Hebrew original of the Old Testament, the Samaritan Pentateuch, the Chaldee, Syriac, Arabic, Persian, and Latin Vulgate, with various readings, notes, etc., constituting one of the chief monuments of Oriental scholarship in England, and still considered "the most complete biblical apparatus in any language." In its preparation Dr. Walton received aid from Archbishop Usher, John Selden, Samuel Clarke, Drs. Edmund Castell,

Thomas Hyde, Edward Pocock, and John Lightfoot, and several other noted Orientalists, and for its publication subscriptions to the amount of £9000 were made. He wrote in 1658 his *Dissertatio* on the antiquity and authority of his texts, usually styled in later editions the *Prolegomena*, and in reply to the attack made by the celebrated Dr. John Owen in his *Vindication of the Purity and Integrity of the Hebrew and Greek Texts, etc.* (1658), wrote his conclusive treatise, *The Considerator considered, etc.* (1659). Walton became chaplain to Charles II. at the Restoration, was consecrated bishop of Chester Dec. 2, 1660, and took part in the Savoy Conferences 1661. D. in London Nov. 29, 1661. *Memoirs of his Life and Writings* (2 vols., 1821) were written by Henry John Todd. PORTER C. BLISS.

Walton (GEORGE), b. in Frederick co., Va., in 1740; was apprenticed to a carpenter; acquired a tolerable education by private study; was admitted to the bar and settled in Savannah, Ga., 1774; was one of the four persons who called the first public meeting at Savannah (July 27, 1774) to concert measures for the defence of that colony; drew up the resolutions passed on that occasion; was a delegate to the Continental Congress 1776–81, and signed the Declaration of Independence and the Articles of Confederation; was colonel of militia in the defence of Savannah Dec., 1778, when he was dangerously wounded, and was a prisoner until Sept., 1779; was chosen governor of Georgia in Oct., 1779, and again 1789; became chief-justice of Georgia 1783, and judge of the State supreme court 1793; was appointed delegate to the Philadelphia convention for remodelling the Articles of Confederation and the formation of the present Constitution, but declined; and was U. S. Senator 1795–96. D. at Augusta, Ga., Feb. 2, 1804. A. H. STEPHENS.

Walton (IZAAK), b. at Stafford, England, Aug. 9, 1593; became a linen-draper in Fleet street, London, 1624, in which business he acquired a competency, upon which he retired in 1644; sympathized with the royalist cause in the great rebellion, and from that time "lived mostly in the families of eminent clergymen of England, of whom he was much beloved," devoting himself to literature, the contemplation of nature, and the pleasures of the fishing-rod. D. in Winchester Dec. 15, 1683. He wrote *Lives* of Dr. John Donne (1640), Sir Henry Wotton (1651), Richard Hooker (1665), George Herbert (1670), and Dr. Robert Sanderson (1678), which have often been published together, and are known collectively as *Walton's Lives*; *The Compleat Angler, or the Contemplative Man's Recreation* (1653), one of the best-known works of the seventeenth century, and various minor productions. Walton was twice married—first in 1626 to Rachel Floud, a descendant of Archbishop Cranmer, who d. 1640; and secondly, about 1647, to Anne, half-sister of Bishop Ken, who d. 1662. He left a son Izaak, who became a clergyman. A *Life of Izaak Walton, including Notices of his Contemporaries* (1823), was published by Thomas Zouch, D. D.

Walton (WILLIAM), D. D. See APPENDIX.

Waltz [Ger. *walzen*, to "revolve"], a German round dance, probably of Slavic origin. It was originally in $\frac{3}{4}$ or $\frac{3}{8}$ time, but the *valse à deux temps* now prevails. It is performed by couples.

Waltz, p.-v. and tp., Wabash co., Ind. P. 2361.

Wal'worth, county of Central Dakota, bounded W. by Missouri River. Area, about 900 sq. m. Not included in the census of 1870.

Walworth, county of S. E. Wisconsin, bordering on Illinois, drained by affluents of Rock and Pishtaka rivers, and traversed by Western Union and other railroads; surface level, with alternating forest and prairie, and containing several small lakes; soil productive. There are flour-mills and manufactories of carriages, pumps, iron castings, and paper. Live-stock, especially sheep, is very numerous. Staples, wheat, Indian corn, oats, potatoes, hay, wool, lumber, and dairy products. Cap. Elkhorn. Area, 576 sq. m. P. 25,972.

Walworth, p.-v. and tp., Wayne co., N. Y. P. of v. 362; of tp. 2236.

Walworth, p.-v. and tp., Walworth co., Wis. P. 2291.

Walworth (MANSFIELD TRACY), son of Chancellor Reuben H., b. at Saratoga in 1830; graduated at Union College 1849; became a lawyer at Albany, and published several highly successful novels, among which were *Hotspur* (1864), *Stormcliff* (1866), and *Warwick, or the Lost Nationalities of America* (1869). He was killed by his son at the Sturtevant House, New York, June 3, 1873.

Walworth (REUBEN HYDE), LL.D., b. at Bozrah, Conn., Oct. 26, 1789; passed his early years on a farm at Hoosick, N. Y.; was for the most part self-educated; taught a district school at the age of sixteen; studied law at Troy; was admitted to the bar 1809; settled at Plattsburg; was an officer of volunteers 1812, and acting adjutant-general of New York militia during the British campaign against Plattsburg 1814; became master in chancery and county judge 1811; took a high position at the bar; removed to Saratoga; was a member of Congress 1821–23; was a circuit judge 1823–28; was chancellor of New York 1828–48, taking rank as one of the masters of equity jurisprudence; was prominent in connection with the temperance cause and a vice-president of the Bible and Tract societies. His decisions as circuit judge are in Cowen's *Reports* (9 vols., 1824–30); those pronounced as chancellor are contained in Paige and Barbour's *Reports* (14 vols., 1830–49), and his opinions delivered as an *ex-officio* member of the court for the correction of errors may be found in the *Reports* of Wendell, Hill, and Denio (38 vols., 1829–50). D. at Saratoga Nov. 21, 1867. Author of *Rules and Orders of the Court of Chancery of the State of New York* (Albany, 1829) and *The Hyde Genealogy, or the Descendants, in the Female as well as in the Male Line, from William Hyde of Norwich* (2 vols. 8vo, 1864, with 22 steel portraits), the most elaborate genealogical work which had at that time appeared in the U. S., and the first which fully brought down to a recent date the descendants in the female lines. He also contributed articles on the Delamater and Mason families to the *N. E. Genealogical Register*, vols. xiv. and xv.—His son CLARENCE, b. about 1828, graduated at Union College 1838, became a Roman Catholic, and a priest of the Paulist order at Albany. Author of *The Gentle Skeptic* (1863), a reply to Bishop Colenso.

Wamego, p.-v., Pottawattamie co., Kan., on Kansas Pacific R. R., 100 miles W. of Kansas City, has a fine school-house, 1 bank, 1 newspaper, and a furniture-factory. The round-house, machine-shops, and turn-table of Kansas Pacific R. R., are located here. A fine iron bridge, 960 feet in length, spans Kansas River here. P. about 1200.
R. CUNINGHAM, ED. "BLADE."

Wam'pum [from an Algonkin root signifying "white"], the strings and belts of beads used as money by some tribes of North American Indians. The shells of *Venus mercenaria*, the round clam, or quahaug, were the favorite material. These were drilled lengthwise and strung upon a thread. Wampum was either white or of a black or violet-purple color, the last being valued twice as highly as the first. The wampum-belt served not only as money, but as an ornament, and the beads seem to have been used as counters or aids to memory in such simple computations as the Indians made.

Wanamin'go, p.-v. and tp., Goodhue co., Minn. P. 1468.

Wanatah, p.-v., La Porte co., Ind.

Wan'dering Jew, The, is the hero of a legend which first appeared in the middle of the thirteenth century in the chronicle of Matthew of Paris, who professes to have received his information from the lips of an Armenian bishop, to whom the Wandering Jew himself had communicated the events. According to this version, he was a servant in the house of Pilate, by the name of Cartaphilus, and gave Christ a blow when he was dragged out of the palace to be executed. According to another version—probably of the fifteenth century and of German origin—he was a shoemaker by the name of Ahasuerus, and refused Christ permission to sit down and rest when, on his way to Golgotha, he passed by his house. All versions, however, agree with respect to the verdict of Christ, that he should remain wandering on the earth until the second coming, and consequently the myth-forming imagination immediately went to work to narrate his travels, now and then supported by actual fraud and impostures. In the sixteenth century Ahasuerus was seen in Hamburg and other German cities, and held long conferences with Dr. Paulus von Eizen, bishop of Sleswick. In the beginning of the eighteenth century Cartaphilus appeared in London in the higher circles, and communicated to the most learned professors of Oxford, who came to see him, anecdotes from his personal acquaintance with the apostles, Mohammed, Tamerlane, and others. In the nineteenth century he has not appeared personally, but he has figured very largely in works of fiction by Schubart, A. W. Schlegel, Julius Mosen, Lenau, Klingemann, Edgar Quinet, Béranger, Eugène Sue, H. C. Andersen, etc. (See Grässe, *Die Sage vom ewigen Juden*, 1844.)

Waderoo', the name of several monkeys. See APPENDIX.

Wanika, a Caffre race of Eastern Africa, numbering perhaps 50,000 people. They are divided into twelve tribes, and live with the Suahili near the coast between lat. 2° and 6° S. They are indolent and morally corrupt, and are worshippers of fetiches and spirits, but have in part imbibed Mohammedan ideas.

Wanklyn (James Alfred), b. in England in 1834; received a thorough scientific education; studied chemistry at Heidelberg under Bunsen; made several important discoveries in chemistry, especially in settling the relation of the sugar group to the alcoholic series, and the ammonia process of water-analysis; became professor of chemistry at the London Institution, and public analyst for the county of Berks, and in 1871 conducted for the government the analysis of the milk supplied to the London workhouses. Author of treatises on *Water-Analysis* and *Milk-Analysis* (1873), and *On Tea, Coffee, and Cocoa* (1874).

Wan'tage, tp., Sussex co., N. J. P. 3636.

Wapakone'ta, p.-v., cap. of Anglaize co., O., on Dayton and Michigan R. R., 121 miles N. of Cincinnati and 84 miles S. of Toledo, contains 7 churches, a fine union school, 2 newspapers, and several manufacturing interests. The town was laid out in 1833, and was previously an ancient Indian capital. In Aug., 1831, treaties were signed here with the Senecas and Shawnees, by the terms of which they consented to give up their lands to the U. S. and remove to the Indian Territory. This was the last point in Ohio occupied by the Indians. The county is noted for its rich agricultural lands. P. 2150.

R. McMurray, Ed. "The Auglaize Democrat."

Wapella, p.-v. and tp., De Witt co., Ill. P. 1437.

Wapel'lo, county of S. E. Iowa, intersected by Des Moines River, and traversed by the Des Moines Valley, Burlington and Missouri River, and St. Louis Kansas City and Northern R. Rs.; surface undulating, soil fertile. Bituminous coal and limestone occur. There are flour-mills, saw-mills, pork-packing establishments, and manufactories of woollen goods, boots and shoes, agricultural implements, carriages, furniture, and brick. Live-stock of all kinds is numerous. Staples, Indian corn, wheat, oats, hay, wool, lumber, and dairy products. Cap. Ottumwa. Area, 432 sq. m. P. 22,346.

Wapello, p.-v. and tp., cap. of Louisa co., Ia., on Burlington Cedar Rapids and Minnesota R. R., 30 miles N. of Burlington, has 3 churches, excellent schools, 1 bank, 2 newspapers, 1 large flouring-mill, 1 woollen-factory, and 3 hotels. Principal business, farming and stock-raising. Iowa River affords immense water-power. P. of v. 870; of tp. 1870. L. W. Myers, Ed. "Republican."

Wap'iti, the *Cervus Canadensis*, a noble North American deer. (See Appendix.)

Wappanoc'ca, tp., Crittenden co., Ark. P. 320.

Wap'pers (Gustave), b. at Antwerp in 1803; studied painting in his native city and in Paris, and attracted general attention in 1830 by his *Devotions of the Burgomasters of Leyden;* became the first representative and the founder of the romantic school of painting in Belgium, and was made director of the Academy of Antwerp in 1840, and a baron in 1847. In 1853 he resigned his position in the academy, and in 1855 removed to Paris, where he d. Dec. 6, 1874. Of his pictures, chiefly consisting of historical pieces and portraits, some of the most remarkable are—*Charles I. taking Leave of his Children, Charles IX. on the Night of St. Bartholomew, Execution of Anne Boleyn, Defence of Rhodes by the Knights of St. John*, for Louis Philippe, now at Versailles; *The Great Fishery of Antwerp*, for Queen Victoria. His influence on the development of Belgian art was very considerable.

Wap'pinger's Falls, p.-v., Dutchess co., N. Y., 7 miles S. of Poughkeepsie, contains 5 churches, 2 public schools, 2 banks, a library and reading-room, 1 newspaper, 3 hotels, the Dutchess printworks, Franklindale cotton-mills, 2 large comb manufactories, a fine driving-park, and is a resort for summer tourists. P. 2263.

D. S. Dougherty, Ed. "Chronicle."

Wapsin'onoc, tp., Muscatine co., Ia. P. 1944.

Wapsipin'icon River, in Iowa, rises near the Minnesota line, and after a S. E. course of 200 miles reaches the Mississippi 25 miles above Davenport.

War. See International Law (Summary of its Principles), by Pres. T. D. Woolsey, S. T. D., LL.D.

War. *Permanence of the Institution of War.*—The history of war is the history of the human race. It is one of the natural functions of the savage, and the most honored profession of civilized society. The ancient Scandinavian looked forward to a perpetual state of war in paradise, and the enlightened American republic gives to its successful warrior the first place in its councils and its heart. All civilized men regard it as a great evil, yet some one of the leading nations of the world is nearly always engaged in it; and it may safely be said that the sun never sets upon a world wholly at peace. We have recently seen in our own land the philanthropist urging on a hesitating government, the minister of the Christian religion exchanging the gown for the sword, and the fairest and gentlest of "the sex" instilling energy into the uplifted arm. War must therefore be recognized as an instinct of humanity, of divine origin, not to be replaced, as idealists hope, by any human device like tribunals of arbitration or submissive trust in the generosity of competitors. At all events, its permanence is thoroughly believed in by all those most competent to judge, as will become evident by a brief review of the existing armies of civilized powers.

Review of Existing Armies.—The population of the leading powers, their peace forces, annual expenditure exclusive of interest on public debt, etc., are shown with sufficient approximation in the following table:

	Population.	Army.	Navy.	No. of men in army and navy.	Per cent. of population.	Total annual expenditure.	Cost of army and navy.	Per cent. of annual expense.
Great Britain	32,500,000	129,000	54,500	183,500	.58	$248,700,000	$131,104,000	52.7
Germany	41,000,000	422,300	8,000	430,300	1.05	111,117,000	77,104,000	69.4
Russia	82,000,000	768,500	64,000	832,500	1.08	242,000,000	121,500,000	50.0
France	36,000,000	425,000	47,500	472,500	1.30	263,200,000	126,800,000	48.2
Austria	36,000,000	278,000	7,000	285,000	.79	150,000,000	39,000,000	26.0
United States	38,500,000	27,489	10,442	37,931	.10	178,600,000	46,000,000	26.0

A standing army drains the resources of a state in two ways—negatively, by withdrawing its numbers from industrial pursuits, and positively, by the expenditure necessary for its support. It is generally supposed that the maximum number of men which any state can keep permanently under arms is about 1 per cent. of its entire population. A glance at the table will show which nations have reached this limit, and which have passed it. Nevertheless, these figures indicate merely the number actually present with their colors in time of peace, and not the number of trained soldiers that can be called upon in time of war. All the nations, except Great Britain and the U. S., are at this time engaged in organizing and arming their entire able-bodied population. The system by which this is done was originated and perfected by Prussia. The other nations have based their organization upon hers, and have not yet completed it. Accordingly, an examination of the Prussian system as applied to the German empire will be most profitable, and will give a good general idea of the others in their present or future condition.

The Prussian system is based upon the theory that military service is not a trade or craft, to be followed by a portion of the population, but a duty owed by every male citizen to his country. Only members of the reigning or mediatized princely families are exempt, and *in time of peace* an only son of a widow or chief support of a family, an owner of a factory who would be unable to carry on his business, a sole assistant of a father in business, a property-holder whose property would suffer, and a student of theology. Every able-bodied man, with these exceptions, between the ages of 20 and 32, forms part of the army. No substitute or exemption by payment is permitted. All others between the ages of 17 and 42 are liable to be called out upon occasions of great emergency, but they are not regularly organized, although they are enrolled; they are called Landsturm. The standing army consists of the active army and the Landwehr. The active army comprises the field army and the reserves. Every man upon reaching the age of 20 must enter the active army, and serve with it seven years; he serves the first three years continuously in the field army, after which he becomes part of the reserves, and is placed on furlough for the remaining four years. While in the reserves he is bound to take part in not more than two manœuvres, neither of which is to exceed eight weeks; he is recalled to active service whenever an increase of the field army becomes necessary. At the expiration of his seven years in the active army he becomes part of the Landwehr, and so continues for five years, when at the age of 32 he is freed from liability to service except as part of the Landsturm. Students of medicine are allowed to enter the army as surgeons, apothecaries, or veterinary surgeons. Educated young men who provide their own equipment and subsistence are required to serve only one year in the field army, and they may postpone entering it until the age of 23, having been examined, however, at the age of 20. This exception is made on the supposition that superior talents render the acquisition of the necessary military training possible in

one year. These men furnish most of the officers of the Landwehr.

The whole army, including the Landwehr, is divided into 16 army corps, 1 of the guards and 15 of the line. The corps of the guards is somewhat larger than the others, and is recruited from the empire at large. Each of the other corps belongs to a particular province, where it is always kept. Thus, the 1st corps belongs to the province of Prussia, and the 15th to Alsace-Lorraine. The corps never leaves its province except for war, and then it draws all its reinforcements and recruits from it. These provinces are subdivided to correspond with the subdivisions of the army itself. Each corps in time of peace consists of 2 divisions; each division of 2 brigades of infantry and 1 of cavalry; each brigade of 2 to 4 regiments; each regiment of 3 battalions; each battalion of 4 companies; each company of 129 men. There are attached to each corps also 1 battalion of rifles, 1 battalion of pioneers, 1 battalion of military train, and 1 brigade of artillery. Each army corps district is divided into 4 brigade districts, corresponding to its 4 infantry brigades. Each brigade district is divided into Landwehr battalion districts, and these again into company or levying districts. In the states which are divided into circles each company district is composed of 1 circle, and in general the districts coincide with the civil divisions. Each regiment of the line receives its recruits from its own district, in which it is quartered and from which it is rarely moved; it has a *reserve* battalion, consisting of men who have served in its own ranks, upon which it relies to increase its strength to a war-footing. It also has its own Landwehr battalions attached to it, bearing the same number and provincial designation. As before stated, the Landwehr and reserve battalions are not kept under arms; the reserves are on furlough, and the Landwehr are something like our militia. Generally there are 2 Landwehr battalions to each regiment of the line. Each of these Landwehr battalion districts is provided with a permanent staff, consisting of 1 commander, 1 adjutant, 2 sergeants, 3 corporals, and 6 men as orderlies, with 1 sergeant and 1 corporal for each company district. It is the duty of this staff to keep the necessary clothing and equipments, and to have everything prepared in time of peace for the formation of the Landwehr battalions. Dépôts and magazines of arms and equipments for soldiers of the Landwehr are established at the head-quarters of the Landwehr battalion districts. Those of the reserves are at the head-quarters of the regiments of the line.

The field army in time of peace is always ready to take the field. It consists of 401,659 enlisted men. A part of this number, the non-commissioned officers, are encouraged to remain, but the greater portion, probably 90 per cent., is renewed every three years, and about 30 per cent. every year. The number of young men who reach the age of 20 each year is rather more than sufficient to recruit this force. Selection is made by lot, those not chosen being then considered as a special reserve, called the restoration (*ersatz*) reserve. The latter includes also those men who have claimed exemption on account of family circumstances, and those who have been exempted on account of *slight* bodily defects. The mobilization of the army, or placing it on a war-footing, consists of filling up the field troops to their war-strength, and the formation of dépôt troops and of garrison troops. The field troops are placed on a war-footing by increasing the strength of the regiments. For this purpose each infantry regiment calls in about 500 reserves per battalion; this absorbs most of the reserves, and what are left are employed as dépôt troops. Each cavalry regiment calls in about 40 reserves, the peace-strength of cavalry being nearly as great as the war-strength. The field artillery calls in all the reserves and many of the Landwehr. The dépôt troops are intended for filling up vacancies as they occur in the field army. In a year of war the infantry loses 40 per cent., and the cavalry, artillery, and pioneers 20 per cent., of their strength. Each infantry regiment forms a fourth battalion, which it leaves behind as a dépôt battalion; each cavalry regiment leaves a dépôt squadron; each field artillery regiment a dépôt division of four batteries; and each pioneer battalion a dépôt company. As soon as a regiment has lost one-tenth of its men, it calls for that number from its dépôt, and receives them thoroughly prepared for the field. Their places at the dépôt are at once filled by recruiting from the *ersatz* reserve, and, when that is exhausted, from the youngest men of the Landwehr. Should the fourth battalion be required to join the army, a fifth battalion is formed for the dépôt from the Landwehr. The troops required for the garrisons and for guarding the lines of communication are taken from among the Landwehr.

The officers of the field army are permanent, and are usually taken from the aristocratic class. (See MILITARY ACADEMIES.) Officers of the reserve are appointed from among officers who have left the field service, or from among very meritorious soldiers whose active service has expired. Officers of the Landwehr are obtained by transfer from the reserve and by promotion from the ranks. At the mobilization some officers of the field army are always transferred to each infantry and cavalry regiment of Landwehr, and each company receives two or three non-commissioned officers from the line.

By this system Germany can now put into the field within two weeks over 1,200,000 men, 700,000 of whom are in the highest state of instruction and discipline, and the balance are inferior only from being out of practice. After the expiration of twelve years from 1871, the date of the last reorganization, by which the system was extended to the recent additions to the empire, the number will be increased to 1,600,000, with the Landsturm to fall back upon in case of emergency. (For the manner in which this force can be applied see FRANCO-GERMAN WAR.)

The people of the U. S. and Great Britain resemble each other in their jealousy of large standing armies and their abhorrence of a system of universal service, as well as in their warlike spirit and self-sacrificing patriotism. Their military systems are explained in the article MILITIA. The result of such systems is that the army, having to compete with other employments for its recruits, is in time of peace much more expensive per man than that of continental powers, while the cost of carrying on war is enormously greater. It is safe to say that the civil war in America cost the North double what it would, had it had such an organization as Germany. The chance of a collision between the U. S. and a power so prepared is very remote, but not so with Great Britain. What would be the result of such a collision is a question which causes some anxiety to the friends of the latter. One certain result would be great waste of lives and money, and it can only be hoped that with these sacrifices the superior ingenuity, pertinacity, and composure of character of the race would enable her to retain her merited place at the head of the European family of nations.

The natural result of a perfect preparation for war is a less reluctance to enter upon it. Fortunately, these great preparations carry with them a restraining influence—viz. the increased cost of war. We have considered only the organization of the men or the *scale* upon which modern war is waged, but all the implements of war (see ARTILLERY, SMALL-ARMS, GATLING GUN, etc.) have increased in efficiency and expense in full proportion to the perfection of organization. The wars of Napoleon in thirteen years (1802–15) cost France about $1,000,000,000. The civil war in America cost the North in four years about $4,000,000,000, or thirteen times as much per year as Napoleon's, or, allowing one-half of the expense for waste, it cost more than six times as much per year as Napoleon's wars. The work of war is therefore accomplished in less time, and although the total amount of damage that nations inflict upon each other is probably about the same as formerly, there are more years of peace.

Art of War.—The art of war consists of rules for raising, arming, organizing, recruiting, administering, feeding, and fighting armies in the most efficient and economical manner. It includes, therefore, the fabrication and perfection of arms and equipments, the construction of fortifications, the establishment of military institutions, and the preparation of the soldier for duties in the field. These are the preparations for war, and have been more or less fully treated in the articles ARMY, ARTILLERY, BRIDGE (MILITARY), CAVALRY, COMMISSARY, ENGINEERS (CORPS OF), FORTIFICATION, INFANTRY, MILITARY ACADEMIES, MILITIA, SAPPERS, MINERS, AND PONTONIERS, SMALL-ARMS, TORPEDO, etc. We are here concerned with war itself, or the actual employment of armed forces. Some of its details have already been touched upon in BOMBARDMENT, ESCALADE, MINING ENGINEERING, SIEGE, TACTICS (MILITARY), etc.

"War," says Jomini, "far from being an exact science, is a terrible and passionate drama, subjected, it is true, to three or four general principles, but the result is subordinate to a multitude of moral and physical complications." Napoleon I. presents Achilles, born of a goddess and of a mortal, as the image of the genius of war. The divine part relates to moral considerations—to character, talent, the spirit of the soldier, who is strong and victorious or weak and beaten according as he thinks himself to be one or the other. The earthly part relates to arms, intrenchments, positions, orders of battle—all that pertains to the combination of material things. This poetic but accurate conception clearly indicates the imperfection of any theory of strategy. The problem is to direct and estimate the effect of forces the energies of which are only partially known, and the resistances to which are known still less. The data for its solution are obtained from military history.

Although it is not possible to establish rules to fit every case, nevertheless certain general principles underlie the operations of war, and these give rise to rules which are useful for pointing out the errors to be avoided, if for nothing else. These fundamental principles are—(1) that to ensure success we must bring the heaviest force to bear upon the weakest point of the enemy: and (2) that this force must act with the greatest possible velocity. It was one of Napoleon's maxims that the force of an army, like the quantity of motion in mechanics, is measured by the mass multiplied by the velocity.

An army in the field has constant wants which cannot be supplied from the enemy's country, such as ammunition, arms, recruits, medical stores, etc., and frequently also food and forage. It is essential to its existence that it should keep open communication with some part of its own country. That part immediately in rear of the army and covered by it is generally selected, and here are collected special dépôts for supplies. This strip of territory is the foundation of the army, or, as it is technically called, its *base*. The roads leading from the position of an army to its base are called *lines of communication*, or, simply, *communications*. They are the throat of the great machine, of which the base is the head and the army the body. An enemy with his hands upon the communications of an army can quickly choke the life out of it.

The great aim in war is such destruction of the enemy's military power as will compel him to peace. The defeat and dispersion of his troops is not always sufficient: it must generally be accompanied by the occupation of a portion of his country, thus cutting off his sources of recuperation and his power to raise new armies. And it is evident that such cutting off of resources before the dispersion of his troops will facilitate the latter operation. Accordingly, while the defeat of the enemy's army is the first consideration, effort is generally made at the same time to get possession of some important strategic point, such as his capital or great commercial centres. This point is called the *objective*. The line of direction of the objective from the base is called the *line of operations*. It it not a mathematical line, but it may include several parallel roads not farther apart than one or two days' march when they are employed by the different divisions of the same army. Lines of operation are *simple* when the army is not divided into large independent bodies; *double*, when two armies, either independent or commanded by the same general, proceeding from the same frontier, are widely separated for a long interval of time. Double lines are said to be *interior* when used by one or two armies against several hostile bodies, and having such direction that the masses can be concentrated in less time than the enemy would require to collect a greater force; *exterior*, when the army acts at the same time against both extremities of the enemy; *concentric* or *converging*, when, starting from widely-separated points, they meet at the same point; *diverging*, when, leaving a given point, they are directed upon several distinct points. The choice of the line of operations is the most important problem in strategy. The object sought for is to place the army where a victory will be decisive. This will be the case if the enemy's communications are seized, and this object must always be kept in view. At the same time, it must be remembered that the great advantage of the offensive lies in a sudden, unexpected attack—that wide détours are therefore out of place, and the shortest road to the enemy is, other things being equal, the best. In every case, except that of vastly preponderating forces, the line must be directed upon the centre or one of the extremities of the enemy, and not upon all at the same time. If the enemy's front is widely extended, the best direction will be upon the centre; otherwise, upon one of his flanks, and then upon his rear. The latter may expose the assailant's own communications, and he must take care to preserve a safe line of retreat either to the rear or to the right or left. A single line is preferable to double lines, and the latter are adopted only when the topography of the country makes it necessary, or when double lines have been adopted by the enemy and it has become necessary to oppose each of his masses; and then interior are preferable to exterior lines. In the case of converging lines care must be taken that the junction can be made before the armies are separately exposed to the combined masses of the enemy. Diverging lines may be usefully employed when the enemy's forces have been separated to increase the dispersion; they are then interior lines. All other things being equal, the richest provinces are selected to operate in, as facility of subsistence promotes rapidity of movement. Keeping the army concentrated and giving it a proper direction are not the only requisites for success. There must be no hesitation, no rest. The result of slow and hesitating movements is to find the enemy prepared at all points. No time must be lost in opening the campaign, and when a success is obtained it must be followed up with energy. Fortifications must be observed by detachments, and must not be allowed to check the main advance.

In presenting these simple rules of strategy the offensive has been principally considered, because that is the normal characteristic of war, and is the positive side of it. The defensive is the result of necessity, and is therefore negative. It is generally acknowledged that politically a defensive war is the only legitimate one, but a war politically defensive is not necessarily conducted by defensive campaigns. The offensive preserves the assailant's country from devastation and raises the *morale* of his army, while it is the direct road to the object of the war—viz. the destruction of the enemy's military power. On the other hand, the defensive has the advantage of fortifications, knowledge of the country, and facilities for obtaining information of the enemy's movements; and it is frequently assumed at the beginning of a campaign with a view to taking up the offensive as soon as the enemy shall have expended a part of his strength. As a rule, however, it is employed only in case of reverses or decided inferiority, and then it must not be passive. Minor points are neglected to concentrate upon the decisive ones. Fortifications being intended to occupy a considerable part of the enemy's army in their capture, advantage must be taken of this time to beat the other part. Accordingly, the fortifications with their defenders are left to draw off such portions of the enemy's force as they can, and battle is offered at a distance in rear, and not in front of them. Every effort must be made to strike the enemy's communications and compel him to retreat. "Retreats," says Napoleon, "cost many more men and much more material than the bloodiest battles, with this difference—that in a battle the enemy loses nearly as much, while in a retreat the loss is all on one side." But a simple repulse is not sufficient; for unless the blow is returned, the enemy may renew it, and the war being thus carried on at the expense of the defenders, they will in the end succumb.

The fundamental principles of war, concentration upon the decisive point and velocity, apply to battles (see TACTICS) as well as to strategy, but the resulting rules are modified by the differing circumstances, as one deals with the theatre of operations and the other with a battle-field. Good strategy attempts to place the force in the midst of the enemy's masses, but this does not place it in immediate contact with all of them; while in tactics it probably would, on account of the shorter distances involved and the difficulties of preserving secrecy. Hence, in the offensive battle effort is made to overwhelm one wing at a time only. The main force is concentrated upon this effort, while a few troops are employed to occupy the enemy at other points. A great success can only be obtained by depriving the enemy of his line of retreat. This can be attained by attacking his flank or his rear, but the first consideration is to beat him, for a vigorous pursuit can change an indecisive victory into a decisive one.

The application of these principles requires a knowledge of the topography of the country, a perfect familiarity with tactics, and experience in administering and feeding troops. These acquirements are within the reach of men of no extraordinary capacity. There have been many great generals who were not men of learning, or even men with great powers of understanding. The question at once suggests itself, Why is it, then, that there are so few great generals? A glance at some of the difficulties met with at every step in actual campaigning will give the answer. A complete list of them would not be practicable, but the following are given as examples: (1) There are comparatively few men whose minds are not somewhat clouded by the presence of danger; great moral and physical courage are therefore necessary. (2) We are in total or partial ignorance of the enemy's condition and intentions, and our information is contradictory. The natural anxiety as to the correctness of our conjectures upon these points leads, with an ordinary man, to hesitation and doubt, and these are fatal. Perfect self-reliance and calm adherence to original plans are here demanded. (3) There is nearly always some miscalculation in the difficulties of a road or the strength of a post. Expecting to reach a point at a given time, a commander finds himself a long distance from it. Great energy, strong will, even some severity to obtain the utmost exertions of the troops, are here necessary. (4) The movements of an enterprising enemy call constantly for new combinations, and these must be made and acted on without hesitation. This demands great decision of character. (5) To ensure the full support of troops, the general must be able to impress upon them his own spirit. This requires a deep knowledge of men. (6) There is always the element of chance; a sudden rainstorm or a fog may neutralize the greatest efforts.

The following are some of the principal maxims of war.

in addition to those already given: (1) Foresee everything that the enemy may do, and provide means to thwart him. (2) The forces employed must be proportionate to the obstacles to be overcome. (3) Debate well at the outset whether to assume the offensive or defensive; but the offensive having been selected, pursue it to the last extremity. The evils of retreats have been referred to above. (4) Be ready to meet the enemy at all hours of the day or night, whether on the march, at a halt, or in camp. (5) With an army inferior in numbers avoid a general battle, and supply the place of numbers by rapidity of marching. (6) The honor of his arms is a general's first consideration, the lives of his men secondary, though the two are entirely consistent with each other, for safety to the whole is found in audacity and persistency. (7) Never do what the enemy wishes you to, for the reason merely that he desires it. (8) When surprised by a superior enemy, a bold attack will generally disconcert him. (9) On the day of battle neglect no chance of success; a battalion sometimes decides the day.

Laws of War.—Besides the articles of war and laws relating to the internal government of armies and the establishment of martial law, there are certain usages generally recognized among civilized nations, and forming part of the general law of nations, which regulate the intercourse of belligerents with each other. The following is a brief synopsis of the more important of these usages.

The laws of war permit the destruction or capture of *armed* enemies, and the capture of any other enemy who is of importance to the hostile government, the destruction of property and of channels of traffic, the withholding sustenance from the enemy, and the appropriation of everything in the enemy's country necessary for the safety and subsistence of the army. They prohibit wounding except in fight, torture to extort confession, and all cruelty, the use of poison in any way, and all wanton devastation. They admit of deception, but not perfidy. It is lawful to starve the enemy, whether armed or unarmed, so that it leads to the speedier reduction of his army. Hence, noncombatants expelled from a besieged place may be driven back, so as to hasten the surrender. Warning of bombardment should usually be given a besieged place, but this may be omitted when a surprise is necessary. As soon as a capitulation is signed, the capitulator forfeits all right to injure the works, arms, or stores in his possession. The unarmed citizen is to be spared in person, property, and honor as much as the exigencies of war will permit. The subjects of the enemy are not to be forced into the service of the victors. Private property is to be protected, but an invader may levy taxes and forced loans, billet soldiers, and appropriate houses, boats, etc., for temporary use. Private property is to be seized only from necessity, and receipts are to be given to the owner to serve him in procuring indemnity. All pillage, even after taking a place by main force, all rape, all wounding of inhabitants, are strictly prohibited. All captures and booty belong to the government of the captor. A victorious army seizes all public money and public property, and sequesters all revenues of real property, the title to said property being in abeyance during military occupation. The property of churches, hospitals, and educational institutions may be used when necessary, but is to be protected from injury. Works of art, libraries, scientific collections, and precious instruments, like telescopes, are to be secured from injury. They may be removed for the benefit of the conquering nation, the ultimate ownership being settled by the treaty of peace, but in no case are they to be sold or given away or privately appropriated. Retaliation, the sternest feature of war, is sometimes necessary, but is only resorted to protectively, and after careful inquiry into the occurrence which requires it. Deserters who have entered the enemy's service, and are recaptured, suffer death. If the people of a district actually held by an army rise against it, they violate the laws of war, whether called upon by their government or not; but if the district is not yet occupied, there is no such violation in a general rising *en masse* under a duly-authorized levy. Chaplains, physicians, and nurses are not usually made prisoners. A prisoner of war is subject to no punishment for being a public enemy, and no revenge is to be wreaked upon him by the infliction of any suffering or disgrace; but he is answerable for any crime he may have committed against the captor's army or people before his capture, and he is subject to the infliction of retaliatory measures. A prisoner of war may be required to work, according to his rank and condition. If he escapes, he may be shot in his flight, but no punishment is to be inflicted for an attempt to escape. If, however, a conspiracy for the purpose of a general escape is discovered, the conspirators may be severely punished, even with death. Every wounded prisoner is to be medically treated, according to the ability of the medical staff. A resolution in hatred and revenge to give no quarter is illegal, but a commander may give such an order when in great straits and when his own salvation makes it *impossible* to encumber himself with prisoners. Troops who give no quarter receive none. Troops who give no quarter have no right to kill enemies already disabled on the ground or prisoners captured by other troops. Troops who fight in the uniform of their enemies without plainly distinguishing marks can expect no quarter. The use of the enemy's national flag or standard is an act of perfidy, by which the perpetrator forfeits the protection of the laws of war. Men who commit hostilities without belonging to the enemy's army are treated as pirates. A spy (see Spy) is punishable with death by hanging. The person of a bearer of a flag of truce is sacred, but firing is not required to cease on the appearance of a flag of truce in battle. The bearer is rarely admitted during an engagement, and if admitted he may be retained. It is customary to designate hospitals by special flags, so that the enemy may avoid firing on them, and these flags are respected if practicable. It is an act of infamy to deceive the enemy by such flags. Breaking a parole is punished with death. Proclaiming any subject of the hostile government an outlaw who may be slain without trial by any captor is illegal. Persons who violate the laws of war are no longer entitled to their protection.

(For naval warfare see Navy, Naval Tactics, etc.)

O. H. Ernst.

Warasdin', town of Austria, in Croatia, on the Drave, is the seat of many civil, ecclesiastical, and educational institutions, and manufactures tobacco, liqueurs, rosoglio, and vinegar. P. 8978.

War'beck (Perkin), a pretender to the crown of England who personated Richard, duke of York, younger brother of Edward V., with whom he is supposed to have been murdered in the Tower in 1483. He was said to have been the son of a Jew of Tournay, where he went in the above year. In 1490 he appeared at the court of Burgundy, where an extraordinary resemblance to Edward IV. was noted, and it is supposed that he was then instructed in the part he was to play on a future occasion. In 1492, in anticipation of the outbreak of hostilities between England and France, he landed at Cork, Ireland, and was joined by numerous partisans, but was soon obliged to fly to France, where he was acknowledged by Charles VIII. as duke of York, received a pension, and was assigned a body-guard. After the Peace of Etaples, however, he had to leave France; repaired again to Flanders 1493, where he was recognized by Margaret, the duchess-dowager (sister of Edward IV.), as her nephew. After being repulsed from the coast of Kent July, 1495, and from Ireland 1496, he proceeded to Scotland; was acknowledged by James IV., and married to Lady Catharine Gordon, daughter of the earl of Huntley; invaded England with Scottish forces Oct., 1496, and again in the spring of 1497, when he besieged Norham Castle; landed in Ireland July 30 of that year; proceeded thence to Cornwall, landing at Bodmin Sept. 7; assumed the title of Richard IV., and gathered around him 7000 men, with whom he besieged Exeter; was driven back to Taunton; being hard pressed by the royal forces, he took sanctuary in Beaulieu Abbey, Hampshire; was induced to give himself up by the promise of a pardon; confessed his imposture, and was committed to the Tower in October; escaped to the sanctuary at Sheen June 9, 1498; was retaken the following year, placed in the stocks at Westminster and at Cheapside, forced to read aloud his confession, and recommitted to the Tower, where, being soon afterward detected in another plan to escape, along with his fellow-prisoner, Edward, earl of Warwick, son of the duke of Clarence, he was hanged, drawn, and quartered at Tyburn Nov. 23, 1499, Warwick being beheaded five days later. Modern opinion favors the belief that he was really an illegitimate son of Edward IV., and that his pretended "confession" was forged by the agents of the court.

War'blers, the name of numerous birds. See Appendix.

War'burton (Eliot Bartholomew George), b. at Aughrim, near Tullamore, county Galway, Ireland, in 1810; educated at Queen's and Trinity colleges, Cambridge; was called to the Irish bar, but soon relinquished that profession to devote himself to the care of his Irish estates, to country sports, literature, and foreign travel; was a genial member of society, and proved himself a generous landlord during the famine of 1846–47. He travelled in the East in 1843; published on his return *The Crescent and the Cross, or Romance and Realities of Eastern Travel* (2 vols., 1844), which obtained immense popularity; settled in London 1844; published *Memoirs of Prince Rupert and the Cavaliers* (3 vols., 1849), *Reginald Hastings* (3 vols., 1850), a

novel of the great rebellion, *Memoirs of Horace Walpole and his Contemporaries* (2 vols., 1851), and *Darien, or the Merchant Prince, an Historical Romance* (3 vols., 1851). He perished in the burning of the steamer Amazon off Land's End Jan. 4, 1852, being on a voyage to the West Indies.—His brother GEORGE was for some years a major in the British army in Canada; subsequently sat in Parliament for Harwich, and d. by suicide 1857. Author of *Hochelaga, or England in the New World* (2 vols., 1846), *The Conquest of Canada* (2 vols., 1849), both anonymous and edited by his brother Eliot, and *A Memoir of Charles Mordaunt, Earl of Peterborough* (3 vols., 1853).

Warburton (WILLIAM), D. D., an English prelate of great learning and ability, but paradoxical, dogmatic, and overbearing, b. Dec. 24, 1698, at Newark-upon-Trent, where his father was an attorney and town-clerk; attended school at Newark and Oakham; in 1719 began the practice of law at Newark, but in 1723 abandoned the law and took deacon's orders; in 1726 was ordained priest, and made vicar of Gryesly, Nottinghamshire; became rector of Brant Broughton, Lincolnshire, 1728; preacher to the society of Lincoln's Inn 1746; prebend of Gloucester 1753; king's chaplain in ordinary 1754; prebend of Durham 1755; dean of Bristol 1757, and in 1760 bishop of Gloucester, where he d. June 7, 1779. His spirited defence, in 1739–40, of Pope's *Essay on Man* against the charge of atheism made the poet his ardent and life-long friend. In 1741, Pope introduced him to his friend Allen of Prior Park, near Bath, and when he d. in 1744 bequeathed to him half his library and all his copyrights not otherwise disposed of. In 1746 he was married to Miss Gertrude Tucker, the favorite niece of Mr. Allen, and ultimately came into possession of Prior Park. He published *Miscellaneous Translations in Prose and Verse* (1723), *An Inquiry into the Causes of Prodigies and Miracles* (1727), *Alliance between Church and State* (1736), *Divine Legation of Moses* (his greatest work, 1738–41), a very poor edition of *Shakspeare* (1747), *Julian* (1750), an edition of *Pope's Works* (1751), *The Doctrine of Grace* (1762). His own works were published by his friend Bishop Hurd in 7 vols. 4to (1788), with a *Memoir* prefixed (1794). His *Letters* to Hurd appeared in 1808, and *Literary Remains* in 1841. A new *Life* of Warburton, by Rev. John Selby Watson, was published in 1863. R. D. HITCHCOCK.

Ward, in feudal law, means the heir of the king's tenant in capite during his nonage, but in general language the term is applied to all infants under the power of guardians. The guardian—that is, in law, he who has the custody of infants, or generally, of such persons as are incapable of directing themselves—may now be said, on the father's death, to belong to one of the following five classes: (1) testamentary, or appointed by will; (2) customary, or appointed by local usage; (3) *ad litem*, or appointed by a court in order to conduct legal proceedings; (4) by appointment of chancery; and (5) in tort, or by intrusion, as when a person wrongfully intrudes in the management of an infant's estate, he must account in chancery as if he had been a guardian. The old kinds of guardianship at common law are now nearly obsolete. In France, as in England, guardianship lasts until the full age of twenty-one, except in case of marriage or judicial emancipation. The court of wards and liveries, for cognizance of various matters relating to the king's prerogative, was established by Henry VIII., and abolished at the Restoration.

Ward, tp., Yell co., Ark. P. 359.

Ward, tp., Randolph co., Ind. P. 1614.

Ward, tp., Clarke co., Ia. P. 421.

Ward, tp., Allegany co., N. Y. P. 745.

Ward, tp., Hocking co., O. P. 1305.

Ward, tp., Tioga co., Pa. P. 285.

Ward (ADOLPHUS WILLIAM), b. in England about 1835; educated at and fellow of St. Peter's College, Cambridge, and became professor of history at Owen's College, Manchester. Author of *The House of Austria in the Thirty Years' War* (1869) and *Dramatic Literature of the Age of Elizabeth* (2 vols., 1875), translator of Curtius's *History of Greece* (5 vols., 1868–74), and editor of Pope's *Poems* (Globe edition, 1869).

Ward (ANDREW HENSHAW), b. at Shrewsbury, Mass., May 26, 1781; graduated at Harvard 1808; was admitted to the bar at Northampton 1811; practised law in his native town; was some years an officer of customs at Boston, and was a member of the State constitutional convention of 1853. D. at Newtonville, Mass., Feb. 18, 1864. Author of a *History of Shrewsbury* (1847) and of genealogies of the Ward family (1851) and the Rice family (1858).

Ward (ARTEMAS), b. at Shrewsbury, Mass., Nov. 27, 1727; graduated at Harvard 1748; became major of a Col. Williams's regiment 1755; took part in the campaigns against the French near Lake Champlain, attaining the rank of colonel; represented Shrewsbury in the legislature, and took an active part in political questions; was appointed a general officer by the Massachusetts provincial congress Oct. 27, 1774, and commander-in-chief of Massachusetts forces May 19, 1775; was in nominal command at the battle of Bunker Hill, though he remained at head-quarters at Cambridge, and had no actual share in determining the events of that day; was appointed by the Continental Congress first on the list of major-generals June 17, 1775; was in command of the forces besieging Boston until the arrival of Gen. Washington, after which he was second in command, with head-quarters at Roxbury; resigned Apr., 1776, in consequence of ill-health; was chief-justice of common pleas for Worcester co. 1776; president of the Massachusetts executive council 1777; sat in the legislature sixteen years; was Speaker of that body 1785, and member of Congress 1791–95. D. at Shrewsbury Oct. 27, 1800.

Ward (ARTEMUS). See BROWNE (CHARLES FARRAR).

Ward (EDWARD), generally known under the name of NED WARD, b. in Oxfordshire, England, about 1660; was a noted tavern-keeper and poet in London, and d. there in 1731. He published *The London Spy* (London, 1698), often reprinted, and containing his famous voyage to New England and description and character of Boston about 1690; *Hudibras Redivivus, or a Burlesque Poem on the Times* (2 vols., 1705–07), for which he was fined 40 marks and condemned to stand twice in the pillory; *Complete and Humorous Account of all the Remarkable Clubs and Societies in London and Westminster* (1709), *Vulgus Britannicus* (1710), *Nuptial Dialogues and Debates* (2 vols., 1710), *Life and Adventures of Don Quixote, merrily translated into Hudibrastick Verse* (2 vols., 1711–12), *History of the Grand Rebellion digested into Verse* (3 vols., 1713), and *The Whigs Unmasked*, 1713. (See Thomas Campbell's *Essay on English Poetry*.)

Ward (EDWARD MATTHEW), R. A., b. at London, England, in 1816, was a nephew on the mother's side of Horace and James Smith, authors of the *Rejected Addresses*; became in 1834 an art-student at the Royal Academy, where he enjoyed special instruction from Wilkie, and exhibited a decided talent for original composition and color; studied at Rome 1836–39, gaining the silver medal of the Academy of St. Luke 1838; pursued a course of fresco-painting under Cornelius at Munich; exhibited his first picture at the Royal Academy 1839; presented unsuccessfully his *Boadicea* in the cartoon competition at Westminster Hall 1843; was brought into favorable notice by his *Dr. Johnson reading the MS. of the Vicar of Wakefield* (1843), *Goldsmith as a Wandering Musician* (1844), and *Dr. Johnson in the Anteroom of Lord Chesterfield* (1845), the latter having been bought by Mr. Vernon; devoted himself successfully to the illustration of English and French history by a series of large pictures; was commissioned to paint eight pictures in oil for the corridor of the House of Commons 1852, three of which have since been reproduced in fresco and two in water-glass, and became an academician 1856. His numerous later pictures have placed him at the head of the historical school of British art. D. Jan., 1879.

Ward (FREDERICK TOWNSHEND), b. at Salem, Mass., in Nov., 1831; educated at the Salem High School; was a lieutenant in the French service during the Crimean war; was with Walker in Nicaragua; became admiral-general in the service of the emperor of China; trained the Chinese into good soldiers, and won many victories over the rebel Tae-Pings, but was killed in an engagement with them near Ningpo Oct. 7, 1862.

Ward (HENRY AUGUSTUS), b. at Rochester, N. Y., Mar. 9, 1834; educated at Williams College and at the Lawrence Scientific School of Harvard University, where he became assistant to Prof. Agassiz in the museum of comparative zoology; went to Europe 1854; studied zoology at Paris, and mineralogy at Freiberg; travelled in Palestine, Arabia, Egypt, Nubia, and the W. coast of Africa, ascending the Niger; subsequently visited the West Indies, Central America, and the Western Territories of the U. S. as a mining engineer; was professor of natural sciences at Rochester University 1861–66; established there a laboratory for the production of fac-similes of rare fossils; made an extensive collection of modern zoology, and was naturalist to the U. S. expedition to Santo Domingo 1871. The "Ward cabinets" of mineralogy and geology at the University of Rochester now fill fourteen rooms.

Ward (Sir HENRY GEORGE), son of Robert Plumer, b. in England about 1796; entered the diplomatic service 1816; married in 1824 a daughter of Admiral Sir John Edward

Swinburne; was chargé d'affaires in Mexico, where he made extensive travels 1825–27; sat in Parliament for St. Alban's 1832–37, and for Sheffield 1837–49; was secretary to the admiralty 1846–49; lord high commissioner of the Ionian Islands 1849–55; governor of Ceylon 1855–60; was transferred to Madras as successor of Sir Charles Trevelyan, and d. there of cholera a few days after his arrival, Aug. 2, 1860. He had been originator and editor of the *Weekly Chronicle*; was its proprietor until May, 1849, and was author of a valuable work, *Mexico in 1827* (2 vols., 1828), which in the 2d ed. bore the title *Travels in Mexico* (1829). It was illustrated by his wife, who also published two volumes of *Views of Towns in Mexico* (1829).

Ward (John Elliott), b. in Sunberry, Liberty co., Ga., Oct. 2, 1814. His early education was partly at the Sunberry Academy and partly at Walthourville in the same county. He commenced a collegiate course at Amherst College, Mass., in 1830, but left before graduation in consequence of the excitement in that institution against Georgians because of the imprisonment of Wooster and Butler, Cherokee missionaries; on his return to his native State he studied law in the office of Hon. Matthew Hall McAllister in Savannah, and was admitted to the bar in Jan., 1835, by special act of the legislature, before he was twenty-one years of age; after this, before beginning practice, he attended law lectures at Dane Law School, Cambridge, Mass. In 1836 he opened an office in Savannah, and was soon appointed solicitor-general of the eastern judicial circuit of Georgia. He became U. S. district attorney for Georgia in 1838. This position he resigned in 1839, and became a member of the State legislature. In 1854 he was Speaker of the House; was afterward mayor of the city of Savannah, and in 1857–58 was State senator from the county of Chatham. During this term he was president of the senate, and thereby lieutenant-governor of the State. He was also president of the Cincinnati Democratic Presidential convention in 1856. Upon the resignation of Judge Berrien of the office of U. S. Senator from Georgia in 1851, his unexpired term was tendered to Mr. Ward, which, however, from private reasons, he declined to accept. In 1858, while president of the State senate, he was appointed U. S. minister to China, and was occupying this position when Georgia passed her ordinance of secession in 1861. On the receipt of this intelligence he resigned and returned to his native land and home in Savannah. While he was strongly opposed to the policy of secession, he did not, however, question the right. His fortunes were cast with those of the people of his State. After the war, he took no active part in politics or public affairs, but moved to the city of New York, where he opened a law-office, and has since, to this time (May, 1875), been eminently successful in the active prosecution of his profession. A. H. Stephens.

Ward (John Quincy Adams), b. at Urbana, O., June 29, 1830; studied medicine, but never practised; was engaged in the studio of H. K. Brown, the sculptor, 1850–56; resided two years at Washington, where he executed portrait-busts of several eminent men; settled in New York City 1861; has gained a high reputation by his bas-reliefs and groups; executed in bronze for the Central Park the famous *Indian Hunter*, the *Shakspeare*, and the *Private of the Seventh Regiment*, and was chosen in 1874 president of the National Academy of Design.

Ward (Joseph), b. at Newton, Mass., July 2, 1737; d. in Boston, Feb. 14, 1812; taught school in Boston and other places; was a vigorous advocate of the independence of the colonies; joined the patriot army at Lexington; distinguished himself at Bunker Hill; received a complimentary letter from Washington; was commissary-general, with rank of colonel, till 1780, when he returned to business in Boston.

Ward (Nathaniel), b. at Haverhill, Suffolk, England, about 1570; graduated at Emmanuel College, Cambridge, 1603; was for some years a lawyer; travelled on the Continent upon commercial business; studied theology; became preacher at St. James's, Duke's Place, London, and afterward rector of Standon Massaye, Essex; became connected with the Massachusetts Company 1630; was brought before Bishop Laud for nonconformity 1631; was silenced 1633; sailed for Massachusetts Apr., 1634; immediately became pastor at Agawam or Ipswich, being colleague first of Thomas Parker, and afterward of John Norton; resigned his charge on account of ill-health Feb., 1637; took part in the settlement of Haverhill (named from his native place) May, 1640; was the author of the *Body of Liberties* adopted Dec., 1641, being the first code of laws established in New England; preached the election sermon 1641; was a member of a committee appointed to draw up new laws 1645; returned to England 1646; preached before the House of Commons June 30, 1647; took part as a pamphleteer in the great political struggle then going on; became pastor of Shenfield, Essex, 1648, and d. there in 1653. Author of *The Simple Cobler of Agawam* (1647), a quaint political satire, and *Mercurius Anti-Mechanicus, or the Simple Cobler's Boy, with his Lap full of Caveats* (1648). A *Memoir* by John Ward Dean was published at Albany in 1848.

Ward (Robert Plumer), b. in London, England, Mar. 19, 1765, son of a wealthy merchant resident at Gibraltar, where he spent his early years, his mother being a Spanish lady; educated at Walthamstow and at Christ Church, Oxford; was called to the bar at the Inner Temple 1790; went on the western circuit for some years; spent some time in Paris during the early period of the French revolution; was brought into favorable notice as a jurisconsult by his works written at the instance of Lord Eldon, *An Enquiry into the Foundation and History of the Law of Nations in Europe, from the Time of the Greeks and Romans to the Age of Grotius* (2 vols., 1795), *A Treatise of the Relative Rights and Duties of Belligerent and Neutral Powers in Maritime Affairs, etc.* (1801), and *An Essay on Contraband* (1801); declined an offer of a judgeship in the admiralty court of Nova Scotia; sat in Parliament for Cockermouth 1802–05, through the influence of Earl Mulgrave, who had married a sister of his wife, and of Pitt, to whom he had rendered services in the treason trials of 1794; was frequently employed in cases before the privy council; became under-secretary of foreign affairs 1805, Earl Mulgrave being his immediate superior; retired from office on the death of Pitt 1806; was member of Parliament for Haslemere 1807–20; became lord of the admiralty in the Portland administration 1807; was clerk of the ordnance from 1811–23, and auditor of the civil list from 1823 to 1831, when he retired from political life on a pension of £1000, and spent his remaining years in literary leisure. D. at Okeover Hall, Staffordshire, the residence of his father-in-law, Lieut.-Gen. Sir George Anson, Aug. 13, 1846. The name Plumer was first assumed in 1828, on his marriage with Mrs. Plumer Lewin. He published anonymously *Tremaine, or the Man of Refinement* (3 vols., 1825), and *De Vere, or the Man of Independence* (4 vols., 1827), novels which had extraordinary popularity as delineations of English society, and subsequently issued *De Clifford* (4 vols., 1841) and other novels, and *An Historical Essay on the Real Character and Amount of the Precedent of the Revolution of 1688* (2 vols., 1838). A portion of his diaries and correspondence was published by Hon. Edmund Phipps, accompanying the interesting *Memoirs of the Political and Literary Life of Robert Plumer Ward, Esq.* (2 vols., 1850). The diary extends from 1809 to 1820, the later portion being still unpublished. Porter C. Bliss.

Ward (Samuel), b. at Newport, R. I., May 27, 1725, son of Richard, who was secretary of Rhode Island 1714–33, and governor 1741–42; became a wealthy farmer at Westerly; was delegate to the Hartford military convention 1758; chief-justice of Rhode Island 1761, governor 1762 and 1765–67; was one of the founders of Rhode Island College (1764), afterward Brown University; a delegate to the Continental Congress 1774–76, and several times presided over that body when in committee of the whole. D. at Philadelphia Mar. 26, 1776. A *Life* by Prof. William Gammell was published in Sparks's *American Biography*.

Ward (Samuel), son of Gov. Samuel, b. at Westerly, R. I., Nov. 17, 1756; graduated at Rhode Island College 1771; was a captain under Arnold in the expedition against Quebec 1775; was taken prisoner, and not exchanged until late in 1776; took part in the defence of Red Bank, N. J., and in the Rhode Island campaign, attaining the rank of lieutenant-colonel; was subsequently for several years a wealthy merchant in New York City, and was a delegate from Rhode Island to the Hartford Convention 1814. D. in New York City Aug. 16, 1832.—His son Samuel, a banker in New York City and a liberal benefactor of the New York Historical Society and the Stuyvesant Institute, was father of the distinguished poetess, Mrs. Julia Ward Howe.

Ward (Seth), D. D., F. R. S., b. at Buntingford, Hertfordshire, England, in 1617; graduated at Sidney-Sussex College, Cambridge, about 1637; became fellow there 1640; was ejected from his fellowship for refusing to sign the Solemn League and Covenant 1643; became a private tutor; afterward went to Oxford, where he was Savilian professor of astronomy 1649–61; elected principal of Jesus College 1657, but did not receive possession, and president of Trinity College 1659; was obliged to resign the latter post at the Restoration 1660, receiving the vicarage of St. Lawrence, Jewry, London, and the precentorship of Exeter; was promoted to the deanery of Exeter 1661; became bishop of that diocese 1662, bishop of Salisbury 1667, chancellor of the order of the Garter 1671, prebendary of Salisbury 1672, archdeacon of Wilts 1675, prebendary of Winchester 1676, chancellor of Salisbury 1681,

and treasurer of Salisbury 1687; founded at that place a college for the widows of clergymen 1682, and lost his mental faculties about 1687. D. at Knightsbridge Jan. 6, 1689. He was a distinguished mathematician and natural philosopher, and was one of the founders of the Royal Society. Author of *A Philosophical Essay on the Being and Attributes of God, etc.* (1652), *Prælectio de Cometis* (1653), *Astronomia Geometrica* (1656), and other works.

Ward (Thomas), b. at Danby Castle, Yorkshire, England, Apr. 13, 1652; became a Roman Catholic schoolmaster; served in the pope's guards and in a maritime war against the Turks; returned to England 1686; received a commission in the guards of James II., and retired to Flanders after the Revolution. D. at St. Germain's in 1708. Author of *The Errata of the Protestant Bible* (1687), *Monomachia* (1687), and a poem in Hudibrastic verse, *England's Reformation, from the time of King Henry VIII. to the End of Oates's Plot* (1710). He left in MS. a *History of England*, never published.

Ward (William), b. at Derby, England, Oct. 20, 1769; learned the printer's trade; was licensed as a Baptist preacher; was sent in both capacities as a missionary to India 1799; settled at Serampore; printed numerous religious works in the Bengalee language; wrote *An Account of the Writings, Religion, and Manners of the Hindoos, including Translations from their Principal Works* (Serampore, 4 vols. 4to, 1811; 5th ed., Madras, 1863); visited England, Holland, and the U. S. 1819–21, delivering addresses upon the cause of missions, and printed *Farewell Letters to Friends in the U. S.* (1821). D. of cholera at Serampore Mar. 7, 1823. His *Account* was long a leading authority upon Indian matters, and may still be profitably consulted upon some points, although later works have revealed many inaccuracies in the description of native religions, and still more in the translations. A volume of *Memoirs* (1825) was prepared by Samuel Stennett, and a more adequate biography may be found in the *Life and Times of Carey, Marshman, and Ward, embracing the History of Serampore Mission* (2 vols., 1859; abridged ed., New York, 1867), by John Clark Marshman.

Ward (William Hayes), D. D., b. at Abington, Mass., June 25, 1835; graduated at Amherst College 1856, at Andover Theological Seminary 1859, ordained in 1859, and became acting pastor of the Congregational churches of Oskaloosa and Grasshopper Falls, Kan.; in 1857–58 taught the natural sciences in Beloit College; in 1862 became teacher of sciences in the Utica Free Academy; in 1865 accepted the position of professor of Latin in Ripon College, Wis., which he left in 1868 to enter the editorial staff of the New York *Independent*, of which he became superintending editor in 1870, and has continued in that position to this date (1877). He is a member of the American Oriental Society, before which he has read various papers. He has published various articles in the *Bibliotheca Sacra* on biblical criticism and Assyriology. The second statement of the American Palestine Exploration Society contains a paper of his on the Hamath inscriptions.

Ward-Burton Rifle. See Small-Arms, by Gen. P. V. Hagner, U. S. A.

Ward'en (David Baillie), M. D., b. in Ireland in 1778; came to the U. S. in youth; received a classical education; graduated at the New York Medical College; was appointed secretary of legation to France 1804, and resided at Paris forty years, filling most of the time the office of U. S. consul; was well known in literary circles, and formed two libraries of American books which were acquired respectively by Harvard College (1823) and by the New York State Library (about 1840). D. at Paris Oct. 9, 1845. Author of *A Statistical, Political, and Historical Account of the U. S. of North America* (Edinburgh, 3 vols., 1819); also published in French (Paris, 5 vols., 1820) and in German (Ilmenau, 1824), *L'Art de vérifier les Dates, Chronologie historique de l'Amérique* (Paris, 10 vols., 1826–44), *Bibliotheca Americana septentrionalis, etc.* (1820), and *Bibliotheca Americana* (1831), *Recherches sur les Antiquités de l'Amérique septentrionale* (Paris, 1827), which originally appeared in *Antiquitates Mexicanæ* (Paris, 2 vols. folio, 1834–36), and other minor publications.

War Department of the U. S. See Secretary of War.

Wardian Case [named from W. B. Ward, its inventor, an Englishman], a box whose sides and top are of glass, containing at the bottom a layer of earth, and used for growing ferns and other plants in parlor-culture. Probably from the fact that the air within is highly charged with moisture, many beautiful plants thrive well in Wardian cases which cannot be grown in the open air.

Ward'law (Ralph), D. D., b. at Dalkeith, Midlothian, Scotland, Dec. 22, 1779; educated at the University of Glasgow and at the divinity school of the United Secession Church, for the ministry of which he was intended, but joined the Independent or Congregational Church; in 1803 was ordained pastor of the North Albion street chapel, Glasgow, where, and at the new chapel of the same congregation in West George street, he labored through life, filling also gratuitously from 1811 the professorship of systematic theology in the Independent theological academy of that city. He received his degree from Yale in 1818. In 1853 the fiftieth anniversary of his ministry was celebrated by a public meeting and the formation of a fund for the establishment of the "Wardlaw Jubilee School and Mission-house" at Dove Hill, Glasgow. He was for many years the recognized head of the Independent body, which through his influence was widely extended through Scotland. D. at Glasgow Dec. 17, 1853. Author of several treatises on the Socinian controversy, infant baptism, and Christian ethics, of *Expository Lectures on the Book of Ecclesiastes* (2 vols., 1821), *Lectures on Systematic Theology* (3 vols., 1856–57), and other works. His *Life* was written by Rev. Dr. W. L. Alexander (1856).

Wards'borough, p.-v. and tp., Windham co., Vt. P. 866.

Ward's Grove, tp., Jo Daviess co., Ill. P. 530.

Ward's Island, New York co., N. Y. P. 1760.

Ward'ville, p.-v., Bergen tp., Genesee co., N. Y. P. 788.

Ware, town of England, county of Herts, on the Lea, has large breweries, malting establishments, and manufactures of tiles. P. 5002.

Ware, county of S. E. Georgia, intersected by Satilla River, drained by its tributaries, and traversed by Atlantic and Gulf and Brunswick and Albany R. Rs. The surface is level, and frequently swampy, Okefinokee Swamp, which lies partly in this county, being 30 miles long and 17 miles wide. The soil is for the most part fertile, producing large quantities of oranges and figs. There is considerable livestock, especially cattle and swine. Staples, cotton, Indian corn, fruit, sweet potatoes, and wool. Cap. Waresborough. Area, about 850 sq. m. P. 2286.

Ware, p.-v. and tp., Hampshire co., Mass., on Ware River R. R., 25 miles N. E. of Springfield, contains 7 churches, a public library of 2000 vols., 2 banks, 2 newspapers, 2 hotels, 5 extensive cotton and woollen factories, and a beautiful cemetery, Aspen Grove. P. 4259.

W. L. Demond, Ed. "Standard."

Ware, tp., Gloucester co., Va. P. 3013.

Ware (Ashur), b. at Sherburne, Mass., Feb. 10, 1782; graduated at Harvard University in 1804, where he was engaged as tutor 1807–11, and professor of Greek 1811–15; practised law at Boston, and editor of *Boston Yankee* 1816; removed to Portland, Me., in 1817; was the first secretary of state for that State on its separation in 1820; was judge of the U. S. district court of Maine from 1822 until 1866. Author of *Reports of Cases U. S. District Court of Maine* (1822–39) and of articles on "Admiralty Jurisdiction," on the "Duty of Masters of Vessels," and on "Privileged Debts," in Bouvier's *Law Dictionary*.

Ware (Henry), D. D., b. at Sherburne, Mass., Apr. 1, 1764; graduated at Harvard 1785; taught the town school at Cambridge while pursuing the study of theology 1785–87; was ordained pastor of the first church at Hingham, Mass., Oct. 24, 1787; was a leader in the direction of the Unitarian opinions then becoming prevalent among the Congregationalists of New England; precipitated the theological crisis by his acceptance of the Hollis professorship of divinity in Harvard University 1805, but took no part in the controversy thereby excited until some years later, when he published *Letters to Trinitarians and Calvinists, occasioned by Dr. Woods's Letters to Unitarians* (Cambridge, 1820), followed by *An Answer to Dr. Woods's Reply* (1822) and *A Postscript to an Answer, etc.* (1823); printed a number of single sermons, and issued in 1842 one of his courses of theological lectures with the title *An Inquiry into the Foundation, Evidences, and Truth of Religion* (Cambridge and London, 2 vols., 1842). In addition to his professorship, which he resigned 1840, he had charge of the Harvard Divinity School from its foundation in 1826 to his death at Cambridge, July 12, 1845. He had been totally blind for nearly eighteen years. With Drs. Noah Worcester, William E. Channing, and Andrews Norton he laid the foundation of what is now the conservative school of American Unitarianism.

Ware (Henry), Jr., D. D., son of the preceding, b. at Hingham, Mass., Apr. 21, 1794; was prepared for college by his cousin, Ashur Ware, and at Phillips Academy at Andover; graduated at Harvard 1812; taught at Phillips (Exeter) Academy 1812–14; studied theology under his father's direction; was ordained pastor of the Second

church (Unitarian) at Boston Jan. 1, 1817; took an active part in the formal organization of the Unitarian body, editing its organ, the *Christian Disciple*, which afterward became the *Christian Examiner*; visited Europe 1829–30; resigned his pastorate on account of ill-health 1830, and filled the Parkman professorship of pulpit eloquence in the Divinity School of Harvard University 1830–42. D. at Framingham, Mass., Sept. 22, 1843. Author of *Hints on Extemporaneous Preaching* (1824), *Recollections of Jotham Anderson, Minister of the Gospel* (about 1824), *On the Formation of the Christian Character* (1831), *Life of the Saviour* (1832; new ed., New York, 1868), *The Feast of the Tabernacles* (1837), a poem prepared for an oratorio, *Memoirs* of Rev. Dr. Parker (1834), Dr. Noah Worcester, Dr. Joseph Priestley, and of Oberlin, and *Scenes and Characters illustrating Christian Truth* (2 vols., 1837), besides miscellaneous poems and single sermons. A *Memoir* was published by his brother, John Ware, M. D. (1845). Four volumes of selections from his writings were edited by Rev. Dr. Chandler Robbins (1846–47).

Ware (Sir James), LL.D., b. at Dublin, Ireland, Nov. 26, 1594; educated at Dublin College; was knighted 1629; succeeded his father as auditor-general of Ireland 1632; became an eminent antiquarian; distinguished himself by his zeal in defence of the earl of Strafford; was deprived of his offices and committed to the Tower by the Parliamentary party; recovered the auditorship at the Restoration, when he was chosen a member of the Irish Parliament for the University of Dublin, and declined a baronetcy and a peerage. D. at Dublin Dec. 1, 1666. Author of *De Scriptoribus Hiberniæ* (1639), *De Hibernia et Antiquitatibus ejus Disquisitiones* (1654), and *Hibernia Sacra* (1717), which, with other treatises, were translated into English by his son Robert under the title *The Antiquities and History of Ireland* (London, folio, 1705). His *Whole Works* (3 vols., 1739–46), with a revision and continuation of the *Antiquities*, was subsequently edited by Walter Harris, who has married a descendant.

Ware (John), M. D., son of Dr. Henry, Sr., b. at Hingham, Mass., Dec. 19, 1795; graduated at Harvard 1813, and at Harvard Medical School 1816; began to practise at Duxbury; removed to Boston 1817; was professor of the theory and practice of medicine at Harvard 1832–58, and several years president of the Massachusetts Medical Society. D. at Boston Apr. 29, 1864. Author of several professional treatises, of many lectures on peace, temperance, etc., of occasional poems, and a biography of his brother Henry.

Ware (Nathaniel A.), b. in Massachusetts about 1789; graduated at Yale College; became a teacher in South Carolina, where he studied and practised law; removed to Natchez, Miss.; became a major of militia and secretary of the Territorial government; acquired a large fortune by judicious purchases of lands; travelled extensively; was noted for his wide attainments in literature, especially in geography, botany, and the natural sciences, and resided during his later years at Philadelphia and at Cincinnati, O., superintending the education of his daughters Catharine and Eleanor, who became known as poetesses. (See Lee, Eleanor Percy, and Warfield, Catharine A.) D. at Galveston, Tex., in 1854. Author of a small work on the Pestalozzian system of education, of *Views of the Federal Constitution*, and of a work on political economy.

C. G. Forshey.

Ware (William), son of Dr. Henry, Sr., b. at Hingham, Mass., Aug. 3, 1797; graduated at Harvard 1816; taught school at Hingham 1816–17; studied theology under his father's direction, graduating at Cambridge 1819; preached successively at Northborough, Mass., Brooklyn, Conn., and Burlington, Vt.; was pastor of the First Unitarian church in New York City from Dec. 18, 1821, to Oct. 19, 1836; preached at Brookline, Mass., 1836–37, at Waltham 1837–38; settled without pastoral charge at Jamaica Plains 1838, and at Cambridge 1839; was editor and proprietor of the *Christian Examiner* 1839–44; was pastor of a church at West Cambridge 1844–45; resigned on account of ill-health; settled again at Cambridge, where he occasionally preached; spent a year in Europe, chiefly in Italy, 1848–49, and delivered a course of lectures on European travel 1849–51. D. at Cambridge Feb. 19, 1852. Author of *Letters from Palmyra* (New York, 2 vols., 1837), which originally appeared in the *Knickerbocker Magazine* the previous year, and were subsequently republished in London and New York with the title *Zenobia, or the Fall of Palmyra* (new ed. 1868); *Probus, or Rome in the Third Century* (2 vols., 1838), subsequently republished as *Aurelian* (new ed. 1868); *Julian, or Scenes in Judea* (New York, 2 vols., 1841), *Sketches of European Capitals* (1851), *Lectures on the Works and Genius of Washington Allston* (1852), and a *Life of Nathaniel Bacon*, in Sparks's series, and editor of *American Unitarian Biography* (2 vols., 1850).

War Eagle, tp., Madison co., Ark. P. 1465.

Ware Creek, tp., New Kent co., Va. P. 1012.

Ware'ham, town of England, county of Dorset, between the Frome and the Piddle, is surrounded with old Roman walls, and has manufactures of various kinds, but on a small scale. P. 6532.

Wareham, p.-v. and tp., Plymouth co., Mass. P. 3098.

Ware'house is a building or other suitable place adapted to and used for the storage of goods and merchandise on behalf of their owners, and generally for hire. There are two distinct species, the public and the private. Public warehouses—or, as they are often called, "bonded warehouses"—form an important feature in the system for the collection of the customs revenue in the U. S. and in Great Britain, and their consideration does not belong to the present article. Private warehousing occupies a distinct position in the mercantile law, because, like the business of forwarding or of common carrying, with which it is sometimes connected, it is a separate species of bailment for hire. Private warehouses are designed to be convenient depositories of goods, which are received and kept in safety subject to the order of the owners, and delivered either to them or to the persons whom they designate. One particular form which has come into extensive use in many parts of the U. S. is called the "elevator," and is employed exclusively for the storage or transhipment of grain. The wheat, corn, or other grain, separated into various classes or grades, is raised by powerful machinery from the cars or vessels, and stored in bulk in vast bins, so that an owner who had delivered a certain quantity—say 10,000 bushels—of wheat of a particular grade, receives back not the identical grain which he deposited, but the same number of bushels of a like class. This business of "elevating," especially in the great grain-shipping ports of the West, as Chicago and Milwaukee, has grown to be one of enormous magnitude, involving a vast amount of capital; and some of the principal elevators themselves are among the largest business structures of the world. In ordinary warehouses the identical goods which are received from a particular owner are kept distinguished from others, and are delivered upon his order. In large commercial cities, and especially in the principal seaports which are the centres of an importing trade, the wholesale merchants and manufacturers do not always, nor perhaps generally, keep their goods in their own stores or places of business. Warehousing forms a distinct branch of mercantile traffic. The merchandise of a particular merchant, importer, or manufacturer is often placed at once in a warehouse, and the warehouse-man gives to the depositor a written instrument—known as a "warehouse-man's receipt"—which acknowledges the reception from the owner named of the goods as specified and described, and engages to keep the same in safety and to deliver them upon his order on payment of the fees and charges incident to the storage. These receipts are transferable, and although they are not regarded by the law as fully negotiable, like promissory notes and bills of exchange, yet in the practice of merchants they are treated, somewhat like bills of lading, as semi-negotiable, and merchandise in vast amounts is constantly sold and delivered by a simple endorsement and transfer of the warehouse-man's receipts. The merchant whose goods are thus in store usually transacts his business and negotiates his sales by means of samples, which he either keeps on hand or leaves with his broker, and the delivery of the articles thus purchased is effected either by an assignment of the warehouse-man's receipt or by giving an order on the warehouse-man for the specific articles bought in case they constitute a part only of those contained in the receipt. The assignment of the receipt or the giving the order is a delivery of the goods to the buyer, at least when the same has been presented to the warehouse-man, and he has assented to it by transferring the goods on his books into the name of the purchaser, and thus recognizing him as their owner and depositor. *A fortiori*, if he makes an actual delivery to the buyer, the sale is fully consummated. The warehouse-man has no right to refuse his assent to such transfer unless he has a lien on the goods for his charges which neither the original depositor nor the purchaser is willing to pay. The warehouse-man is a bailee for hire, and is therefore bound to exercise ordinary care, skill, and diligence in respect of the merchandise while it is under his control, and is liable for all losses and injuries resulting from his ordinary negligence or want of ordinary skill. He is bound to deliver the goods to the depositor or to his order upon being paid his lawful charges thereon; and as a security for such payment he has a lien upon the articles which are subject to the charges, but not a general lien for any balance due on account of prior transactions between himself and the depositor. (See the articles on Lien and Bailment.)

John Norton Pomeroy.

Warehouseman. See WAREHOUSE.

Warehouse Point, p.-v., Hartford co., Conn.

Warehousing System. See WAREHOUSE.

Ware River, is formed in Barre, Worcester co., Mass., by the union of several small streams. Its course is S. S. W., and it joins Chicopee River at Three Rivers, Mass. It furnishes valuable water-power.

Wares'boro', p.-v. and tp., cap. of Ware co., Ga. P. 819.

War'field, p.-v., cap. of Martin co., Ky.

War'field (CATHARINE ANNE **Ware**), b. at Natchez, Miss., about 1814, daughter of Major Nathaniel, and sister of Eleanor Percy Ware (afterward Mrs. Lee); educated at Philadelphia, at New Orleans, in France, and at Cincinnati, and in 1833 married Elisha Warfield of Lexington, Ky. From some early poetic compositions of the two sisters their father, without their knowledge, selected enough to form a volume entitled *The Wife of Leon, and other Poems, by Two Sisters of the West* (1843), which was received with favor, and was followed by another volume selected by the sisters themselves, entitled *The Indian Chamber, and other Poems* (1846). In 1855, Mrs. Warfield published *The Household of Bouverie* (new ed. 1875), a novel which attracted great attention for its originality and its striking dramatic effects. She has since issued *The Romance of Beauseincourt* (1867), *The Romance of the Green Seal* (1867), *Miriam Monfort* (1873), *A Double Wedding* (1875), *Hester Howard's Temptation* (1875), and other novels. C. G. FONSHEY.

War'ham (JOHN), b. in England about 1590; became a distinguished Puritan minister at Exeter; came to Massachusetts 1630 as colleague pastor with John Maverick of a church which removed thither from Plymouth, England; was settled at Dorchester until 1635, when he accompanied his church to Windsor, Conn., where he d. Apr. 1, 1670.

Warham (WILLIAM), D. D., LL.D., b. at Okely, Hampshire, England, about 1450; educated at Winchester School and at New College, Oxford, of which he became fellow 1475; was ordained priest; was a joint envoy to the duchess of Burgundy to complain of her countenance to the pretender Perkin Warbeck 1493; was master of the rolls 1494–1502; joint envoy to Maximilian of Burgundy 1501–02; became keeper of the great seal Aug. 11, 1502, lord chancellor Jan. 1, 1503, bishop of London 1503, archbishop of Canterbury Mar. 9, 1504, chancellor of Oxford University soon after; was an intimate friend of Erasmus, and a rival of Fox, bishop of Winchester, and later of Cardinal Wolsey, with whom he had sharp contentions about jurisdiction and precedency; opposed the marriage of Henry VIII. with Catharine of Aragon, but officiated at the ceremony June, 1509; resigned the great seal to Wolsey Dec. 22, 1515, and lent some support to the pretensions of the Nun of Kent. D. near Canterbury Aug. 23, 1532.

Wa'ring (GEORGE E.), b. at Middletown, Conn., July 21, 1833; was agricultural engineer of the Central Park, New York; in 1861 entered the volunteer service of the U. S., and became colonel of the 4th Missouri Cavalry; published *Draining for Profit and Health, Elements of Agriculture*, etc., and contributed to periodical literature.

Warm-blooded Animals. See APPENDIX.

Warming and Ventilation. See APPENDIX.

War'minster, tp., Bucks co., Pa. P. 840.

Warm Springs, p.-v., tp., Madison co., N. C. P. 498.

Warm Springs, cap. of Bath co., Va., known as BATH COURT-HOUSE (which see).

Warm Springs, tp., Bath co., Va. P. 890.

War'ner, tp., Chippewa co., Mich. P. 238.

Warner, p.-v. and tp., Merrimack co., N. H. P. 1667.

Warner (CHARLES DUDLEY), b. at Plainfield, Mass., Sept. 12, 1829; graduated at Hamilton College 1851; was a member of a surveying party in Missouri; studied law in New York; was admitted to the bar in Philadelphia 1856; practised in Chicago until 1860; became editor of the Hartford *Press and Courant*, and twice travelled in Europe and the East as correspondent of several American newspapers. He has contributed to the *Atlantic* and other magazines, and is author of *My Summer in a Garden* (1871), *Saunterings* (1872), *Back-Log Studies* (1872), *Mummies and Moslems* (1876), and joint author with Samuel L. Clemens of *The Gilded Age* (1873).

Warner (HIRAM), b. in Hampshire co., Mass., Oct. 29, 1802; moved to Georgia in 1819, and taught school for three years. Before leaving his native State he had acquired a pretty good common-school education, with some knowledge of the classics, and he was therefore well qualified to teach a Georgia country school at that time. With his earnings as teacher he laid up sufficient funds to enable him to study law, and was admitted to the bar in 1825, and opened an office first at Knoxville, Crawford co. From 1828 to 1831 he was a member of the general assembly of the State; in 1833 was elected by the legislature one of the judges of the superior courts of the State, and in 1836 was re-elected to the same position for another term of four years. In 1845, upon the organization of the supreme court of the State, he was elected one of its three judges, which position he held for eight years; then resigned, and was elected to Congress in 1855, but declined a re-election to the same body in 1857. In 1860 he was a member of the celebrated Charleston convention, where he exerted his utmost powers against the secession movement. In 1861 he was a member of the Georgia secession convention. He opposed the ordinance, but after it was passed pledged himself to sustain the cause of the State. After the war he accepted the situation, and sustained the first Reconstruction act of Congress, and was again, on the reorganization of the judiciary under the new constitution, appointed to the bench of the supreme court of the State, and in 1872 was appointed chief-justice of that court, which position he still holds (Sept., 1876) with great ability, dignity, and honor. ALEXANDER H. STEPHENS.

Warner (RICHARD), b. in England in 1763; was for twenty-three years curate of St. James's church, Bath, and subsequently rector of Chelwood, Somerset, and of Great Chalfield, Wiltshire. D. in 1857. Author of numerous works on local history and antiquities, among which were histories of the Isle of Wight (1795), of Hampshire (5 vols., 1795), of Bath (1801) and of Glastonbury (1826), *Walks through Wales* (2 vols., 1798–99), *A Tour through the Northern Counties of England* (2 vols., 1802), and *Illustrations of the Waverley Novels* (1823). He also published *Literary Recollections* (2 vols., 1830) and a poetical *Diary of an Aged Parson* (1848).

Warner (SETH), b. at Roxbury, Conn., May 17, 1743; settled at Bennington, Vt., 1765; was a leader of the "Green Mountain Boys" in the conflicts of jurisdiction with the New York authorities, by whom he was outlawed; was second in command to Ethan Allen at the capture of Ticonderoga and Crown Point 1775; was chosen colonel of Vermont troops July 27, 1775; took part in Montgomery's campaign in Canada; rendered good service in the retreat to Ticonderoga May, 1776; commanded in a sharp engagement at Hubbardton July 7, 1777; participated in the battle of Bennington, and continued in the service until 1782, when he retired from ill-health, and returned to Roxbury, Conn., where he d. Dec. 26, 1784. A *Memoir* by Daniel Chipman was published at Middlebury in 1848.

Warner (SUSAN), b. in New York in 1818, daughter of Henry W. Warner (d. 1875); has published *The Wide, Wide World* (1850), a novel which had great success both in England and the U. S., *Queechy* (2 vols., 1852), *The Hills of the Shatemuc* (1856), *Wych Hazel* (1876), and other works, in some of which she was aided by her sister ANNA, who has also written several novels.

Warner (WILLIAM), b. in Oxfordshire, England, about 1558; educated at Magdalen College, Oxford; became an attorney, and is supposed to have spent most of his life as business-agent of Henry Carey, Lord Hunsdon. D. at Amwell, Hertfordshire, Mar. 9, 1609. Author of *Pan, his Syrinx* (1584), a pastoral novel, and *Albion's England, a Continued History of the same Kingdom from the Originals of the First Inhabitants thereof*, etc. (1586), a long poem which enjoyed contemporary popularity, passing through 9 eds., the last of which was in Chalmers's series (1810).

Warner's Ranch, tp., San Diego co., Cal. P. 246.

War of Succession. See SUCCESSION WARS.

Warped Surface, sometimes called a **Twisted Surface,** a surface that may be generated by a straight line moving so that no two of its consecutive positions shall be in the same plane. Warped surfaces are divided into two classes—those having a *plane director*, and those which have *no plane director*. Every warped surface of the first class may be generated by a straight line moving so as to touch two given lines and continue parallel to a given plane. The moving line is called the *generatrix*, the lines which it touches are called *directrices*, and the plane to which the moving line is parallel is the *plane director*. Any position of the generatrix is an *element* of the surface. Every warped surface of the second class may be generated by a straight line moving so as to touch three lines, which are called *directrices*. Warped surfaces may be generated in a great variety of ways, but all the methods of generation may be reduced to one of the two described.

If one of the directrices of the first class of surfaces is a straight line and the other a curve, the surface generated is a *conoid*. In this case the rectilineal directrix is called the *line of striction*, because the elements are nearer together

along this line than along any other line of the surface. If both directrices are straight lines, the surface is called an *hyperbolic paraboloid*. If two of the elements of such a surface are taken as directrices, and if a plane parallel to the original directrices is a plane directer, the corresponding surface will be identical with the given surface. As a consequence of this property, it follows that two straight lines of the surface may be drawn through any point of the surface, and it may be shown that only two such lines can be drawn. The surface is named from the fact that all its plane sections are either hyperbolas or parabolas. If the plane of any section is parallel to two right-lined elements which intersect, the section is an hyperbola, of which the two right lines constitute a particular case. All other sections are parabolas, of which one right line constitutes a particular case. From what has been said it is to be inferred that the hyperbolic paraboloid is a particular case of the conoid.

If all the directrices of a warped surface of the second order are straight lines, the surface is called an *hyperboloid of one nappe*, or, sometimes, an elliptical hyperboloid. All plane sections of such a surface are either ellipses or hyperbolas. If any three elements of an elliptical hyperboloid are taken as directrices, the corresponding surface is identical with the given surface. Hence, two right lines lying in the surface can always be drawn through any one of its points. All sections made by planes parallel to two such lines are hyperbolas, of which these lines constitute a particular case. All other plane sections are ellipses. If the three directrices are symmetrically situated with respect to a fourth line, the surface is an *hyperboloid of revolution of one nappe*. Such a surface may be generated by revolving a straight line about a second line to which it is neither parallel nor secant. It can also be generated by revolving an hyperbola about its conjugate axis. (For a more complete explanation of warped surfaces and their properties see Davies' *Descriptive Geometry*.) W. G. Peck.

War'rant (in law). This word is used in several different senses: (1) It denotes an order or writ issued by a court, judge, or magistrate having criminal or police jurisdiction, directed to a sheriff, constable, or police-officer, commanding him to arrest the person therein named, who is charged with committing some crime therein briefly described, and to bring him before a court, judge, or magistrate for examination, trial, or sentence, as the case may be. If issued by a court, it is called a "bench warrant," and when this form is used it is generally for the purpose of apprehending a criminal who is at large either on bail or otherwise after an examination, indictment, or trial, or who has committed an offence in presence of the court. Unless a statute has dispensed with the seal, a warrant must not only be signed by the judicial officer who issues it, but must also be sealed. If the offence was not done in open court in presence of the judge—as, for example, a manifest perjury by a witness testifying at a trial—the warrant must be preceded by and based upon an oath or affirmation of some person having sufficient knowledge of the crime that the facts contained in his deposition will constitute a probable cause for the charge and the arrest. The officer makes return of what he has done, either that he has arrested the party named and brought him before the court or magistrate as directed, or that he has been unable to find such person. As a general rule, offenders cannot be arrested unless by warrant. The common law admits of exceptions to this principle where the offence was committed in the sight of an officer, or even of a private citizen if it was felonious, and where the crime was recent and notorious, the criminal was known, and there was danger that he might escape. Statutes have frequently clothed policemen with much more ample powers of arresting without a warrant. In this connection see the article Search-Warrant. (2) *Warrant of attorney* is the name, now somewhat obsolete, synonymous with Power of Attorney (which see). (3) The verb "*to warrant*" signifies that a grantor, in and by his deed of conveyance, covenants that he will assure and defend the grantee in the title and the undisturbed possession of the lands conveyed. In other words, the grantor binds himself, his heirs, executors, and administrators, by a special covenant contained in the deed, that the title is good, and that the grantee shall not be disturbed by any one claiming under the grantor himself, or by virtue of a title paramount to his own. This clause in the deed is called the covenant of warranty. (See article Warranty.) John Norton Pomeroy.

War'ranty (in law). This name is given to a class of agreements which are always based upon and collateral to some other and principal contracts. There are three distinct species in common use to which the term is applied.

Warranty on the Sale of Land.—This is an express covenant contained in a deed of conveyance, whereby the grantor binds himself and his representatives to warrant and defend the grantee, his heirs and assigns, in the quiet and peaceable possession of the land conveyed against any one claiming the same by a title paramount to that of the grantor. Another form protects the grantee against persons only claiming under the grantor himself. This covenant does not purport to guard the grantee against the act of mere trespassers, or of those who have no valid superior claim to the land; it becomes operative against the grantor only when the grantee or his assigns are evicted, either in fact or in contemplation of law, from the premises or a portion thereof, by virtue of a valid paramount title or outstanding prior incumbrance.

Warranty on the Sale of Chattels.—This is a collateral agreement by the vendor on the sale of chattels or other kinds of personal property, based upon the same consideration as the principal contract, and stipulating either as to the good quality and condition of the articles, or that the title of the seller is perfect. It may be either express or implied. If express, the agreement is made by the very language employed by the parties, and especially by the seller; if implied, it is inferred by the law from the fact of the sale without any express words to that effect. *First, Express Warranty.*—Of course the vendor may use the most formal language, such as, "I warrant," "I agree that the goods are," etc.; but this is by no means necessary. Every distinct affirmation made by the seller at the time of the sale of the existence of a fact in connection with the thing sold is a warranty, *provided it was so intended*; and whether so intended is a question of fact for the jury to decide. When the description of the article relates to a matter of opinion, it is not presumed of itself to be a warranty, but it may be if the vendor so intended it, and this is to be determined as a fact from the consideration of all the circumstances. When the description of the article relates to a matter of fact within the knowledge of the vendor, it is presumed to have been intended as a warranty. A *mere representation* is not actionable, unless intentionally false, and then not as a warranty, but on the ground of the deceit. The practical question is, In which of these three classes—the affirmation of a fact, the statement of an opinion, or a mere representation—does the language of the vendor fall? and this question is left to the jury for decision. It is a settled rule, however, that an express warranty is not broken if the defects in the article covered by it were at the time open, visible, and plain, so as to be seen or known by an ordinary observer, and there was no attempt to conceal them from the buyer. *Second, Implied Warranty.*—The general doctrine of the common law is *caveat emptor*—"Let the buyer take care." Warranties are not therefore generally implied on the sale of chattels, even from the payment of a full price. The English courts have lately shown a strong disposition to relax this rule, to hold sellers to a more rigid liability, and even to adopt the Roman-law doctrine, *caveat venditor*—"Let the seller take care." The American courts have not as yet sanctioned this innovation. To the general rule of the common law there are a few well-defined exceptions, as follows: I. *Of Title.*—When the vendor has the article in his possession at the time of the sale, a warranty of his title is implied, and if the thing should turn out to be another's, the buyer can recover its value which he has lost. But if the article was not at the time in the seller's possession, no such warranty arises. II. *Of Quality.*—(1) When provisions are sold for domestic use, there is an implied warranty that they are fit for consumption. (2) When a purchaser orders an article to be manufactured for a special purpose, or buys such an article from the manufacturer, the law implies a warranty by the manufacturer that it is reasonably fit for the purpose indicated. (3) Sales by sample. Although it has sometimes been said that the mere exhibition of a sample as the basis of a sale implies a warranty that the bulk of the goods corresponds therewith, it is the settled rule, in most of the U. S. at least, that the seller must in some manner agree that the commodity and the sample correspond. This renders the warranty an express and not an implied one. (4) When the vendor, though not a manufacturer, is told of the purpose for which the article is wanted, and the purchaser relies wholly on the seller's judgment to furnish such a commodity, which the seller undertakes to do, he warrants that the thing sold is reasonably fit for the object intended. (5) If, however, the buyer orders or purchases a certain ascertained article known in the market, there is no implied warranty that it shall be fit for the purpose designed. The distinction between this and the preceding case is, that here the buyer trusts to his own knowledge and judgment, while in the other he trusts to the knowledge and judgment of the seller. (6) Finally, in all executory contracts to sell—that is, in contracts to sell at a future time—the law implies a warranty that the article when delivered shall be of a fair merchant-

able quality. *The Remedy.*—It is the settled doctrine in England and in most of the States, that upon the breach of a warranty of quality, either express or implied, collateral to a sale, the buyer is entitled to recover his damages without any recission of the sale or return of the goods. If the price has been paid, the vendee may sue the vendor in a direct action for the damages. If the price has not been paid, and he is sued for it by the vendor, he may recoup or counterclaim his damages, and thus reduce, or perhaps prevent, a recovery against himself. In either case, the measure of damages is generally the difference between the value of the commodity, had it been of the quality as warranted, and the actual value in its inferior condition. In some special cases consequential damages have been allowed greatly exceeding the value of the goods. The law of a few States requires the vendee to rescind the sale, and to return, or offer to return, the thing bought before he can claim to recover his damages.

Warranties in Policies of Insurance.—These are stipulations by the assured which constitute the conditions upon which the policy is issued. They are express when incorporated into the instrument; implied when inferred by the law from the very contract of insurance, as, for example, in a marine policy, that the vessel shall be seaworthy at the commencement of the voyage. All such warranties must be literally complied with, or else the policy is avoided, although perhaps the risk may not have been increased, because the parties have expressly made these stipulations to be the conditions upon which the validity of the entire contract is rested. In marine policies the warranties generally relate to the character and condition of the vessel and the voyage upon which she is to sail; in fire policies, to the nature, position, ownership, occupation, and use of the building; and in life policies, to the health, physical condition, and habits of the person whose life is the subject of insurance. JOHN NORTON POMEROY.

War'ren, county of E. Georgia, bounded S. W. by Ogeechee River, and traversed by Georgia and Macon and Augusta R. Rs.; surface undulating, soil fertile. There are many cattle, sheep, and swine. Staples, cotton, Indian corn, and sweet potatoes. Cap. Warrenton. Area, 450 sq. m. P. 10,545.

Warren, county of W. Illinois, drained by Henderson River, and traversed by Chicago Burlington and Quincy and Rockford Rock Island and St. Louis R. Rs.; surface level, soil highly fertile. Bituminous coal and limestone are abundant. There are flour-mills, saw-mills, and manufactures of agricultural implements, carriages, iron castings, and woollen goods. Cattle and swine are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Monmouth. Area, 540 sq. m. P. 23,174.

Warren, county of W. Indiana, bordering on Illinois, bounded E. by Wabash River, and traversed by Wabash and Erie Canal and Toledo Wabash and Western R. R.; surface partly level prairie, and partly undulating, soil fertile. Live-stock is numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Williamsport. Area, 360 sq. m. P. 10,204.

Warren, county of S. Iowa, intersected by South, Middle, and North rivers, drained by tributaries of the Des Moines, and penetrated by a branch of Chicago Rock Island and Pacific R. R., which terminates at the county-seat; surface diversified with prairie and woodland, and abounding in bituminous coal; soil fertile. There are saw-mills, flour-mills, and some woollen manufactures. Live-stock of all kinds is numerous. Staples, Indian corn, wheat, wool, hay, lumber, and dairy products. Cap. Indianola. Area, 482 sq. m. P. 17,980.

Warren, county of S. W. Kentucky, bounded N. by Green River, intersected by Big Barren River, and traversed by Louisville and Nashville R. R.; surface somewhat hilly, soil generally fertile. It contains several remarkable caves and a number of ancient monumental mounds. There are saw-mills, grist-mills, tanneries, and manufactures of carriages, woollen goods, and marble and stone work. Horses, mules, cattle, sheep, and swine are numerous. Staples, tobacco, hay, Indian corn, wheat, oats, and wool. Cap. Bowling Green. Area, 455 sq. m. P. 21,712.

Warren, county of W. Mississippi, separated from Louisiana by Mississippi River, bounded S. E. by Big Black River, intersected by the Yazoo and by Steel's Bayou, and traversed by Vicksburg and Meridian R. R. The surface is low and level along the rivers and bayous, which are navigable by steamboats, and hilly back from the water; soil generally fertile. There are some manufactures of railway cars, cotton-seed oil, machinery, and iron castings. Live-stock is not numerous. The chief staple is cotton, in which it is exceeded by only one county in the State: there are also Indian corn and sweet potatoes. Cap. Vicksburg. Area, 575 sq. m. P. 26,769.

Warren, county of E. Missouri, bounded S. by Missouri River and traversed by St. Louis Kansas City and Northern R. R.; surface varied, soil fertile along the river. There are flour-mills and some manufactures. Live-stock numerous. Staples, Indian corn, oats, wheat, wool, tobacco, and dairy products. Cap. Warrenton. Area, 350 sq. m. P. 9673.

Warren, county of N. W. New Jersey, separated from Pennsylvania by Delaware River, intersected by Paulinskill and Paquest rivers, and traversed by Morris Canal and by New Jersey Central, Morris and Essex, and Delaware Lackawanna and Western R. Rs. The surface is hilly in parts, but there are fertile valleys, and the elevated portions are well adapted for pasturage. Iron ore, zinc, manganese, marble, soapstone, and roofing-slate are found. There are numerous flour-mills, grist-mills, and tanneries, and manufactories of agricultural implements, carriages, furniture, clothing, lime, iron, and paper. Cattle, horses, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Belvidere. Area, 550 sq. m. P. 34,336.

Warren, county of N. E. New York, partly bounded E. by Lake George and partly S. and W. by Hudson River, drained by Schroon River, and traversed by Adirondack and a branch of Rensselaer and Saratoga R. Rs. The surface is mountainous, hardly a third of the area being adapted for cultivation. Iron ore is abundant, and limestone, marl, and graphite abound. There are numerous saw-mills and tanneries, and some manufactures of boots and shoes and paper. Cattle and sheep form the principal part of the live-stock. Staples, hay, oats, wool, lumber, and dairy products. Cap. Lake George. Area, 912 sq. m. P. 22,592.

Warren, county of N. North Carolina, bordering on Virginia, intersected by Roanoke River, and traversed by Raleigh and Gaston R. R.; surface elevated and undulating, soil fertile; with several mineral springs. There are many saw-mills and grist-mills. Cattle and swine are the principal live-stock. Staples, cotton, tobacco, Indian corn, oats, and wool. Cap. Warrenton. Area, 391 sq. m. P. 17,768.

Warren, county of S. W. Ohio, intersected by Miami and Little Miami rivers, and traversed by Miami Canal and by several railroads, centring at Cincinnati; surface undulating, soil fertile. There are many ancient aboriginal mounds and an abundance of limestone. There are saw-mills, grist-mills, and manufactories of carriages and of malt. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, barley, potatoes, wool, hay, and dairy products. Cap. Lebanon. Area, about 400 sq. m. P. 26,689.

Warren, county of N. W. Pennsylvania, bordering on New York, intersected by Alleghany River, drained by Conewango and Brokenstraw creeks, and traversed by Philadelphia and Erie, Atlantic and Great Western, Oil Creek and Alleghany River, and Dunkirk Alleghany Valley and Pittsburg R. Rs. The surface is hilly, with large forests of good timber and much iron ore. The soil is generally tolerably fertile. This county forms part of the great Pennsylvania oil-region. There are more than 100 saw-mills, planing-mills, flouring-mills, tanneries, oil-refineries, iron-foundries, and machine-shops. Cattle and sheep are the principal live-stock. Staples, petroleum, lumber, oats, potatoes, Indian corn, wool, hay, and dairy products. Cap. Warren. Area, 832 sq. m. P. 23,897.

Warren, county of Central Tennessee, bounded N. E. by the Caney fork of Cumberland River, drained by Collins River and its affluents, and traversed by McMinnville and Nashville R. R.; surface generally mountainous, soil tolerably fertile. There are flour-mills, saw-mills, cotton-mills, and tanneries. Cattle, sheep, and swine are numerous. Staples, Indian corn, a little cotton and tobacco, and wool. Cap. McMinnville. Area, 440 sq. m. P. 12,714.

Warren, county of N. Virginia, intersected by Shenandoah River, and having railroad connections with Washington. The surface is generally hilly, the Blue Ridge running along its S. E. border. The soil is generally good, and iron ore, copper, manganese, and limestone occur. Cattle and sheep are the principal live-stock. Staples, wheat, Indian corn, hay, and wool. Cap. Front Royal. Area, about 200 sq. m. P. 5716.

Warren, p.-v. and tp., cap. of Bradley co., Ark., at the head of navigation on Saline River, 45 miles S. of Pine Bluff, has 2 churches, excellent schools, a library, 1 gin, and corn and flouring mills. H. B. VAN VALKENBURGH.

Warren, tp., Columbia co., Ark. P. 524.

Warren, p.-v. and tp., Litchfield co., Conn. P. 673.

Warren, tp., Henderson co., Ill. P. 84.

Warren, p.-v. and tp., Jo Daviess co., Ill., on Illinois Central and Mineral Point R. Rs., has good schools, a free public library, 1 bank, 1 newspaper, 3 hotels, 3 halls, wood-carpet manufactory, and 1 grist mill. Principal business, grain and stock-raising. P. of v. 1666; of tp. 1786.
HERST C. GANN, ED. "SENTINEL."

Warren, tp., Lake co., Ill. P. 1235.

Warren, tp., Clinton co., Ind. P. 1134.

Warren, p.-v. and tp., Huntington co., Ind. P. of v. 358; of tp. 951.

Warren, p.-v. and tp., Marion co., Ind. P. 2291.

Warren, tp., Putnam co., Ind. P. 1087.

Warren, tp., St. Joseph co., Ind. P. 760.

Warren, tp., Warren co., Ind. P. 1208.

Warren, tp., Bremer co., Ia. P. 927.

Warren, tp., Keokuk co., Ia. P. 799.

Warren, tp., Lucas co., Ia. P. 963.

Warren, tp., Poweshiek co., Ia. P. 1137.

Warren, tp., Wayne co., Ia. P. 514.

Warren, p.-v. and tp., Knox co., Me. P. 1974.

Warren, p.-v. and tp., Baltimore co., Md. P. 317.

Warren, p.-v. and tp., Worcester co., Mass. P. 2625.

Warren, p.-v. and tp., Macomb co., Mich. P. 1938.

Warren, tp., Winona co., Minn. P. 819.

Warren, tp., Camden co., Mo. P. 472.

Warren, p.-v. and tp., Marion co., Mo. P. 2425.

Warren, p.-v. and tp., Grafton co., N. H. P. 960.

Warren, tp., Somerset co., N. J. P. 2705.

Warren, p.-v. and tp., Herkimer co., N. Y. P. 1503.

Warren, p.-v., Haverstraw tp., Rockland co., N. Y. P. 3469.

Warren, tp., Belmont co., O. P. 4099.

Warren, tp., Jefferson co., O. P. 1637.

Warren, p.-v. and tp., cap. of Trumbull co., O., on Atlantic and Great Western, Cleveland and Mahoning, Ashtabula Youngstown and Pittsburg, and Painesville and Youngstown R. Rs., contains 6 churches, 6 fine brick school-houses, 4 banks, 2 newspapers, 3 foundries, 1 rolling-mill, a furnace, 3 machine-shops, a flax, straw, and jute mill for making cotton bagging, a flax-oil mill, 2 carriage-factories, a musical institute, an efficient fire department, gas, and paved streets, a fine park, and several hotels. It is contiguous to an extensive coal and iron district. P. of v. 3457; of tp. 1148. WM. RITEZEL, ED. "CHRONICLE."

Warren, tp., Tuscarawas co., O. P. 822.

Warren, tp., Washington co., O. P. 1604.

Warren, tp., Bradford co., Pa. P. 1421.

Warren, tp., Franklin co., Pa. P. 606.

Warren, p.-b., cap. of Warren co., Pa. P. 2014.

Warren, p.-v. and tp., Bristol co., R. I. P. 3008.

Warren, tp., Colleton co., S. C. P. 1631.

Warren, p.-v. and tp., Washington co., Vt. P. 1008.

Warren, tp., Upshur co., West Va. P. 1601.

Warren, p.-v. and tp., St. Croix co., Wis. P. 467.

Warren, tp., Waushara co., Wis. P. 632.

Warren (GOUVERNEUR KEMBLE), b. at Cold Spring, N. Y., Jan. 8, 1830; graduated at the U. S. Military Academy July 1, 1850, when appointed brevet second lieutenant in the corps of topographical engineers; was employed on surveys of the delta of the Mississippi River 1850–53; topographical engineer of Sioux expedition 1855; aided in Pacific R. R. explorations, and compiled a map and memoir of the territory W. of the Mississippi 1854–58, for vol. xi. *Pacific R. R. Reports;* in charge of surveys, and preparing reports and maps thereon, of Dakota and Nebraska Territories 1855–59; assistant professor of mathematics at West Point 1859–61; lieutenant-colonel of the 5th New York Vols. (Zouaves) May, 1861, which participated in the action at Big Bethel June 10; promoted colonel of his regiment in August, he served in the construction of the defences of Baltimore until the spring of 1862, when his command was united with the Army of the Potomac. In the Virginia Peninsular campaign of 1862 he commanded a brigade in Sykes's division of the 5th (Porter's) corps, and was brevetted lieutenant-colonel for gallantry at Gaines's Mill, where he was wounded. In the battle of Manassas his command was hotly engaged on Aug. 30, and participated in the battle of Antietam. He was commissioned brigadier general of volunteers on Sept. 26, 1862, and continued to command a brigade in the 5th corps in the battle of Fredericksburg. Gen. Hooker appointed him chief topographical engineer, which position he held until after the battle of Chancellorsville, when he was made chief engineer of the Army of the Potomac. At the battle of Gettysburg he rendered conspicuous aid; was wounded, and brevetted colonel for gallant and meritorious services. He was now promoted major-general of volunteers to date from Chancellorsville, and Aug. 12 assigned to temporary command of the 2d corps, which gained a marked advantage over the enemy at Bristoe Station, Oct. 14, for which he was brevetted brigadier-general. In Mar., 1864, the 1st corps was united with the 5th corps, and Warren assigned to this command by the President, which he held through the campaign of 1864, and until the close of the battle of Five Forks, Apr. 1, 1865; was assigned Apr. 2 to the command of the troops between the Appomattox and James, and Apr. 3 placed in command of Petersburg. Ordered to command the department of the Mississippi May 14, he held this till May 27, when, the enemy having all laid down their arms, he resigned his volunteer commission; was brevetted major-general for gallant and meritorious service in the field; as major of engineers has charge of various harbor and river improvements, bridge constructions and investigations, and fortifications in course of construction and modification. Author of numerous military, exploration, and engineering reports, and of a pamphlet on the battle of Five Forks.

Warren (HENRY W.), D. D., b. in Mass. in 1835, graduated at Wesleyan University, Middletown, Conn., in 1858; was 2 years prof. of ancient languages at Wilbraham Academy, Mass.; joined the N. E. Conference of the M. E. Church in 1858, and was pastor of various churches in N. E.; pastor of Arch St. Church in Philadelphia 1871–74; from there he was sent to St. John's church, Brooklyn, N. Y., and in 1877 again became pastor of Arch St. Church; was afterward appointed to Spring Garden Church in same city; has travelled extensively in Europe and the East, and is author of *Sights and Insights* and *Recreations in Astronomy*, etc. He was elected bishop May 12, 1880.

Warren (JAMES), b. at Plymouth, Mass., Sept. 28, 1726; graduated at Harvard 1745; became a wealthy merchant at Plymouth; was high sheriff of the county 1757–75; became a member of the general court 1766; procured the appointment of committees of correspondence 1772; president of the provincial congress 1775; was paymaster-general of the army before Boston 1775–76; subsequently major-general of militia, Speaker of the Massachusetts house of representatives several years, and member of the navy board, and declined the offices of lieutenant-general and judge of the supreme court. D. at Plymouth Nov. 27, 1808.—He married MERCY OTIS, sister of James Otis.

Warren (JOHN), M. D., brother of Gen. Joseph, b. at Roxbury, Mass., July 27, 1753; graduated at Harvard 1771; studied medicine in the office of his brother Joseph; commenced practice at Salem 1777; became in June, 1775, senior surgeon to the military hospital at Cambridge; attended the wounded from the battle of Bunker's Hill; served in the campaigns of New York and New Jersey 1776–77, being present at the battles of Trenton and Princeton; was in charge of the military hospitals in Boston until the close of the war; accompanied Gen. Greene's expedition to Rhode Island 1778, and the campaign against the Shays insurrection 1786; gave a course of dissections to his surgical colleagues 1780; became professor of anatomy and surgery in the medical school established through his efforts in connection with Harvard University 1783; was for forty years the most distinguished surgeon of New England, introducing many operations previously unknown; delivered in 1773 the first of the series of Fourth of July orations at Boston; was grand master of the Freemasons, president of the agricultural and humane societies and of the Massachusetts Medical Society from 1804 to his death, at Boston Apr. 4, 1815. He published numerous professional papers and some miscellaneous addresses and essays.

Warren (Sir JOHN BORLASE), BART., b. at Stapleford, Nottinghamshire, England, in 1754; educated at Winchester School; entered the navy at an early age; subsequently studied at Cambridge; entered Parliament 1774; became a baronet 1778; returned to the navy; performed several gallant exploits during the French war 1778–83; took part in the expedition to Quiberon Bay 1795; captured a French squadron bound with troops for Ireland Oct. 11, 1798; became privy councillor and ambassador to Russia 1802, and full admiral 1810. D. at Greenwich Feb. 27, 1822.

Warren (JOHN COLLINS), M. D., son of Dr. John, b. at Boston, Mass., Aug. 1, 1778; graduated at Harvard 1797; studied medicine with his father, also at Edinburgh and in

the hospitals of London and Paris; began practice at Boston 1802; was assistant professor of anatomy and surgery in the Harvard Medical School 1806–15, and professor (as successor to his father) 1815–47, and emeritus professor 1847–56; was one of the founders of the Massachusetts General Hospital 1820, and of the McLean Asylum for the Insane; founder and editor of the Boston *Medical and Surgical Journal* (1828); president of the Massachusetts Medical Society 1832–36; president for many years of the Massachusetts Temperance Society and of the Boston Society of Natural History; visited Europe 1837 and 1852; carried into effect (1846) the successful application of ether in a surgical operation at the Massachusetts General Hospital, of which he was principal surgeon; was a member of the principal scientific societies of America and Europe, and made fine collections of comparative anatomy, osteology, and palæontology, including the most perfect known specimen of the mastodon. D. at Boston May 4, 1856. By his will he ordered his body to be given for examination to the medical school, and that his skeleton should be deposited in its museum. He contributed largely to medical and scientific journals; was one of the editors of the *Monthly Anthology and Boston Review* (1804) and of the *Gospel Advocate* (1821–22); published numerous and valuable professional monographs, a *Genealogy of Warren, with some Historical Sketches* (1854), and several addresses before scientific bodies. A *Life, chiefly compiled from his Autobiography and Journals* (Boston, 2 vols., 1860), was published by his brother, Edward Warren, M. D.

Warren (Jonathan Mason), M. D., son of Dr. John Collins, b. at Boston, Mass., in 1811; graduated in medicine at Cambridge 1832; studied surgery in London and Paris, and was for many years attending surgeon at the Massachusetts General Hospital. D. at Boston Aug. 19, 1867. Author of many professional papers, collected under the title *Surgical Observations, with Cases and Operations* (1867).

Warren (Joseph), b. at Roxbury, Mass., June 11, 1741; graduated at Harvard 1759; studied medicine under Dr. Lloyd; began practice at Boston 1762; delivered in 1772, and again in 1775, the civic oration on the anniversary of the "Boston Massacre;" was a member of the provincial committee of correspondence 1772; president of the Massachusetts congress and chairman of its committee of public safety 1774, being thus the virtual executive of a *de facto* government at the outbreak of hostilities with Great Britain; was efficient in organizing the volunteers after the battle of Lexington; was chosen major-general by the provincial congress June 14, and took an active part as a volunteer, declining the command, at the battle of Bunker's Hill, at which he was killed June 17, 1775, falling near the spot where the Bunker's Hill Monument now stands. A statue by Dexter was erected on Bunker's Hill June 17, 1857. A *Life* by A. H. Everett may be found in Sparks's *American Biography*, and another by Richard Frothingham was published at Boston in 1865.

Warren (Mercy **Otis**), sister of James Otis, b. at Barnstable, Mass., Sept. 25, 1728 (N. S.), married James Warren about 1754; became a zealous patriot; corresponded with Samuel and John Adams, Thomas Jefferson, and other leaders of the Revolution; wrote several dramatic and satirical poems against the royalists (1773–75), which, with two tragedies, were included in a volume of *Poems, Dramatic and Miscellaneous* (1790), and published *A History of the Rise, Progress, and Termination of the American Revolution, interspersed with Biographical, Political, and Moral Observations* (Boston, 3 vols., 1805). D. at Plymouth Oct. 19, 1814.

Warren (Sir Peter), b. in England in 1703; entered the navy 1727; was commodore of the squadron which conveyed Sir William Pepperell's expedition against Louisburg 1745; was made rear-admiral the same year, and vice-admiral 1747, when with Anson he defeated a French fleet off Cape Finisterre; was elected to Parliament for Westminster 1747; married Miss Susan de Lancey of New York, daughter of Stephen, and acquired a vast estate in the Mohawk Valley, which he placed in charge of his nephew, afterward celebrated as Sir William Johnson. D. in Ireland July 29, 1752.

Warren (Samuel), D. C. L., b. at Racre, Denbighshire, Wales, May 23, 1807; educated at the University of Edinburgh; commenced the study of medicine, but soon abandoned it for that of the law, which he pursued at the Inner Temple, London, 1828–30; contributed to *Blackwood's Magazine* his well-known *Passages from the Diary of a Late Physician* (1830–31); wrote several legal works; became queen's counsel 1851; was recorder of Hull 1854–71; sat in Parliament as a Conservative 1856–59, and was appointed master in lunacy Feb., 1859. He has published *Ten Thousand a Year* (1839), a successful novel, and *Now and Then* (1847), an unsuccessful one; has collected from the pages of *Blackwood* 2 vols. of *Miscellanies, Critical and Imaginative* (1854), and is author of various other literary productions. D. July 31, 1877.

Warren (William), b. in Philadelphia Nov. 17, 1812, and made his first appearance on the stage at the Arch Street Theatre as Young Norval Oct. 27, 1832; played an engagement at the Park Theatre in New York in 1841, and in 1845 appeared in London at the Strand Theatre; in Oct., 1846, appeared as Sir Lucius O'Trigger in *The Rivals* on the opening night of the Howard Athenæum, Boston, where he won an immediate success, which has continued for more than thirty years. In Aug., 1847, he became a member of the Boston Museum company, appearing Aug. 23 as Billy Lackaday. Since that time he has, with the exception of a brief interval, when he made a tour of the principal cities of the U. S., performed continuously at the Museum with unvarying popularity and success, representing probably in that time a greater variety of characters, and appearing a greater number of times, than any living actor. In the old English comedies he is unrivalled, while the number of hits he has made in special character parts are too numerous to mention.

Warren (William Fairfield), D. D., b. at Williamsburg, Mass., Mar. 13, 1833; graduated at Wesleyan University, Middletown, Conn., 1853; became a preacher in the N. E. Methodist conference 1855; subsequently studied theology at Andover, Berlin, and Halle; travelled in the East; became professor of systematic theology in the Methodist missionary institute at Bremen, Germany, 1861, and in the Boston Theological Seminary 1866, and was chosen president of Boston University 1873. Author of treatises on logic (1864) and on systematic theology (1865), both in German.

War'rensburg, p.-v. and tp., cap. of Johnson co., Mo., on Missouri Pacific R. R., 217 miles W. of St. Louis, contains 8 churches, 3 public-school buildings, the State normal school, 3 banks, a foundry and machine-shop, woollen-mills, 1 carriage and 2 wagon factories, 1 jewelry establishment, celebrated sandstone quarries, 3 newspapers, 4 flouring-mills, 1 elevator, and 2 hotels. P. of v. 2945; of tp. 4804. David Nation, Ed. "Journal."

Warrensburg, p.-v. and tp., Warren co., N. Y. P. of v. 715; of tp. 1579.

Warren's Store, tp., Hale co., Ala. P. 480.

War'rensville, p.-v. and tp., Cayahoga co., O. P. 1429.

War'renton, tp., Dallas co., Ala. P. 1057.

Warrenton, p.-v. and tp., Marshall co., Ala. P. of v. 60; of tp. 863.

Warrenton, p.-v., cap. of Warren co., Ga., on Macon and Augusta R. R., 54 miles from the latter city, contains 4 churches, 1 academy, 1 newspaper, and a wagon-factory. P. about 1000. C. E. McGregor, Ed. "Clipper."

Warrenton, p.-v., Warren co., Mo., on St. Louis Kansas City and Northern R. R., 58 miles N. W. of St. Louis, has 3 churches, a college and public school, 3 newspapers, 1 bank, an orphan asylum, 3 hotels, and 2 mills. P. 588. F. T. Williams, Pub. "Citizen."

Warrenton, p.-v. and tp., cap. of Warren co., N. C., 60 miles N. E. of Raleigh, has 6 churches, 1 academy and 2 seminaries, 1 bank, 1 newspaper, a tobacco-factory, 2 carriage-factories, an iron-foundry, 1 hotel, and a fire insurance company. The late Horace Greeley was married in the Episcopal church here. It is a resort for tourists and invalids during the winter months. P. of v. 941; of tp. 2886. H. A. Foote, Ed. "Gazette."

Warrenton, p.-v. and tp., Jefferson co., O. P. 241.

Warrenton, p.-v., Centre tp., cap. of Fauquier co., Va. P. 1256.

War'rick, county of S. W. Indiana, separated from Kentucky by Ohio River, intersected by Wabash and Erie Canal, and partially traversed by Lake Erie Evansville and South-western R. R.; surface undulating, soil fertile. Bituminous coal is found. Horses, cattle, sheep, and swine are numerous. Staples, tobacco, Indian corn, oats, hay, wool, and dairy products. Cap. Boonville. Area, 360 sq. m. P. 17,653.

Warrick's Mill, tp., Washington co., Ala. P. 863.

War'rington, town of England, county of Lancaster, on the Mersey, which here is navigable for vessels of 100 tons burden, manufactures fustians, twills, corduroy, and other cotton goods, glass, leather, soap, all kinds of tools, and ale. P. 32,083.

Warrington, p.-v., Escambia co., Fla.

Warrington, p.-v. and tp., Bucks co., Pa. P. 949.

Warrington, tp., York co., Pa. P. 1726.

Warrington (Lewis), b. at Williamsburg, Va., Nov. 3, 1782; graduated at William and Mary College 1798; became a midshipman in the navy 1800; served under Preble in the war with Tripoli; was a lieutenant on the Chesapeake in her engagement with the Leopard 1807; became master-commandant of the Peacock, and captured the sloop-of-war Epervier; took 14 British merchantmen 1814, and became captain in November of that year; proceeded to the East Indies; captured the Nautilus in the Straits of Sunda June 30, 1815; subsequently commanded a squadron on the West India station, and was a member of the board of navy commissioners 1827–30 and 1840–42, and chief of the bureau of ordnance from Sept., 1842, until his death, at Washington, D. C., Oct. 12, 1851.

War'rior's Mark, p.-v. and tp., Huntingdon co., Pa. P. 1209.

Warrior Stand, tp., Macon co., Ala. P. 2179.

War'saw [Polish, *Warszawa;* Ger. *Warschau;* Fr. *Varsovie*], the fortified capital of the former kingdom of Poland, with 279,502 inhabitants in 1873, of whom 86,000 were Jews, is on the left bank of the Vistula, on a hill which gradually loses itself in a vast flat plain, and consists of the old town, the new town, and several suburbs, of which the most important is Praga, on the right bank of the river, and connected with the city proper by an iron bridge. The location of Warsaw is of extraordinary commercial importance. The city is the entrepôt of the products of Northern Russia and Siberia, which hence reach Western Europe, and the opening of the Suez Canal has given it an opportunity of grasping the Chinese and East Indian traffic, which formerly passed through Nizhnee-Novgorod and Kiachta, and of making itself the centre of the Europo-Asiatic commerce. In architectural respects it still bears the character of being the capital of a country which is governed despotically, small and miserable huts alternating with large and magnificent palaces; but this contrast is diminishing every year, and the more recent parts of the city have a decidedly modern character. The principal public squares are the Saxon Square, Exchange Square, Theatre Square, Krasinski Square, and Sigismund Square, containing a column bearing the statue of Sigismund III., erected in 1643. The principal streets are Long street, Honey street, King street, Elector street, Marshal street, Senator street, Lescino street, and Cracow street, with the equestrian statue of Poniatowski by Thorwaldsen. The most remarkable of the public buildings are—the royal palace, situated on an elevation in the northern part of the city, built by Sigismund III., and containing many magnificent rooms, a library, and the archives; the Saxon palace and the palace of the vice-regent; the Krasinski and Brühl palaces, and numerous palaces belonging to the rich Polish nobility, the families of Potocki, Zamoyski, Lubienski, Raczynski, Sapieha, Branicki, etc.; the Belvedere, with a beautiful park; the Lazienki on an island in the centre of a lake; the city hall, the mint, the arsenal, and the theatre. The city has 85 churches, among which are 7 Greek Catholic, 1 Lutheran, and 1 Reformed. The most remarkable are—the Roman Catholic cathedral of St. John in the old town, connected with the royal palace, the Greek Catholic cathedral, the Lutheran church, the Alexander church, the church of the Holy Cross, with a magnificent front façade, and the church of the Capuchins, with a beautiful marble monument. The three dépôts belonging to the Warsaw-Vienna, Warsaw-Terespol, and Warsaw-St. Petersburg railways are connected by horse-railways. The scientific institutions of the city suffer very much because the Russian government suppresses all that has a national Polish character; thus, the largest part of the library of the university, founded in 1816, has been carried to St. Petersburg. There exist, however, good zoological and mineralogical collections, a botanical garden, an observatory, a picture-gallery, etc. There are also fine private art-collections belonging to the families of Assolinski, Potocki, Dombrowski, etc. The educational and benevolent institutions are numerous, and besides the theatre there are many and good establishments for amusement, as the Poles are very fond of dancing and singing. Manufacturing industry is flourishing. Cloth, carpets, woollen, cotton, and silk fabrics, hats, gloves, saddlery, gold and silver ware, carriages, furniture, etc., are manufactured, and extensive distilleries and breweries are in operation. In order to facilitate the enormous business of the city, there have recently been established several banks, besides the national Polish bank founded in 1830. In the vicinity of Warsaw are several beautiful palaces, such as the Wilanow, built in the seventeenth century in French style, the Krolikarnia, with a park, a menagerie, etc., the Marynout, and others.

Warsaw is said to have been founded in 1185 by King Casimir. In 1550 it became the residence of the Polish kings. At Wola, a village near Warsaw, the elections of the kings took place. In 1655 the Swedes took the city, and held it for a long time. Augustus II. and III. did much to beautify it. In 1764 the Russians captured it, but by the third division of Poland it fell to Prussia. By the Peace of Vienna it became definitely a Russian possession, and it has suffered much from the cruelties which the Russians perpetrated every time they succeeded in suppressing a Polish insurrection. It suffered most, however, in 1831, when it was stormed and taken by Paskevitch. Nevertheless, its favorable commercial location has always enabled it to recover, and even to increase. AUGUST NIEMANN.

War'saw, p.-v. and tp., Sumter co., Ala. P. 2080.

Warsaw, p.-v., Hancock co., Ill., the W. terminus of the Toledo Peoria and Wabash R. R., and upon Mississippi River, 5 miles below the lower rapids, contains 7 churches, a public library, 13 schools, 1 bank, 2 parks, 1 newspaper, a Masonic lodge, large woollen-mill, 3 hotels, wagon and plough factories, several flouring-mills and cooperage establishments, 1 foundry, and a lodge and encampment of I. O. O. F. P. 3583. F. M. DALLAM, ED. "BULLETIN."

Warsaw, p.-v., cap. of Koscinsko co., Ind., on Pittsburg Fort Wayne and Chicago and Cincinnati Wabash and Michigan R. Rs., 109 miles E. of Chicago, has 4 churches, good schools, 2 banks, 2 newspapers, 4 hotels, and 2 large flouring-mills. P. 2206.

WILLIAMS & HOSSLER, EDS. "NORTHERN INDIANIAN."

Warsaw, p.-v., cap. of Gallatin co., Ky. P. 715.

Warsaw, tp., Goodhue co., Minn. P. 1027.

Warsaw, p.-v. and tp., Rice co., Minn. P. 1000.

Warsaw, p.-v., cap. of Benton co., Mo., on the N. bank of Osage River, has 2 churches, 2 places of worship for colored people, 1 bank, 2 newspapers, court-house, jail, 1 grist and 1 saw mill, 1 wagon-shop, and 2 hotels.

SEWALL W. SMITH, ED. "WEEKLY TIMES."

Warsaw, p.-v. and tp., cap. of Wyoming co., N. Y., on New York and Erie R. R., 45 miles E. of Buffalo, in the beautiful Wyoming Valley, contains 6 churches, a fine union free-school building, water and gas works, 2 newspapers, a public library, 2 banks, 4 hotels, wagon and broom factories, an iron-foundry, and a map-roller manufactory. P. of v. 1631; of tp. 3143.

WM. H. MERRILL, ED. "WESTERN NEW YORKER."

Warsaw, p.-v. and tp., Duplin co., N. C. P. 1362.

Warsaw, p.-v. and tp., Jefferson co., Pa. P. 1122.

Warsaw, p.-v., cap. of Richmond co., Va.

Warsaw Landing, tp., Benton co., Mo. P. 498.

Wars of Succession. See SUCCESSION WARS, by PROF. CLEMENS PETERSEN, A. M.

Wart. See WARTS.

War'ta, river of Europe, rises near Cracow, passes through Poland and Prussia, joins the Oder at Küstrin, province of Brandenburg, after a course of 450 miles, navigable for 220 miles, and through its chief affluent, the Netze, it communicates by canals with the Vistula.

Wart'burg, a castle situated in the heart of the Thuringian Forest, was founded in 1067 by Ludwig the Leaper, count of Thuringia, and was for several centuries the residence of his successors, who at times held a brilliant and widely-renowned court here. After passing through many vicissitudes—conflagrations by sieges and lightning, collapses by hurricanes and old age, remodellings after the demands of other times, etc.—it has recently been restored with great magnificence and exquisite taste by Charles Alexander, duke of Saxe-Weimar. It exercises, however, a much greater attraction by its historical remembrances than by its architectural merits. Here the famous contest between the Minnesingers took place in the time of Landgrave Hermann I., about 1206—an event whose historical and mythical elements cannot now be separated (see Lucas, 1838; Plötz, 1851), but which forms the subject of the singular epic, *Der Krieg von Wartburg,* probably written about 1300, edited by Ettmüller in 1830, and translated into modern German by Simrock in 1858. Here lived Elizabeth of Hungary (1207–31), the wife of Landgrave Louis II., and afterward one of the most renowned saints of the Roman Catholic Church; and here Luther was kept concealed May 4, 1521–Mar. 6, 1522, finishing his translation of the Bible. On Oct. 18, 1817, delegates from all the Protestant universities of Germany assembled here to celebrate the third centenary year of the Reformation and the recent liberation of the country from the French yoke. In the excitement of the moment the enthusiasm for liberty and Fatherland ran a little high. Some books which were considered illiberal and unpatriotic were burnt, and some plans were proposed for the reformation and elevation of the students' life at the universities, more especially for the abolition of the

old traditionary barriers which separated the students of various German countries from each other. The whole affair was noble and harmless, in spite of some exaggerations, but the German princes, alarmed by this attempt to revolutionize and republicanize Germany, made it the cause of numerous odious persecutions and chicaneries.

Wartburg, p.-v., cap. of Morgan co., Tenn.

Wart-Hog. See PHACOCHŒRIDÆ, by THEODORE GILL, PH. D.

War'ton (JOSEPH), D. D., brother of Thomas, b. at Dunsford, Surrey, England, in 1722, son of Thomas Warton, D. D. (d. 1746), vicar of Basingstoke, Hampshire, and of Cobham, Surrey, and professor of poetry at Oxford 1718–28; educated at Winchester School; graduated at Oriel College, Oxford, 1744; took orders in the Church of England; was curate to his father at Basingstoke 1744–46; curate at Chelsea 1746–48; became rector of Winslade, Hampshire, 1748; travelled on the Continent with his patron, the duke of Bolton, 1751; obtained the rectory of Tunworth 1754, that of Wickham 1782, and of Upham 1788; was second master of Winchester School 1755–66, and head-master 1766–93; became chaplain to Sir George (afterward Lord) Lyttleton 1756, prebendary of St. Paul's, London, 1782, and of Winchester 1788. D. at Wickham, in Hampshire, Feb. 23, 1800. He published *Odes on Various Subjects* (1746), a poetical translation of the *Eclogues and Georgics of Virgil* (1753), an *Essay on the Genius and Writings of Pope* (2 vols., 1756–82); contributed 24 critical papers to *The Adventurer* (1753–56), and edited the works of Pope (9 vols., 1797) and Dryden, the latter completed after his death (4 vols., 1811). He was engaged upon and announced for publication (1784) a history of Greek, Roman, Italian, and French poetry, but it never appeared. A volume of *Biographical Memoirs* (1806) was published by Rev. John Wooll.

Warton (THOMAS), F. S. A., b. at Basingstoke, Hampshire, England, in 1728; graduated at Trinity College, Oxford, about 1747; became a fellow there 1751; took orders in the Church of England 1755; was professor of poetry in the university 1757–67; became Camden professor of ancient history and poet-laureate 1785; and obtained the livings of Kiddington 1771 and Hill Farrance 1782. D. at Oxford May 21, 1790, having resided for forty years in Trinity College. Author of *Observations on the Faerie Queene of Spenser* (1754), *The Life of Sir Thomas Pope* (1772), and of a valuable *History of English Poetry* (3 vols., 1774–81), intended to extend to the beginning of the eighteenth century, but never continued beyond the Elizabethan age. Revised editions were issued in 1824, 1840, and 1870. Warton edited the Greek *Anthology* (1766), the works of Theocritus (Oxford, 2 vols., 1770), and the *Minor Poems of Milton* (1785; 2d ed. 1791), and published several occasional poems, of which a collection appeared in 1777. His *Poetical Works* (1802) were edited, with a sketch of his life, by Richard Mant, D. D., bishop of Down. They have also been included in Chalmers's *British Poets* (1810).

War'trace Dépôt, p.-v., Bedford co., Tenn.

Warts, or **Verrucæ** [Lat. *verruca*, a "wart"], are developed by hypertrophy, abnormal growth, of the papillæ of the skin. They may be round and ovoid or conical, thread-like, or broad and flat. The so-called "seeds" or points of a dry wart correspond to the number of papillæ which have become elongated and thickened. Each papilla of the skin has an independent supply of blood by a little loop of capillary blood-vessels at its base. Hence, mere removal of the wart is followed by its renewal from the well-nourished base and remaining cells which have transmitted the tendency to excessive growth. Cases are often cited of warts communicated by the blood from other warts, but the best authorities deny them. Warts occur chiefly in children between the second and fourteenth year; their cause is uncertain. Their duration is indefinite; they sometimes disappear suddenly, probably by contraction of the vascular papillary base and casting off of the superabundant dry cells. When they are kept free from handling or irritation, the diet is corrected, and alteratives are given, they may slowly disappear. The common treatment is to snip them off and touch the base with nitric acid, glacial acetic acid, or lunar caustic; saturation with tincture of thujar or thuya (arbor vitæ) daily has the effect to speedily remove them in many cases.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Warville, de (BRISSOT). See BRISSOT DE WARVILLE.

War'wick, or **Warwickshire,** county in the centre of England, watered by the Avon, comprises an area of 881 sq. m., with 633,902 inhabitants. The surface is elevated; in the northern part, which once was covered with the Forest of Arden, moor, heath, and forest alternate; in the southern part the soil is very fertile. Agriculture and dairy-farming are in an advanced state. Coal, chalk, lime, and marl are found; manufactures are extensive.

Warwick, town of England, capital of Warwickshire, on the Avon, an old and interesting place, contains several fine buildings, among which the most remarkable is the castle, many benevolent institutions, and some manufactures, though on a small scale. P. 11,001.

Warwick, county of S. E. Virginia, between York and James rivers; surface undulating, soil good. Staples, oysters, firewood, and Indian corn. Cap. Warwick Court-house. Area, 95 sq. m. P. 1672.

Warwick, p.-v. and tp., Bedford co., Md. P. 320.

Warwick, p.-v. and tp., Franklin co., Mass. P. 769.

Warwick, p.-v. and tp., Orange co., N. Y., on Warwick Valley and Pine Island R. Rs., has 13 churches, Seward and Warwick institutes, a public library, 1 bank, 1 newspaper, waterworks, an efficient fire department, graded streets, butter and cheese manufactories, and rich mines of iron ore and other minerals. P. of v. 938; of tp. 5736.

D. F. WELLING, ED. "ADVERTISER."

Warwick, tp., Tuscarawas co., O. P. 1387.

Warwick, tp., Bucks co., Pa. P. 775.

Warwick, p.-v. and tp., Chester co., Pa. P. 1266.

Warwick, tp., Lancaster co., Pa. P. 3345.

Warwick, p.-v. and tp., Kent co., R. I., on Stonington and Providence R. R. P. 10,453.

Warwick (GUY), EARL OF, a legendary Saxon hero who figures largely in early English metrical romances as a champion against the Danes, and especially noted for his victory over the giant Colbrand, alluded to in Shakspeare's *King John* and *Henry VIII.* He is usually assigned to the period of King Athelstan. *The Booke of the most victorious Prince Guy of Warwick*, a metrical romance of the earlier half of the fourteenth century, was printed before 1567, and a prose French romance on the same subject, printed in 1525, was edited by J. Zupitza for the Early English Text Society 1875–76.

Warwick (HENRY DE **Beauchamp**), DUKE OF, and king of the Isle of Wight, son of Richard, b. at Hanley Castle, Warwickshire, England, Mar. 22, 1424; succeeded to the earldom on the death of his father 1439; distinguished himself in the defence of Normandy 1442–44; was created duke of Warwick, to rank next the duke of Norfolk and before the duke of Buckingham—a provision which led to a controversy with the latter nobleman, which was settled by act of Parliament to the effect that the claimants should take precedence in alternate years; and received from Henry VI., who had been his companion in childhood, many honors, the most extraordinary being that he was crowned by that monarch as vassal king of the Isle of Wight early in 1445. He survived his advancement but a few months, dying without issue June 11, 1445.

Warwick (RICHARD DE **Beauchamp**), TWELFTH EARL OF, b. at Salwarpe, Worcestershire, Jan. 28, 1381, son of Thomas, who was condemned as a traitor in the reign of Richard II., but not executed; was made a knight of the Bath at the coronation of Henry IV. (1399); succeeded to the earldom 1401; fought against Owen Glendower 1401–02, and against the Percies 1403, taking part in the famous battle of Shrewsbury; made a pilgrimage to the Holy Sepulchre 1408; visited several European courts, where he distinguished himself at tournaments; was lord high steward at the coronation of Henry V. (1413), and in the same year commissioner to negotiate peace with France; headed an embassy to the Council of Constance 1414; was an energetic opponent of the Lollards or followers of Wycliffe; became in 1415 captain of Calais, where he entertained the emperor Sigismund with such grace as to receive from him authority to bear the title "father of courtesy;" aided in the siege and capture of Caen 1417; was ambassador to the duke of Burgundy 1418; was created about that period earl of Aumerle (otherwise Albemarle); attended Henry V. on his deathbed (1422); was regent of France 1425–28; directed for nine years the education of the young king, Henry VI., gaining the title "the good earl," and was again regent or lieutenant-general of France and Normandy from 1437 to his death at Rouen Apr. 30, 1439. He was buried and has a magnificent tomb in the church of St. Mary, Warwick. He was possessed of immense landed estates, was father of Anne, the wife of Richard Neville, subsequently earl of Warwick, and known as the "king-maker," and was author of some courtly verses preserved in MSS. in the British Museum.

Warwick (RICHARD **Neville**), EARL OF, known as "the king-maker," b. in England about 1420 (or 1428), was the eldest son of Richard Neville, earl of Salisbury, and Alice, daughter and heiress of Thomas de Montacute,

the previous earl of Salisbury; was first cousin of the earl of March, afterward Edward IV., through the marriage of his father's sister, Lady Cecily Neville, to Richard Plantagenet, duke of York; distinguished himself in an incursion across the Scottish Marches 1448; married Anne Neville, daughter and ultimate heiress of Richard de Beauchamp, earl of Warwick, which title was now conferred upon him 1449; became by this connection the most wealthy and powerful nobleman of the kingdom; fought along with his father in the "war of the Roses," which grew out of the claims of the duke of York to the throne; bore a leading part in the first battle, that of St. Alban's, May 22, 1455, which he decided in favor of the Yorkists by a daring charge into the town; was rewarded with the post of captain of Calais, then the most important in the gift of the king, and also received the command of the fleet for five years; fought in May, 1458, a successful naval battle with a Lubeck fleet of twenty-eight vessels, of which he captured six; joined his father at Ludlow Castle on the renewal of the civil war 1459; escaped to Calais with his cousin, the earl of March, on the dispersion of the Yorkists, Oct., 1459; was deprived of his naval command, but retained Calais by force of arms; fitted out there an expedition of 1500 men, with whom he landed in Kent June, 1460; marched upon and entered London, which opened its gates without a battle; augmented his troops to 40,000 men; defeated the queen's army near Northampton July 10, capturing the imbecile king, Henry VI., after which the duke of York laid formal claim and was recognized as heir to the throne Nov. 1. At the disastrous battle of Wakefield, however, Dec. 30, the pretender was killed, and the earl of Salisbury (Warwick's father) and twelve other Yorkist nobles were captured and beheaded at Pontefract (Jan. 1, 1461). Warwick suffered another defeat at Bernard's Heath, near St. Alban's, Feb. 17, but rallied his forces, effected a junction with the young duke of York, and marched upon London, where they were received with acclamations, and the duke was proclaimed king Mar. 4 under the title of Edward IV. Warwick next defeated the Lancastrians at the desperate battle of Towton (or Ferrybridge), near the city of York, Mar. 29, 1461, and again, three years later, at Hexham, May 15, 1464; captured the deposed king, Henry VI., 1465, and led him as a public spectacle through Cheapside, London, to the Tower June, 1465; was appointed to the offices of high admiral, warden of the West Marches, lord-chamberlain, lord lieutenant of Ireland, and governor of Dover and Calais, together with large grants of forfeited estates, his brother George being made archbishop of York and lord high chancellor, and his brother, Lord Montacute, warden of the East Marches of Scotland and earl of Northumberland. He had now a revenue from his offices alone of 80,000 crowns a year, and displayed a regal magnificence, keeping open house wherever he went and maintaining many thousands of servants or dependents. He was employed on missions to France, Burgundy, and Brittany, and took such deep offence at the king's marriage with Elizabeth Woodville (1464), while he was engaged in negotiating for him the hand of a French princess, that he began to be disaffected; gave his daughter in marriage to Edward's brother, George, duke of Clarence, without the royal permission, 1469, and, taking advantage of an insurrection against certain taxes in Yorkshire, placed himself, with Clarence, at the head of the rebellion; defeated the royal forces at Edgecote July 26, 1469, capturing the king and putting to death the queen's father and brother; had a brief reconciliation with the king; was again in arms against him in the following year (1470); was forced to flee to France; made at Amboise (July 15, 1470) a treaty with Queen Margaret for the restoration of Henry VI., the marriage of Prince Edward of Lancaster to his daughter Anna (August), and the recognition of his son-in-law Clarence as heir-presumptive to the latter. By this double marriage the crown seemed now assured to the descendants of Warwick, who, aided by Louis XI., landed with a body of exiles at Plymouth and Dartmouth Sept. 13, 1470, successfully marched upon London, restored Henry VI., and was reinstated in all his offices, with the addition of that of lord high admiral. The Lancastrian restoration, however, had lasted barely six months before Edward IV., who had escaped to Holland, obtained the aid of Charles the Bold, duke of Burgundy; landed at Ravenspur, near Hull, with 2000 men, English, Dutch, and Flemings, and Warwick, along with his brother Montacute (then earl of Northumberland), betrayed by his son-in-law Clarence, was defeated and killed at the battle of Barnet, Apr. 14, 1471. They were buried at Bisham Abbey, Berkshire. The capture of Queen Margaret and murder of Prince Edward at Tewksbury, May 4, and the murder of King Henry in the Tower in June, terminated the war of the Roses, in which all the members of the house of Neville for two generations perished by the sword, except George, archbishop of York, who d. June 8, 1476. Anne Neville, widow of Prince Edward of Lancaster, married in 1472 Richard, duke of Gloucester, afterward Richard III.; was crowned queen July 6, 1483; lost her only son Apr. 9, 1484, and d. Mar. 16, 1485. The widow of Warwick survived him many years, experiencing great vicissitudes, and was living reduced to poverty in 1490. PORTER C. BLISS.

Warwick (ROBERT **RICH**), EARL OF, a descendant of Lord Chancellor Rich, b. in England about 1590; succeeded to the earldom 1618; became a prominent leader of the Puritan party; took an active part in promoting the colonization of New England, especially of Rhode Island; was an intimate friend and protector of Thomas Hooker, the celebrated founder of Connecticut, and of other Puritan clergymen, whom he protected during the ecclesiastical prosecutions of the reign of Charles I.; adhered to the cause of Parliament during the great rebellion; became lieutenant of the fleet under the earl of Northumberland 1642, and was a prominent supporter of Cromwell as Protector, and was appointed to bear the sword of state in the latter's presence 1657. D. in 1658.

Warwick Court-house, p.-v., cap. of Warwick co., Va. P. 21.

Wa'satch, county of N. E. Utah, intersected by Green River and its affluents; surface mostly desert. Cap. Heber. Area, about 10,000 sq. m. P. 1244.

Wasatch (or **Wahsatch**) **Mountains.** See UTAH.

Was'co, county of Central Oregon, bounded N. by Washington Territory, from which it is separated by Columbia River, and watered by Des Chutes and John Day's rivers; surface generally mountainous, soil better adapted to grazing than tillage. Live-stock numerous in proportion to the population. Staples, oats, Indian corn, potatoes, hay, and wool. Cap. The Dalles. Area, about 12,000 sq. m. P. 2509.

Was'eca, county of S. Minnesota, intersected by Le Sueur River and traversed by Winona and St. Peter R. R.; surface undulating and partly wooded, soil fertile. Live-stock numerous in proportion to the population. Staples, wheat, oats, hay, wool, and dairy products. Cap. Wasecca. Area, 432 sq. m. P. 7854.

Wasecca, p.-v. and tp., cap. of Wasecca co., Minn. P. 551.

Wash'burn, tp., Scott co., Ark. P. 199.

Washburn, p.-v. and tp., Sebastian co., Ark. P. 478.

Washburn, p.-v., Woodford co., Ill., on the Western branch of Chicago and Alton R. R., 125 miles W. of the former place, has 5 churches, a fine school-building, 1 bank, 2 hotels, and 1 flouring-mill. P. 272.
N. V. MALONEY, ED. "REVEILLE."

Washburn, tp., Aroostook co., Me. P. 449.

Washburn (CADWALLADER COLDEN), LL.D., son of Israel Washburn, Sr., b. in Livermore, Me., Apr. 26, 1818; settled at Mineral Point, Wis., in 1841, as a lawyer, and had a large practice as counsel for the early settlers in securing their homes. In 1854 he was elected to Congress, and was re-elected for the two following terms, thus serving through the 34th, 35th, and 36th Congresses. He declined another election, but at the breaking out of the civil war volunteered, and entered the service as colonel of the 2d Wisconsin Cavalry in 1861; was commissioned brigadier-general by Pres. Lincoln in June, 1862, and was engaged in the Arkansas campaign during that year; was commissioned major-general in Nov., 1862; was engaged in the siege of Vicksburg, and at its close was ordered to the department of the Gulf in command of the 13th corps; was ordered to Texas in Nov., 1863, with a portion of the 13th corps, and captured Fort Esperanza, a strong casemated fortification at Pass Cavallo, guarding the entrance to Matagorda Bay; in Apr., 1864, relieved Gen. S. A. Hurlbut in command at Memphis of the district of West Tennessee. This command he held with a short interruption till the close of the war; resigned his commission as major-general June 1, 1865. In 1867 he was again elected to Congress, and re-elected in 1869; in Nov., 1871, was elected governor of Wisconsin for two years. He now resides at Madison, Wis., and is largely engaged in the manufacture of lumber at La Crosse, Wis., and of flour at Minneapolis, Minn.

Washburn (CHARLES AMES), son of Israel Washburn, Sr., b. at Livermore, Me., Mar. 16, 1822; graduated at Bowdoin College 1848; went to California in the spring of 1850; early connected himself with the press of San Francisco, first as editor, and afterward as editor and proprietor, of the *Alta California*; took an active part in the organization of the Republican party there, and his was the first newspaper on the Pacific coast to advocate the distinctive principles of that party; from 1858 to 1861 was

editor and proprietor of the San Francisco *Daily Times*; was chosen an elector at large 1860, and the next year was appointed by Pres. Lincoln minister to Paraguay, where he remained for seven years, and during most of the time of the war between that country and Brazil and its allies. His *History of Paraguay, with Notes of Personal Observations and Reminiscences of Diplomacy under Difficulties* (Boston, 2 vols., 1871), gives a startling account of a strange people who were almost exterminated under the rule of the younger Lopez. (See LOPEZ, FRANCISCO SOLANO.) His exertions to save the lives of his friends and diplomatic associates from the tyrant's indiscriminate rage involved him in the utmost personal danger, and in an accusation of complicity with the pretended "conspiracy" which gave occasion to the massacre of nearly all the Paraguayan and foreign residents above the humblest social position. The circumstances of the violence done to members of his legation (Sept., 1868), and their rescue from impending death through his efforts in compelling the intervention of an American squadron (Dec., 1868), are graphically related in his volumes. His disinterested course under these unparalleled circumstances brought him into collision with several high officers of the U. S. navy, and led to an investigation of the circumstances by the committee of foreign affairs of the House of Representatives, which resulted completely in his favor. He is also the author of several novels, and is the inventor of the "typograph" and several other ingenious machines. Since his return from Paraguay he has resided at Oakland, Cal., and more recently in New York City. PORTER C. BLISS.

Washburn (EDWARD ANIEL), D. D., b. at Boston, Mass., Apr. 16, 1819; graduated at Harvard 1838; studied divinity at Andover and New Haven; was rector of St. Paul's (Episcopal) church, Newburyport, Mass., 1844–51; from 1851–53, after residing six months in China, travelled leisurely homeward through Asia, Egypt, and Europe; was rector of St. John's, Hartford, Conn., 1853–62, and at the same time professor of church polity in the Berkeley Divinity School, Middletown; was rector of St. Mark's, Philadelphia, 1862–65, when he succeeded Bishop Coxe as rector of Calvary church, New York, which position he still (1876) holds. Besides numerous sermons and review articles, he has published *The Social Law of God* (1874). R. D. HITCHCOCK.

Washburn (EMORY), LL.D., b. at Leicester, Mass., Feb. 14, 1800; entered Williams College at the age of thirteen; graduated in 1817; after a course of three years' study at the Harvard Law School was admitted to the bar, and at the age of twenty-one commenced practice at Charlemont, Mass.; afterward removed to his native town of Leicester, and in 1828 settled in Worcester, where he resided for twenty-eight years. In 1825 and 1826 he represented Leicester in the Massachusetts general court, and Worcester in 1838. In 1841 and 1842 was a member of the State senate for Worcester co. He was also nominated for Congress at a time when his party, the Whig, had several thousand majority, but declined the nomination; in 1844 was appointed a judge of the court of common pleas, which office he resigned in 1847. During his absence in Europe in 1852 he was nominated and elected governor of Massachusetts, and was re-elected the ensuing year. The following year the Know-Nothing crusade swept over the State, after which the Whig party never rallied, and the record shows him as the last Whig governor of Massachusetts. He removed to Cambridge in 1856, having been appointed professor of law in the Harvard Law School, which position he held for twenty years, resigning Sept. 1, 1876. Gov. Washburn's published works are numerous, and all of a character showing much thoroughness and research. His *Lectures on the Study and Practice of the Law*, his work on *Easements and Servitudes*, and the more elaborate work in 3 vols. on *The Law of Real Property*, all of which have passed through several editions, are regarded as the highest standard authorities both in the law schools and the courts throughout the country. He has also published a *Judicial History of Massachusetts*, a work of 400 pp., and a *History of Leicester*, of 464 pp., besides many addresses of an historical and genealogical character. His published lectures, orations, and addresses, all evincing high scholarship and close research, would fill several large volumes, and of all the subjects on which he has treated it may be said "he touched nothing which he did not adorn." The comprehensive article in this work on HOMESTEAD LEGISLATION IN THE UNITED STATES was written by him. D. at Cambridge, Mass., March 17, 1877.

Washburn (ISRAEL, SR.), b. in Raynham, Mass., Nov. 18, 1784; moved in 1806 to Maine, and in 1808, in company with Barzillai White, established himself at a point on the Kennebec River then called White's Landing, now Richmond, where he engaged in shipbuilding. In 1809 he established a trading-post at Livermore, Me., at what is now called The Norlands, and soon after moved there, where he settled and had a large family of children, some of whom have held high positions under the national government and by election of the people of their respective States. D. at Livermore Sept. 1, 1876.

Washburn (ISRAEL, JR.), LL.D., son of the preceding, b. at The Norlands, Livermore, Me., June 6, 1813; received a classical education, mostly from private tutors, and studied for the bar, to which he was admitted Oct., 1834; settled in December of that year at Orono, Penobscot co., where he soon had a large practice, which continued till his election to Congress in 1850; was again elected to the four succeeding Congresses. In 1860 he was elected governor of Maine; re-elected in 1861; declining another election, was in 1863 appointed collector of customs for the port of Portland. He is president of the trustees of Tufts College, Mass., and was elected president of the college in 1875, a position he declined to accept. He is a member of several historical and genealogical societies, and in 1874 published *Notes, Historical, Descriptive, and Personal, of Livermore, Me.*

Washburn (PETER THACHER), b. at Lynn, Mass., Sept. 7, 1814; graduate of Dartmouth College, 1835; reporter of the supreme court of Vermont; author of *Vermont Digest* and other legal publications; colonel of Vermont militia; represented Woodstock in the State legislature in 1854 and afterward, and was chairman of judiciary committee; chairman of Vermont delegation to the Chicago Convention of 1860; lieutenant-colonel, and afterward acting colonel, of the 1st Vermont Vols.; commanded the Vermont and Massachusetts troops at the battle of Big Bethel; adjutant and inspector-general of Vermont; elected governor of Vermont, and died while in office, Feb. 7, 1870.

Washburn (SAMUEL BENJAMIN), son of Israel Washburn, Sr., b. at Livermore, Me., Jan. 1, 1824; was a shipmaster in the merchant marine, and was afterward in the lumber-trade in Wisconsin; volunteered for the naval service for the war, and was highly complimented for gallantry and skill by Admiral Rodgers after the battle of Fort Darling. He subsequently commanded a squadron in Berwick Bay, and took part in many engagements.

Washburn (WILLIAM BURRITT), LL.D., b. at Winchendon, Mass., Jan. 31, 1820; graduated at Yale College 1844; engaged in manufacturing in Greenfield, Mass., where he has since resided; was also engaged in banking, and in 1859 was chosen president of the Bank of Greenfield; was elected to the Massachusetts State senate 1850, and a member of the house of representatives 1854. He was nominated as the Republican candidate for Congress for his district in 1862, and had the unusual, if not unprecedented, honor of being elected by a unanimous vote; was re-elected to 39th, 40th, 41st, and 42d Congresses; in 1871 was elected governor of Massachusetts; resigned his seat in the 42d Congress Jan. 1, 1871, to be inaugurated as governor; was re-elected governor in 1872, which office he resigned Apr., 1874, having been elected U. S. Senator to fill the vacancy occasioned by the death of Charles Sumner. His term as Senator expired Mar. 3, 1875. He is now (1876) president of the First National Bank in Greenfield; one of the trustees of Yale College and of the Massachusetts Agricultural College; also a trustee of Smith College at Northampton, Mass., for the education of females, and a member of the board of overseers of Amherst College. The degree of LL.D. was conferred upon him by Harvard College in 1872.

Washburn (WILLIAM DREW), b. at Livermore, Me., Jan. 14, 1831; youngest son of Israel Washburn, Sr.; graduated at Bowdoin College 1854, and having studied law was admitted to the bar 1857; emigrated to Minnesota the same year, and in 1861 was appointed surveyor-general of that State, which office he held during the administration of Pres. Lincoln. Since then he has been one of the largest lumber-dealers and manufacturers in the North-west; is president of the Minneapolis and St. Louis R. R. Co.

Washburne (ELIHU BENJAMIN), b. at Livermore, Me., Sept. 23, 1816, the third son of Israel Washburn, Sr.; early learned the trade of a printer, but gave up type-setting at the age of eighteen and commenced the study of the classics, which he pursued at the academy at Kent's Hill, Readfield, Me.; afterward studied law in Hallowell and Boston and at the Harvard Law School; in 1840 went West, and settled in Galena, Ill., where he commenced the practice of law in company with Charles S. Hempstead, Esq.; in 1852 was elected to Congress, and continued to represent his district till Mar., 1869. At the time of his retirement he was by consecutive elections the oldest member, or, in Congressional parlance, the "father of the House." On the accession of Gen. Grant to the Presidency he was appointed secretary of state, but soon after resigned that position to accept that of minister plenipotentiary to France. He was serving in this capacity at the outbreak of the war between

France and Prussia, and remained at his post during the siege of Paris by the Prussians and the more terrible reign of the Commune, all the other foreign ministers having left their posts at this time, when their presence was most required to protect the lives and property of their respective countrymen. Mr. Washburne sturdily refused to leave, but gave shelter and protection as far as possible to all foreigners who had been abandoned by the ambassadors of their own governments. His firmness and resolution in protecting those unfortunate Germans who were unable to leave Paris won the admiration not only of all persons who were exposed to the trials and dangers of this protracted siege, but of all foreign governments. PORTER C. BLISS.

Washing of Feet, is supposed accordance with the Lord's example and mandate (John xiii. 5 14), is a practice insisted on by some Protestant Christians. In the Roman Catholic Church the pope himself and the bishops and priests of certain dioceses wash the feet of twelve pilgrims once a year on Maunday Thursday, after the celebration of a solemn mass.

Wash'ington, county of S. W. Alabama, bordering on Mississippi, bounded E. by Tombigbee River and traversed by Mobile and Ohio R. R.; surface uneven, soil usually sandy. Staples, cotton, Indian corn, sweet potatoes, and wool. Cap. St. Stephen's. Area, 940 sq. m. P. 3912.

Washington, county of N. W. Arkansas, bordering on the Indian Territory, and drained by the head-streams of Illinois and White rivers; surface varied, soil productive. Cattle, sheep, and swine numerous. Staples, Indian corn, wheat, tobacco, and wool. Cap. Fayetteville. Area, 870 sq. m. P. 17,266.

Washington, formerly a county of the District of Columbia. (See DISTRICT OF COLUMBIA.)

Washington, county of W. Florida, bordering on the Gulf of Mexico; surface undulating, soil poor on the coast, good in the interior. Live-oak abounds and is largely exported. Staples, Indian corn, sweet potatoes, tobacco, cotton, and sugar. Cap. Vernon. Area, about 1100 sq. m. P. 2302.

Washington, county of E. Georgia, lying between Oconee and Ogeechee rivers, and intersected by Georgia Central R. R.; surface diversified, soil fertile. Many fossils have been found in caves. Cattle and swine are numerous. Staples, cotton and Indian corn. Cap. Sandersville. Area, 760 sq. m. P. 15,842.

Washington, county of S. W. Illinois, drained by Kaskaskia River, and traversed by Illinois Central and St. Louis and South-eastern R. Rs.; surface level, with considerable woodland, soil fertile. There are flour-mills, saw-mills, and manufactories of carriages and agricultural implements. Live-stock numerous. Staples, Indian corn, wheat, oats, wool, and hay. Cap. Nashville. Area, 580 sq. m. P. 17,599.

Washington, county of S. Indiana, drained by Lost River, which runs for a considerable distance under ground, and Great Blue River, and traversed by Louisville New Albany and Chicago R. R.; surface generally undulating, but rising in the E. part to hills; soil fertile. There are flour-mills, saw-mills, tanneries, and manufactories of carriages, clothing, and furniture. Live-stock numerous. Staples, Indian corn, wheat, oats, leather, lumber, wool, and dairy products. Cap. Salem. Area. 510 sq. m. P. 18,495.

Washington, county of S. E. Iowa, drained by Iowa, Skunk, and Eagle rivers, and traversed by Chicago Rock Island and Pacific R. R.; surface level, with woodland and prairie, soil fertile. There are flour-mills and saw-mills, and manufactures of woollen goods, agricultural implements, furniture, and iron castings. Live-stock numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Washington. Area, 556 sq. m. P. 18,952.

Washington, county of N. E. Kansas, bordering on Nebraska, and watered by Little Blue River; surface rolling prairie-land, with wooded river-bottoms; soil moderately fertile. Staples, Indian corn, wheat, and hay. Cap. Washington. Area, about 900 sq. m. P. 4081.

Washington, county of Central Kentucky, drained by Lick Creek; surface undulating, soil fertile. Live-stock numerous. Staples, Indian corn, wheat, oats, wool, hay, tobacco, and dairy products. Cap. Springfield. Area, 550 sq. m. P. 12,461.

Washington, parish of S. E. Louisiana, bordering upon Mississippi, from which it is separated by Pearl River; surface generally undulating, soil sandy and moderately fertile. Staples, cotton, Indian corn, sweet potatoes, and wool. Cap. Franklinton. Area, about 700 sq. m. P. 3330.

Washington, county of S. E. Maine, upon the Atlantic Ocean, separated from New Brunswick by St. Croix River, drained by the Machias and Schoodic rivers, and traversed by European and North American, St. Croix and Penobscot, and Whitneyville and Machinsport R. Rs. The surface is generally undulating, with numerous lakes, some of considerable size, and the coast line, which is nearly 80 miles long, is indented by many bays and inlets. The soil in the interior is moderately fertile. There are more than 300 manufacturing establishments, including shipyards, saw-mills, tanneries, cooperage, carriages, fish curing, iron, sails, and machinery. Cattle and sheep are numerous. Staples, manufactured articles, lumber, oats, potatoes, wool, hay, and dairy products. Cap. Machias. Area, about 2700 sq. m. P. 43,343.

Washington, county of N. W. Maryland, bordering on Pennsylvania and on Virginia, from which it is separated by the Potomac, intersected by Antietam and Licking creeks, and traversed by Chesapeake and Ohio Canal, Baltimore and Ohio, and Cumberland Valley and Western Maryland R. Rs.; surface hilly, soil in parts fertile. There are manufactures of agricultural implements, furniture, carriages, iron, tinware, paper, and cement; flour mills, saw-mills, tanneries, and distilleries. Cattle, swine, sheep, and horses are numerous. Staples, wheat, Indian corn, oats, wool, leather, and dairy products. The battle of Antietam was fought in this county (Sept. 17, 1862) between the Union army under Gen. McClellan and the Confederates under Gen. Lee. Cap. Hagerstown. Area, 520 sq. m. P. 34,712.

Washington, county of E. Minnesota, bordering on Wisconsin, bounded S. by the Mississippi, and traversed by Lake Superior and Mississippi, North Wisconsin, and West Wisconsin R. Rs.; surface diversified, and containing many small lakes; soil fertile. There are saw-mills, flour-mills, and breweries. Live-stock not numerous. Staples, wheat, oats, and Indian corn. Cap. Stillwater. Area, 380 sq. m. P. 11,809.

Washington, county of W. Mississippi, separated from Arkansas by Mississippi River, and intersected by Sunflower River, Steele Bayou, and Deer Creek; surface low, liable to overflow, and containing many small ponds and lagoons; soil very fertile. Staples, cotton, Indian corn, and oats. Cap. Greenville. Area, 1220 sq. m. P. 14,569.

Washington, county of S. E. Missouri, lying between Big and Maramec rivers, and traversed by St. Louis and Iron Mountain R. R. The surface is hilly and rugged, and abounds in mineral wealth, Iron Mountain, near the S. W. corner, being a mass of magnetic iron ore; copper, lead, plumbago, and copperas are also found. There are saw-mills, lead-furnaces, and ironworks. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, and wool. Cap. Potosi. Area, 870 sq. m. P. 11,719.

Washington, county of E. Nebraska, separated from Iowa by Missouri River, and traversed by Omaha and North-western and Sioux City and Pacific R. Rs.; surface undulating, soil fertile, with timber along the streams. Staples, Indian corn, wheat, and oats. Cap. Blair. Area, about 400 sq. m. P. 4452.

Washington, county of E. New York, bordering on Vermont, from which it is partly separated by Lake Champlain, touching upon the Hudson River and Lake George, and traversed by Champlain Canal and Rensselaer and Saratoga R. R.; surface generally mountainous or hilly, containing iron ore, lead, marble, slate, and limestone. There are more than 400 manufacturing establishments, including agricultural implements, carriages, machinery, iron, woollen goods, marble and stone work, stone and earthen ware, flax, and paper; saw-mills, planing-mills, tanneries, and flour-mills. Cattle and sheep are very numerous. Staples, potatoes, oats, Indian corn, hay, flax, wool, and dairy products. Caps. Salem and Sandy Hill. Area, 850 sq. m. P. 49,568.

Washington, county of E. North Carolina, bordering on Albemarle Sound; surface level and swampy, abounding in valuable red cedar and cypress timber. Staples, lumber, Indian corn, cotton, and sweet potatoes. Cap. Plymouth. Area, 360 sq. m. P. 6516.

Washington, county of S. E. Ohio, separated from West Virginia by Ohio River, intersected by Muskingum River, and traversed by Marietta and Cincinnati and Marietta and Pittsburg R. Rs.; surface diversified, abounding in bituminous coal and iron ore; soil fertile. There are flour-mills, saw-mills, planing-mills, tanneries, and manufactories of boots and shoes, furniture, cooperage, iron, and woollen goods. Cattle, sheep, and swine are numerous. Staples, tobacco, Indian corn, wheat, oats, potatoes, hay, wool, and dairy products. Cap. Marietta. Area, 713 sq. m. P. 40,609.

Washington, county of N. W. Oregon, bounded E. by Willamette River, and bordering W. on the Coast Range,

watered by Tualatin and other rivers, and traversed by Oregon Central R. R.; surface diversified, with prairies and timber-land, and abounding in iron ore; soil usually fertile. Staples, wheat, oats, wool, and hay. Cap. Hillsborough. Area, 750 sq. m. P. 4261.

Washington, county of S. W. Pennsylvania, bordering on West Virginia, bounded E. by Monongahela River, and traversed by several railroads. The surface is generally hilly, and well adapted to grazing; soil in the valleys a rich dark loam. There are many manufactories, including those of carriages, furniture, saddlery, and woollen goods; flour-mills, saw-mills, planing-mills, tanneries, and distilleries. Live-stock, especially sheep, are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Washington. Area, 888 sq. m. P. 48,483.

Washington, county of S. Rhode Island, bounded E. by Narragansett Bay, S. by the Atlantic Ocean, drained by Pawcatuck River, and traversed by Stonington and Providence R. R.; surface hilly, soil tolerably productive. There are numerous manufactories of cotton and woollen goods. Staples, manufactured goods, with some potatoes, Indian corn, hay, wool, and dairy products. Cap. Kingston. Area, 367 sq. m. P. 20,097.

Washington, county of N. E. Tennessee, separated from North Carolina by Bald Mountain, drained by Watauga and Nolinchy rivers, and traversed by East Tennessee Virginia and Georgia R. R.; surface diversified by hills and valleys, abounding in iron ore, with traces of bituminous coal. There are many cattle, sheep, and swine. Staples, Indian corn, wheat, oats, tobacco, and hay. Cap. Jonesborough. Area, 439 sq. m. P. 16,317.

Washington, county of S. E. Texas, lying W. of Brazos River, and traversed by Houston and Texas Central R. R.; surface undulating, soil generally fertile, with much live oak and red cedar. Horses, cattle, and swine are numerous. Staples, cotton, Indian corn, and sweet potatoes. Cap. Brenham. Area, 726 sq. m. P. 23,104.

Washington, county of S. W. Utah, bordering on Nevada and Arizona, watered by Rio Virgin and Santa Clara rivers, and having the Wahsatch Mountains on the N. Surface varied, soil generally unproductive, but with some fertile lands along the streams. Some gold has been found. Cattle and sheep are the principal live-stock. Staples, wheat, Indian corn, and wool. Cap. St. George. Area, 1890 sq. m. P. 3061.

Washington, county of N. Vermont, drained by Onion River and its affluents, and traversed by Vermont Central R. R.; surface broken, and in parts mountainous, but well adapted to pasturage. There are many saw-mills, tanneries, manufactories of agricultural implements, carriages, saddlery, machinery, and woollen goods. Cattle and sheep are numerous. Staples, potatoes, oats, Indian corn, maple-sugar, hay, and dairy products. Cap. Montpelier, which is also the capital of the State. Area, 580 sq. m. P. 26,520.

Washington, county of S. W. Virginia, bordering on Tennessee, intersected by the forks of Holston River, and traversed by Atlantic Mississippi and Ohio R. R. The surface is hilly, with an abundance of bituminous coal, iron, and gypsum, and there are several valuable salt-wells. There are saw-mills, tanneries, wool-carding and pork-packing establishments, and manufactories of furniture and carriages. There are many cattle, sheep, and swine. Staples, Indian corn, wheat, oats, wool, tobacco, and dairy products. Cap. Abingdon. Area, 529 sq. m. P. 16,816.

Washington, county of S. E. Wisconsin, drained by Milwaukee and other rivers, and traversed by Milwaukee and St. Paul R. R.; surface generally level, with several small lakes, and abounding in limestone suitable for building, with some iron; soil very productive. There are saw-mills, flour-mills, and manufactories of agricultural implements, furniture, carriages, and saddlery. Live-stock numerous. Staples, wheat, oats, Indian corn, hay, wool, and dairy products. Cap. West Bend. Area, 432 sq. m. P. 23,919.

Washington, tp., Bradley co., Ark. P. 655.

Washington, tp., Conway co., Ark. P. 487.

Washington, p.-v., cap. of Hempstead co., Ark.

Washington, tp., Independence co., Ark. P. 869.

Washington, tp., Jefferson co., Ark. P. 231.

Washington, tp., Ouachita co., Ark. P. 401.

Washington, tp., Sevier co., Ark. P. 619.

Washington, tp., Sharpe co., Ark. P. 503.

Washington, tp., Van Buren co., Ark. P. 117.

Washington, tp., Alameda co., Cal. P. 3019.

Washington, p.-v. and tp., Nevada co., Cal. P. 638.

Washington, tp., Plumas co., Cal. P. 520.

Washington, tp., Sonoma co., Cal. P. 548.

Washington, tp., Stanislaus co., Cal. P. 281.

Washington, tp., Yolo co., Cal. P. 809.

Washington, p.-v. and tp., Litchfield co., Conn. P. 1563.

Washington, p.-v., cap. of Wilkes co., Ga., on a branch of Georgia R. R., has a newspaper. P. 1506.

Washington, p.-v., Idaho co., Id.

Washington, tp., Carroll co., Ill. P. 603.

Washington, p.-v. and tp., Tazewell co., Ill., on Toledo Peoria and Warsaw, western division of Chicago and Alton, and Chicago Pekin and South-western R. Rs., 12 miles E. of Peoria, contains 6 churches, 3 excellent graded schools, a library association, 2 banks, 3 large elevators, 7 wagon, carriage, and furniture establishments, 2 hotels, and 1 newspaper. P. of v. 1607; of tp. 3456.
THOMAS HANDSAKER, ED. "HERALD."

Washington, tp., Will co., Ill. P. 1564.

Washington, tp., Adams co., Ind. P. 1846.

Washington, tp., Allen co., Ind. P. 1628.

Washington, tp., Blackford co., Ind. P. 1008.

Washington, tp., Boone co., Ind. P. 1391.

Washington, tp., Brown co., Ind. P. 2187.

Washington, tp., Carroll co., Ind. P. 920.

Washington, tp., Cass co., Ind. P. 1220.

Washington, tp., Clarke co., Ind. P. 1357.

Washington, tp., Clay co., Ind. P. 1867.

Washington, tp., Clinton co., Ind. P. 1692.

Washington, city and tp., cap. of Daviess co., Ind., on Ohio and Mississippi R. R., equidistant from Cincinnati and St. Louis, contains 6 churches, good schools, and 2 newspapers. There are 7 extensive coal-mines worked here, and large quantities of cannel and bituminous coal, flour and small grains, besides numbers of cattle, horses, and hogs, are shipped from this point. P. of city, 2901; of tp. 4956. S. F. HORRALL, ED. "GAZETTE."

Washington, tp., Dearborn co., Ind. P. 510.

Washington, tp., Decatur co., Ind. P. 4591.

Washington, tp., Delaware co., Ind. P. 1190.

Washington, tp., Eikhart co., Ind. P. 1391.

Washington, tp., Gibson co., Ind. P. 757.

Washington, tp., Grant co., Ind. P. 1139.

Washington, tp., Greene co., Ind. P. 640.

Washington, tp., Hamilton co., Ind. P. 3590.

Washington, tp., Harrison co., Ind. P. 1176.

Washington, tp., Hendricks co., Ind. P. 1502.

Washington, tp., Jackson co., Ind. P. 960.

Washington, tp., Knox co., Ind. P. 1537.

Washington, tp., Kosciusko co., Ind. P. 2288.

Washington, tp., Marion co., Ind. P. 2439.

Washington, tp., Miami co., Ind. P. 1306.

Washington, tp., Monroe co., Ind. P. 990.

Washington, tp., Morgan co., Ind. P. 3151.

Washington, tp., Newton co., Ind. P. 983.

Washington, tp., Noble co., Ind. P. 766.

Washington, tp., Owen co., Ind. P. 2517.

Washington, tp., Parke co., Ind. P. 1213.

Washington, tp., Pike co., Ind. P. 2363.

Washington, tp., Porter co., Ind. P. 647.

Washington, tp., Putnam co., Ind. P. 1843.

Washington, tp., Randolph co., Ind. P. 2051.

Washington, tp., Ripley co., Ind. P. 1206.

Washington, tp., Rush co., Ind. P. 1148.

Washington, tp., Shelby co., Ind. P. 1390.

Washington, tp., Starke co., Ind. P. 546.

Washington, tp., Tippecanoe co., Ind. P. 1376.

Washington, tp., Warren co., Ind. P. 1251.

Washington, tp., Washington co., Ind. P. 4172.

Washington, tp., Wayne co., Ind. P. 2010.

Washington, tp., Whitley co., Ind. P. 1246.

Washington, tp., Adair co., Ia. P. 495.

Washington, tp., Adams co., Ia. P. 535.

Washington, tp., Appanoose co., Ia. P. 1873.

Washington, tp., Black Hawk co., Ia. P. 548.

Washington, tp., Bremer co., Ia. P. 948.

Washington, tp., Buchanan co., Ia. P. 1259.
Washington, tp., Butler co., Ia. P. 402.
Washington, tp., Chickasaw co., Ia. P. 668.
Washington, tp., Clarke co., Ia. P. 591.
Washington, tp., Clinton co., Ia. P. 995.
Washington, tp., Dallas co., Ia. P. 468.
Washington, tp., Des Moines co., Ia. P. 1081.
Washington, tp., Dubuque co., Ia. P. 963.
Washington, tp., Franklin co., Ia. P. 1079.
Washington, tp., Greene co., Ia. P. 1111.
Washington, tp., Iowa co., Ia. P. 619.
Washington, tp., Jackson co., Ia. P. 1051.
Washington, tp., Jasper co., Ia. P. 498.
Washington, tp., Johnson co., Ia. P. 933.
Washington, tp., Jones co., Ia. P. 860.
Washington, tp., Keokuk co., Ia. P. 1467.
Washington, tp., Lee co., Ia. P. 1075.
Washington, tp., Linn co., Ia. P. 1483.
Washington, tp., Lucas co., Ia. P. 753.
Washington, tp., Marion co., Ia. P. 1285.
Washington, tp., Marshall co., Ia. P. 806.
Washington, tp., Montgomery co., Ia. P. 426.
Washington, tp., Page co., Ia. P. 606.
Washington, tp., Polk co., Ia. P. 640.
Washington, tp., Poweshiek co., Ia. P. 626.
Washington, tp., Ringgold co., Ia. P. 518.
Washington, tp., Story co., Ia. P. 1666.
Washington, tp., Taylor co., Ia. P. 401.
Washington, tp., Van Buren co., Ia. P. 1036.
Washington, tp., Wapello co., Ia. P. 1596.
Washington, tp., Warren co., Ia. P. 3379.

Washington, city and tp., cap. of Washington co., Ia., on Chicago and Rock Island and Chicago and Southwestern R. Rs., was settled in 1835, and contains 12 churches, an academy and high schools, 2 steam-elevators and flouring-mills, 2 newspapers, a conversational club and free home lectures, 2 woollen-mills, 2 foundries and machine-shops, and 2 carriage establishments. Business, chiefly agriculture. P. of city, 2575; of tp. 4013.
H. A. Burrell, Prop. "Washington County Press."

Washington, tp., Wayne co., Ia. P. 693.
Washington, tp., Webster co., Ia. P. 765.
Washington, tp., Winneshiek co., Ia. P. 1460.
Washington, tp., Anderson co., Kan. P. 427.
Washington, tp., Crawford co., Kan. P. 595.
Washington, tp., Doniphan co., Kan. P. 2513.
Washington, p.-v. and tp., cap. of Washington co., Kan. P. 1238.
Washington, p.-v., Mason co., Ky. P. 240.
Washington, p.-v., St. Landry parish, La. P. 907.
Washington, p.-v. and tp., Knox co., Me. P. 1276.
Washington, p.-v. and tp., Berkshire co., Mass. P. 694.
Washington, tp., Gratiot co., Mich. P. 551.
Washington, p.-v. and tp., Macomb co., Mich. P. 2057.
Washington, tp., Sanilac co., Mich. P. 370.
Washington, tp., Le Sueur co., Minn. P. 359.
Washington, tp., Buchanan co., Mo. P. 3042.
Washington, tp., Cedar co., Mo. P. 978.
Washington, tp., Clarke co., Mo. P. 1316.
Washington, tp., Clay co., Mo. P. 2609.
Washington, tp., Dallas co., Mo. P. 1470.
Washington, tp., Daviess co., Mo. P. 810.
Washington, tp., De Kalb co., Mo. P. 2029.
Washington, tp., Douglas co., Mo. P. 213.

Washington, p.-v. and tp., Franklin co., Mo., on the S. bank of Missouri River, 54 miles W. of St. Louis by Missouri Pacific R. R., which passes directly through the town, has 7 churches, including the Roman Catholic (St. Borgia's); a fine public school building, the Jeffries High School; a convent, with a school for young ladies within the building and under the charge of the sisters; a Roman Catholic parochial school; a free Lutheran school; 1 bank (savings institution), 2 weekly newspapers (German and English), 2 steam merchant flouring-mills (capacity of 200 barrels per day), 1 steam planing and saw mill, with door, sash, and blind factory attached, 1 tannery, 2 packing-houses (beef and pork), and 4 hotels and several boarding-houses. A steam-ferry plies across the Missouri River daily. There are two inexhaustible clay banks adjoining the town of fire and potter's clay, large quantities of which are shipped to St. Louis. The site of the town proper is on a high ridge running parallel with the river, and is the healthiest locality in the State. The town is improving quite rapidly. The people are sociable, well educated, and fond of social amusements. The Turnvereins have a very roomy hall. The trade of the town is large, and it ships more produce than any other point on the railroad between St. Louis and Kansas City. P. 5614.
Edward N. Parker, Ed. "Franklin Co. Observer."

Washington, tp., Grundy co., Mo. P. 1014.
Washington, tp., Harrison co., Mo. P. 469.
Washington, tp., Jackson co., Mo. P. 2305.
Washington, tp., Johnson co., Mo. P. 2992.
Washington, tp., Lafayette co., Mo. P. 2533.
Washington, tp., Mercer co., Mo. P. 808.
Washington, tp., Monroe co., Mo. P. 1512.
Washington, tp., Nodaway co., Mo. P. 1058.
Washington, tp., Osage co., Mo. P. 1591.
Washington, tp., Pettis co., Mo. P. 1753.
Washington, tp., Ripley co., Mo. P. 680.
Washington, tp., St. Clair co., Mo. P. 599.
Washington, tp., Stone co., Mo. P. 506.
Washington, tp., Webster co., Mo. P. 1438.
Washington, tp., Nemaha co., Neb. P. 323.
Washington, p.-v. and tp., Sullivan co., N. H. P. 839.
Washington, tp., Bergen co., N. J. P. 2514.
Washington, tp., Burlington co., N. J. P. 609.
Washington, tp., Camden co., N. J. P. 1567.
Washington, tp., Mercer co., N. J. P. 1294.
Washington, tp., Morris co., N. J. P. 2484.
Washington, p.-b. and tp., Warren co., N. J. P. of b. 1880; of tp. 4040.
Washington, tp., Dutchess co., N. Y. P. 2792.

Washington, seaport, p.-v. and tp., cap. of Beaufort co., N. C., at the head of Pamlico River, about 80 miles from the ocean, contains 4 churches, excellent schools, 1 newspaper, 3 benevolent institutions, 1 bank, 2 hotels, 1 carriage-manufactory, 2 shipyards, 1 block and pump factory, 1 saw and 2 grist mills, and several fisheries. The town was nearly destroyed by fire during the late war. P. of v. 2091; of tp. 3301. Richard Granger, Ed. "Echo."

Washington, tp., Guilford co., N. C. P. 823.
Washington, tp., Nash co., N. C. P. 2139.
Washington, tp., Auglaize co., O. P. 840.
Washington, tp., Belmont co., O. P. 1367.
Washington, tp., Brown co., O. P. 1082.
Washington, tp., Carroll co., O. P. 740.
Washington, tp., Clermont co., O. P. 2818.
Washington, tp., Clinton co., O. P. 1250.
Washington, tp., Columbiana co., O. P. 2228.
Washington, tp., Coshocton co., O. P. 768.
Washington, tp., Darke co., O. P. 1537.
Washington, tp., Defiance co., O. P. 1016.
Washington, v., Fayette co., O. P. 2117.
Washington, tp., Franklin co., O. P. 1334.
Washington, tp., Guernsey co., O. P. 712.
Washington, tp., Hancock co., O. P. 1579.
Washington, tp., Hardin co., O. P. 883.
Washington, tp., Harrison co., O. P. 1098.
Washington, tp., Henry co., O. P. 1141.
Washington, tp., Highland co., O. P. 972.
Washington, tp., Hocking co., O. P. 1534.
Washington, tp., Holmes co., O. P. 1285.
Washington, tp., Jackson co., O. P. 1133.
Washington, tp., Lawrence co., O. P. 1446.
Washington, tp., Licking co., O. P. 1252.
Washington, tp., Logan co., O. P. 812.
Washington, tp., Lucas co., O. P. 1549.
Washington, tp., Mercer co., O. P. 1148.
Washington, tp., Miami co., O. P. 1305.
Washington, tp., Monroe co., O. P. 1720.
Washington, tp., Montgomery co., O. P. 1758.
Washington, tp., Morrow co., O. P. 916.

Washington, tp., Muskingom co., O. P. 1242.
Washington, tp., Paulding co., O. P. 957.
Washington, tp., Pickaway co., O. P. 996.
Washington, tp., Preble co., O. P. 3414.
Washington, tp., Richland co., O. P. 1496.
Washington, tp., Sandusky co., O. P. 2282.
Washington, tp., Scioto co., O. P. 1085.
Washington, tp., Shelby co., O. P. 1092.
Washington, tp., Stark co., O. P. 1980.
Washington, tp., Tuscarawas co., O. P. 1113.
Washington, tp., Union co., O. P. 819.
Washington, tp., Van Wert co., O. P. 2241.
Washington, tp., Warren co., O. P. 1229.
Washington, p.-v., Wills tp., Washington co., O. P. 554.
Washington, tp., Wood co., O. P. 1321.
Washington, tp., Armstrong co., Pa. P. 1180.
Washington, tp., Berks co., Pa. P. 1609.
Washington, tp., Butler co., Pa. P. 996.
Washington, tp., Cambria co., Pa. P. 1904.
Washington, tp., Clarion co., Pa. P. 1240.
Washington, tp., Dauphin co., Pa. P. 1255.
Washington, tp., Erie co., Pa. P. 1943.
Washington, tp., Fayette co., Pa. P. 1065.
Washington, tp., Franklin co., Pa. P. 2364.
Washington, tp., Greene co., Pa. P. 765.
Washington, tp., Indiana co., Pa. P. 1466.
Washington, tp., Jefferson co., Pa. P. 1124.
Washington, b., Lancaster co., Pa. P. 673.
Washington, tp., Lawrence co., Pa. P. 612.
Washington, tp., Lehigh co., Pa. P. 2464.
Washington, tp., Lycoming co., Pa. P. 1122.
Washington, tp., Northampton co., Pa. P. 801.
Washington, tp., Schuylkill co., Pa. P. 1313.
Washington, tp., Snyder co., Pa. P. 1541.
Washington, p.-b., South Strabane tp., cap. of Washington co., Pa., on Chartiers Creek and on Pittsburg Cincinnati and St. Louis (Chartiers branch) and Baltimore and Ohio R. Rs., has 11 churches, 2 banks, 3 weekly newspapers, 2 iron-foundries, woollen, coach, and other factories, a female seminary, and several schools, and is the seat of Washington and Jefferson College. P. 3571.
Washington, tp., Westmoreland co., Pa. P. 1416.
Washington, tp., Wyoming co., Pa. P. 793.
Washington, tp., York co., Pa. P. 1444.
Washington, tp., Edgefield co., S. C. P. 1025.
Washington, p.-v., cap. of Rhea co., Tenn. P. 223.
Washington, p.-v., Washington co., Ut.
Washington, p.-v. and tp., Orange co., Vt. P. 1113.
Washington, tp., Alexander co., Va. P. 555.
Washington, tp., Norfolk co., Va. P. 2124.
Washington, p.-v., cap. of Rappahannock co., Va.
Washington, tp., Richmond co., Va. P. 1760.
Washington, tp., Westmoreland co., Va. P. 2467.
Washington, tp., Boone co., West Va. P. 1015.
Washington, tp., Braxton co., West Va. P. 1395.
Washington, tp., Calhoun co., West Va. P. 582.
Washington, tp., Jackson co., West Va. P. 1449.
Washington, tp., Kanawha co., West Va. P. 1065.
Washington, tp., Lincoln co., West Va. P. 543.
Washington, tp., Marshall co., West Va. P. 993.
Washington, tp., Ohio co., West Va. P. 533.
Washington, tp., Pleasants co., West Va. P. 820.
Washington, tp., Upshur co., West Va. P. 1016.
Washington, tp., Door co., Wis. P. 384.
Washington, tp., Eau Claire co., Wis. P. 527.
Washington, tp., Green co., Wis. P. 901.
Washington, tp., La Crosse co., Wis. P. 870.
Washington, tp., Sauk co., Wis. P. 1012.
Washington, tp., Shawano co., Wis. P. 71.

Washington (Bushrod), LL.D., nephew of Gen. George, b. in Westmoreland co., Va., June 5, 1762; graduated at William and Mary College 1778; studied law with James Wilson at Philadelphia; commenced practice in his native county 1780; served as a private soldier at Yorktown 1781; was a member of the Virginia house of delegates 1787, of the Virginia convention to ratify the U. S. Constitution 1788; afterward practised law at Alexandria and at Richmond; was appointed by Pres. Adams an associate justice of the U. S. Supreme Court Dec. 20, 1798; inherited from his uncle the Mount Vernon estate 1799, and was the first president of the American Colonization Society. D. at Philadelphia Nov. 26, 1829. He published *Reports of the Virginia Court of Appeals 1790–96* (2 vols., 1798–99) and *Reports of the U. S. Circuit Court, Third Circuit, 1803–27* (4 vols., 1826–29), the latter being edited by R. Peters.

Washington (George), first President of the U. S., b. in Washington parish, Westmoreland co., Va., near the junction of Pope's Creek with the Potomac River, Feb. 22 (O. S. 11), 1732, being the son of Augustine Washington by his second wife, Mary Ball, daughter of Col. Ball of Lancaster co., Va. Of Washington's English ancestry, though much has been written, nothing is known with certainty, since recent researches have proved the defectiveness of the genealogies which were formerly thought to trace his lineal descent from the ancient family of the name at Washington Manor, Durham, or that at Sulgrave, Northampton. The first American ancestor, John Washington, came to Virginia about 1657, and became a prosperous planter in the "Northern Neck," or district between the Potomac and Rappahannock rivers. He served as a colonel in expeditions against the Indians, and married Ann Pope of the family which gave name to Pope's Creek, by whom he had two sons, Lawrence and John. Lawrence married Mildred Warner of Gloucester co., and had three children, John, Augustine, and Mildred. Augustine first married Jane Butler, who bore him four children, of whom two sons, Lawrence and Augustine, reached maturity. Of six children by the second marriage, George was the eldest, the others being Betty, Samuel, John Augustine, Charles, and Mildred, of whom the youngest died in infancy. Little is known of the early years of Washington, beyond the fact that the house in which he was born was burned during his early childhood, and that his father thereupon removed to another farm, inherited from his paternal ancestors, situated in Stafford co., on the N. bank of the Rappahannock, nearly opposite Fredericksburg, where he acted as agent of the Principio Ironworks in the immediate vicinity, and died there in 1743. The well-known anecdotes of Washington's boyhood in connection with his father's teachings cannot be accepted with any confidence, as they rest exclusively upon the statements of one biographer, the eccentric Mason L. Weems. Left an orphan at the age of twelve years, he inherited the paternal residence, while his elder half-brother, Lawrence, inherited the large estate on Hunting Creek, afterward known as Mount Vernon. The early education of George was somewhat defective, being confined to the elementary branches taught him by his mother and at a neighboring school. He developed, however, a fondness for mathematics, and enjoyed in that branch the instructions of a private teacher. On leaving school he resided for some months at Mount Vernon with his brother Lawrence, who acted as his guardian, and who had married a daughter of his neighbor at Belvoir on the Potomac, the wealthy William Fairfax, for some time president of the executive council of the colony. Both Fairfax and his son-in-law, Lawrence Washington, had served with distinction in 1740 as officers of an American battalion at the siege of Carthagena, and were friends and correspondents of Admiral Vernon, for whom the latter's residence on the Potomac had been named. George's inclinations were for a similar career, and a midshipman's warrant was procured for him, probably through the influence of the admiral, but, through the opposition of his mother, the project was abandoned. The family connection with the Fairfaxes, however, opened another career for the young man, who at the age of sixteen was appointed surveyor to the immense estates of the eccentric Lord Fairfax, the head of the family, who was then on a visit at Belvoir, and who shortly afterward established his baronial residence at Greenway Court, in the Shenandoah Valley. Three years were passed by young Washington in a rough frontier life, gaining experience which afterward proved very essential to him. In 1751, when the Virginia militia were put under training with a view to active service against France, Washington, though only nineteen years of age, was appointed adjutant with the rank of major. In September of that year the failing health of Lawrence Washington rendered it necessary for him to seek a milder climate, and George accompanied him in a voyage to Barbadoes. They returned early in 1752, and Lawrence shortly afterward died, leaving his large property to an infant daughter. George was named in his will as one of the executors and as eventual heir to Mount Vernon, and by the death of the infant niece soon succeeded to that estate. On the arrival of Robert Dinwiddie as lieutenant-governor of Virginia in 1752, the militia was reorganized, and the province divided into four military dis-

tricts. Washington was commissioned by Dinwiddie adjutant-general of the northern district in 1753, and in November of that year a most important as well as hazardous mission was assigned him. This was to proceed to the Canadian posts recently established on French Creek near Lake Erie (in North-western Pennsylvania) to demand, in the name of the king of England, the withdrawal of the French from a territory claimed by Virginia. This enterprise had been declined by more than one officer, since it involved a journey through an extensive and almost unexplored wilderness in the occupancy of savage Indian tribes, either hostile to the English or of doubtful attachment. Major Washington, however, accepted the commission with alacrity, and, accompanied by Capt. Gist, the pioneer settler on the Monongahela, he reached Fort Le Bœuf on French Creek, delivered his despatches, and received the reply; which, of course, was a polite refusal to surrender the posts. On their return, Washington and Gist narrowly escaped death through the treachery of an Indian guide, and again by the shattering of a raft in the ice in the Allegheny River near the present site of Pittsburg. Washington's journal of this perilous expedition, prepared for the information of Lieut. Gov. Dinwiddie, was by him sent to London, where it was published, and deservedly raised its author in public esteem. The answer of the commander of the French posts near Lake Erie was of such a character as to induce the assembly of Virginia to authorize the executive to raise a regiment of 300 men for the purpose of maintaining the asserted rights of the British crown over the territory claimed. As Washington declined to be a candidate for that post, the command of this regiment was given to Col. Joshua Fry, professor of mathematics at William and Mary College, and Major Washington, at his own request, was commissioned lieutenant-colonel. On the march to the Ohio, while at head-quarters at the mouth of Will's Creek, Md. (afterwards the site of Fort Cumberland), news was received that a party previously sent to build a fort at the confluence of the Monongahela with the Ohio had been driven back (Apr. 7, 1754) by a considerable French force, which had completed the work there begun, and named it Fort Duquesne in honor of the marquis Duquesne, then governor of Canada. This was the beginning of the great "French and Indian war," which continued seven years. Washington was sent forward with 150 men to retrieve this loss, but, being unsupported by the promised reinforcements, was unable to make a formal attack upon the fort. Meanwhile, he succeeded to the command of the regiment by the death of Col. Fry, and had a successful engagement with an advanced party of French, but, being afterward surrounded by overwhelming numbers of French and Indians within a post he had thrown up on the "Great Meadows," and named "Fort Necessity," was at last obliged to sign a capitulation, surrendering his artillery (July 4, 1754), and returned thereafter to Virginia. In the course of the following winter orders were received "for settling the rank of His Majesty's forces when serving with the provincials in North America," which being deemed by Washington derogatory to the merits of the provincial officers, he indignantly resigned his commission and retired to Mount Vernon. In the spring of 1755, Gen. Edward Braddock arrived in Virginia with two British regiments as a nucleus for a formal campaign against the French on the Ohio; and that officer, being informed of the services of Col. Washington and his extensive knowledge of the destined theatre of operations, persuaded him to join his military family as a volunteer aide-de-camp. The well-known result of this campaign, and the distinguished part borne in it by Col. Washington in saving the shattered remnants of the army from the field where Braddock and all his chief officers had fallen (July 9, 1755), need no elaborate notice here. His conduct was the theme of general praise, and the Virginia assembly, having hastily directed the enlistment of a regiment of sixteen companies for the defence of the province, commissioned Washington as commander-in-chief of all the forces raised and to be raised in the colony, with authority to appoint his own officers. Soon after this, Lord Loudon, who was sent out from England as the commander-in-chief of the British forces in the colonies, visited Virginia. Washington submitted to him a detailed account of the late operations against the French on the Ohio, assigning the reasons of their failure. He urged an active campaign with increased forces. To impress more effectually his views upon Lord Loudon, he visited that nobleman during the ensuing winter at Philadelphia, where he had convened the governors of Pennsylvania, Maryland, and North Carolina and the lieutenant-governor of Virginia to consult with them in relation to the ensuing campaign. Washington was disappointed in his hope and object. Loudon determined to direct all his efforts against Canada. Instead of receiving assistance, Virginia was required to send aid to South Carolina against Indian outbreaks in that colony. Washington, however, did not abandon his object, and urged upon the Virginia authorities the importance not only of passing a more effective militia law, but of increasing the number of her regular troops. In this, however, he was again disappointed. He was compelled to do the best he could with the inadequate forces under his command in defence of an Indian frontier of about 400 miles. In the latter part of 1757, Lord Loudon returned to England, and Gen. Abercrombie succeeded to the command of the British forces in the colonies. The department of the middle and southern provinces was committed to Gen. Forbes, who to Washington's great gratification determined to undertake an expedition against Fort Duquesne. Washington urged a quick movement and an early campaign, but was disappointed in both respects, and also as to the route by which the general determined to advance. Instead of taking, as he should have done, the old Braddock road across the mountains, Forbes determined upon making a new one farther N. in Pennsylvania, which consumed months in its preparation, so that it was not until late in November that the army reached its rendezvous in the Allegheny Valley. Col. Washington led the front, and his forces took possession of the ruins of Fort Duquesne Nov. 25, 1758, the French having evacuated and burned that post the night before. The elder Pitt, the great war-minister of England, was now at the head of the British ministry. Washington therefore changed the name of this fortification from Fort Duquesne to Fort Pitt (now Pittsburg), and after detaching 200 men from his regiment as a garrison, he marched the others back to Winchester, where he left them and proceeded himself to Williamsburg to take his seat in the general assembly, of which he had been elected a member. A cessation of all Indian hostility on the frontier having followed the expulsion of the French from the Ohio, the object of Washington in accepting his last command was accomplished, and he therefore resigned his commission as commander-in-chief of the Virginia forces. Though much attached to the military service, he well knew that he could not receive a commission in the regular British service that would place him on an equal footing, in all respects, with native British officers of like grade, and therefore directed his views for the future to a purely civil career—a most fortunate event for Washington as well as for his country; for had he been in the British army when the colonial troubles came to a crisis in 1774, whatever might have been his conduct, he could not have been placed at the head of the American cause. Soon after resigning his commission and entering the legislature he married (Jan. 17, 1759) Mrs. Martha (Dandridge) Custis, a young and beautiful widow lady of great wealth, and devoted himself for the ensuing fifteen years to the quiet and peaceful pursuits of agriculture at his magnificent estate of Mount Vernon, which he greatly enlarged by purchases, interrupted only by his annual attendance in winter upon the sessions of the colonial legislature at Williamsburg, until summoned by his country to enter upon that other arena in which his fame was to become world-wide.

It is unnecessary here to trace the details of the struggle upon the question of local self-government which after ten years culminated in the closure by act of Parliament of the port of Boston. Throughout the length and breadth of the land the cry went up, "The cause of Boston is the cause of us all!" It was at the instance of Virginia that a Congress of all the colonies was called to meet at Philadelphia Sept. 5, 1774, to secure their common liberties—if possible by peaceful means. To this Congress Col. Washington was sent as a delegate. Its remonstrances and appeals exhibited the highest abilities as well as the loftiest patriotism. Lord Chatham said in the British Parliament of the papers issued by them, that "Though he had studied and admired the free states of antiquity, the master-spirits of the world, yet for solidity of reasoning, force of sagacity, and wisdom of conclusion no body of men could stand in preference to this Congress." On dissolving in October it recommended the colonies to send deputies to another Congress the following spring. In the mean time, several of the colonies felt impelled to raise local forces to repel insults and aggressions on the part of British troops, so that on the assembling of the next Congress, on May 10, 1775, the war-preparations of the mother-country were unmistakable. The battles of Concord and Lexington had been fought. Amongst the earliest acts, therefore, of the Congress was the selection of a commander-in-chief of the colonial forces. This high office was unanimously conferred upon Washington, still a member of the Congress. His commission was in the name of each colony separately. He accepted it on June 19, but upon the express condition that he should receive no salary. He would keep an exact account of his expenditures, and expect Congress to pay for them, and nothing more. He immediately repaired to

the vicinity of Boston, against which point the British ministry had concentrated their forces. As early as April, Gen. Gage had 3000 troops in and around this proscribed city. During the fall and winter the British policy clearly indicated a purpose to divide public sentiment and to build up a British party in several if not all of the colonies. Those who sided with the ministry in their schemes of effecting a general submission were stigmatized by the patriots as "Tories," while the patriots took to themselves the name of "Whigs." As early as Jan., 1776, many of the leading men and colonies had come to the conclusion that there was no hope except in separation and independence. In May, 1776, Washington wrote, from the head of the army in New York, "A reconciliation with Great Britain is impossible. . . . When I took command of the army, I abhorred the idea of independence, but I am now fully satisfied that nothing else will save us." The sentiment in favor of independence soon became universal. Most of the colonies instructed their delegates in Congress to vote for independence, and on July 4, 1776, the Declaration of Independence proclaimed to the world that "All governments derive their just powers from the consent of the governed." In making this Declaration, as upon all other questions since the first organization of the Congress, each colony had an equal vote, and the paper stands upon the record headed "In Congress, 4th of July, 1776. The Unanimous Declaration of the Thirteen United States of America."

It is not the object of this sketch to trace the military acts of the patriot hero to whose hands the fortunes and liberties of the people of the U. S. were confided during the seven years' bloody struggle that ensued until the treaty of 1783, in which England acknowledged the independence of each of the thirteen States, and negotiated with them, jointly, as separate sovereignties. (See article UNION, AMERICAN.) The merits of Washington as a military chieftain have been considerably discussed, especially by writers in his own country. During the war he was most bitterly assailed for incompetency, and great efforts were made to displace him; but he never for a moment lost the confidence of either the Congress or the people. On Dec. 4, 1783, the great commander took leave of his officers in most affectionate and patriotic terms, and went to Annapolis, Md., where the Congress of the States was in session, and to that body, when peace, quiet, and order prevailed everywhere, resigned his commission (Dec. 23), and, again in search of that repose ever so agreeable to him, retired to Mount Vernon. He had previously addressed a circular letter to the governors of the States, in which he urged several changes in "the constitution" under which they were then united. This constitution, to which he referred, was set forth in the Articles of Confederation reported to the Congress eight days after their Declaration of Independence. These Articles constituted what the Germans style a *Staaten-Bund* (see article UNION, AMERICAN), and, though a great war had been successfully conducted under them, yet they were found to be defective in a few particulars, chiefly in these—that the States in Congress assembled had no authority to regulate commerce with foreign nations, nor had they any authority to execute with their own machinery any of the numerous powers delegated to them. They could only recommend to the States necessary action to carry out the purposes of the union, which recommendation had to receive the sanction of the States before it became binding on the people. The States severally could alone act directly upon their own citizens, even in the matter of raising the taxes to make up the amount of the quota apportioned to the States by Congress. It was not till 1787 that these great changes were effected in the new Constitution which was agreed upon by the celebrated convention of the States which assembled that year in the old Independence Hall in the city of Philadelphia. The history of this convention it is not in the purview of this article to relate. Suffice it to say that it was called for a revision of the Articles of union between the States. It met May 14, 1787, and was unquestionably the ablest body of jurists, legislators, and statesmen that had ever assembled on the continent of America. Washington was a member of it as a delegate from the State of Virginia, and was unanimously chosen to preside over its deliberations. In this body, as in Congress up to this time, each State upon all questions had an equal vote, without reference to the number of its delegates. The proceedings of this body were with closed doors, and its sessions lasted till the 17th of September. The result of their proceedings was the present new Constitution, with the exception of subsequent amendments incorporated in it according to the terms of its own provisions. These revised Articles for a more perfect union of the States were submitted to the Congress of States, and by them were submitted to the several States for their ratification and adoption. It was to be binding "between" all the States that should ratify it, provided as many as nine did so. Washington in his letter to Congress earnestly recommended its ratification. It was to go into effect Mar. 4, 1789, in case the required number of States should in the mean time so ratify it. In point of fact, it was adopted and ratified by conventions duly called in all the States (except North Carolina and Rhode Island) before the close of the year 1788. No one took a deeper interest in the events passing during the interval than he who has been so justly styled "the father of his country." Neither his voice nor his pen was idle. Many of his most interesting letters were written upon this subject. (See Washington's *Writings*, pp. 278, 389, 390.) All eyes were now turned to the great military chief of the Revolution as the first civil executive of the new organization. The Constitution had not been framed by the convention nor adopted by the States without a close and bitter contest in every stage of its progress. In the convention that framed it two antagonistic parties developed themselves soon after their assembling. These were known as the Nationals and the Federalists. The Nationals were led by Gov. Randolph of Virginia, supported by Madison, Hamilton, King, and others, and the Federalists by Charles Pinckney of South Carolina, supported by Ellsworth, Ames, Yeates, and others. The former were for utterly disregarding the powers conferred upon them and the instructions under which they were to act, and were in favor of doing away entirely with the States and forming one single or consolidated republic. Their idea was to institute what the Germans style a *Bundes-Staat*, with the sovereignty of all the States merged in a consolidated union; while the other side unyieldingly contended for the maintenance of the federal system under the present form, preserving the equality of the States in one branch of the Congress of the States at least, without any regard to their respective size, population, or wealth. This point they ultimately carried, so that, under the new Constitution as under the old, no act or measure can become a law against the votes of a majority of the States in the Senate. The retention of the federative feature in the new Constitution caused most of the Nationals in the Philadelphia convention to oppose it in every stage of its progress in that body, but they espoused its adoption in the ratifying State conventions as a temporary expedient, and the best thing that could then be obtained on their line, in view of the prevailing popular sentiment at the time. The main opposition to it in the State conventions sprung from the new machinery introduced for the execution of all the delegated powers by the general government within its limited sphere, without awaiting the sanction of the several States for final valid action, and from the absence of an express reservation in the instrument to the States of all their sovereign powers not delegated by the Constitution to the U. S. This was the position of Patrick Henry and Mr. Monroe of Virginia and Samuel Adams and John Hancock of Massachusetts. This class were perfectly satisfied with the Constitution on the adoption of the Tenth Amendment, which they insisted upon, and which was soon unanimously adopted by the States, and is in the following words: "The powers not delegated to the U. S. by the Constitution nor prohibited by it to the States are reserved to the States respectively, or to the people." The new machinery, however, was by far the greatest and most important change in the new system. This ideal of a confederated republic seems to have emanated from the brain of Mr. Jefferson. The first intimation of it in the history of the country was given by him in a letter written to Mr. Madison from Paris in 1786, when the question of remodelling the then existing Articles of union between the States was agitating the public mind. It was in this letter he suggested the outlines of that new feature of the federal machinery to operate directly upon the citizens of the States within the limits of the specific and enumerated powers delegated to the general government, which has, in the language of De Tocqueville, effected such momentous results. His suggestion was, that in the Federal government, as in the State governments, there should be three separate and distinct departments—the executive, the legislative, and the judiciary; and in this way the U. S. would present to the world one nation as to all foreign and extra-State affairs, while among themselves they would remain separate and distinct nations as to all internal affairs and the exercise of all sovereign powers not delegated to the general government. How the parties of the time referred to subsequently developed and changed their names, as well as their policies, space will not allow us to trace in this article, even if it were otherwise pertinent to do so.

Washington, it was known, was devoted to the federative feature retained in the new system. That, besides his other eminent qualities of head and heart, secured him the unanimous voice of the friends of the new Constitution for the chief magistracy in putting it into operation.

He received every electoral vote cast in all the colleges of the States voting for the office of President. New York, the eleventh State ratifying the Constitution, did not cast any electoral vote in this election, because she had not time after her ratification, late in the fall of 1788, to provide for holding the election within the time prescribed. The 4th of Mar., 1789, was the time appointed for the government of the U. S. to begin its operations under its new organization; but several weeks elapsed after this time before quorums of both the newly-constituted houses of the Congress were assembled. The city of New York was the place where the Congress then met. Washington, having been duly notified of his election, left his home at Mount Vernon on the 16th of April to enter upon the discharge of his new duties. He set out with a purpose of travelling privately and without attracting any public attention; but this was impossible. Everywhere on his way he was met by thronging crowds, eager to see the man whom they regarded as the chief defender of their liberties, and everywhere he was hailed with those public manifestations of joy, regard, and love which spring spontaneously from the hearts of an affectionate and grateful people. His reception in New York was marked by a grandeur and an enthusiasm never before witnessed in that metropolis. The inauguration took place Apr. 30, in the presence of an immense multitude which had assembled to witness the new and imposing ceremony. The oath of office was administered by Robert R. Livingston, chancellor of the State. When this sacred pledge was given in the presence of his fellow-citizens, with an appeal to Heaven, "to the best of his ability," in the execution of the office of President, "to preserve, protect, and defend the Constitution of the U. S.," he retired with the other officials into the Senate chamber, where he delivered his inaugural address to both houses of the newly-constituted Congress in joint assembly.

In the manifold details of his civil administration, as previously in the direction of military operations, Washington proved himself equal to the requirements of his position. The greater portion of the first session of the first Congress was occupied in passing the necessary statutes for putting the new organization into complete operation. In the discussions brought up in the course of this legislation the nature and character of the new system came under general review. On no one of them did any decided antagonism of opinion arise. All held it to be a limited government, clothed only with specific powers conferred by delegation from the States. The Nationals now came warmly in support of the new system as it had been amended and enlarged. Failing in their object in the convention, they now accepted the new Constitution as the best thing they could obtain on their line, as before stated. It was admitted on all hands that the federative feature was retained in the new system. There was therefore no change in the name of the legislative department or of the style of the government. The former still remained "the Congress of the U. S. of America." There was no change in the original flag of the country, and none in the seal, which still remains with the Grecian escutcheon borne by the eagle, with other emblems, under the great and expressive motto, "*E Pluribus Unum.*" All friends of the new Constitution now assumed the name of Federalists. This state of things, however, did not last very long. The first division of parties arose upon the manner of construing the powers delegated, and they were first styled "*strict* constructionists" and "*latitudinarian* constructionists." The former were for confining the action of the government strictly within its specific and limited sphere, as clearly defined by the language of the Constitution, while the others were for enlarging its powers by inference and implication, thus securing by construction what the States in convention had expressly refused to confer. In the ranks of the latter class the old Nationals almost universally took position. They still adhered, however, to the popular name of Federalists, while the strict constructionists took the name of Republicans in some places, and of Democrats in others. Hamilton and Jefferson, both members of the first cabinet, were soon regarded as the chief leaders, respectively, of these rising antagonistic parties, which have existed, under different names, from that day to this. Washington was regarded as holding a neutral position between them, though, after mature deliberation, he vetoed the first apportionment bill (in 1790) passed by the party headed by Hamilton, which was based upon a principle constructively leading to centralization or consolidation. This principle was manifested in applying the ratio of representation under it to the entire population of all the States, as constituting one aggregate mass or nation, instead of applying it to the population of each State severally, as one distinct member of a confederative republic. The latter was the only way in which it could be made upon correct federal principles, as Mr. Jefferson insisted in a written cabinet opinion, notwithstanding large fractions of population in several of the States were left out by this mode of apportionment. This was the first exercise of the veto power under the present Constitution. In it Washington showed his devotion to the federative principle still retained in the new system. The veto created considerable excitement at the time in the ranks of the Nationals. Another bill was soon passed in pursuance of Mr. Jefferson's views, which has been adhered to in principle in every apportionment act passed since.

At the second session of the new Congress, Washington announced the gratifying fact of "the accession of North Carolina" to the Constitution of 1787; and on June 1 of the same year he announced by special message the like "accession of the State of Rhode Island," with his congratulations on the happy event which "united under the general government" all the States which were originally confederated. In 1792, at the second Presidential election, Washington was desirous to retire, but he yielded to the general wish of the country, and was again chosen President by the unanimous vote of every electoral college. At the third election (1796) he was again most urgently entreated to consent to remain in the executive chair. This he positively refused. In September, before the election, he gave to his countrymen his memorable *Farewell Address*, which in language, sentiment, and patriotism was a fitting and crowning glory of his illustrious life. After Mar. 4, 1797, he again retired to Mount Vernon for peace, quiet, and repose. His administration of the new system for two terms had been successful beyond the expectation and hopes of even the most sanguine of its friends. The finances of the country were no longer in an embarrassed condition, the public credit was fully restored, life was given to every department of industry, the workings of the new system in allowing Congress to raise revenue from duties on imports proved to be not only harmonious in its federal action, but astonishing in its results upon the trade and commerce of all the States. The exports from the Union increased from nineteen million to over fifty-six million dollars per annum, while the imports increased in about the same proportion. Three new members had been added to the Union; the progress of the States in their new career under their new organization thus far was exceedingly encouraging, not only to the friends of liberty within their own limits, but to their sympathizing allies in all climes and countries. Of the call again made on this illustrious chief to quit his repose at Mount Vernon and take command of all the U. S. forces, with the rank of lieutenant-general, when war was threatening with France in 1798, nothing need here be stated, except to note the fact as an unmistakable testimonial of the high regard in which he was still held by his countrymen of all shades of political opinion. He patriotically accepted this trust, but a treaty of peace put a stop to all action under it. He again retired to Mount Vernon, where, after a short and severe illness, he died Dec. 14, 1799, in the sixty-eighth year of his age. The whole country was filled with gloom by this sad intelligence. Men of all parties in politics and creeds in religion, in every State in the Union, united with Congress in "paying honor to the memory of the MAN, first in war, first in peace, and first in the hearts of his fellow-citizens." His remains were deposited in a family vault on the banks of the Potomac at Mount Vernon, where they still (1876) lie entombed. ALEX. H. STEPHENS.

Washington (WILLIAM AUGUSTINE), b. in Stafford co., Va., Feb. 28, 1752, was a distant relative of Gen. George Washington; received a good education; became a captain under Mercer in the Virginia line; fought at the battles of Long Island, Trenton, and Princeton; became lieutenant-colonel of Baylor's dragoons 1778; commanded a light corps of cavalry in the campaign of the Carolinas 1779–81, being distinguished at Cowpens, Guilford, Hobkirk's Hill, and at Eutaw Springs, where he was taken prisoner. He settled at Charleston, S. C.; was a member of the legislature, and became a brigadier-general and aide-de-camp to Gen. George Washington about 1798. D. at Charleston Mar. 6, 1810.

Washington and Jefferson College, Washington, Pa., is the result of the union of Washington College and Jefferson College, located respectively at Washington and Canonsburg, two villages 7 miles apart in Washington co., Pa. Jefferson College grew out of Canonsburg Academy, which was organized in 1791, and by act of the legislature in 1802 received college privileges under the name of Jefferson College. Its first president was Rev. John Watson, A. M., who was chosen principal Aug. 29, 1802; and d. Nov. 30, 1802. Until 1852 no funds were collected except for buildings and appliances, such as libraries and apparatus. In that year a plan of endowment was adopted by the trustees, under which $60,000 were raised, and the in-

stitution began operating under the system of giving free tuition to scholarship holders and supporting its faculty on the income of its endowment. By a general catalogue recently published its graduates are reported as ministers 921, lawyers 408, physicians 193, other occupations 368; total, 1890. Washington College grew out of an academy, and received its charter in 1806. Its first president was Rev. Matthew Brown, D. D., LL.D., elected Dec. 3, 1806; resigned Apr. 30, 1817. Until 1853 it was a close corporation. At that time a contract was entered into with the synod of Wheeling (O. S.) that on condition that they endowed it they should have the right to its trustees and faculty. This agreement took effect with the college year 1853–54. By a general catalogue lately published, the list of its alumni numbers 846—to wit, ministers 329, lawyers 205, physicians 109, other occupations 203.

Throughout nearly the whole history of these institutions efforts and plans for uniting them were proposed. With the cost of living increased by the war, their endowments, whose incomes furnished but a bare support before, became thereafter altogether inadequate. Under these circumstances the trustees of both institutions accepted the offer of Rev. C. C. Beatty, D. D., LL.D., of Steubenville, O., of $50,000 if they would unite, and in 1865 the enabling act passed the legislature. By that union the preparatory department, scientific department, and the freshman class of the classical department were located at Washington, the sophomore, junior, and senior classes at Canonsburg. This duplex arrangement proved undesirable, and application was made to the legislature for leave to consolidate the whole institution at one place; which request was granted, and the trustees under that authority located the whole at Washington, Pa. This being unacceptable to some, they brought suit to prevent it by an injunction. The case was tried both before the supreme court of Pennsylvania and the Supreme Court of the U. S., and unanimously decided by both courts in favor of the college. Its first president was Rev. Jonathan Edwards, D. D., LL.D., who was succeeded in 1870 by Rev. George P. Hays, D. D., who is still in office. Its present endowment fully supports its faculty of nine professors. New buildings are now erecting, which when completed will furnish ample room for all purposes. GEORGE P. HAYS.

Washington and Lee University, an institution of learning at Lexington, Va., derived its origin from the Augusta Academy at Greenville, which in 1776 took the name of Liberty Hall; was chartered in 1782; was removed to the vicinity of Lexington in 1785, and to its present grounds in 1803. It received from Gen. Washington, in 1796, 100 shares of stock in the James River Canal Co., which was commuted by the legislature to an interest-bearing fund of $50,000, and the name was changed to Washington College. It received in 1803 a fund of $25,000 from the Cincinnati Society, and in 1826 a bequest of $40,000 from Mr. John Robinson. On the death of Gen. Robert E. Lee in 1870 the name was changed to its present form. The institution resembles in plan of organization the UNIVERSITY OF VIRGINIA (which see), being divided into thirteen elective schools, including the applied sciences, engineering, and law. Scholarships are conferred upon students for the ministry, sons of clergymen, persons intending to become practical printers, journalists, or teachers, and upon the students ranking first in several academies and high schools. Degrees are conferred only upon examination in the courses of the several schools. The government is in the hands of a board of trustees, and is more immediately conducted by the president and faculty. Instruction was suspended during the civil war, when the college suffered by the destruction of its scientific apparatus during the occupation of the town by the national forces, but these losses have been more than compensated by liberal contributions. The institution was reorganized in 1865 under the presidency of Gen. Robert E. Lee, who was succeeded in 1871 by his son, Gen. G. W. Custis Lee. It has a library of 12,000 volumes, and an average of 300 students and 20 instructors.

Washington City, the capital of the United States of America, and the seat of the Federal government since 1800, is situated on the eastern bank of the Potomac River, 106 miles above its mouth, and 105 miles in a straight line W. of the Atlantic Ocean, in 38° 53′ 39″ N. lat. and 77° 2′ 48″ lon. W. of Greenwich. The population of the city in 1875 was 125,000 (estimated). The population at each decennial period was, by the census of 1800, 3210; 1810, 8208; 1820, 13,247; 1830, 18,826; 1840, 23,364; 1850, 40,001; 1860, 61,122; 1870, 109,199. Out of the population in 1870 there were—white, 73,731; colored, 35,455; Indian, 13; natives of the District of Columbia, 12,694; of other parts of the U. S., 52,748; of foreign birth, 13,757—viz. Great Britain, 8505; Germany, 4133; all other countries, 1119. Washington ranks as the twelfth city of the U. S. in number of inhabitants, containing, in 1870, 21,343 families and 19,545 dwelling-houses. (For facts regarding the climate, geology, natural history, agriculture, manufactures, commerce, education, and civil history of Washington, see DISTRICT OF COLUMBIA.)

Washington is almost alone among the capitals of great nations of modern times in the fact of its creation for the sole purpose of a seat of government, apart from any questions of commercial greatness or population. While London, Paris, Berlin, St. Petersburg, Vienna, and Madrid are respectively the commercial capitals and the most populous cities of the nations they represent, Washington never was, and probably will never be, the leading city of the U. S., or the great metropolis of a commercial and a manufacturing population. Although not isolated in position, and possessing some natural advantages in the water-power of the Potomac, the city has no natural harbor. Though located at the head of tide-water navigation, just below the Little Falls of the Potomac at Georgetown, it could not become a great shipping-point without the expenditure of many millions. In trade and manufactures it is overshadowed, no doubt permanently, by the neighboring great commercial capitals of Baltimore and Philadelphia, from which it is distant only 39 and 137 miles respectively, while New York is but 227 miles distant by railway.

The history of the selection of Washington as the seat of government shows that there was a protracted conflict in the Congress of the republic over the claims of rival localities, and that the confluence of the Potomac and Anacostia was finally selected as a compromise. After the settlement of the cession to the U. S. by Maryland and Virginia of a Federal district 10 miles square (elsewhere recorded), the site of the city and the location of the public squares and buildings were selected by Pres. Washington in person on the Maryland side of the Potomac, in accordance with the act of Congress of Mar. 30, 1791. At the time of this location the city was almost precisely in the geographical centre between the northern and the southern limits of the Union. On Apr. 15, 1791, the corner-stone of the Federal territory was laid by three commissioners appointed by the President, together with the officials of Alexandria, Va.; and in the following year the lines of boundary directed by the President's proclamation were permanently marked by square milestones. The place was called "the Federal City" by Washington and in the records of the time until Sept. 9, 1791, when the commissioners directed that the Federal district should be called "the Territory of Columbia," and the Federal city "the city of Washington." Major L'Enfant, a French engineer, prepared the topographical plan of Washington City under the direction of Pres. Washington and Thomas Jefferson, secretary of state. L'Enfant took as a basis for his design the topography of Versailles, the seat of the government of France, and introduced the scheme of broad transverse avenues intersecting the main streets of the city, with constantly-recurring squares, circles, and triangular reservations, which form at this day the main features of the plan of the city. Having determined upon the location of the Capitol as the initial point, a true meridian line was drawn through it, crossed by another due E. and W. line, by the accurate measurement of which the acute angles were determined, and the avenues and streets laid down by strict measurement. The ideas of the founders of the city proposed a seat of government of ample territorial proportions, and provided for the future wants of a swarming population, as well as for the embellishment of the fine natural features of the city by the aid of art. The grand scope of the superficial design, contrasted with the poverty of the results achieved in the shape of public improvements for many years, led to the proverbial designation of Washington as the "city of magnificent distances." Thus, the public streets throughout were projected on the scale of a width of 160 feet down to 70 feet, no street in the city being less than the latter width. The aggregate length of the streets and avenues is 264 miles, and they are wider than those of any other city in the world. There are 21 avenues in all, which bear the names of various States in the Union. Pennsylvania Avenue, the principal street of Washington, is a magnificent thoroughfare 160 feet wide, running from the Capitol to the Treasury Department, where it is deflected to the N. and continued past the President's House to Georgetown at the width of 130 feet. On the other side of the Capitol it runs 160 feet wide to the Anacostia River. This avenue was originally laid out in three roadways, with a double row of Lombardy poplars planted, at the instance of Mr. Jefferson, between the central or main street and that on each side. These trees were cut down in 1832, and the avenue thrown into one broad thoroughfare, now (1876) paved with smooth concrete, constituting the most splendid and attractive *corso* or driveway in the

country. Massachusetts Avenue is over 4½ miles long, running in an unbroken course 160 feet in width from the N. W. boundary of Washington at Twenty-second street to the Anacostia beyond Lincoln Park. The other avenues are named Maine, New Hampshire, Vermont, Connecticut, Rhode Island, New York, New Jersey, Maryland, Delaware, Virginia, North Carolina, South Carolina, Georgia, Louisiana, Missouri, Tennessee, Kentucky, Ohio, and Indiana. To these must be added the newly laid out Executive Avenue, which starts from Pennsylvania Avenue at the President's House and follows a serpentine course through the Washington Monument grounds, in full view of the Potomac, till it reaches the grounds of the department of agriculture, whence it passes through the Smithsonian reservation and the Mall to the Botanic Garden at the foot of the Capitol. Executive Avenue affords a fine drive about 2 miles in length, and will soon be adorned with shade trees through its whole extent, as it now is in the grounds of the Smithsonian Institution. The Mall, through which the drive runs, was originally covered with majestic oaks, which were cut down about 1820 under an unwise agreement of the commissioners of Washington with the proprietors, that they should be entitled to all the wood on the lands reserved by the U. S. East Capitol street, running at a uniform breadth of 160 feet from the E. front of the Capitol to Lincoln Park, was originally designed to be the chief street of the city, and has recently become one of the most attractive, many fine residences having been located upon it. K street, 148 feet wide, extending from Rock Creek, the Georgetown boundary, to the Anacostia, is one of the most splendid thoroughfares of the city. Sixteenth street, 160 feet wide, runs from La Fayette Square opposite the President's House due N. to the boundary, where it climbs the heights toward Columbian College, presenting a fine view of the city and environs. Boundary street, running along the northern limit of the city, is also a fine driveway or boulevard.

Every grand transverse avenue was laid out 160 feet wide. The crossings of the streets and avenues created opportunity for constant parks or reservations as centres of attraction, interspersed with business blocks and dwelling-houses. Besides these fractional reservations, there were set apart more extensive parks or squares, including the following: the Capitol grounds, 52 acres; President's grounds, 20 acres; La Fayette Square, 7 acres; the Park or Mall (not yet fully opened), about 100 acres; Judiciary Square, 19 acres; the Arsenal grounds, 11½ acres; the Navy-yard, 27 acres; Farragut Square, 1⅛ acres; McPherson Square, 1⅛ acres; Scott Circle, 1 acre; Franklin Square, 4 acres; Rawlins Square, 1¼ acres; Lincoln Park, Capitol Hill, 6¼ acres; Stanton Place, Capitol Hill, 2¼ acres. Besides these, are numerous smaller squares and several circular plots of ground, the most conspicuous of which are Washington Circle, midway between Washington and Georgetown, Fourteenth street Circle, at the corner of Massachusetts and Vermont avenues, and P street Circle, at the

Fig. 1.

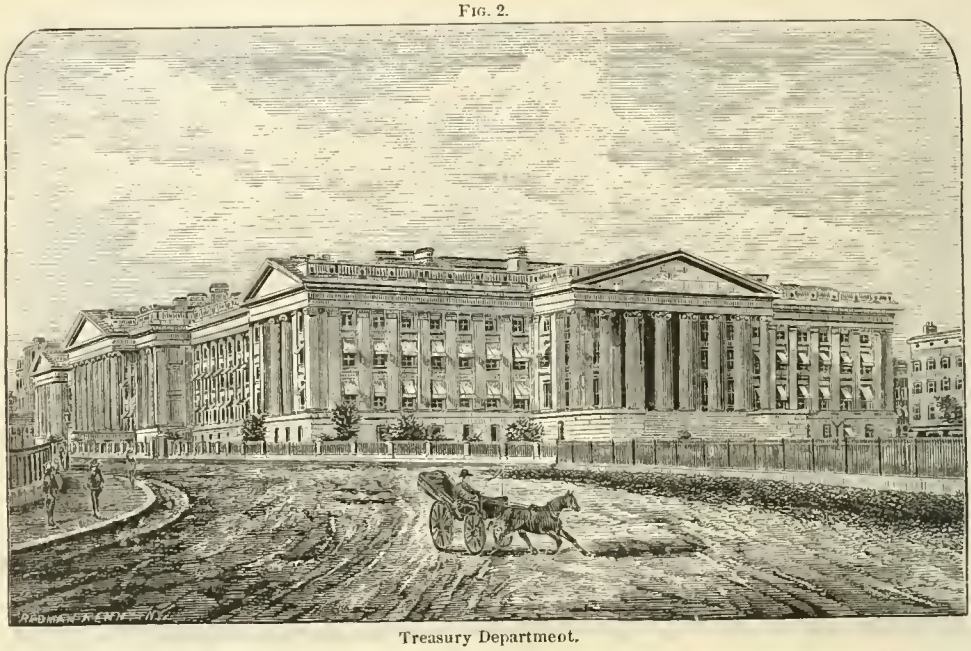
The Capitol.

intersection of Connecticut, Massachusetts, and Vermont avenues. Numerous triangular reservations at the intersections of streets and avenues have been enclosed and beautified with trees and shrubs.

Notwithstanding the magnitude and far-sightedness of the original plans for the laying out of the Federal capital, more than half a century was suffered to elapse before any portion of the city could be said to have assumed the beauty and attraction due alike to its natural advantages and to the liberality of the schemes for its adornment. The narrowest views of economy prevailed in Congress, and all attempts to expend even the smallest sums of public money upon making the Federal capital attractive, or even of contributing to its salubrity as a residence by draining its numerous marshes or rendering its muddy streets and avenues accessible by suitable pavements, were steadily defeated. The descriptions which have come down to us of the appearance of Washington in early days concur in representing it as a gigantic failure. Mrs. John Adams, the first occupant of the White House, has described, in letters familiar to the public, the rude and uncomfortable condition of the city when Congress first came to occupy the new capital. For ten years before the public offices were removed from Philadelphia, the area of the future capital embraced scarcely 500 inhabitants. Oliver Wolcott wrote in 1800, "The Capitol is situated on an eminence near the centre of the immense country here called the city. There is one good tavern about forty rods from the Capitol, and several other houses are built and erecting." John Cotton Smith, Congressman, wrote: "The Pennsylvania avenue was then nearly the whole distance a deep morass, covered with alder-bushes." The place was simply a backwoods town in the wilderness, and Senators and Representatives in Congress were for years in the habit of finding such comfort as they could in lodgings in Georgetown, 3 miles distant, though within the District of Columbia. Yet the nascent capital of the republic was not without its experiences of the soaring ambition of the early owners of land in the vicinity of the capital that was to arise in such magnitude out of the primitive swamps and forests which had so long occupied the site of Washington. When the bluff overlooking the Potomac was selected as the site for the Capitol, the owners of lots on the plateau facing eastward, where the edifice was to front, immediately put up the prices of their lots to 75 cents or $1 a square foot. The result was, that settlers in Washington, avoiding Capitol Hill, purchased land and erected their houses in the swampy district lying between the Capitol and the Potomac, where lots could be obtained at the low price of from 10 to 25 cents a square foot. Thus it came to pass that the broad plateau of Capitol Hill, the highest, most commanding, and most salubrious portion of Washington, remained unsettled for more than half a century, save by a small straggling population. The shops and residences of the citizens grew steadily in the north-western direction, following the valley, on either side of Pennsylvania Avenue, and extend-

ing slowly toward the northern limits of the city, as well as westward toward Georgetown. In 1839, George Combe, the English traveller, wrote of Washington: "The town looks like a large straggling village reared in a drained swamp." It was not until the year 1851 that anything was done toward laying out or adorning the numerous public parks and reservations contemplated by L'Enfant sixty years before. In that year A. J. Downing, the landscape-gardener, was employed by Pres. Fillmore, pursuant to a small appropriation by Congress, and his plans for roadways planted with a picturesque selection of trees were partially carried out in the park occupied by the Smithsonian Institution. The death of the artist in 1852, and the neglect of Congress, suspended these needed improvements for twenty years longer. All visitors to Washington before 1871 cannot fail to remember the crude and unkempt condition of the Capitol grounds, and the neglected aspect of the approaches to all the noble public buildings which adorn the capital. The streets and avenues were in a chronic state of neglect, the drifting of dust alternating with the deepest mud, and the thoroughfares of the city being at times almost impassable. At length in 1871, under the combined influence of a more liberal spirit in Congress, and the energetic determination of some of the private citizens, a new order of things was inaugurated. Congress having abolished the municipal governments of Washington and Georgetown, and created for the District of Columbia a Territorial government with a governor, legislature, and board of public works, the latter body became invested with exclusive power over the streets, sewers, and avenues of Washington and Georgetown, with authority to improve the same on a comprehensive plan. Endowed with these great powers, and the ability to raise money by tax and loan, the new government went vigorously into the business of improving the Federal city. An extensive system of sewerage and of street pavements was drawn up, through which the greater portion of the city was reclaimed from neglect and filth, the great ditch known as the Washington Canal was filled up, and about 160 miles of streets and avenues were paved with stone, wood, or concrete. Many streets were completely re-graded; the public squares were all fenced and planted with shade trees; while in the streets and avenues about 29,000 umbrageous trees have been set out. These comprise elm, maple, linden, tulip, ash, Carolina poplar, and other native forest trees. The magnitude and extent of these improvements, carried on with a vigor and rapidity almost without precedent in American municipal history, of course entailed a corresponding amount of extravagance. While the seat of government reaps solid and permanent benefit from some of these improvements, others, hastily executed, have already fallen into decay. Whatever may be the verdict of history upon the much-controverted acts of the Territorial government, during whose short reign of three years the city of Washington was so transformed, it cannot be doubted that a new era for the Federal capital

Fig. 2.



Treasury Department.

dates from these improvements. Coincident with them, the erection of an unprecedented number of public buildings and private residences has contributed to render the city at once more attractive and more habitable to residents old and new. The net result of the operations of the board of public works is the substantial completion of these vast improvements, and the creation of a public debt of more than $20,000,000, which still hangs over the city unadjusted by the legislation of Congress, while the interest thereon is paid partly by taxation of the property of the District and partly out of the public treasury.

The government of Washington was strictly municipal in character, with a mayor and city council, until 1871, when Congress created a Territorial government for the District of Columbia, repealing the charters of the cities of Washington and Georgetown, and merging them into the same government. This government was abolished by act of June 20, 1874, and a provisional government of three commissioners, appointed by the President and Senate, was constituted until Congress should devise a more permanent form. The affairs of the District, including those of Washington, still continue to be managed by these commissioners under the direct legislation of Congress for the levying and disbursement of taxes and for all public improvements. The financial operations of the government are administered directly by the treasury department. The assessed valuation of real estate in Washington in 1876 was a little less than 80 millions of dollars. The rate of tax levied that year was 1½ per cent., with the same amount on personal property. The government property in buildings and reservations has never been subjected to tax. Congress exercises, under the Constitution, the power of exclusive legislation.

Since the retrocession of Alexandria and the territory on the W. bank of the Potomac to Virginia in 1846, the city of Washington, together with the District of Columbia, embraces only 64 sq. m. The city extends 4½ miles in one direction by about 2½ in the other, and its circumference is 14 miles, having a water-front on the Potomac of 4 miles, and on the Anacostia of 3¼ miles. The city proper covers 6111 acres, being about 9½ sq. m.; and out of this territory the government reservations comprise 541 acres, while the avenues and streets embrace 2554 acres (or 3095 acres in all), leaving only 3016 acres to the squares on which private residences are built. There is thus a much larger proportion of land unbuilt upon in Washington than in any large city on the globe—a circumstance which conduces in the highest degree to the public health, securing as it does large open spaces and abundant ventilation in every quarter of the city. The returns of the board of health exhibit a death-rate of slightly less than 2 per cent. per annum, considerably below the average mortality of cities in all countries. The continuous heat of summer, though often intense, is mitigated by breezes which blow up the valley of the Potomac, while in winter snow seldom falls, and for many days together the thermometer rarely indicates a temperature below the freezing-point. By the original plan the city is divided into four sections, starting

from the Capitol as a centre, with N. and S. Capitol street as the dividing-line on one side, and E. and W. Capitol street (the latter not opened) on the other. The streets and avenues are numbered by what is known as the Philadelphia plan, 100 numbers to each square, and the streets running E. and W. are called by the letters of the alphabet from A to W inclusive, while those running N. and S. bear numerical names from First to Twenty-eighth street inclusive. This poverty of street-nomenclature will probably be superseded by more expressive designations.

The site of the city of Washington is admirably adapted by nature for the building up of an attractive and imposing city. Situated in part on the tongue of land lying at the confluence of two broad rivers, from which the ground rises in natural and not abrupt ridges into the expanded plateau of Capitol Hill, about 100 feet above the Potomac, the surface of the city presents a gentle undulation which gives variety and constant transition of prospect, without producing any obstructions to travel. The city proper is surrounded on the E., N., and W. by an amphitheatre of well-wooded hills, embracing in most cases the ancient forest-growth of tall timber, which was cut off or burned on the Maryland side (as on the Virginia) during the ravages of civil war. Viewed from the vantage-ground of the Capitol dome, or even the western portico, the environs of Washington present a landscape of rare beauty and picturesqueness. The near view includes the mass of the city, thickly covered with dwellings, stores, and shops, intersected by the two great arteries of Pennsylvania Avenue, running to the Treasury, and Maryland Avenue, running westward to the Potomac. At frequent intervals through the perspective of roofs rise the tall steeples of churches and the massive white marble edifices of the various government buildings. Turning westward, the bright broad current of the Potomac—nearly 1 mile wide opposite the Capitol—sweeps southward, while there comes in on the left, joining its broad stream at Greenleaf's Point (on which the government arsenal is situated), the deep current of the Anacostia, or Eastern Branch of the Potomac. To the S., on the heights beyond the Eastern Branch, is seen the long mass of the government insane asylum building. On the Virginia shore rises a long picturesque range of hills, amid which may be discerned Arlington Heights, with its pillared edifice erected by George Washington Parke Custis, now occupied by the government, and its National Cemetery or city of the dead, where 15,000 Union soldiers are interred, while the spire of Fairfax Seminary, 6 miles distant, rises above the horizon in the direction of Alex-

Fig. 3.

Interior Department (Patent Office).

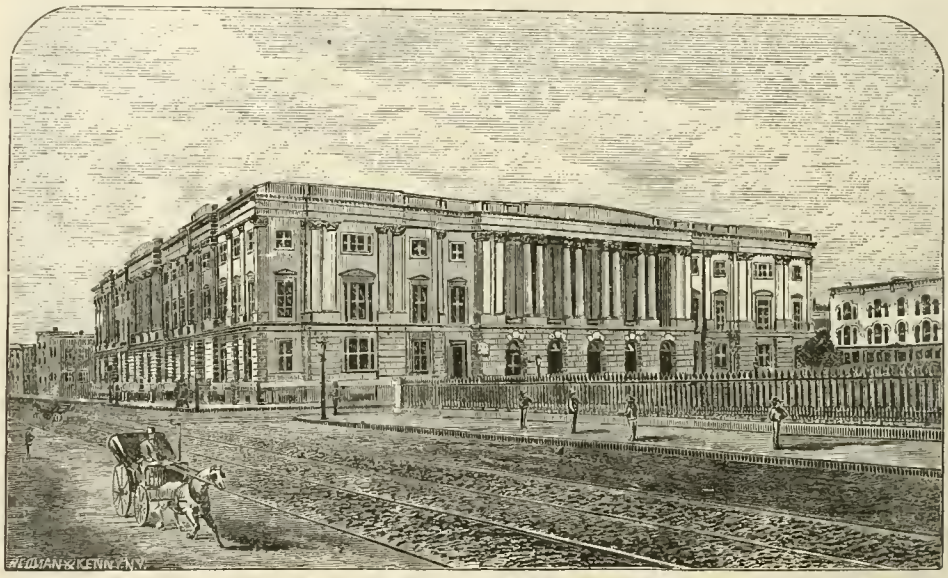
andria. The latter little city, with its houses, churches, and shipping lying along the harbor, is clearly visible, and the river is at almost all seasons dotted with the sails of river-craft and with steamers plying up and down. To the N. W., over the roofs of the Executive Mansion and the new State Department, rise the lofty and picturesque heights of Georgetown, attaining at the adjoining village of Tenallytown, just outside the borders of the District of Columbia, a height of some 400 feet above the level of the sea. To the N. are seen the buildings of Howard University crowning Seventh street hill, and beyond the tower of the Soldiers' Home, a free refuge for the disabled soldiers of the army, comprising a beautiful park of 500 acres in extent. It was this delightful and comprehensive view which drew from Baron von Humboldt the remark, as he stood on the western crest of Capitol Hill and surveyed the scene, "I have not seen a more charming panorama in all my travels."

The Capitol building, as the most conspicuous object in the scenery of Washington, its lofty white dome being visible from all directions for miles around the city, first merits a description. It is situated very nearly in the geographical centre of the city, the great plateau of Capitol Hill extending from the E. front about 1 mile, and gently sloping toward the Anacostia, while from the W. front the ground falls off by a partly abrupt and partly gradual decline to the level of the Potomac. This building, constructed in the purely classic style, with a centre and two projecting wings of great extent, is ornamented on the E. front with 68 Corinthian columns. The entire length of the building is 751 feet 4 inches, with a breadth of from 121 to 324 feet in the different portions. The whole edifice covers nearly 3½ acres. The height of the centre and wings from the ground to the roof is 70 feet. From the main or central building springs a lofty iron dome 135½ feet in diameter at its base, and containing 8,009,200 pounds, or 3575 tons, of cast and wrought iron. The apex of the dome is surmounted by a tholus or lantern 15 feet in diameter and 50 feet high, and this is crowned by a bronze statue of Freedom, designed by Crawford, facing the E., the height of which is 19½ feet. The total height from the eastern front of the Capitol to the crest of the statue of Freedom is 285½ feet. The advantageous position, great architectural mass, and harmonious and imposing effect of the Capitol seen from most points of view are such as to have secured for it the almost unanimous praise of the best judges of all countries as the most impressive modern edifice in the world. The material of the central building is Virginia freestone; that of the wings is white marble, from Massachusetts quarries; while the fluted marble columns are from the Cockeysville (Md.) quarries near Baltimore. The solidity and durability of the structure are in harmony with its character and cost. The total expenditure upon the Capitol for erection, extension, and repairs has been a little more than 13 millions of dollars. Owing to the fact that the main building

was constructed many years before the wings, there is some want of harmony between the older and newer portions, but this is more perceptible in the interior than the exterior. The chief want in the latter direction is a greater projection of the eastern and western fronts of the central building, so as to afford a more ample support to the enormous superincumbent weight and mass of the dome. The Capitol has had several superintending architects. The central building was designed chiefly by B. H. Latrobe, and the wings and dome by Thomas U. Walter. The present central structure dates from 1818 (completed 1827), and the extension or wings from 1851. The first Capitol building, erected on the same site, was commenced in 1793, the corner-stone having been laid by George Washington Sept. 18 of that year, seven years before the removal of Congress to Washington. Two wings were first constructed, the N. wing being occupied by Congress in 1800, and the S. wing, connected by a wooden passage, in 1811. Before the completion of this first Capitol building, the whole was destroyed by the British army at the invasion of Washington in Aug., 1814; after which Congress found temporary apartments in other buildings until the completion of the central portion of the present Capitol in 1827, which was surmounted by a wooden dome, afterward replaced (between 1855 and 1863) by the present one of iron. The corner-stone of the Capitol extension was laid July 4, 1851, and the new Hall of Representatives in the S. wing was occupied in 1857, and the Senate chamber in 1859. The work was continuously prosecuted during the civil war, the great dome rising foot by foot while hostile armies were struggling for the possession of the capital, until the great statue of Freedom crowned the summit on Dec. 12, 1863.

The rotunda forms the central attraction of the Capitol, and consists of a circular hall 96 feet in diameter, by 180 feet in height to the canopy above, on the concave interior of which is painted a mammoth fresco by Brumidi representing allegorical and historical subjects. The eight panels which surround the rotunda, nearly on a level with the spectator, are adorned by historical paintings, most of which have become familiar to all through their repeated multiplication by the art of the engraver. These comprise Col. Trumbull's four paintings, *The Declaration of Independence*, *The Surrender of Burgoyne*, *The Surrender of Cornwallis*, and *The Resignation of General Washington*; *The Landing of Columbus*, by Vanderlyn; *The Embarkation of the Pilgrims*, by Weir; *The Baptism of Pocahontas*, by Chapman; and *De Soto's Discovery of the Mississippi*, by Powell. The portico of the eastern front of the Capitol presents two sculptured groups on either side—one by Persico, representing the discovery of America by Columbus, the other by Greenough, being an allegorical representation of the first settlement of America. Neither group can be esteemed happy in conception or pleasing in treatment. In niches on the right and left of the main entrance-door are two colossal statues by Persico, representing Peace and War. But the best embodiment of the sculptor's art in the external decorations of the Capitol is the group by Thomas Crawford on the tympanum of the

Fig. 4.



Post-Office Department.

eastern front of the Senate wing. This represents the progress of civilization in the U. S. The great bronze doors by Randolph Rogers, which adorn the eastern front entrance of the Capitol, represent in sculptured *alto-rilievo* events in the discovery of America and life of Columbus, while the similar doors in bronze which constitute the main entrance to the Senate wing, designed by Thomas Crawford, represent Revolutionary battles and prominent civic events in the history of the country.

The Senate Chamber, occupying the centre of the N. wing, is 113 by 81 feet in dimensions, with seats for 76 Senators, the galleries furnishing accommodations for over 1000 spectators. The Senate Chamber is without artistic decoration except in the glass panels of the ceiling, which have symbolic designs. The most elaborate decorations in the Capitol are beneath the Senate Chamber in the corridors and connecting passages, where the vaulted ceilings and walls are completely covered with designs in fresco and distemper, representing natural scenery, birds, animals, flowers, and heads of historical characters in great variety of graceful combination. Several of the Senate committee-rooms are richly and elaborately frescoed—notably, the naval committee room, with its frescoes of sea-gods and goddesses and other nautical subjects, exquisitely painted in the style of some of the panels unearthed at Pompeii; and the military committee room, which has five paintings of Revolutionary battle-scenes, done in pure fresco by Brumidi. The grand staircase of white marble, ascending from the basement story to the Senate floor on the W., presents one of the finest gems of interior architecture in the world. The long apartment in the rear of the Senate Chamber known as the Marble Room is constructed wholly of marble, the ceiling resting upon four Corinthian columns of Italian marble, while the walls are wholly of variegated Tennessee marble highly polished. Adjoining the Marble Room is the President's Room, which presents a crowded assemblage of decorations too numerous and ornate for so small an apartment. On the opposite side is the room of the Vice-President, furnishing a contrast to the former, being furnished in severely simple though pleasing taste. The Senate post-office, just beyond, has a ceiling elaborately frescoed with emblematic designs.

The S. wing of the Capitol is occupied by the House of Representatives and its offices and committee-rooms. The hall of the House is the largest legislative chamber in the world, measuring 139 feet in length by 93 feet in width, and 36 feet in height. The galleries are capable of accommodating about 1500 persons, while the floor affords ample space for 300 members, each of whom is provided with a writing-desk. On the right of the Speaker's chair is Vanderlyn's full-length portrait of Washington, and on the left a fine portrait of La Fayette by Ary Scheffer, presented by that artist to Congress.

The Library of Congress occupies the whole western projection of the central building. It consists of three communicating halls, lined throughout with iron shelves and alcoves, finished in ornate but chaste and beautiful style. The floor is of black and white marble, and no wood has been used in any part of the construction of the library, which is thus impregnably fireproof. The library embraces

over 310,000 volumes, and a new building is proposed to contain its overflowing stores, together with the copyright bureau, which is attached by law to the office of the librarian of Congress. Copies of every work secured by copyright, including books, periodicals, musical compositions, prints, chromos, photographs, engravings, etc., must be deposited in this office, and hundreds of thousands of these publications are already gathered here, the number constantly increasing. The law department of the library is located in the basement of the Capitol, occupying the room formerly used by the Supreme Court of the U. S. It has 35,000 volumes. The vestibule or entrance to this library is marked by six columns of what may be styled an American order of architecture, being carved in imitation of Indian corn stalks, while the capitals of the columns represent the silken corn in full ear. In like manner, the columns in the upper vestibule are crowned by capitals representing the flower and leaf of the tobacco plant, instead of the traditional acanthus.

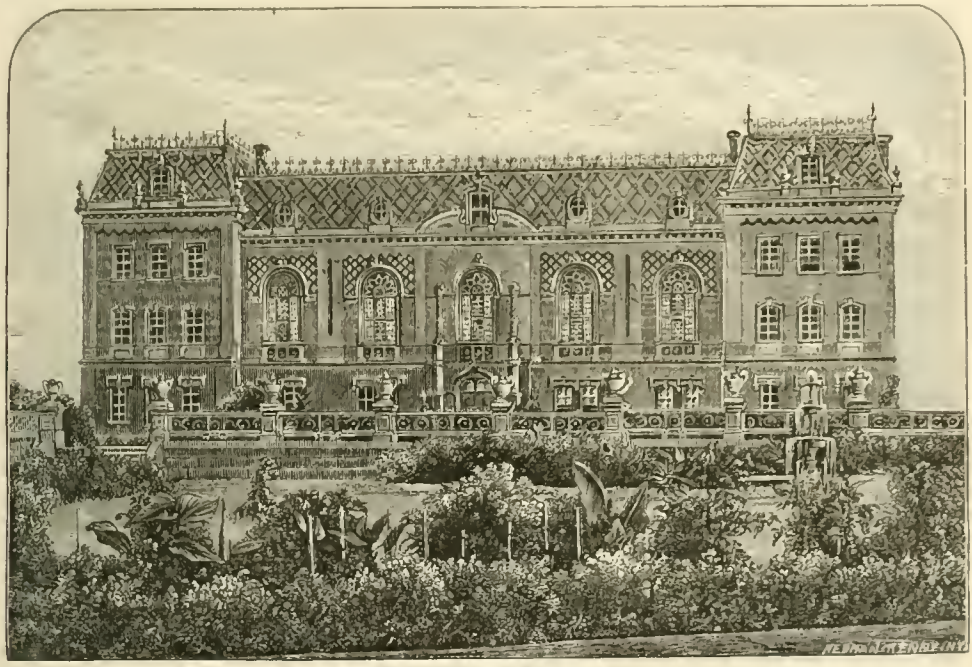
The Supreme Court room and offices occupy the old Senate Chamber in the central building and rooms adjacent. The court of claims, which has jurisdiction of cases involving claims on the government of the U. S., is located immediately beneath.

The old hall of the House of Representatives, through which one passes from the rotunda to reach the present hall of the House, is built in the form of a semicircle, surrounded by columns of variegated marble from the Potomac River. This hall was devoted by act of 1864 to the purposes of a national memorial hall, each State in the Union being invited to contribute statues of two of its most distinguished citizens in marble or bronze. As yet, only Rhode Island, Connecticut, Massachusetts, Vermont, New York, and New Jersey have sent contributions to this hall of fame. In this hall, too, is the exquisite piece of sculpture by Franzoni representing the Muse of History on the winged car of Time, with a clock recording the hours.

The Capitol contains, besides these, the historical paintings in the rotunda and the frescoes, a considerable number of works of art of various merit. At the head of the grand staircase W. of the House is Lentze's large painting representing an emigrant train crossing the Rocky Mountains. Powell's picture of *Perry's Victory on Lake Erie* is at the head of the eastern staircase in the Senate wing. Two paintings of American scenery on the Colorado and Yellowstone by Thomas Moran are in the corridor to the E. of the Senate gallery. Statues of Franklin and Jefferson by Powers, and of Hancock, Hamilton, and Baker by Horatio Stone, are among the decorations of the Capitol.

The Treasury Department, situated at the corner of Fifteenth street and Pennsylvania Avenue, is an imposing edifice in the pure Ionic style of architecture, with a stone balustrade running around the entire roof of the building.

Fig. 5.



Agricultural Department.

It has four fronts, the western of which, facing the city, represents the older part of the building, constructed 1836–41, and is of Virginia freestone. The other three fronts, built 1855–61, are of solid granite from the State of Maine. The monolithic columns in the S. front are among the largest in the world, being 31½ feet high and 4½ feet in diameter. The building measures 468 feet by 261, exclusive of porticoes and stairways, contains 195 rooms, exclusive of attic and sub-basement, and cost $6,000,000. It was designed by Robert Mills and T. U. Walter.

The great building of the state department, which when finished will accommodate the war and navy departments as well, is the latest erection among the public buildings of Washington, and is a massive piece of architecture in the Italian Renaissance style from designs by A. B. Mullett, surmounted by a Mansard roof. The material of the basement is Maine granite, and the entire superstructure is of granite from the quarries near Richmond, Va. The building was commenced in 1871, and the southern portion finished and occupied by the state department in 1875. The dimensions of the entire edifice will be 567 feet by 471, and it will have four façades, looking to the E., W., N., and S. respectively. The two buildings now occupied by the war department and navy department are situated on Seventeenth street, near the corner of Pennsylvania Avenue, and are plain edifices of brick, which will shortly give place to the magnificent new structure erected in part for their use, the total cost of which will approach $7,000,000.

The department of the interior, best known as the Patent Office building, is located near the centre of the city, occupying the entire square between F and G streets, and running from Seventh to Ninth. This splendid building is of severely simple though massive proportions, the architecture being pure Doric, the edifice measuring 453 by 331 feet, with an elevation of 75 feet. The older part of the structure, constructed 1837–42, and fronting on F street, is of freestone. The three remaining fronts, constructed 1850–64, are of Maryland marble, and the interior, fronting on a court in the centre, is of New England granite. The Parthenon at Athens furnished the model of the columns, capitals, and tympanum of this building; designed by W. P. Elliott. In it are located, besides the patent office, which occupies by far the larger portion of its 191 rooms, the Indian office, and the office of the public lands, together with the offices of the secretary of the interior and clerks. The patent business of the U. S. (treated elsewhere) is of enormous extent, and the models exhibited in this building number upward of 160,000, while the annual registry of new patents now averages about 15,000. The cost of the patent office building was $2,700,000.

The building of the post-office department is located immediately opposite the patent office, occupying the square embraced between Seventh and Eighth streets on one side,

and E and F streets on the other. It is constructed of Maryland marble. It is 300 feet long by 204 wide, with a central quadrangle 195 by 95 feet. The order of architecture is pure Corinthian. The building, erected about 1855, cost $1,700,000.

The department of agriculture occupies a large brick building with brownstone trimmings, in the Renaissance style, 170 by 61 feet, situated on a public reservation adjoining the Smithsonian Institution. It was erected in 1868, from designs by A. Cluss, at a cost of $140,000. Its appendages consist of greenhouses and graperies and experimental grounds covering about 10 acres, with terraces beautifully laid out in front and planted with beds of assorted flowers grouped in excellent taste. The business of the agricultural department is the distribution of seeds, plants, agricultural reports, and information, chiefly through members of Congress.

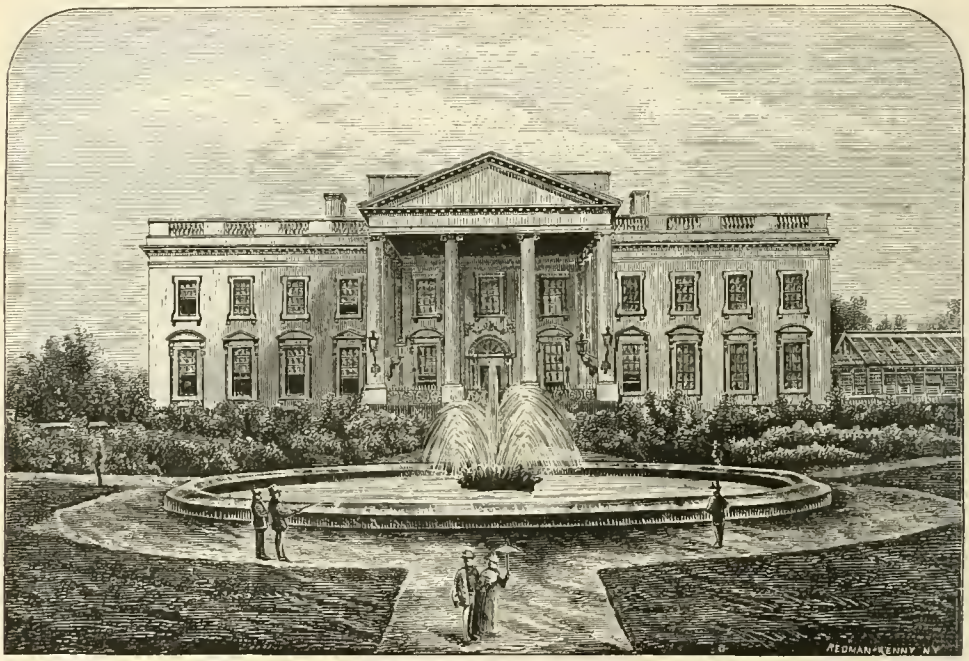
The Naval Observatory of the U. S. is situated on the banks of the Potomac, midway between Washington and Georgetown. The grounds occupy 19 acres. The main building of the observatory, erected in 1844, is surmounted by a dome, from the flagstaff of which a signal-ball, dropped daily at the hour of 12, indicates the hour of mean noon by electric wires to the telegraph company running to all parts of the U. S. Another domed edifice in the immediate vicinity of the observatory contains the great equatorial telescope, mounted in 1873, with an object-glass of 26 inches, made at a cost of $47,000. This is the largest refractor in the world.

The Army Medical Museum, formerly Ford's Theatre, is on Tenth street between E and F, and contains the hospital records of the U. S. army in over 10,000 MS. volumes and a vast assemblage of curious and instructive specimens representing the effects upon the human body of wounds, morbid conditions, surgical operations, etc. The microscopic section of this museum has been carried to a high point of perfection, and exhibits wonderful results, while the models assembled of hospitals, barracks, ambulances, surgical instruments, etc., constitute the finest museum of the kind in the world. The library of the surgeon-general's office, here deposited, embraces about 40,000 volumes, and is by far the most complete medical collection in the U. S.

The government printing-office and book-bindery occupy a plain brick building 300 by 175 feet at the corner of N. Capitol and H streets. This is the largest printing establishment in the world, and its equipment is very complete, as many as 1,000,000 volumes having been turned out in a single year.

The Washington Navy-yard, established 1804, occupies 27 acres on the Anacostia River at the foot of Eighth street, about 1 mile S. E. of the Capitol. It embraces two ship-houses, several boat-houses, and shops for the manufacture of ordnance, together with buildings for officers' quarters. This yard, though practically disused for the construction

Fig. 6.



Executive Mansion (White House).

of naval vessels, is an important dépôt for the manufacture of naval supplies. Above it are the extensive though not attractive buildings known as the Marine Barracks, the head-quarters of the marine corps of the U. S. navy.

The President's House, known also as the Executive Mansion, and popularly called the White House, stands on Pennsylvania Avenue, occupying a reservation of about 20 acres of ground midway between the Treasury and the departments of state, war, and navy. It is a plain edifice of freestone painted white, 170 feet long by 86 feet wide, with a colonnade of eight simple Ionic columns in front and a semicircular portico in the rear. The grounds are adorned with fountains, flowers, and shrubbery, and form a pleasing retreat in the midst of buildings and streets devoted to commercial and public business. The building is adorned by excellent portraits of the ex-Presidents of the U. S. The largest apartment, known as the East Room, is 80 by 40 feet in dimensions, and 22 feet high. The adjoining Blue Room, a beautiful apartment finished in blue and gold, is devoted to receptions, diplomatic and social. The Green Room and Red Room (so called from their furnishings) are each 30 by 20 feet. The rooms of the second floor are occupied by the executive office and the President's secretaries, together with apartments for the Presidential family. The first President's house, commenced in 1792, was occupied by Pres. Adams in 1800, and was burned by the British army in 1814. The present edifice was constructed 1818–29, and there have been appropriated for its erection and maintenance up to the present time about $1,800,000.

Besides the public buildings erected by the government, various public offices occupy rented buildings in different parts of the city. The department of justice is accommodated in the upper stories of the Freedman's Bank building, opposite the Treasury. The pension office and its valuable records occupy the upper portions of a fireproof building on the corner of Pennsylvania Avenue and Twelfth street. The bureau of statistics is on Fifteenth street, and the Coast Survey rents the fine buildings with fireproof store-rooms attached, erected especially for its use, on New Jersey Avenue near the Capitol. The large operations of the signal service of the army are conducted in two buildings on G street, W. of the War Department, and the army paymaster's office, commissary bureau, *Nautical Almanac* office, etc., are bestowed in hired apartments elsewhere.

The fine arts are not yet well represented in Washington, though numerous ambitious attempts have been made to decorate the city with statuary. The earliest executed of these, including the bronze equestrian statues of Gen. Jackson in La Fayette Square and of Washington in the circle on Pennsylvania Avenue, both by Clark Mills, belong to the grotesque and exaggerated style, which is gradually giving place to better models. H. K. Brown's fine equestrian statue of Gen. Winfield Scott in bronze, erected in 1874, occupies the circle at the intersection of Massachu-

setts and Rhode Island avenues on Sixteenth street. Rawlins Square is distinguished by a full-length statue in bronze of Gen. Rawlins, secretary of war in 1869, executed by Bailly in 1873. The Soldiers' Home is ornamented by a very superior work of art in bronze, being a colossal full-length statue of Gen. Scott by Launt Thompson. Ball's fine bronze statue, emblematic of Emancipation, erected in Lincoln Park in 1876, represents Abraham Lincoln freeing a slave in chains. Greenough's marble statue of Washington, classical in style and colossal in size, is situated immediately before the E. front of the Capitol.

The only public institution devoted exclusively to the fine arts is the Corcoran Gallery of Art, on the corner of Pennsylvania Avenue and Seventeenth street, erected in 1859 from designs by Renwick, and opened with a collection of paintings, statuary, bronzes, and casts from the antique in 1873. This gallery, founded by the liberality of W. W. Corcoran of Washington, is managed by a board of trustees, and is open to the public free during three days of the week, with an admission fee of 25 cents on Mondays, Wednesdays, and Fridays.

The Washington National Monument, so long a truncated column of 174 feet in height, was commenced in 1848 by an association incorporated by Congress. After an expenditure of $230,000, raised by voluntary subscription, the monument came to a stand-still for twenty years. By act of Congress passed in 1876, appropriating the sum of $200,000, this monument is to be finished, and will form a lofty and imposing plain obelisk, 70 feet square at the base and 470 feet high. It is constructed of great blocks of crystal Maryland marble, lined with blue gneiss stone, and while simple and majestic in form, without attempt at ornament, will constitute a mausoleum that will last for ages, erected by the people of the whole country to its greatest citizen on a scale worthy of the nation.

The cemeteries of Washington are not numerous. The Congressional Cemetery, located on the banks of the Anacostia 1 mile E. from the Capitol, embraces 30 acres. It has about 200 square cenotaphs of freestone erected to the memory of members of Congress who have died in Washington, and contains also the graves of many distinguished officials and citizens. Oak Hill Cemetery, on Georgetown Heights, is the most attractive and beautiful place of sepulture about Washington, occupying the undulating hills above Rock Creek, and thickly planted with noble forest trees and shrubbery. Glenwood Cemetery, at the extremity of Lincoln Avenue, N. of the city, and Rock Creek Cemetery, near the Soldiers' Home, with Mount Olivet, are the principal other cemeteries.

The Soldiers' Home, a national institution for the invalid soldiers of the regular army, was established in 1851 by a purchase of 200 acres 3 miles N. of the Capitol with a sum of money levied by Gen. Scott on the City of Mexico. It has been more than doubled in extent of grounds, and is kept up by a fund derived from retaining 12½ cents a month from the pay of each private in the army. The buildings are handsome and costly, and the grounds, laid out in meadows, groves, and lakes, afford 7 miles of beautiful drives, serving as a free public park for the city of Washington. At the Soldiers' Home, Pres. Lincoln and some of his predecessors were wont to find relaxation during the heated term of summer.

FIG. 7.

New State, War, and Navy Departments.

Of minor public buildings erected by the government may be mentioned the Naval Hospital, a handsome edifice at the corner of Ninth and Pennsylvania Avenue E.; the Columbia Institution for the Deaf and Dumb, founded 1857, with its picturesque semi-Gothic buildings, occupying 100 acres at Kendall Green, and accommodating 100 pupils; the government Hospital for the Insane (opened 1855), a commodious structure on the crest of hills on the E. bank of the Anacostia opposite Washington, with 419 acres and 600 patients, belonging to the army and navy and the District of Columbia; and the Reform School of the District of Columbia (150 acres), established in 1871, on the Bladensburg turnpike, 3 miles from the Capitol. The SMITHSONIAN INSTITUTION, one of the most important and attractive features of Washington, is fully treated under that head.

Charitable institutions abound in Washington, and many of them have received continuous or occasional aid from the treasury by act of Congress. The principal ones are Providence Hospital, a large edifice on Capitol Hill, accommodating 200 patients; the Louise Home, a fine building on Massachusetts Avenue, erected and endowed by W. W. Corcoran in 1871 for indigent gentlewomen; the Columbia Hospital for Women; the National Soldiers' and Sailors' Orphans' Home; the Washington Orphan Asylum; St. Joseph's and St. Vincent's orphan asylums; St. John's Hospital for Children; the Freedmen's Hospital and the Home for the Aged, under the care of the Little Sisters of the Poor.

The markets of Washington are profusely supplied with all the products of the soil and of the waters, the best qualities of meats, and the finest game at low rates. The two principal markets are the Central, erected in 1870, an ornate structure of brick on Pennsylvania Avenue between Seventh and Ninth streets, and the Northern Liberty Market, running from K to L streets on Fifth, erected in 1874.

The water-supply of Washington is brought by a capacious aqueduct from the Great Falls of the Potomac, 16 miles above the city. It affords a daily supply of 80,000,000 gallons to the reservoir, the consumption, however, only reaching 23,000,000 gallons per diem. The aqueduct cost $3,500,000. The public parks and squares are well supplied with fountains, none of which, however, are of remarkable size or artistic beauty.

Washington is connected with the Virginia shore by three bridges across the Potomac. The Long Bridge, which has a track for the Washington and Alexandria R. R. and a carriage-way for vehicles and pedestrians, is laid on piers. The Aqueduct Bridge at Georgetown is the only toll-bridge in the District. The Chain Bridge at Little Falls, 4 miles above, has given place to an iron truss bridge erected in 1874. Across the Eastern Branch or Anacostia runs the Navy-yard Bridge, an iron structure erected in 1875, and Ben-

ning's Bridge, of wood, lies about a mile above the navy-yard.

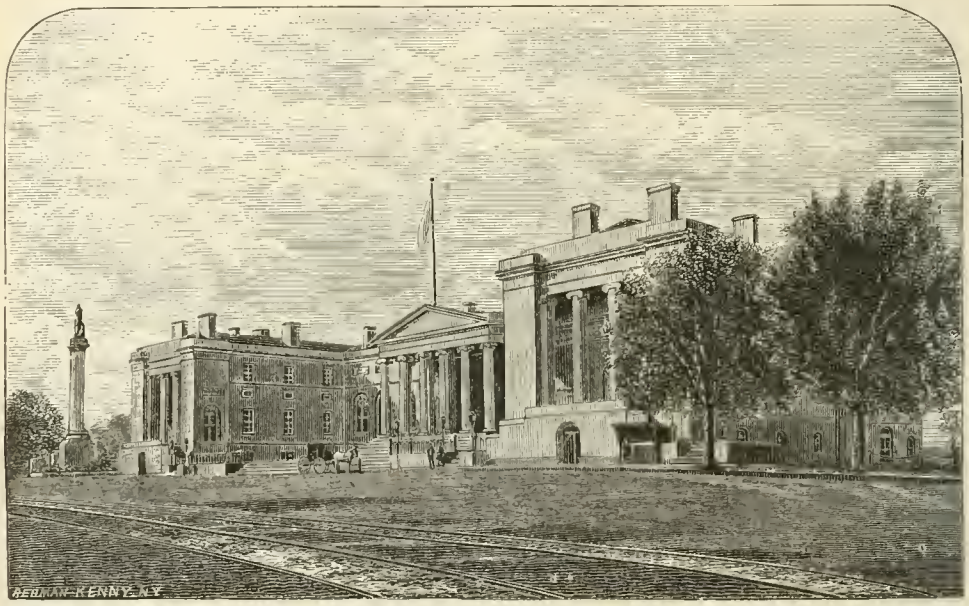
The schools of Washington are treated under the head of DISTRICT OF COLUMBIA. There are several colleges or universities, the chief of which are—Columbian University, with its law and medical department and preparatory school of over 100 pupils; Gonzaga College (Roman Catholic); Howard University for colored youth (see HOWARD UNIVERSITY); and the law school of the National University.

Five daily newspapers and 12 weekly periodicals, with several monthlies, are issued, but as yet the capital possesses no journal of first-rate power and importance to the country, the local papers being overshadowed by the keen competition of the metropolitan press.

As the political capital of the U. S., Washington enjoys a distinction to which no other metropolis, however extensive its population, commerce, shipping, or manufactures, can lay claim. The vast and varied interests connected with the legislation for a people of 45,000,000, now embracing 38 States and 9 Territories, draw to Washington an annually increasing number of citizens from motives of interest or curiosity, while its mild and salubrious climate in the winter season renders it an attractive resort for persons of wealth and leisure from all quarters. The society of Washington is marked by a degree of freedom and liberality of intercourse such as prevails in scarcely any other city of the Union. While the vast majority of the population is distinctively American, the presence of travellers and sojourners from all parts of the world, and the residence of the diplomatic corps representing foreign nations, render the society cosmopolitan in the best sense of the term. The opening of the fashionable season is nearly coincident with the opening of Congress on the first Monday in December. From that time until the Lenten holidays there is a constant succession of receptions, balls, dinners, etc., invitations to which are freely distributed, while the partly official, partly social receptions, termed levees, given by the President, the members of the cabinet, and the Speaker of the House of Representatives, are open to all comers. The President receives the calls of the public daily from 12 to 3 P. M., except on Sundays and cabinet days, Tuesdays and Fridays. New Year's reception at the White House is attended by foreign ministers in their official costumes, by the officers of the army and navy in full uniform, and by officers of the government, Senators and Representatives, and the public generally.

The chief places of amusement are Ford's Opera-house, corner of Louisiana Avenue and Ninth street, and the National Theatre. There are several public halls where concerts and lectures are of frequent occurrence during the season. The principal are Lincoln Hall, Masonic Temple, Odd Fellows' Hall, Willard's Hall, and Tallmadge Hall. The principal hotels are the Arlington, Ebbitt House, Willard's, Riggs House, the National, and the Metropolitan. Washington has 120 church edifices, few of which are

FIG. 8.



City Hall and Court-house.

remarkable for architectural beauty, divided between 15 different religious denominations. Nearly all parts of the city and of Georgetown are accessible by street cars, there being 10 street-railway companies and branches in active operation.

Washington is to a great extent a city of boarding-houses, and thousands of its citizens depend upon the rental of apartments, etc., for a portion of their incomes. The number of officers and clerks in government employ is nearly 5000, and as most of these have families, there is an extensive local market for goods and commodities of all kinds, which is met by a large and excellent variety of stores of merchandise.

During the civil war of 1861–65, Washington was the centre of military operations of prodigious magnitude. The city was fortified soon after the outbreak of hostilities by a cordon of strong earthworks or forts. These works, as finally completed, "consisted of 68 enclosed forts and batteries, having an aggregate perimeter of about 14 miles, and emplacements for 1120 guns, of which 807, besides 98 mortars, were mounted; of 93 unarmed batteries, having 401 emplacements; and of 20 miles of infantry trenches. The entire circuit of the line was, exclusive of the Chain Bridge works, and of the stretch across the Potomac from Fort Greble to Fort Lyon, 33 miles. Thirty-two miles of military roads, besides the existing roads and avenues of the District, afforded the means of communication from the interior to the periphery, or from point to point." (Draper's *Civil War in America.*) These works "exerted no small influence in saving Washington after the Bull Run defeat. They afforded a temporary shelter to the shattered national forces in Virginia after the disasters of the campaign of 1862, and they were again instrumental to the same result when Early marched on Washington—a third time saving the capital." (*Ibid.*) (See also *The Defences of Washington*, by Gen. Barnard.) Washington constituted throughout the war a great dépôt for military supplies of all kinds, and the rumble of the long trains of army-wagons moving to the front sometimes resounded all night long through its streets. Immense temporary hospitals were erected for sick and wounded soldiers sent in from the army in Virginia and elsewhere, and many churches and public institutions, including the Capitol building itself, were pressed into service as hospitals. Great depression prevailed during those critical years throughout the city. Property depreciated fearfully, and no new building was erected for years. Alternate seasons of profound gloom and of patriotic elation marked the varying fortunes of the war until the fall of Richmond and the surrender of Lee, followed by the unexampled catastrophe of the assassination of Pres. Lincoln, which threw the whole city into a panic on Apr. 14, 1865. On the return of peace and the assured restoration of the Union, confidence in the future revived, and Washington, which had been so long retarded by the incubus of war, began to extend its growth by the erection of multitudes of new buildings, and other evidences of prosperity. From this period may be said to date that new Washington which, with its magnificent pub-

lic improvements and multitude of private edifices of taste and elegance, has taken the place of the mean little village which but a few years ago appeared so unworthy the capital of a great nation. There were erected in 1875, 1400 new buildings, at a cost of about $3,500,000.

The environs of Washington abound in natural beauties which need only the hand of wealth and taste to render

FIG. 9.

Washington Monument.

them more attractive than those of any other American city. Favorite drives out of town take the visitor to Soldiers' Home, whence an enchanting view of city, river, and hilly landscape is unrolled: to Rock Creek Valley, notable for its picturesque wildness and wealth of flowers and forest trees; to the heights above Georgetown, by the splendid driveway of K street and Connecticut Avenue, climbing hills which command the widest and most impressive prospect in the District of Columbia; and to Arlington Heights, on the Virginia shore, with its city of the dead containing 15,000 Union soldiers' graves, and its lovely views down and across the Potomac to where the Capitol lifts its airy dome into the eastern sky.

The question whether it is good policy to build up a great city expressly for a seat of government is not now an open one. Washington has been built, and was laid out by the fathers of the republic on a scale of greatness commensurate with the permanent wants of a capital for a populous and powerful nation, destined to hold a front rank in civilization. The question of the removal of the seat of government westward, or nearer to the present or prospective centre of the country, is no longer agitated. The present capital, with its storied memories, founded by the first President, whose name it bears, is felt to be a worthy centre of the political union of a great people, symbolized by the inscription engraved on the dome of the Capitol—"*E pluribus unum.*"

A. R. SPOFFORD.

Washington Court-house, p.-v., and cap. of Fayette co., O.

Washington Lake, tp., Sibley co., Minn. P. 608.

Washington Plantation, tp., Franklin co., Me. P. 62.

Washington Territory, an organized portion of the Pacific domain of the U. S., lying between the parallels of 45° 32′ and 49° N. lat., and between the meridians of 117° and 124° 28′ W. lon. from Greenwich. It is bounded on the N. and N. W. by British Columbia, from which it is separated for nearly one-fourth of the distance by the Straits of San Juan de Fuca, the Canal de Haro, and the Gulf of Georgia; on the E. by Idaho Territory; on the S. by Oregon, the Columbia River forming the boundary for three-fourths of the distance; and W. by the Pacific Ocean. Its greatest length from E. to W. is about 360 miles, and its greatest breadth from N. to S. about 400. Its area, according to the U. S. land office report, is 69,994 sq. m., or, including its water surface, 79,128 sq. m.

Topography.—The Territory is divided by the Cascade Mountains and the Columbia River into Western Washington, lying W. of the Cascade Mountains, and extending to the Pacific; Central Washington, between the Cascade Mountains and the Columbia River; and Eastern Washington, E. of the Columbia. Western Washington, besides the Cascade Mountains, which form its eastern wall, has the Coast Range, extending in somewhat disorderly masses from the Coast Mountains of Oregon, and trending N. W. between Puget's Sound and the Pacific, and finally terminating in the bold and lofty headlands of Cape Flattery. The southern portion of this range is low, but W. of Hood's Canal, in Jefferson co., it rises to an elevation of 5000 feet, and in one of its summits, Mount Olympus (which gives its name to this part of the chain), to 8150 feet. The Pacific coast is generally abrupt and forbidding except the two harbors of Shoalwater Bay and Gray's Harbor, but the Straits of San Juan and the extensive inland sea known by the general name of Puget's Sound have some of the best harbors and roadsteads in the world. Puget's Sound, with its bays and inlets, known as Bellingham Bay, Hood's Canal, Admiralty Inlet, etc., covers 2000 sq. m., and has a coast-line of about 1600 miles. There are numerous islands in the Sound and Straits, some of them of large size. The Sound receives numerous rivers, among which are the Nesqually, Puyallup, White, Cedar, Snohomish, Snoqualmie, Stalukwamish (or Stillaguamish), Duwamish, Skokomish, Skagitt (or Skayit), and Nooksahk (or Lummi). The Chehalis falls into Gray's Harbor, and is navigable for 60 miles. It receives the Newaukum River. The Willopah empties into Shoalwater Bay. The Columbia River, of which we shall speak further on, has several small tributaries in Western Washington, the principal of which are Cowlitz, and its branches, Strong's and Gray's rivers. This western division of the Territory is much broken, but it is well watered and most of it very fertile, while the fine harbors and bays of its central valley make it readily accessible to commerce. Central Washington comprises the summits of the Cascade Mountains, the valley of the Yakima, and the plateau stretching to the Columbia River. The mountains on its western border form an unbroken range from 5000 to 8000 feet above the sea, and several lofty peaks rise from 2000 to 6000 feet higher. Thus, Mount Baker is said to be 11,100 feet in height; Mount Rainier, 14,444 feet; Mount Adams, over 9000 feet, and Mount St. Helen's, 9750 feet. Stretching eastward toward the Columbia River is a lofty plateau channelled by the valleys of the Yakima, Methow, Okinapum, and Nehoiatpugun rivers and their tributaries. The Blue Mountains, the summits of this plateau, rise to 8000 or 9000 feet, but near Walla Walla sink to 5000 feet. Its lands are barren, sterile, and dry; the river-valleys are very fertile. Much of the plateau is scantily wooded. Eastern Washington comprises the valley of the Columbia and its great affluents, the Clark's, Spokane, and Lewis (or Snake) rivers, and the Spokane plains or plateau—the latter elevated and sterile, and without forests; the former well watered, fertile, and containing a sufficiency of timber. Columbia River rises in British Columbia, and pursues a very devious course, receiving Clark's River, just as it enters the Territory, running S. to the mouth of the Spokane, thence W. to the point where it receives the Okinikane, and shortly afterward the Methow, Chelan, and several smaller streams, when it flows S. E. to the Oregon line, receiving the Yakima on one side and Snake River with its tributaries on the other; a few miles below it receives the Walla Walla, and then turns sharply to the W. and forms the boundary between Oregon and Washington for almost 300 miles. In this last course it has in Eastern or Central Washington no important tributary except the Klickatat. There are many lakes in Washington; some of them very beautiful. The most considerable are Quinault, American, Whatcom, Union, and Washington lakes in W. Washington; Lakes Natchess, and Kitchelus high up in the Cascade Mountains; Kleattam, Chelan, and Osoyoos in the central section; and Lakes Arnold and Silkatqua in E. Washington.

Geology.—The shore of the Pacific, the lower valley of the Columbia, and the great valley drained by Puget Sound are Tertiary and Quaternary; the islands W. of the Canal de Haro in the Gulf of Georgia are Cretaceous; the Coast Range is Eozoic; the Cascade Mountains to about 47° 40′, and the great plain of the Columbia River in Central and Eastern Washington S. of the Spokane River, are volcanic; Northern Washington is Eozoic, except two narrow and small outcrops of Silurian age in the extreme N. E.—one E., the other W. of Clark's Fork.

Minerals.—Coal of excellent quality has been mined near Bellingham Bay and Lake Whatcom, also back of Seattle, on Lake Washington, and in the Coast Range. Some of it probably belongs to the Tertiary coal-beds, but that in the N. is from the coal-measures. It is mostly bituminous, but it is claimed that deposits of anthracite coal have been found in Puyallup Valley and Green River. Gold has been found in the N. E., near the Columbia River. Iron is plentiful of different ores.

Zoology.—The wild animals are the same as are found in Oregon. Salmon are nearly as abundant as in Oregon, and form a profitable article of commerce.

*Population.**

Census year.	Total population.	Male.	Female.	White.	Colored, including Chinese and Indians.	Native.	Foreign.	Density.	Ratio of increase.	Number of families.	Persons in a family.	Number of dwellings.	Persons to a dwelling.	Illiteracy.	Of school age, 5 to 20.	Of military age, 18-45, males.	Of voting age, 21 and upward, males.	Citizens, males.
1860	11,594	8,446	3148	11,138	456	8,450	3144	0.06	.....	2798	4.14	3037	3.82	438	2279	5880	6166	4231
1870	23,955	14,990	8965	22,195	1760†	18,931	5024	0.34	106.61	5673	4.22	6066	3.95	1307	7060	7835	9241	7902

Soil, Vegetation, and Botany.—The forest trees of Western Washington are unsurpassed in height and beauty except by the giant redwoods and sequoias of California. The white, red, and yellow pine, the red, black, and yellow fir, and the Oregon cedar, are from 175 to 350 feet in height and from 8 to 15 feet in diameter. The deciduous trees are principally maple, ash, laurel, and alder. There is less timber in Central and Eastern Washington; but wherever there is sufficient water, the plains yield immense crops. In Walla Walla, Whitman, and Stevens cos. large tracts have yielded 85 bushels of wheat to the acre, the wheat weighing 62 pounds to the bushel. Flax, sugar-beets, hops, and fruit of most kinds are raised in large quantities. The nutritious bunch-grass is abundant, and most of Central and Eastern Washington is admirably adapted for grazing. In the N. the nights are too cool for Indian corn.

Climate.—Western Washington has a climate similar to that of Oregon. The winters are mild, without much snow or ice. During sixteen successive years only three winters were so severe as to render it necessary to house and feed stock. The summers are delightful, the temperature seldom rising above 80°, and the nights cool and agreeable. The mean difference between the hottest and coldest month is but 26°. The mean annual temperature is 52°. In Eastern and Central Washington the winter corresponds with that of Pennsylvania; the summers are dry and hot. The rainfall near the Cascade Mountains is 36 inches; on and near the coast, from 100 to 130 inches; in Eastern Washington, 12 to 14 inches on the plains, and from 20 to 24 in the more elevated districts.

Agricultural Productions.—In 1870 only 649,139 acres had been taken up in farms—not quite $\frac{1}{100}$th of the area. Of this, 192,016 acres had been improved. There has been a considerable increase in the amount of improved land since 1870. The value of farms in 1870 was $3,978,341; of farming implements, etc., $280,551. The value of all farm products was $2,111,902; of animals slaughtered, etc., $292,280; of home manufactures, $28,890; of forest products, $19,705; of market-garden products, $74,462; of orchard products, $71,863; of wages paid, $215,522. The crops raised were—wheat, 217,043 bushels; Indian corn, 21,781; oats, 255,169; barley, 55,787; wool, 162,713 pounds; hay, 30,233 tons; hops, 6162 pounds (200,000 pounds in 1875); tobacco, 1682 pounds; potatoes, 281,144 bushels; peas and beans, 15,790; honey, 25,636 pounds; grass and clover seed, 1566 bushels; flaxseed, not reported in 1870, is now raised extensively in Eastern Washington; butter, 407,306 pounds; cheese, 17,465 pounds; milk sold, 21,060 gallons. The value of live-stock in the Territory in 1870 was $2,103,343; number of horses, 13,923; neat cattle, 51,979, of which 16,938 were milch cows; sheep, 44,063; swine, 17,491.

Manufactures, of course, are in their infancy, yet in 1870 there were 269 establishments, employing 1026 hands (all males but one), with a capital of $1,893,674, paying $574,936 wages, using $1,435,128 of raw material, and producing $2,851,052 of manufactured goods. Of these products, $1,872,310 was lumber, planed and sawed (in 1875 over 300,000,000 feet of lumber was sawed in the 60 saw-mills of the Territory); $282,728 flouring-mill products. In 3 mining establishments the same year there were employed 90 hands, $301,200 capital, and $209,064 was produced, mainly coal. The same year 17 fisheries, employing 234 hands and $165,565 capital, produced $289,746 of fishery products. This amount (which includes salmon, halibut, cod, and oysters) has since been very largely increased.

Railroads.—There were in Jan., 1875, 170.7 miles of railroad, costing $7,856,701 for road and equipment. This railway was a continuation of the Oregon and California line, sometimes called the western division of the Northern Pacific, to Olympia on Puget Sound and to Steilacoom.

Finances, etc.—The true valuation of real and personal estate in 1870 was $13,562,164. There was no Territorial debt, but county debts to the amount of $71,196, and town, city, etc., $17,631. The Territorial tax was $33,743, and all taxation not national, $163,992. There are no banks or savings banks or insurance companies in the Territory, and in 1875 there were but 2 private banking-houses.

Commerce.—Washington Territory has but one customs district, that of Puget Sound. The imports into this district in the year ending June 30, 1875, were $24,954, and the exports from it, all products of the Territory, $395,330.‡ During the same year 342 vessels of 115,215 tons burden and manned by 5241 men entered the ports of the district from foreign countries, of which 235 were ocean steamers, of 87,440 tons burden, and crews numbering 4617 men; 365 vessels, of 129,973 tons aggregate tonnage and 5587 men, cleared from the same ports, of which 239 were ocean steamers, of 92,760 tons and manned by 4808 men. In the coastwise trade and fisheries the number of vessels entered was 120, their tonnage 67,881, their crews 1706 men; the number cleared was 41, the tonnage 23,481, the crews 686; 103 registered, enrolled, and licensed vessels belonged to the district, and their tonnage 24,209 tons.

Churches in 1870 and 1875.

Denominations.	Organizations, 1870.	Church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Organizations, 1875.	Church edifices, 1875.	Ministers, etc., 1875.	Communicants or members, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations	51	36	6000	$62,450	94	72	58	2398	21,465	$105,700
Baptists	3	2	.....	.....	12	9	9	224	1,100	7,200
Christian Connection	4	1	250	600	5	2	2	120	600	1,500
Congregationalists	2	1	250	5,000	6	4	3	94	500	8,000
Protestant Episcopalians	4	3	500	7,650	9	7	6	215	1,200	10,500
Methodists	16	12	2200	21,650	24	14	10	1213	6,350	32,600
Presbyterians	3	3	600	5,500	7	6	5	121	690	10,200
Roman Catholics	11	12	1785	18,400	19	19	15	.....	9,000	26,700
Second Adventists	1	1	40	150	1	1	1	30	150	250
United Brethren in Christ	7	2	400	3,200	10	9	6	306	1,500	8,150
Union	...	1	100	300	1	1	1	75	375	600

Education.—The total receipts for school purposes in the Territory in 1874 were $39,294. The scholastic age is from four to twenty-one years, and the number of persons of scholastic age was about 11,937; the number enrolled during the school year was 7592; the average attendance is not given; school-rooms, 225; teachers necessary to supply the public schools, 117; the average duration of the school in days, 165. The schools of Olympia and Seattle are graded and of high character. There are 2 colleges. The Territorial University at Seattle, organized in 1872, had in 1874, 3 professors and 50 students (27 males and 23 females, all in the preparatory department), but having organized academic and collegiate departments, in which classes would soon be formed; the university had buildings and grounds

* Gov. Ferry estimates the population in 1875 at 36,000, aside from tribal Indians.

† Besides 13,477 Indians sustaining tribal relations on reservations in the Territory.

‡ Gov. Ferry (message Oct. 5, 1875) gives the exports of the year ending July 31, 1875, as $759,230, the imports as $49,125, and the foreign and coastwise commerce over $5,000,000.

valued at $50,000; endowment, $15,000; income from productive funds, $2000; volumes in library, 125. The Holy Angels' College at Vancouver City, a Roman Catholic institution, was organized in 1865. It has 3 professors and 56 students, and a library of 500 volumes. Provision is made for the insane in the Oregon hospital.

Newspapers.—In 1870 there were 14 newspapers in the Territory, having an aggregate circulation of 6785, and a total annual issue of 396,500 copies. Of these, 1 was a daily, with 460 circulation; 1 a tri-weekly, with 600 circulation; 10 weekly, with 1525 circulation; and 2 monthly, with 1500 circulation. In 1875 the number was 17, of which 3 were dailies, 1 semi-weekly, and 13 weekly.

Government, Courts, etc.—All male citizens of the U. S. who are qualified to vote elsewhere are voters. The President appoints the governor and secretary; the auditor and treasurer are chosen under Territorial authority. The legislative assembly, which convenes annually, is composed of a council of 9 members, elected for three years, and a house of representatives of 30 members, elected for one year. The judicial power (aside from U. S. district courts) is vested in a supreme court consisting of a chief-justice and two associate justices, who hold their offices for four years; in three district courts, one for each judicial district, in each of which one of the justices of the supreme court presides; and in justices' courts, held by justices of the peace. The Territory is represented in Congress by a delegate.

Counties (24).

Counties.	Pop., 1870.	Males, 1870.	Females, 1870.	Pop., 1860.	Assessed valuation, 1875.	True valuation, 1870.
Chehalis.....	401	238	163	285	$301,799	$202,829
Clallam.....	408	267	141	149	126,905	216,155
Clarke.....	3,081	1,725	1,356	2,381	679,008	803,029
Columbia.....	New	co.	.....	.....	800,000	
Cowlitz.....	730	432	298	406	614,259	351,566
Island.....	626	435	191	294	460,363	366,268
Jefferson.....	1,258	937	331	531	495,264	709,870
King	2,120	1,359	761	302	1,778,172	1,113,765
Kitsap.....	855	691	175	544	789,029	1,050,000
Klikitat	329	193	136	230	275,404	201,016
Lewis	888	516	372	384	1,155,650	626,125
Mason	289	212	77	162	178,510	196,000
Pacific.....	738	460	278	420	322,945	600,000
Pierce.....	1,409	810	599	1,115	1,123,063	505,607
San Juan.....	New	co.	.....	.....	732,848	
Skamania....	133	96	37	173	124,911	158,439
Snohomish...	599	448	151	.....	239,629	138,570
Stevens.....	734	509	225	996	253,527	201,480
Thurston.....	2,246	1,372	874	1,507	1,358,537	2,183,650
Wahkiakum	270	190	80	42	172,761	375,000
Walla Walla	5,300	3,108	2,192	1,318	1,992,065	3,187,555
Whatcom.....	1,088	731	357	352	469,267	177,158
Whitman	New	co.	.....	.....	376,887	
Yakima.....	432	261	171	.....	413,167	192,052
Totals.....	23,955	14,990	8,965	11,594	$14,569,156	$13,562,164

Principal Towns.—Olympia, the capital, had, in 1870, 1203 inhabitants; Walla Walla, 1394; Seattle, 1107; while Steilacoom, Port Townsend, and Vancouver were places of some importance.

History.—The region about Puget Sound was a favorite resort for the Indian tribes for centuries. In 1840 there were 25,000 Indians who claimed the Puget Sound region as their home. The number has been greatly reduced since that time. The Straits of San Juan de Fuca were first entered in 1592 by a Greek navigator of that name in the Spanish service; the coast was revisited in 1775 by Heceta, a Spanish navigator, and in 1787 and 1788, Capts. Berkeley and Meares, Englishmen, successively entered the straits, and the latter revived the name of the old Greek discoverer. An American, Capt. Gray, discovered Gray's Harbor in 1791, and Lewis and Clark penetrated to it in 1815. The Hudson's Bay Company attempted to take possession of it from 1828 to 1841, but the U. S. claimed it by a double title—from the Spanish and from Gray's discovery—and American settlers occupied it from 1845. After a long controversy the American claims were admitted, but the islands in the Gulf of Georgia were not adjudged to them till 1873. The Territory was organized in 1853, had a severe Indian war in 1855, comprised most of Idaho Territory from 1859 to 1863, since which time it has had its present boundaries.

Governors of the Territory.

Isaac J. Stevens.....	1853–57	Marshall F. Moore.....	1867–69
J. Patton Anderson.....	1857–57	Alvin Flanders	1869–70
Fayette McMullen.....	1857–61	Edward S. Salomon.....	1870–71
Richard D. Gholson.....	1861–61	James F. Legate.....	1871–72
William H. Wallace.....	1861–61	Elisha P. Ferry.....	1872–77
William Pickering.....	1861–67		

(The writer acknowledges the receipt of valuable documents and statistics from His Excellency, Hon. Elisha P. Ferry, governor of the Territory.) L. P. Brockett.

Washington Territory, University of, was chartered in 1860, when most of the lands granted by Congress were sold to prepare the grounds in Seattle, King co., and to erect buildings. The school was first organized as a graded school with regular courses of study in the autumn of 1872, by Pres. E. K. Hill. The courses of study include a preparatory department and an academic department, containing academical, classical, scientific, and English courses of four years each.

Washington University, an institution of learning at St. Louis, Mo., incorporated in 1852, consisting of an academy, a female seminary, a polytechnic institute (1857), and a law school (1867), besides the college proper, which was organized 1859. The entire number of students averages 700, and of instructors 58, but of these only 30 students and 5 professors are assigned to the college proper. The latter has a library of 5500 volumes, and the O'Fallon Polytechnic School one of 30,000 volumes. The president of the university is Rev. W. G. Eliot, D. D.

Wash'ingtonville, v., Columbiana co., O. P. 517.

Washingtonville, v., Mahoning co., O. P. 232.

Washingtonville, b., Montour co., Pa. P. 172.

Washita. See Ouachita.

Wash'ita River (frequently spelled **Ouachita**) rises by its Brushy Fork in Polk co., Ark., and flows first E. and then S., crossing the Louisiana State line, and finally discharges its waters into Red River. It is navigable by steamboats throughout the year to Camden, Ark., and for two-thirds of the year to Arkadelphia, Ark. It is 600 miles long, and flows through a rich corn and cotton region. Its navigation is extensive and important.—Another Washita, called also the False Washita, traverses the Indian Territory between the S. fork of the Canadian and Red River, and falls into the latter stream at Washita Bend, above Preston, Tex. (See Red River.)

Wash'oe, county of N. W. Nevada, bordering on California, traversed along the S. border by Central Pacific R. R. The N. part is mainly a desert; in the S. part is Truckee Lake and several other considerable bodies of water. Gold, silver, and copper have been found, but not in any great quantities, and there are large forests in the mountains which border the Truckee Valley, in which there is a tract of arable land. Staples, hay and a little barley, oats, and potatoes. Cap. Reno. Area, 2316 sq. m. P. 3091.

Washoe City, p.-v., Washoe co., Nev. P. 552.

Wash'tenaw, county of S. E. Michigan, drained by Huron and Raisin rivers, and traversed by Michigan Central and Michigan Southern R. Rs.; surface undulating, interspersed with prairie and woodland and several small lakes; soil a rich sandy loam. There are saw-mills, planing-mills, flour-mills, tanneries, and more than 500 manufacturing establishments, among which are those of agricultural implements, carriages, saddlery, cooperage, furniture, clothing, boots and shoes, paper, and woollen goods. Live-stock, especially sheep, very numerous. Staples, wheat, Indian corn, oats, potatoes, wool, hay, and dairy products. Cap. Ann Arbor. Area, 720 sq. m. P. 41,134.

Wasioja, p.-v. and tp., Dodge co., Minn. P. of v. 324; of tp. 1134.

Wasp [Ang.-Sax. *wäsp*; Lat. *vespa*], a name popularly applied to hymenopterous insects of the families Vespidæ, Crabronidæ, Nyssonidæ, Larridæ, Sphegidæ, and Pompilidæ, which essentially agree in form, but properly applicable to the Vespidæ alone as a family designation. This family is typified by the paper-wasp and hornet, and the physiognomy in all is nearly alike; the prothorax is extended backward as far as the origin of the wings; the abdomen sessile or pedicellate, composed of seven segments in the males and of six in the females, and terminated by a retractile sting: the mandibles are variable; the lip is mostly quadrifid or quadrilobed, sometimes only bifid; labial palpi 4-jointed; maxillary 6-jointed; the antennæ are geniculate, 13-jointed in the males, 12-jointed in the females; the eyes are generally emarginate; the wings are folded longitudinally when at rest, and have two recurrent nervures, and three or four cubital cells; they are developed in both sexes; the legs are slender and hairless. Such are in substance the characters of the family given by its latest monographer, De Saussure. The species are numerous, not far from 1000 being known, and are quite widely distributed. The North American representatives are many, among which are 53 species of *Zethus*, 53 of *Eumenes*, and 156 of *Odynerus*. The species differ considerably in habits, and these, being co-ordinated with structural characteristics, have furnished the basis on which De Saussure has differentiated the family into three sub-families—viz. (1) Masarinæ, or parasitic wasps; (2) Eumeninæ or Odynerinæ, or solitary wasps; and (3) Vespinæ, or social wasps. The first of these is only represented in the U. S. by three known species, the others by very many. The social wasps are the ones most generally known, and to this category

belong the common species framing papery cells (*e. g. Vespa maculata, Vespa arenaria*), the hornet (*Vespa crabro*), and the species which form the silky nests, with the mouths of the cells downward, which are found attached to bushes, etc. (*Polistes annularis, Polistes canadensis*, etc.). The typical wasps are quite omnivorous in their diet, attacking fruits and berries, as well as other insects and raw meat. In their assaults on insects they use almost solely their jaws, and not their stings. The common honey-bees frequently fall victims to their rapacity, and after being dismembered their abdomen is devoured by their destroyers. The American solitary wasps are described in vol. i. of a *Synopsis of American Wasps*, by Dr. Henri de Saussure of Geneva, recently (Dec., 1875) published by the Smithsonian Institution. (See also ENTOMOLOGY and HORNET.)

THEODORE GILL.

Wasson (DAVID ATWOOD). See APPENDIX.

Waste (in law). When a tenant for years or for life, either through actual misconduct or through negligence, does or suffers permanent damage to the land in his possession—technically, to the inheritance—so that the rights of the ultimate owner, the reversioner, heir, or remainderman are prejudiced, such injury is termed "waste," and the tenant is responsible therefor to the party who stands behind him, and to whom the land will finally come. Waste may be voluntary or permissive. It is voluntary when caused by the intentional act of the tenant, by his doing what he ought not to have done. It is permissive when it results from his negligence, from his not doing what he ought to have done. As examples of the first are the cutting down of trees more than may be needed for actual use for firewood or for repairing buildings, fences, or agricultural instruments, and especially the cutting down timber trees, fruit trees, or ornamental trees; the changing the nature and use of fields; the opening of new mines, quarries, etc.; the tearing down or altering houses; and the like. Some of the strict common-law rules concerning the use of farming land have been considerably modified in the U. S., and the tenant is permitted here to do all such acts which would be regarded as a proper and husbandlike treatment of the land in the neighborhood. Examples of permissive waste are the suffering buildings to become dilapidated or ruinous, or fences to become out of repair, or orchards to become decayed, or fields to become overrun with weeds and briers from lack of proper cultivation. When acts of waste are committed by a stranger, the tenant is liable therefor, since it is his duty to protect the possession against all trespassers. The remedies which the reversioner may have for waste are three: (1) An action at law to recover the damages already done; (2) a suit in equity, wherein the tenant will be enjoined from committing any further injury, and will be compelled to account for and pay the damages which have accrued: as this remedy is the most effective, it is the one generally used; (3) ancient English statutes, which have been enacted in many of the States, give the reversioner an action for treble damages, and also enable him to recover the land on which the waste is actually committed. In England life estates are frequently created and conferred by will or family settlement "without impeachment of waste." While this clause enables the tenant to do most acts which the law would treat as waste, equity will not suffer him to do acts of wanton injury, such as pulling down or dilapidating houses, cutting down ornamental trees, destroying pleasure-grounds, and the like. The object of the provision is to permit the tenant to use the land in such a manner as to make it profitable. JOHN NORTON POMEROY.

Wa'tab, p.-v. and tp., Benton co., Minn. P. of v. 22; of tp. 58.

Wa'taga, p.-v. and tp., Knox co., Ill. P. 1205.

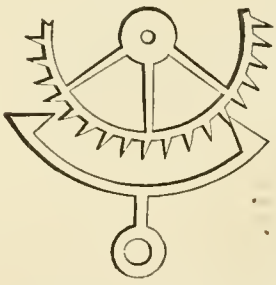
Watau'ga, county of N. W. North Carolina, bordering on Tennessee, and drained by Watauga and New rivers. The surface is generally mountainous, containing some iron ore, with fertile valleys. Staples, Indian corn, oats, and rye. Cap. Boone. Area, 550 sq. m. P. 5287.

Watauga, tp., Watauga co., N. C. P. 556.

Watauga River rises in Watauga co., N. C., and passes through a mountain-region into Tennessee, flowing into Holston River (S. fork). It is navigated to a point 6 miles above Elizabethton, Tenn. It affords fine water-power.

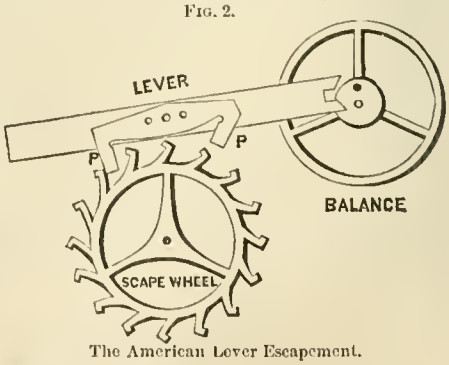
Watches. The name "watch," as applied to a pocket timepiece, is not so old as the thing itself. In the article CLOCKS (which see) we have given a condensed history of the slow processes by which the civilized world attained to an accurate measurement of time. The clock was the mother of the watch. The means of producing motion were substantially the same; for in the early part of the fifteenth century it had been discovered that "clockwork" could be set in motion as well by the gradual uncoiling of a spring as by the running down of weights, and that these motions could be made isochronous either by the swing of a pendulum attached to the escapement or by a balance-wheel acting upon the escapement. Yet the pocket-clock, or "Nuremberg animated egg," was not made till 1477 by Peter Helé, a clockmaker of that city, and was reckoned one of the wonders of the world. Its production cost a year's labor; it varied nearly an hour a day from the true time; it required winding up twice a day, and the price put upon it and its fellows by the inventor was equal to $1500 in gold at the present time. It was egg-shaped, and its size was about that of a goose-egg. The hair-spring was not then invented, but Helé did probably invent the *fusee*. The main-spring was enclosed in a small brass box called the "barrel," the inner end being attached to a "pinion" or movable stem in the centre of the barrel, by the turning of which the spring was drawn up, while the outer end passed through a small slit in the barrel, and was attached to the barrel: the other end was fastened to the base of a conical wheel, the pinion of which was armed with teeth: as the spring uncoiled, the chain was wound up on this conical fusee, whose decreasing diameter aided in regulating the relaxation of the spring, and producing that uniformity of motion considered necessary in an instrument which was to measure time with accuracy. For the first 125 years or more, the fusee-chain was made of catgut, a material peculiarly susceptible to atmospheric changes. A watch in the library of the American Watch Co. at Waltham, which bears the date of 1600, has this catgut chain. Not long after, some watchmaker, probably in England, substituted for this the metallic fusee-chain, composed of several hundred minute and highly-finished steel links—a great improvement, but liable to break or become unfastened. As yet, the balance was only the old balance-wheel of De Vick (see CLOCKS), the principal weight being concentrated in the rim, to correspond to the weights suspended on the horizontal lever; but this proved unsatisfactory. The application of the coiled hair-spring—or pendulum-spring, as the old watchmakers called it—to the balance, and the discovery that within certain limits the vibrations of this spring are isochronous, were the most important improvements made in the watch. The hair-spring is claimed both by Dr. Robert Hooke and the astronomer Huyghens, but Hooke's claim (of having applied it in 1658 or 1659) seems to be the best substantiated; Huyghens's earliest date is 1674. For 100 years after this great improvement was introduced, the ingenuity of watchmakers was expended on the escapement, but with very meagre results: the scape-wheel has its teeth a little different in form, the pallets are changed somewhat, and the "lever" is attached to a moving bar; but beyond these changes, mostly in form, and also to some extent in greater efficiency of action, there is but a slight difference between Dr. Hooke's escapement of 1666 and the "patent lever," "detached lever," or "detached escapement" now in use in the best English, Swiss, and American watches. In the latter the lever has a nick or slot in it, which catches a pin in the balance, and is thrown to the right or left; this raises the pallet, which, immediately falling again, catches the next tooth of the scape-wheel, stops the train, and so releases or *detaches* the balance from the lever for a single half-revolution, when the pin again falls into the

FIG. 1.



De Vick's Escapement.

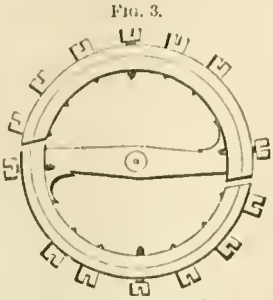
FIG. 2.



The American Lever Escapement.

slot of the lever, and the same results follow in reversed action. This isochronous swing of the balance acts like the pendulum of the clock, and determines the rate of movement of the train. The next improvement in the construction of the watch was made about 1700, and consisted in the use of jewels for the bearings of the pivots. These had previously run on metallic bearings; but it was found that after a moderate period they became so worn that the watch would no longer keep good time. For these bearings, minute jewels of ruby, sapphire, chrysolite, garnet, or agate, each shaped in a diamond-armed lathe and drilled by a diamond-pointed drill, were substituted. In some of the cheapest and least serviceable of Swiss watches the harder descriptions of glass are used for jewels, but these do not wear well. The next improvement was not discovered till 1767; it was the compensation balance, invented by John Harrison. The cut illustrates this compensation balance. The circumference is divided into two sections, the opposite ends of which are fastened to the cross-bar of steel; the outer rim of the balance is of brass; the inner rim, which is soldered to it, of steel, and each half of the circle has one end free, while the different contractility or expansibility of the two metals compensate each other.

Fig. 3.



The Compensation Balance.

With these improvements the English watch attained its highest development. It was, it is true, thick and clumsy, justifying the slang names, "bull's eye," "turnip," etc., often applied to it. A more delicate manipulation and finer, lighter wheels and pinions reduced its thickness somewhat, though it was always a heavy, thick watch, but was regarded by the English people and some others as the more valuable and durable for its solidity. It was made almost entirely by hand, and the different parts by different workmen, so that the mere work of putting it together was no small labor. In no instance could the wheels, pinions, fusees, barrels, escapements, or compensation balances of two watches be produced exactly alike, and there was a great deal of difficult work necessary in adapting and adjusting the different parts to each other, so that they would work together harmoniously without serious friction or wear. When this was accomplished, the price of the watch was necessarily high; and though, when the watch was well made, the substantial character of the work ensured its lasting longer than the continental watches, yet when repairs were needed they were necessarily very costly. Any portion of the watch-movement which was broken or destroyed could only be replaced by making another as nearly like it as possible; and as workmen differed in skill and in capacity to adapt their work to that which was still sound in the watch, it often happened that a watch which had been injured when put into the hands of even a tolerably skilful workman for repairs was rendered worthless as a timekeeper. Still, the English watches of the celebrated makers Reid, Arnold, Earnshaw, Frodsham, Tobias, etc., had a high reputation for many years. The French and Swiss watchmakers very early abandoned two features of the English watch as unnecessary, and as increasing the size and cost of the watch—viz. the fusee and chain and the vertical escapement. In their watches the great wheel which had been attached by the English watchmakers to the base of the fusee was transferred to the base of the barrel which held the main-spring, and set in motion the centre wheel and pinion, which in turn imparted motion to the third wheel and pinion, and this to the contrate wheel and pinion, which connected directly with the balance and escapement, which by their alternate motions regulated and compelled isochronous action in the uncoiling of the main-spring. More than 600 of the 800 parts of the English watch were thus thrown out, and at the same time the capacity of the watch as a timekeeper was rather increased than impaired. The Swiss, who for the last forty years have been the principal watchmakers of Europe, carried the division of labor so far that most of their workmen made only a single piece of the watch through life; they used some machinery for this purpose, but the workmen worked at their own homes, and the watches were afterward put together by workmen who made this their sole business. So low were the wages of labor in that country that they were able to undersell other countries, and for the past fifteen or twenty years the greater part of the pieces which go to make up an English watch have been imported from Switzerland, and English workmen have found their occupation gone. Yet this cheap labor had its disadvantages; there was a large amount of poor and imperfect work. It is stated on high authority that one-third of all the pieces made are rejected by the best watchmakers; but it has been the practice of less conscientious dealers to buy them up, put them together, and, covering them with showy cases, send them to distant markets—the U. S., South America, Australia, etc.—and sell them at low prices as Swiss watches. For a long time our markets were flooded with these worthless watches, but for reasons which will subsequently appear we are now rid of them. The better class of Swiss watches were, and are, really very good timekeepers, and are perhaps the best made wholly or mainly by hand labor.

The manufacture of watches in the U. S. is not yet (1876) twenty-five years old. There had been, it is true, for more than sixty years isolated cases where ingenious workmen, who had imported the springs, the jewels, the escapements, and the fusee-chain, had supplied the remainder of the parts of a watch-movement and set it up, so as to make a very serviceable watch; there were numerous instances where watchmakers, having imported all the parts of a watch-movement, had put them together and made cases for them; but this was not watchmaking. In 1852, Mr. A. L. Dennison, a watchmaker of Boston, conceived the idea that by gathering all the machines used in Switzerland for making the parts of a watch under one roof, operating them by the same steam or water power, and supplementing them by other machines of American invention and by such hand-labor as might be necessary, it would be possible to create a manufactory which would turn out ten watches a day. His friends thought the man insane, but he succeeded in persuading three other watchmakers, Edward Howard, David P. Davis, and Samuel Curtis, to join him, and the four erected a watch-factory in Roxbury, Mass. Difficulties surrounded them from the start. The Swiss authorities prohibited, under severe penalties, the exportation of either machines, models, or drawings, and prevented, as far as possible, the migration to this country of any of their skilled workmen; the pioneers were therefore compelled to invent and construct their own machines, and after a year of hard, and at times almost hopeless, labor they completed their first watch in 1853. It was by no means as elegant as many timepieces they have since made, but it was, and is, an excellent timekeeper. They were now met by an unexpected obstacle to their success; the soil of that part of Roxbury immediately surrounding their factory is a fine clay, and in dry weather an almost impalpable dust rises from it which they found fatal to the more delicate operations required in the manufacture of a watch. Nothing daunted, however, they removed to a site on the banks of Charles River, a little above the village of Waltham, where other partners soon came in and the manufactory was organized at first as the Boston Watch Co., and some years later as the American Watch Co. In their new location their growth has been rapid but steady. They now have a capital of $1,500,000, a manufactory covering nearly 2 acres, with a park in front, an extensive enclosed flower-garden, cottages and other dwellings for their employés, and when running at full time employ about 900 hands, half of them women, paying for all their work by the piece, but at such prices that the wages average $1.40 per day for women and $2.75 per day for men. They can turn out 350 watch-movements a day, and produce 5000 silver watch-cases monthly. Their gold cases are made in New York by Messrs. Robbins & Appleton, the general agents of the company, who also own the large building they occupy there. Their actual production ranges from 60,000 to 100,000 watches per annum. They have sold in this and other countries, in the twenty-two years since they began work at Waltham, over 1,000,000 watches, and have now a large demand for export, as well as an ample home-market. Their sales average about $1,500,000 a year. It was to be expected that this success would have induced others to enter the field as competitors. In all, there have been eight or nine watch manufactories started in the U. S., most of them since 1860. The first was, we believe, that of Mr. Edward Howard, one of the original members of the American Watch Co., who withdrew from it at an early date and established himself in Roxbury, Mass., in the manufacture of watches, chronometers, regulator clocks, and tower clocks. Mr. Howard has not attempted to produce so large a number of watches as some of the others, his production ranging from 25 to 50 watches a day, and employing about 200 or 250 men, but his watches, like all his timepieces, are of excellent quality, and all of them of the higher grades. In 1864–65 several companies were organized. The most prominent and successful of these was the National Watch Co., established at Elgin, Ill., and now gen-

erally known as the Elgin National Co. The capital as well as the enterprise which originated this company came from Chicago. Their works are extensive, employing a large number of hands, more than half of them women, and turning out many thousand watch-movements per annum of sixteen grades. They make no cases, the competition in the manufacture of watch-cases having, they affirm, reduced this part of the business below a living profit. They have agencies in Europe, export their watch-movements largely, and at the same time absorb a fair share of the home-trade. They are, next to the American Watch Co., much the largest manufacturers of watches in the U. S. The United States Watch Co., at Marion, N. J., and the New York Watch Co., at Springfield, Mass., were organized in 1866 or 1867. The former has met with many misfortunes, and after changing its corporate title to the Marion Watch Co., and finally to the Empire Watch Co., is doing a moderate business at Marion. The New York Watch Co. (Springfield, Mass.) has recently been reorganized as the New York Watch Manufacturing Co. under very favorable circumstances. They have facilities for producing 90 to 100 watches *per diem* with a force of from 200 to 225 hands, but are now (Oct., 1876) producing about 60 watches daily with a force of from 150 to 175 hands. They manufacture sixteen different grades, some of them stem-winders. The watches of this company have always borne a high reputation for perfection of finish and excellence as timekeepers. The Cornell Watch Co., first started at Newark, N. J., was transferred from thence to Chicago, and finally to San Francisco, where the banker Ralston became interested in it, connected it with some of his land speculations, and finally, on his sudden death, left it in an embarrassed condition, from which it is now emerging. The Springfield (Ill.) Watch Co., organized in 1869 or 1870, is in some sense an offshoot from the National, and several of the former employés of that company are now among its leading men. It has facilities for making 90 to 100 watch-movements a day of eleven grades, and can employ about 250 hands. At present it is turning out about 50 watches a day and employs 125 hands. It makes no cases. There are, or were recently, small watch-factories at Rockford, Ill., Lancaster, Pa., and Washington, D. C., but we have no definite information concerning them.

And now let us attempt to describe what an American watch is; for, though differing in some minor details, the American watches are all substantially alike. The foundation of the watch is what is technically called the plate (or rather two plates, an upper and under, between which the train or running-gear except the balance-wheel and hair-spring are placed). In these plates are drilled the twenty-one holes for the jewels on which the axles of the wheels revolve, and for the tiny screws which hold the jewels in place. These plates, which are of hardened brass, or, in the higher-priced movements, of nickel, are drilled, and if of brass are gilded, and then sent to the engraving-room for such lettering as is to be placed upon them. The jewels—which have been already described, and which in American watches are always of ruby, sapphire, or garnet, and finished with great care—the pivot-holes or perforations for the axles of the wheels, which vary, according to the size of the watch-movement, from $\frac{1}{300}$ to $\frac{1}{1200}$ of an inch in diameter. The finest movement made by the American manufacturers has nineteen jewels, the cheapest has seven. The jewels having been inserted and fastened in their places by the tiniest screws, some of them weighing 150,000 to the pound, the axles of the wheels of the train are inserted in these minute pivot-holes, and the wheels being geared to each other, the watch-movement is "set up." The American watch-movement has no fusee or chain; its main-spring and going-barrel store the power which is to move the wheels of the watch; the escapement and compensating balance let out this power in regular motion; and thus regulated, it is distributed to the hands of the watch through the toothed wheels and the pinions that fit them. We have already described and illustrated the present form of the escapement-wheel and the compensating balance. All the wheels of the American watch-movement are stamped out in blanks and the teeth cut by machinery in quantities of thirty to fifty at a time; but this, which is a very simple matter in the ordinary regularly-formed toothed wheels, is much more difficult in the escapement, which is of steel, and has, as our illustration shows, teeth peculiarly formed and of a curiously-hooked shape. There are fourteen of these teeth, and the cutting of each involves six different operations. The machine which does this work is a very ingenious one. Thirty of the blanks are slipped upon a rod and screwed in a firm, compact mass, and then put into the escapement-wheel machine. On the cylindrical face of the machine are six revolving cutters, each pointed with sapphire; and as the rod with the blanks upon it passes automatically along the cylinder, one of these cutters ploughs through the thirty wheels, making a deep furrow; as the rod comes back, the cylindrical face has turned one-sixth round, and a second cutter is ready to do its work at a different angle from the first, and so on till each of the six cutters has performed its part and one tooth is finished. The process is repeated (the blanks being turned automatically one-fourteenth round each time) till the whole fourteen teeth are cut, when the machine throws itself out of gear, and waits for another set of blanks to be fed to it. The balance-wheel goes through the same number of operations, though in an entirely different machine. The number of parts of an American watch range from 156 to 162. The minor differences are mainly in the form of the pivots, in the dust-rings or excluders, the form of the centre pinions, the methods of removing the barrel, etc. One of the most striking peculiarities of the American watch-movements, and one which gives them an immense advantage over all hand-made watches, is that every part, even to the infinitesimally-small screws, is exactly duplicated thousands of times, so that any broken or defective parts can be sent by mail to any part of the world if the number of the watch is known. There is one modification, however, which the larger companies have been slow in adopting, but which is now in use in most of the best watches, and in about one-half of all that are made. This is the stem-winding and stem-setting attachment. The objection to it has been that the complicated gearing required for both purposes increased the liability of the movement to get out of order. The advantages were manifold. There was no necessity for a key, which was always liable to be lost; the arrangement was much more convenient for the owner of the watch; and there was no need of opening the watch except when it required cleaning, so that dust and everything which would obstruct its action could be completely excluded. Some of the foreign as well as a few of the American manufacturers attempted to surmount the difficulty by making the watches stem-winding, but not stem-setting, as the gearing for the former purpose was less complicated than for the latter. Others have adopted a variety of devices which accomplish both results with much less elaborate machinery than the foreign gearing. The perfection to which the higher grades of American watches have attained as timekeepers is simply marvellous. The adjusted and carefully-regulated watches of the American, Howard, National, and New York Watch Cos. have been known to run for several months together with a variation not exceeding two seconds per month. Of course, such a rate is exceptional, but one of ten to fifteen seconds per month is often maintained in the best grades of most American watches.

For some years the larger companies were greatly annoyed by the tricks of unscrupulous importers, who brought over large quantities of inferior and nearly worthless Swiss watches marked with the names of their best movements, or names so nearly like them as readily to deceive unwary purchasers. This was a double fraud: it passed off a worthless watch upon the purchaser, and it damaged the reputation of genuine American watches. The rigorous application of the trade-mark law finally broke up this swindle. But our markets have been for some years past flooded with watches, the rejected movements of the Swiss watchmakers put in showy but cheap and often base-metal cases, which have been sold at very low prices, but were dear at any price. The American watch companies resolved to put an end to this imposition also upon the public. They have therefore manufactured a variety of cheap but substantial movements—good timekeepers, but not full-jewelled, and so not as imperishable as the best—which they furnish at prices as low as the worthless Swiss watches, and have already stopped the importation of those watches in American markets. At the same time, the American companies, except the Howard, have, as a result of their complete adaptation of machinery to watchmaking and their increased facilities for doing work on a large scale, reduced the prices of all grades of their watches from 33⅓ to 40 per cent., and thus have greatly enlarged their market, making what was a few years ago an article of luxury a necessity for all classes.

The manufacture of watch-cases has greatly expanded within the past ten or fifteen years, and they are now made of as exquisite workmanship as in Europe, and at a much lower price.

A *chronometer* is a watch adjusted to the variations of temperature, and fitted with all the contrivances which experience has shown to be conducive to accurate timekeeping. The marine chronometers are larger than an ordinary watch, and are set in gimbals—an arrangement by which they maintain a horizontal position whatever the motion of the vessel. Their escapement also differs from those of other watches or clocks, and is only valuable when the chro-

nometer is kept in a horizontal position. The pocket chronometer, or chronometer watch, as now made, is a carefully-adjusted watch which has been tested at certain intervals by a regulator clock which is kept at absolutely correct time by daily comparison with the observations made with a transit instrument. Many of these chronometer watches made by American watch companies, though none of them have the chronometer escapement, have proved as accurate as any timepieces ever made. Repeating watches were very popular in the early part of this century, but very few are now made. They require a separate train and main-spring, as well as a spring or bell on which to strike, and are too bulky and inconvenient to be in demand at the present day. The horse-timers or racing watches are also very complicated in their construction, and liable to derangement of their action. Neither of these descriptions of watches is made in this country. L. P. BROCKETT.

Watch Hill, p.-v., Washington co., R. I.

Watch Hill Point, the south-westernmost point of the State of Rhode Island, is in the town of Westerly. It is a favorite place of summer resort. It has a granite lighthouse 40 feet high, showing a fixed white light 62 feet above the sea; lat. 41° 18′ 11″ N., lon. 71° 51′ 11″ W.

Watchmaking. See WATCHES.

Wa'ter [Sax. *wæter*; Ger. *Wasser*; Fr. *eau*; Lat. *aqua*; Gr. ὕδωρ], hydrogen oxide or protoxide, H_2O.

Occurrence.—In the liquid form it constitutes the ocean, seas, lakes, rivers, springs, etc., covering three-fourths of the earth's surface. It also occurs disseminated throughout the rocky strata which constitute the earth's crust. In the solid state it covers the polar regions and high mountainous districts permanently, and the temperate regions periodically, appearing as snow, ice, glacier, and iceberg. In the state of vapor it is always contained in the atmosphere, and gives rise to clouds, fog, mist, rain, dew, snow, hail, etc. It is a constituent of many minerals, as water of crystallization; gypsum contains 20 per cent., alum 45. It occurs in all plants in quantities reaching sometimes 99 per cent. Air-dried wood contains 20 per cent. In animals it is always present in considerable quantities. An average man weighing 154 pounds contains about 116 pounds of water, or three-fourths his weight.

Composition.—The Hindoos and the Egyptians considered water the element from which all other bodies were formed. Among the Greeks the idea was maintained that water was the first or fontal element; that from it all other substances were produced; that even plants and animals owed their origin to it. Aristotle regarded water as one of four elements, and this idea was maintained for more than 1000 years, though the old idea that water was the primal element seems to have been mingled with this idea; for it was supposed that these four elements, fire, earth, air, and water, were mutually convertible. Heat converted water into invisible air; repeated evaporation, they said, converted water into earth, so that there seems to have been an original idea that water was the only sole element. Lavoisier in 1770 tested experimentally the question of the conversion of water into earth. It had long been known that when water was placed in a glass retort or alembic, and distilled, there remained behind a small quantity of earthy matter, and if the water was returned to the alembic and distilled again, the quantity of earthy matter increased, and it continued to increase as often as the water was distilled from it. It was supposed, therefore, that the water was gradually converted into earth. Lavoisier distilled 3 pounds of water again and again in an alembic provided with a condenser, the whole apparatus being hermetically sealed, that not a particle of water should be lost. At the close of the experiment he found that while the quantity of water had not diminished in the least, he had a residue of 20 grains of earthy matter in the alembic. As the water had not diminished, he justly concluded that it had not come from the water; it must then have been derived from the alembic itself. On cleansing the alembic and condenser, and weighing them, it was found that they had lost 17 grains; 17 grains of the earthy matter had therefore been produced by the action of the boiling water on the glass. The remaining 3 grains were attributed by Lavoisier to the natural impurities of the water. Scheele tested the same question, and not only proved that the earthy matter was derived from the glass, but analyzed it and found it to consist of the same constituents, potash, lime, and silica. Dalberg repeated the experiment in a silver vessel and obtained no earthy matter. So the conversion of water into earth was proved to be a fallacy due to the action of the water upon the glass vessel. In 1781, Cavendish and Watt proved its composition by synthesis. In 1805, Humboldt and Gay-Lussac determined the ratio of its constituents, hydrogen and oxygen, to be as 2 : 1, and Berzelius and Dulong proved the ratio by weight to be as 1 : 8. Their method of investigation consisted in passing pure and dry hydrogen gas over red hot oxide of copper. The oxide gives up its oxygen to form water with the hydrogen. This water is collected in a receiver and chloride of calcium tubes. By comparing the weight of the water produced with the weight of the oxygen given up by the oxide of copper, its loss in weight, the composition of the water is determined. It is—

Molecular weight.		Calculated.	Berzelius and Dulong	Dumas.
H_2	2	11.111 +	11.1	11.11
O	16	88.888 +	88.9	88.89
H_2O	18	100.	100.	100.

1 U. S. gallon (231 cu. in.) of water contains about 620 gallons of oxygen and 1240 of hydrogen.

Decomposition.—Water may be decomposed (1) with liberation of both constituents (*dissociation*) by (*a*) heat, first noticed by Grove (see *Am. Chemist*, vi. 126); (*b*) by electricity, as when the poles of a galvanic battery are placed in water slightly acidulated with sulphuric acid to increase its conducting power. (2) With liberation of one constituent only: (*a*) by the metals of the alkalies and alkaline earths at ordinary temperatures, $H_2O + Na = NaOH + H$; by iron and some other metals at high temperatures; by zinc and some other metals in the presence of an alkali; the oxygen is always taken into combination by the metal, while the hydrogen is liberated; (*b*) carbon decomposes steam at a red heat, yielding hydrogen and carbonic oxide, with a little carburetted hydrogen (see WATER-GAS); (*c*) some lower oxides decompose water or water-vapor, with evolution of hydrogen, as hydrated silicious oxide, carbonic oxide, etc.; (*d*) chlorine decomposes water with the liberation of oxygen under the influence of light, or watery vapor at a red heat. Bromine vapor produces the same decomposition at a red heat; iodine does not. (3) With combination of both constituents: (*a*) phosphorus in the presence of an alkali forms phosphuretted hydrogen and an hyposphite; (*b*) Schönbein says that when boiled in contact with nitrogen (air) water is converted into ammonic nitrite, $2H_2O + 2N = NH_4NO_2$; (*c*) many chlorides decompose water, $PCl_5 + 4H_2O = H_3PO_4 + 5HCl$; (*d*) arsenious and sulphurous oxides decompose water in the presence of chlorine, $SO_2 + 2H_2O + 2Cl = H_2SO_4 + 2HCl$; (*e*) certain oxides decompose water, or at least combine both its constituents in a new state:

$$SO_3 + H_2O = H_2SO_4$$
$$CaO + H_2O = Ca(OH)_2.$$

(See HYDRATES and HYDROXYL.)

Formation.—Water is formed whenever hydrogen or combustible bodies containing hydrogen are burned in oxygen, atmospheric air, or any gas capable of supplying oxygen. It is one of the products of most forms of combustion for heating and lighting purposes, also of the combustion which occurs in animal life, fermentation, etc. It is also produced in many cases when bodies containing hydrogen are heated with easily-reducible metallic oxides or salts capable of yielding oxygen under these conditions.

Properties.—Between 32° and 212° F., under the ordinary atmospheric pressure, water is a limpid liquid. When pure, it is entirely free from smell and taste, and has neither an acid nor an alkaline reaction. It is colorless in small quantities—blue when viewed in mass. The impurities in large bodies of water often produce decided colors, as the mud in rivers, the red microscopic plants seen at times in the Red Sea, etc. The density of water in the liquid state is about 770 times that of the atmosphere, and is greatest at about 4° C. (39.2° F.). Taking the density of water at 4° C. as unity, it is 0.999877 at 0° C. (32° F.) and 0.999107 at 15.5° C. (60° F.). The density of water is always taken as the standard unit for comparing the densities of all other liquids and of solids—on the Continent at 4° C., in Great Britain and the U. S. at 60° F. (15.5° C.). Its density or specific gravity is therefore 1.000. (See GRAVITY, SPECIFIC.) A cubic centimètre of water at 4° C., under a barometric column of 760 millimètres of mercury (29.922 inches), weighs 15.432349 grains, or 1 gramme, which is the unit of weight in the metric system. As 1000 grammes make a *kilogramme*, and 1000 cubic centimètres a *litre*, the litre of water at 4° C. weighs 1 kilogramme. A cubic inch of water at 62° F. weighs 252.458 grains, equivalent to 16.386 grammes. A cubic foot of water weighs 62.355 pounds avoirdupois, 436,495 grains, 28.315 grammes. Our U. S. or wine gallon (231 cu. in.) of water at 60° F. weighs 58.318 grains or 8.331 pounds avoirdupois. The imperial gallon, used only in Great Britain, weighs 70,000 grains or 10 pounds avoirdupois. (See GALLON; also *Am. Chemist*, i. 318, 398.) Water is slightly elastic; an increased pressure of 1 atmosphere reduces its volume .000045 (*Oersted*) or .000047 (*Regnault*); 200 atmospheres reduces its volume $\frac{1}{13}$th (*Perkins*). Taking the volume of water at 0° C. as 100, it expands to 104.2986 when heated to 212° F. = 100° C. (*Kopp*), and to

110.16 when heated to 314.24° F. = 156.8° C. (*Mendelejeff*). The specific heat is greater than that of any other substance; that is, it requires more heat to raise a given weight a given number of degrees in temperature. Its specific heat is taken as the standard of unity. It is a very poor conductor of heat and of electricity. At 32° F. or 0° C. water becomes solid, freezes, crystallizes, expanding considerably at the same time. Pressure lowers the freezing-point. The crystallized form of ice is hexagonal. Snow, which is ice produced by the freezing of aqueous vapor in the air, consists of minute compound crystals.

Fig. 1.

Snow-Crystals.

Ice is colorless, or in masses blue when pure. Its density is less than that of water at 32° F. (0° C.), being about 0.920. Ice always floats on the surface of water; and as water attains its maximum density—is heaviest—at 39.2° F. (4° C.), it follows that water cooled below this temperature expands, becomes lighter, and remains on the surface of lakes, rivers, etc., where it may finally be converted into ice, while the water below remains at 39.2° F. The bursting of pipes and other vessels by the freezing of water is due to the almost irresistible expansion which accompanies the act of freezing, and which amounts to nearly $\frac{1}{11}$th the volume of the water. Freezing water is a powerful agent in the disintegration of rocks. In order to convert water into ice, it is necessary to deprive it of considerable heat after it has been cooled to 32°; and to convert ice into water, it is necessary to add considerable heat. A pound of water at 174.56° contains just enough heat to melt a pound of ice at 32°, the resulting 2 pounds of water exhibiting a temperature of 32°. 174.56 − 32 = 142.56 degrees of heat are required to melt the ice without affecting the sensible temperature; they become latent in the resulting water. To convert the water into ice, this latent heat must be withdrawn. Water evaporates at all temperatures when in contact with air or other gases. The higher the temperature, the dryer the air, and the more rapid the air-currents, the greater will be the evaporation. Water boils at 212° F. (100° C.) under the ordinary atmospheric pressure, equivalent to a column of mercury of 29.922 inches or 760 m. m., and yields more than 1700 volumes of vapor. When the pressure is reduced, the boiling-point is lowered. Vacuum-pans are constructed for the purpose of boiling sugar solutions, milk, glue, etc., at low temperatures to prevent decomposition. If the pressure is increased, the boiling-point rises. The following table is given by Arago and Dulong (*Ann. Chim. Phys.*, 2 ser., xliii. 74):

Pressure in atmospheres.	Boiling-point.	
	Centigrade.	Fahrenheit.
1.	100°	212°
1.5	112.2	233.96
2.	121.4	250.52
3.	135.1	275.18
4.	145.4	293.72
5.	153.1	307.58
6.	160.2	320.36
7.	166.5	331.70
8.	172.1	341.78
10.	181.6	358.88
12.	190.	374.00
14.	197.2	386.96
16.	203.6	398.48
18.	209.4	408.92
20.	214.7	418.46
25.	226.3	439.34
30.	236.2	457.16
35.	244.8	472.64
40.	252.5	486.50
45.	265.9	510.62

The boiling-point of water is influenced slightly by the nature of the vessel. In clean smooth vessels of glass it boils one or two degrees higher than in rough metallic vessels. Vapor of water is colorless and transparent, and becomes visible only when partially condensed, as when steam escapes into the air. At 212° the specific gravity of the vapor is 0.622 compared with air at the same temperature, or 0.455 compared with air at 32° F. A large amount of heat is rendered latent in the conversion of water into vapor—5.37 times as much as is required to raise it from 32° F. to 212° F.; that is, 180 × 5.37 = 966.6 degrees. The latent heat of steam is exactly 966.06 (*Regnault*), 964.386 (*Favre* and *Silberman*), 964.62 (*Andrews*). 966.6 + 180 = 1146.6 degrees represent the amount of heat necessary to convert water at 32° F. into vapor, no matter what the temperature at which the evaporation occurs.

To condense the vapor back to water this latent heat must be withdrawn. One pound of steam at 212° F. is therefore capable of heating 5.37 pounds of water from 32° to 212° F.; and if the steam is passed directly into the water, the result will be 6.37 pounds of water at 212° F. On account of the large quantities of heat which water is capable of absorbing in passing from the solid to the liquid or vapor state, and of liberating when the order is reversed, as well as on account of its great capacity for heat (specific heat), it is the great regulator of temperature. Climate is largely influenced by its presence or absence, and the temperature of plants and animals is largely controlled by it. Evaporation from the lungs and skin preserves the normal temperature of 98° F. in the human body. Water is a very general solvent for solids, liquids, and gases; many substances, as sugar, salt, etc., are very soluble, others but slightly soluble. Thus $MgSO_4$ requires 3.278 parts of water (*Gay-Lussac*); $CaSO_4$, 429.14 (*Poggiale*); $SrSO_4$, 6895 (*Fresenius*); $BaSO_4$, 806,451 (*Calvert*). (See Storer, *Dictionary of Chemical Solubilities.*) Certain substances, as metals, resins, carbon, sulphur, fat-oils, etc., are practically insoluble. With a few exceptions, calcic hydrate, calcic sulphate, thoric sulphate, etc., heat increases the solubility of solid substances in water, while it diminishes the solubility of gases. Hot saturated solutions generally deposit crystals on cooling. Carbonic acid increases the solubility of many substances. It converts the almost insoluble carbonates of lime, magnesia, iron, etc., into soluble acid- or bi-carbonates ($CaH_2(CO_3)_2$), and basic tricalcic-ortho-phosphate, $Ca_3(PO_4)_2$, into soluble mono-calcic-ortho-phosphate, $CaH_4(PO_4)_2$. Some salts and other compounds increase, some diminish, the solubility of bodies in water. Solutions of solids and of many gases are heavier than water. Some solutions, as that of ammoniacal gas, are lighter than water. The specific gravity of the solution is in most cases a measure of the degree of concentration of the solution.

The freezing-point of saline solutions is lower than that of pure water, and the ice formed is free from the saline body, except as it is entangled mechanically. A 10-per-cent. solution of common salt freezes at 21.2° F. (−6° C.), a saturated solution of calcic chloride at −5.8° F. (−21° C.). The boiling-point of saline solutions is higher than that of pure water. Liquids and gases sometimes raise, sometimes lower the boiling-point. Pressure, by raising the boiling-point of water, generally increases its solvent power, often to a remarkable degree. The solution of solids in water generally results in a lowering of the temperature, due to the absorption of the heat of liquefaction by the solid. The most notable case is that of ammonic sulphocyanide. According to Phipson, 35 grammes of this salt dissolved in 35 c. c. of water at 73.4° F. lowered the temperature to 14° F. (See Rüdorff, *Ber. Duet. Chem. Gesel.*, 1869.) According to Raoult (*Compt. rend.*, Oct., 1869), electricity is developed when salts are dissolved in water. He says the dissolution of a salt in water is a complex phenomenon, whereby we distinguish—1st, the *fusion* (melting) or *disintegration* of the salt, whereby heat is absorbed; 2d, the *diffusion* of saline molecules in water, which also absorbs heat; 3d, the *combination* of the salt with water, whereby heat is set free. The author then states that the conditions alluded to under Nos. 1 and 2 do not produce any electricity, but that, on the other hand, the combination of a salt with water certainly does give rise to an electric current, to prove which the author records a series of experimental results. Pressure increases the solubility of gases in water. (See further article "Solution" in Watts's *Dict.*, and I. Walz, "Theory of Solubility," *Am. Chem.*, v. 279.) Water combines in several other ways with bodies. In some of the compounds formed it exists as water, and may be expelled by heat; in others its elements appear to have entered into new combinations. (See Hydrates.) Bodies which attract water from the atmosphere and form solutions with it are said to be *deliquescent*. Crystallized bodies which lose water by exposure to the air, and crumble to powder, are said to be *efflorescent*.

Natural Waters.—Water, being a great solvent, dissolves to some extent whatever it comes into contact with.

I. Atmospheric Waters.—Even atmospheric waters, the rain and melted snow, are not pure. Rain, as it falls through the air, washes out the solid particles of dust and the germs of animals and plants. In addition to these, it dissolves the oxygen, nitrogen, carbonic acid, and ammonia of the atmosphere, but a greater proportion of the oxygen than of the nitrogen. The air which is dissolved in water is much richer in oxygen than ordinary atmospheric air. This seems to be a special provision of nature for the fishes. They extract the small quantity of oxygen which

is dissolved by the water from the air. The quantity is very small: 25 cubic feet of water take up only 1 cubic foot of oxygen. But this quantity is sufficient for the maintenance of life in the fishes; their gills enable them to absorb it, and they die without it.

Water which is collected from roofs in the city is never pure. It contains gases which are only developed in cities, sulphur compounds, products of the combustion of coal. After thunderstorms the rain-water is always found to contain minute quantities of nitric acid, produced by the electric sparks, which cause the oxygen and nitrogen of the air to unite. Rain-water almost always contains a little organic matter, causing it to become putrid when kept for some time. "Boussingault found .004 grm. per litre in rain-water collected in Paris, and in that collected in the country only .00079 grm. per litre. Dew he found to contain from .001 to .006 grm. per litre. In water condensed from fog he found .0197 grm., and on another occasion in Paris .1378 grm. per litre. Barral found from .002 to .003 grm. per litre in rain-water collected in Paris." (*Ann. Ch. Phys.* [3], xxxix. 257; xl. 129.) In rain-water collected at Lyons, Bineau found as much as .03 grm. per litre. The amount of ammonia in rain is also much larger in summer than in winter.

Nitric acid is commonly present in rain-water, chiefly in combination with ammonia. The amount varies considerably, and is greater in rain falling during thunderstorms. Boussingault estimated the average amount at .0002 grm. per litre. In rain-water, collected during a hailstorm in Paris, he found .055 grm. per litre, and in the melted hail .083 grm. per litre; on other occasions from .0004 to .0021 grm. per litre in rain-water, from .0003 to .004 grm. per litre in snow-water collected in Paris, and in water condensed from fog .0101 grm. per litre. In the country (Alsace) he found in rain-water from .00004 to .00028 grm. per litre; in that collected during a thunderstorm .0021 grm. per litre; and in water condensed from fog, from .0004 to .0018 grm. per litre. Barral found from .002 to .036 grm. per litre in rain-water collected in Paris. The amount is less after rain has continued for some time, and it is generally greater in summer than in winter. (*Compt. rend.*, xxxiv. 283, 821; xxxv. 427; xlvi. 1123, 1175.)

Nitrous acid is also present in rain-water, and, according to Schönbein, ammonia-nitrite is formed by the direct combination of nitrogen with water. Lawes, Gilbert, and Way estimate the average amount of nitrogen contained in rain-water, as ammonia, nitrous and nitric acid, at about .985 grm. per litre. (See *Report of the Brit. Assoc.* for 1854.)

Rain water perhaps always contains a small amount of *organic substance*, in consequence of which it readily becomes putrid when kept some time. Angus Smith found .01 grm., Marchand .024 grm., and Chatin .05 grm. per litre.

Sulphuric acid is often found in the rain-water falling in towns, and near factories where sulphurous gas is generated and discharged into the atmosphere. A. Smith found .1 grm. per litre in rain water collected at Manchester.

Rain-water sometimes contains a very small amount of *hydrochloric acid, sodic or calcic chlorides*, and other *saline substances*. Barral found the rain-water collected in Paris gave, on evaporation to dryness, a residue amounting to .022 grm. per litre, and that collected in the neighborhood of Paris .0078 grm. per litre. A. Smith also found a minute quantity of coal-ash in rain-water collected in Manchester.

Rain-water is stated by some observers to contain *iodine*. (Chatin, *Compt. rend.*, xlvi. 399; l. 420; li. 496; Marchand, *ibid.*, xlvi. 806; De Luca, *ibid.*, xlvii. 644; xlix. 170; li. 177.)—*Watts's Dict.*

The accompanying engravings, showing the residues obtained by evaporating rain-water, are taken from R. Angus Smith's *Air and Rain*.

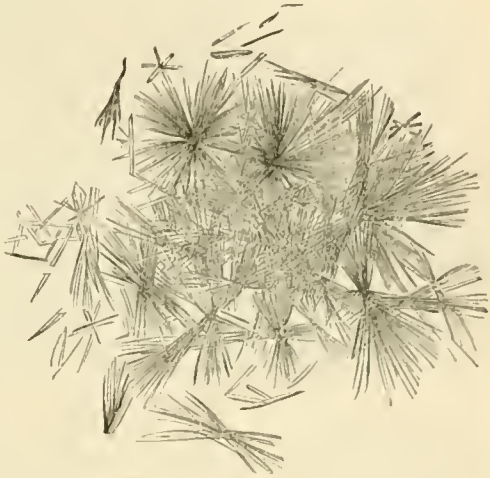
Fig. 2.

Newcastle Rain.

Fig. 3.

Manchester Rain.

Fig. 4.



London Rain, fixed residue, London Hospital.

II. Spring Waters.—Terrestrial waters are always impure. Rain falling upon the earth's surface is absorbed by the porous soil, and the materials of which the soil is composed, being to a greater or less extent soluble, the water becomes contaminated with mineral matter. The character of spring water, therefore, depends upon the character of the soil through which it has passed before it issues as a spring. In New England, where the rocks are granitic, and the minerals chiefly quartz, feldspar, and mica, water is nearly pure. But in limestone countries, where carbonate of lime and magnesia abound, we find the spring waters largely contaminated with these substances. These carbonates are rendered much more soluble in water by the carbonic acid present, which forms bicarbonates with them. To such solutions of bicarbonate of lime are due many curious phenomena in nature. Where they trickle down from the roofs of caves, the evaporation of a portion of the carbonic acid causes the separation of an equivalent quantity of carbonate of lime. Each drop, as it hangs for a moment and then falls, leaves behind a thin pellicle of solid spar, and finally, in years of dripping, a stalactite is formed. Where the drops strike the floor of the cave, corresponding stalagmites gradually spring up, often meeting the stalactites at last, and forming columns of glistening stone. Sometimes where the water falls from a crevice, a series or row of columns is produced, which finally becomes a solid wall or partition of calcareous spar. On boiling solutions of bicarbonate of lime and magnesia, the excess of carbonic acid is expelled, and the carbonates, having no longer a solvent, are precipitated. In this way incrustations are formed in tea-kettles and steam-boilers.

Spring-Waters.

Grains in 1 U. S. gallon.	Spring in Massachusetts.	Clyde, N. Y.	Weedsport, N. Y.
Chloride of potassium	.....	0.14	0.26
Chloride of sodium	0.264	.....	0.02
Sulphate of potassa	0.156	0.18	
Sulphate of soda	.....	0.45	0.69
Sulphate of lime	.....	.....	7.94
Carbonate of soda	0.133		
Carbonate of lime	1.229	9.66	6.30
Carbonate of magnesia	0.541	4.41	4.79
Alumina and oxide of iron	trace.	trace.	0.07
Silica	1.120	1.58	0.36
Organic and volatile	0.233	2.16	0.75
Total	3.676	17.58	21.18

Spring water is generally very clear, although it may be quite impure. It holds its impurities in solution. The soil through which it has passed, although it has conferred upon it its impurities, has at the same time filtered it, and thus rendered it clear and sparkling. As it comes from below the surface, it is generally cool. For these reasons spring water has always been highly prized.

Ordinary open wells are supplied partly by springs and partly by surface-drainage. The water usually contains the alkaline and alkaline earthy salts of spring water, the total quantity of mineral matter and the relative proportions of the various salts depending upon the nature of the soil. In the neighborhood of dwellings the proportion of chloride of sodium or common salt is generally increased by the drainage of house-refuse, which also leads to the contamination of the water with the products of the decomposition of animal matters, such as salts of ammonia, nitrites, and nitrates. In many cases, from the proximity of cesspools and privy-vaults, the water becomes contaminated with filtered sewage-matters, which, while they hardly affect the taste or smell of the water, have nevertheless the power to create the most deadly disturbances in the persons who use the waters. In the neighborhood of graveyards the water of wells is often impregnated with animal matters from the recently-filled graves. As long ago as 1808 it was decreed in France that no one should dig a well within 100 mètres of any cemetery. (See article by Jules Lefort in *American Chemist*, vol. ii. p. 448.) The water of driven wells does not differ in any respect from that of open wells in the same localities, except in cases where there is near the surface a bed of clay or "hard pan" impervious to water. When such a stratum is penetrated by the tube, and the water is drawn from beneath it, the well is somewhat protected from surface-drainage.

Well-Waters.

Grains in 1 U. S. gallon.	Brooklyn, N. Y.	Rochester, N. Y.	New York City.
Chloride of potassium	trace.	0.96	
Chloride of sodium	0.557	4.82	9.655
Chloride of magnesium	.....	1.53	1.968
Sulphate of potassa	.....	.....	2.103
Sulphate of soda	0.414		
Sulphate of lime	.....	6.46	6.239
Carbonate of soda	0.193		
Carbonate of lime	3.770	16.92	9.368
Carbonate of magnesia	1.714	8.88	17.770
Alumina and oxide of iron	0.198	0.10	0.321
Silica	1.137	0.90	1.166
Organic and volatile	0.116	1.60	8.059
Total	8.099	42 17	56.649

Artesian Wells.—Occasionally wells are sunk to great depths by boring. Such wells are called artesian wells, from the district in France where they were first bored. (See ARTESIAN WELLS.) The earth's crust consists in many localities of strata of gravel, sand, or clay, resting upon sandstones, limestones, or shales. In many cases these strata are in basins, and their edges often come to the surface at the margin of the basins. Some of these strata, which are porous, constitute reservoirs of water, and by boring down to them this water is reached. It may rise above the surface and overflow if the strata rise elsewhere to higher levels; otherwise it must be pumped. Often the pressure of gases forces the water above the surface. At Grenelle, near Paris, an artesian well was bored down 1798 feet, or about one-third of a mile. The water rises 80 feet above the surface, and flows at the rate of 90 cubic feet per minute. Coming from so great a depth, it is very warm, and must be stored in a reservoir to cool. At Rochefort, in France, is a well 2676 feet deep, or, more than half a mile. This is the deepest well in Europe. Some of the deepest artesian wells have been put down in this country. At Louisville, Ky., there is one 2086 feet deep, the water of which has a temperature of 82° F. But instead of being suitable for domestic purposes, the water proved to be heavily charged with saline compounds, which gave it a medicinal value. At Charleston, S. C., there is a well 1250 feet deep, yielding similar mineral water. At Columbus, O., an artesian well at the depth of 180 feet yielded sulphur water, but it proved to be hard water. At the depth of 675 feet salt water was obtained. As fresh water was required, the well was pushed down a half-mile, or 2575 feet, but no water was obtained of a satisfactory quality. At St. Louis a well was bored to the depth of 3881 feet, or two-thirds of a mile, but no water of any consequence was obtained, and the well is a failure. Artesian wells are in some localities of the greatest economic and sanitary importance, yielding water where it could not otherwise be obtained at all, or pure water when the shallow surface-wells are too impure for domestic use. The former case is illustrated in the Libyan desert, where there are no rivers or springs, and upon which rain never falls; the latter case in the city of London, where the surface-wells are contaminated by sewage, while the artesian wells 400 or 500 feet deep bring up from the chalk-beds below a very pure water. In many instances water which rises in artesian wells comes from great distances. At Tours, in France, the well is sometimes obstructed, and when the obstruction is removed, it is found that the leaves which come to the surface, and which caused the obstruction, do not grow within 100 miles of Tours, showing that there is some subterranean communication by which the leaves, as well as the water, are brought from a distance.

Ordinary Spring-Waters (fresh waters, as they are generally called) contain salts of the alkalies and alkaline earths—chlorides, sulphates, and bicarbonates of potassa, soda, lime, and magnesia. The most common salts are the chlorides of potassium and sodium, the sulphates of soda and lime, and the bicarbonates of lime and magnesia. Besides these alkaline and earthy salts, we almost invariably find silica, the substance of quartz, to the amount of a grain or less in a gallon. In wells which receive drainage-waters in the neighborhood of dwellings we generally find nitrates, nitrites, and ammonia salts, derived from decomposing animal matter in the soil. The total quantity of dissolved impurities in ordinary spring waters varies from 1 or 2 grains to 80 or 90 grains in a U. S. gallon of 231 cubic inches.

Hard and Soft Waters.—Lime salts in water are the cause of what is called *hardness*. They decompose the soap used in washing, forming a flocculent insoluble compound and destroying its detergent properties. In Glasgow the saving to the people in soap, due to the introduction of the pure water of Loch Katrine in place of the hard well waters previously used, is said to amount to $180,000 per annum. Soap is an excellent reagent for testing water—a fact which is well known, though but few persons understand that it indicates the lime compounds only. As bicarbonate of lime is destroyed by boiling, with the formation of insoluble carbonate of lime, which does not act on soap, it is said to produce *temporary hardness*, while sulphate of lime, which is not affected by boiling, produces *permanent hardness*.

Organic matters of various kinds are always present in natural waters. They are derived from the decomposition of plants and animals, chiefly the former. They are both nitrogenous (*albuminoid*) and non-nitrogenous. Several of them have been identified as crenic and apocrenic acids (see article HUMUS), but most of them are of unknown nature.

Pond, lake, and river waters are generally purer than spring water, for the reason that while those bodies of water receive the waters of springs, they also receive a considerable quantity of water which has simply run *over* the surface of the earth. When a shower comes up, a portion of the water goes through the soil and issues as a spring, but a large portion of it runs over the soil, and goes into the lakes and rivers without taking with it much mineral matter. For this reason the waters of lakes and ponds are much purer than those of the springs in the same locality. One of the purest waters known is the

River-Waters.

Grains in 1 U. S. gallon.	Croton, N. Y.	Genesee, Rochester, N. Y.	Hudson, Albany, N. Y.	Mohawk, Utica, N. Y.
Chloride of potassium	.....	0.28	.....	0.12
Chloride of sodium	0.402	0.05	0.361	0.17
Chloride of magnesium	.....	.....	0 157	
Sulphate of potassa	0.179	.....	0.076	
Sulphate of soda	0.260	0.85	.....	0.57
Sulphate of lime	0.158	3.16	0.980	1.31
Carbonate of lime	1.648	4.64	2.571	4.60
Carbonate of magnesia	1.100	2.06	0.803	1.71
Alumina and oxide of iron	trace.	0.09	0.070	0.09
Silica	0.621	0.90	0.408	0.47
Organic and volatile	0.670	1.64	0.699	1 61
Total	5.038	13.67	6.125	10.68

water of the river Loka in Sweden, which contains only $\frac{1}{70}$th of a grain of impurities in a gallon. Rivers are more likely to be charged with *suspended impurities*, for the reason that their waters, which have not been filtered through the soil, carry with them a certain quantity of mud and organic matter. That is what we see in Potomac water; it has had no opportunity to settle, and has not been filtered out. When water flows into lakes and the sediment subsides, it becomes clear; but in streams where the water runs rapidly it has no opportunity to deposit its sediments, and it often appears very turbid. The water of the Mississippi contains 40 grains of mud per gallon, and it is estimated that this river carries 400,000,000 tons of sediment per annum into the Gulf of Mexico; the Ganges is said to carry down 6,368,000,000 cubic feet annually. This transportation of mud in suspension has produced large deposits at the mouths of these rivers. All of the State of Louisiana, and considerable portions of other States which border upon the lower Mississippi, have been formed by the deposition of these sediments brought from higher levels. This mud is rich in plant-food, and the land which it produces is very fertile. The Mohawk Flats are famous for their fertility, and the annual overflow of the Nile is the chief reliance of the poor Egyptians who cultivate the fields enriched by its sediments.

Rivers flowing through populous districts and receiving the drainage of the towns on their banks often become contaminated with sewage to such a degree as to make them positively offensive, and dangerous to those who drink their water.

The waters of ponds are more largely supplied by springs; they are generally clearer than those of rivers, as the suspended impurities subside. They often exhibit more or less color, due to peaty matters held in solution. This is specially the case in the Dismal Swamp and in new reservoirs; such matters are entirely harmless.

Living Organisms in Water.—In addition to the soluble and suspended impurities already mentioned, we find

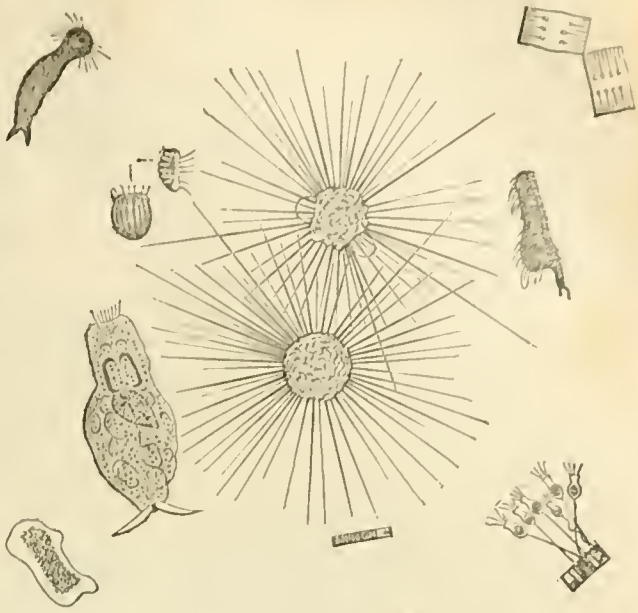
Fig. 5.

Organisms in Croton Water.

living organisms in water—animals and plants. Figs. 5 and 6 show some of the most common forms of the Croton and Ridgewood waters. They were prepared by Dr. William B. Lewis for the metropolitan board of health.

These animals when magnified by the microscope are very frightful in their appearance and motions, but they are not really objectionable. The plants even exercise a purifying influence on the water. It is stated by a celebrated English author that the providential spread of the American weed *Anacharis alsinastrum* has saved thousands of lives by the purifying influence which it has exerted on the watercourses in certain districts in England. These plants liberate oxygen, which attacks poisonous dead organic matter and destroys it, thus ridding the water of its most dangerous impurities. It occasionally happens, however, owing perhaps to some peculiarity of the season, that microscopic animals or plants multiply to such an unusual extent in the waters of lakes or rivers as to produce serious annoyance. This occurred some years ago in the Croton Lake. The subject was investigated by Dr. John Torrey, who reported the presence of myriads of minute plants (*Nostoc*), which by their death and decomposition communicated to

Fig. 6.



Organisms in Ridgewood Water.

the water a disagreeable taste and odor. It may be considered as fully established that the ova of entozoa (the eggs or embryos of parasitic worms) gain sometimes entrance to the body by the water we drink. We have no reason to believe, however, that the animalcula in the Croton, Ridgewood, and other city waters of the U. S. are such embryos, or, in fact, that they are in any way objectionable. In Iceland, however, it is stated that one-sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia or tapeworm of the dog. Young leeches, contained in drinking-water, sometimes fix themselves on the pharynx. In a march of the French in Algiers 400 men were in the hospital at one time from this cause. (See F. Cohn, *Microskop. Analyse der Brunnenwässer, Beit.* 3; *Biol. d. Pflanze*, i. 108; James Bell, *Microscopical Examination of Water for Domestic Use, Monthly Micros. J.*, Apr., 1871, p. 163; C. F. Gissler, *Contributions to the Fauna of the Croton Water*, New York, 1872.)

III. Sea-Water.—The ocean is the great and final receptacle of all waters which escape evaporation, and it consequently receives the mineral and other impurities which the rivers and smaller streams carry along in solution or suspension. From the surface of the ocean the water evaporates, rising into the atmosphere to fall again in the form of rain.

Analysis of Sea-Water, by Von Bibra.

	Atlantic Ocean.	Dead Sea.
Specific gravity	1.0275	1.17205
Chloride of sodium	1671.34	6702.73
Chloride of potassium	.....	682.63
Chloride of ammonium	.....	3.35
Chloride of calcium	.....	1376.75
Chloride of magnesium	199.66	4457.23
Chloride of aluminum	.....	31.37
Chloride of iron	trace.	1.50
Chloride of manganese	.....	3.35
Bromide of sodium	31.16	156.53
Iodide of sodium	trace.	trace.
Sulphate of potassa	108.46	
Sulphate of magnesia	34.99	
Sulphate of lime	93.30	38.07
Phosphate of soda	trace.	
Carbonate of lime	trace.	trace.
Silver	trace.	
Copper	trace.	
Lead	trace.	
Arsenic	trace.	
Silica	trace.	trace.
Organic matter	trace.	34.59
Bitumen	.....	trace.
Total in 1 U. S. gallon	2138.91 grs.	13488.10 grs.
Percentage by weight	3.569	19.733
Water	96.431	80.267
	100.	100.
Weight of 1 gallon	59922. grs.	68352. grs.

Entering the soil, it again issues in the form of springs, with a fresh quantity of dissolved mineral matters, which it bears onward to the ocean. Thus, again and again, the raindrops have performed the voyage to the sea, each time laden with the little cargo of dissolved salts. In this manner the ocean has become very saline; it is the receptacle for the soluble matters which are washed out of the earth's crust. The foregoing analysis of sea-water was made by Von Bibra. The numbers represent grains in 1 U. S. gallon of 231 cubic inches. The analysis of the water of the Dead Sea was made by the Herepaths.

"In addition to the substances already mentioned, sea-water contains about .3 grm. per litre of *bromine*, and very minute amounts of *iodine* and *fluorine*; also *silica*, *phosphoric acid* (Voelcker, *Chem. Gaz.*, viii. 346), *calcic* and *magnesic carbonates* in small proportions. The amount of carbonates is largest near the land, and is very small in the water of the ocean (J. Davy, *Ed. New Phil. Journ.*, xlvii. 320). *Silver*, *lead*, *copper*, and *arsenic* have been detected either in sea-water, the ashes of marine plants or animals, or in the deposit formed inside the boilers of ocean steamers (Malagnti, Durocher, Sarzeaud, *Ann. Chim. Phys.* [3], xxviii. 122; Field, *Chem. Gaz.*, 1857, p. 93; Daubree, *Compt. rend.*, xxxii. 827). In fact, since the ocean is the common recipient of by far the greater part of the water discharged from springs and constituting rivers, most of the material abstracted by their water from the interior and surface of the earth passes into it, and all substances which exist in spring-water may be expected to exist, to some extent, in sea-water. The gaseous contents of sea-water are nitrogen, oxygen, and carbonic anhydride, amounting altogether to from 10 to 30 c. c. per litre, according to different observers. The amount appears to be greater at a depth of about 2000 feet than near the surface, but at about 4000 feet the water contains scarcely any dissolved gases. The relative proportions of the gases have not been estimated with much accuracy. Carbonic anhydride is stated to vary from 2 to nearly 40 c. c. per litre, oxygen from about 1 to 3 c. c. per litre, and nitrogen from 12 to 17 c. c. per litre. (Aimé, *Pogg. Ann.*, lx. 404; Hayes, *Sill. Am. J.*, 1851, 421; *Compt. rend.*, vi. 616; Lewy, *Ann. Chim. Phys.*, ii. 535; viii. 425; xii. 5; Bischof, *Chem. Phys. Geol.*, i. 113; Thorpe, *Chem. Soc. J.* [2], v. 189.)"—*Watts's Dict.*

The question arises, If these saline substances are being carried to the sea, is it not becoming much salter? A calculation has been made, by which it appears that about 36 cubic miles of water are poured into the ocean daily by the rivers. But then this vast quantity of water is so small in comparison with the amount of water in the ocean that it would take 30,000 years for all the water in the ocean to rise as vapor, fall as rain, and make one trip back to the ocean again.

Inland Seas.—Where evaporation is rapid, inland seas and lakes which drain considerable areas become even more salt than the ocean. The Dead Sea and the Great Salt Lake are examples. The Dead Sea receives the waters of the Jordan, which drains the surrounding country. There are no outlets to this lake, and evaporation is rapid. Thus, in the course of time, the Dead Sea has come to contain a large quantity of salt. The above analysis of this water by the Herepaths shows that it contains nearly 31 ounces of saline matter in a gallon, while the water of the Atlantic contains less than 5 ounces. The following table gives a comparison of the waters of some other inland seas with that of the ocean:

	Density.	Grains of saline matter in 1 gallon.	Ounces of saline matter in 1 gallon.
The Atlantic Ocean	1.027	2139	4.89
The Dead Sea	1.172	13488	30.86
The Great Salt Lake	1.170	15203	34.72
Lake Oroomiah, in Persia	1.188	18209	41.60

The difference in the character of the salts contained in the Dead Sea water and in the water of the ocean is not surprising. The ocean receives the saline matters washed out of all the continents, while these inland seas are local in their sources of supply. They receive the washings of limited areas, and the salts they contain must necessarily partake of the character of those particular countries in which they are situated.

IV. Mineral Waters.—Waters which contain unusually large quantities of any of the ordinary impurities, or which are characterized by unusual constituents, are known as mineral waters. Such waters may be valuable for their medicinal properties or as sources of the special substances which they contain. As examples of medicinal waters we have sulphur springs, which contain sulphuretted hydrogen; chalybeate springs, which contain iron, etc.; while brines and borax-waters are valuable for the extraction of salt and borax.

Sulphur Waters.—Waters containing sulphuretted hydrogen gas are found in many parts of the world. Those of Harrowgate, Croft, and Aix-la-Chapelle are renowned in Europe, while we have in the U. S. numerous examples, among which are the White, Red, and Salt Sulphur springs of Virginia, the White Sulphur springs of Ohio, and the Richfield, Sharon, Chittenango, and Florida springs of New York State. The sulphuretted hydrogen gives these waters a sweet taste and a very peculiar odor, which some consider offensive. These waters have the property of blackening silver; persons who visited these springs in the earlier days of the republic, when specie was current, noticed a gradual darkening of their "change," which finally became quite black, owing to the formation of a black sulphide of silver. The following analyses by the writer show the composition of such waters:

In 1 U. S. gallon of 231 cubic inches.	Chittenango, Madison co., N. Y.			Florida, Montgomery co., N. Y.
	White Sulphur Spring.	Cave Spring.	Magnesia Spring.	Florida Spring.
	Grains.	Grains.	Grains.	Grains.
Hydrosulphate of sodium (NaS,HS)	0.117	0.386	0.757	2.008
Hydrosulphate of calcium (CaS,HS)	.....	1.123	0.929	
Sulphate of potassa	.....	.....	.....	1.390
Sulphate of soda	0.213			
Sulphate of lime	81.420	106.126	115.085	
Sulphate of strontia	trace.	trace.	trace.	
Sulphate of magnesia	1.953	7.589	12.718	
Hyposulphite of soda	.....	0.257	0.020	0.711
Bicarbonate of soda ($NaO,HO,2CO_2$)	.....	.....	.....	22.143
Bicarbonate of lime	.....	.....	.....	8.317
Bicarbonate of magnesia	22.017	23.973	20.779	6.972
Bicarbonate of iron	0.078	0.156	0.325	
Chloride of potassium	0.156	0.233	0.333	
Chloride of sodium	1.037	1.569	1.833	5.880
Chloride of lithium	trace.	trace.	trace.	
Alumina	0.082	0.222	trace.	trace.
Silica	0.286	0.519	0.577	0.793
Sulphur (in suspension)	trace.			
Sulphide of iron (in suspension)	.....	.....	.....	0.176
Total solid contents per gallon	107.359	142.113	153.356	43.390
Total sulphur in the metallic sulphides and sulphuretted hydrogen	0.339	1.397	2.4	1.91654
Cubic Inches of Gas per Gallon.				
Sulphuretted hydrogen gas	0.884	2.754	5.623	3.765
Carbonic acid gas	20.480	15.934	19.436	32.169

With the exception of the following compounds, the substances found in these waters are not essentially different from those contained in most spring-waters:

Hydrosulphate of sodium.....(NaS,HS).
Hydrosulphate of calcium.....(CaS,HS).
Hyposulphite of soda.....(NaO,S_2O_2).
Sulphur.....(S).
Sulphide of iron.....(FeS).
Sulphuretted hydrogen gas.....(HS).

To the last-mentioned substance the peculiar odor of the water is due, while by the free sulphur, which is formed by the action of the oxygen of the air on this gas, the white milky turbidity is produced.

Saline Waters.—The chlorides of sodium, calcium, and magnesium often occur in spring waters in such quantities as to cause a decided saline taste—agreeable in the case of the first-mentioned salt, if not too intense, but bitter and disagreeable when caused by either of the others. Sulphate of soda (Glauber salt) or of magnesia (Epsom salt) may also be the cause of a saline taste. Brines, which are important sources of national wealth in many countries, belong to the first-mentioned class. Nearly all the salt manufactured in the U. S. is obtained from salt springs or wells. This table exhibits analyses of some of the brines of Michigan and New York, made by Dr. C. A. Goessmann of the Massachusetts Agricultural College:

Analyses of Brines.

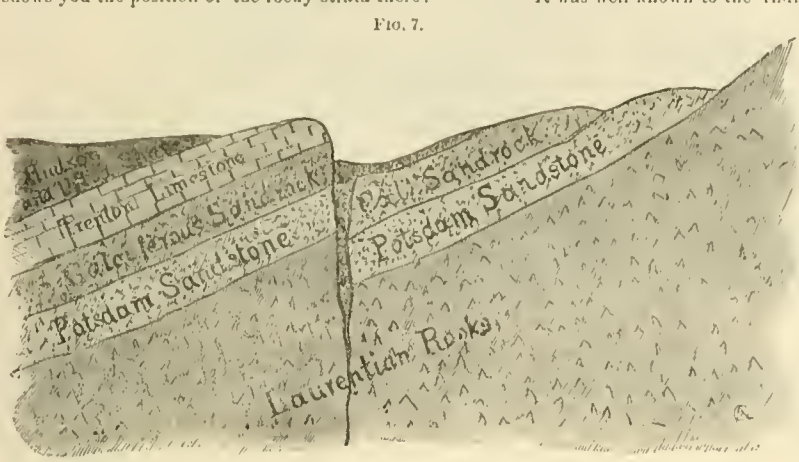
	Michigan.		New York.	
	East Saginaw Co.'s well.	Bangor Co.'s well.	Syracuse.	Salina.
Chloride of sodium	16.86	19.86	15.36	14.94
Chloride of magnesium	0.96	1.26	0.14	0.13
Chloride of calcium	2.27	2.96	0.08	0.08
Sulphate of lime	0.15	0.07	0.57	0.59
Total saline matter	20.24	24.15	16.15	15.74
Water	79.76	75.85	83.85	84.26
	100.00	100.00	100.00	100.00

Similar brines occur in Kansas, Ohio, West Virginia, and other States. Over 9,000,000 bushels of salt have been

manufactured in the neighborhood of Syracuse in a single season. The brine is here pumped up through artesian wells from a depth of 100 or 500 feet. It is undoubtedly derived from beds of rock-salt, such beds having been already discovered in Canada, not very far distant. The famous St. Catharine's Spring in Canada contains large quantities of the chlorides of calcium and magnesium, which give its water a bitter taste. The Kissingen bitter water illustrates the class of waters that owe their peculiar qualities to the sulphates of soda and magnesia.

Acidulous Springs.—Waters charged with such quantities of carbonic acid as to cause them to sparkle and effervesce as they flow from the spring are called *acidulous*. Owing to the solvent power of this acid upon limestones and some other rocks, such waters generally hold considerable quantities of lime, magnesia, and iron in solution in the form of bicarbonates; when the latter is present in quantities of a grain or more to the gallon, the spring is called a *chalybeate*, from the name of an ancient people who worked in iron at an early day, the *Chalybes*. These waters often contain considerable quantities of chloride of sodium, and frequently bromide and iodide of sodium, as well as bicarbonates of soda and lithia. Such is the character of the most celebrated mineral waters in this country, the well-known springs of Saratoga and Ballston in New York. Fig. 7 is a section of the Saratoga valley, which shows you the position of the rocky strata there:

Fig. 7.



Section of Saratoga Valley.

Beginning with the uppermost, the rocks of Saratoga county are: (1) the Hudson River and Utica shales and slates; (2) the Trenton limestone; (3) the Calciferous sandrock, which is a silicious limestone; (4) the Potsdam sandstone; and (5) the Laurentian formation of gneiss and granite of unknown thickness. The northern half of the county is occupied by the elevated ranges of Laurentian rocks; flanking these occur the Potsdam, Calciferous, and Trenton beds, which appear in succession in parallel bands through the central part of the county. These are covered in the southern half of the county by the Utica and Hudson River slates and shales. The most remarkable feature is, however, the break or vertical fissure which occurs in the Saratoga valley, which is indicated in the diagram. The strata on one side of the fissure have been elevated above their original position, so that the Potsdam sandstone on the left meets the edges of the Calciferous sandrock, and even the Trenton limestone, on the right. It is in the line of this fissure, or *fault*, in the towns of Saratoga and Ballston, that the springs occur. The Laurentian rocks, consisting of highly crystalline gneiss, granite, and syenite, are almost impervious, while the overlying Potsdam sandstone is very porous, and capable of holding large quantities of water. In this rock the mineral springs of Saratoga probably have their origin. The surface-waters of the Laurentian hills, flowing down over the exposed edges of the Potsdam beds, penetrate the porous sandstones, become saturated with mineral matter, partly derived, perhaps, from the limestones above, and are forced to the surface at a lower level by hydrostatic pressure. The valley in which the springs all occur indicates the line of a fault or fracture in the rocky crust, the strata on the W. side of which are hundreds of feet above the corresponding strata on the E. The mineral waters probably underlie the southern half of the entire county, many hundred feet below the surface, the accident of the fault determining their appearance as springs in the valley of Saratoga Springs, where, by virtue of the greater elevation of their distant source, they reach the surface through crevices in the rocks produced by the fracture. Their common origin is also shown by analysis; all the springs contain the same constituents in essentially the same order of abundance; they differ in the degree of concentration merely. Those from the deepest strata are the most concentrated. The constituents to which the taste of the water and its most immediate medicinal effects are due are—chloride of sodium, bicarbonate of lime, bicarbonate of magnesia, bicarbonate of soda, and free carbonic acid. Other important though less speedily active constituents are—bicarbonate of iron, bicarbonate of lithia, iodide of sodium, and bromide of sodium. Besides the natural springs, several artesian wells have been bored to depths reaching in some cases 650 feet. All these have been successful in bringing up very concentrated waters of the same chemical character as the natural springs. It is probable, therefore, that water can be obtained anywhere in the southern portions of the county by tapping the underlying Potsdam sandstone. In all of these wells the water rises to and above the surface. Down in the rocky reservoir the water is charged with gases under great pressure. As the water is forced to the surface the pressure diminishes, and a portion of gas escapes with effervescence. The wells deliver, therefore, enormous volumes of gas with the water—a perfect suds of water, carbonic acid, and carburetted hydrogen.

The High Rock Spring was the first to attract attention. It was well known to the Indians, who highly prized the medicinal virtues of its waters. The Indian name Saraghtoga means "place of salt." In 1767 they brought Sir William Johnson to the spring on a litter. The spring rises in a little mound of stone three or four feet high, which appears like a miniature volcano, except that sparkling water instead of melted lava flows from its little crater. When Sir William Johnson visited the spring, and in fact until quite recently, the water did not overflow the mound, but came to within a few inches of the summit, some other hidden outlet permitting it to escape. The Indians had a tradition, however, which was undoubtedly true, that the water formerly flowed over the rim of the opening. A few years ago the property changed hands, and the new owners, convinced that by stopping the lateral outlet they could cause the water again to issue from the mouth of the rock, employed a number of men to undermine the mound, and with a powerful hoisting-derrick to lift it off and set it one side, that the spring might be explored.

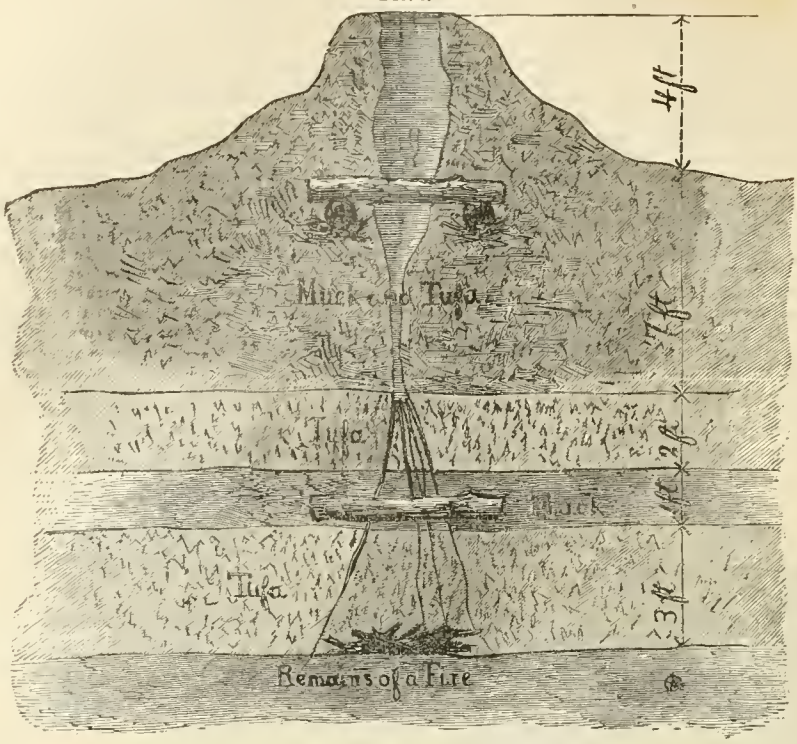
Analysis of a Fragment of the High Rock.

Carbonate of lime	95.17
Carbonate of magnesia	2.49
Sesquioxide of iron	0.07
Alumina	0.22
Sand and clay	0.09
Organic matter	1.11
Moisture	0.39
Undetermined and loss	0.46
	100.00

Just below the mound were found four logs, two of which rested upon the other two at right angles, forming a curb. Under the logs were bundles of twigs resting upon the dark brown or black soil of a previous swamp. Evidently some ancient seekers after health had found the spring in the swamp, and to make it more convenient to secure the water had piled brush around it and then laid down the logs as a curb. The rock was formed by the water. It is composed of tofa, carbonate of lime, and was formed in the same manner as stalactites and stalagmites were formed. As the water flowed over the logs, the evaporation of a portion of the carbonic acid caused the separation of an equivalent quantity of insoluble carbonate of lime, which, layer by layer, built up the mound. Below the rock the workmen followed the spring through 4 feet of tofa and muck. Then they came to a layer of solid tofa 2 feet thick, then 1 foot of muck, in which they found another log. Below this were 3 feet of tufa; and there, 17 feet below the apex of the mound, they found the embers and charcoal of an ancient fire. The Indian tradition went back only to the time when the water overflowed the rock; how many centories may have elapsed since even the logs were

placed in position? There are springs in the Auvergne, in France, in which the peasantry are in the habit of suspending little wire baskets containing egg-shells, or crawfishes, or medallions, which become thickly incrusted with tufa in a few days. The table below gives the writer's analyses of several of these springs. Thus, there are

FIG. 8.



Section of the High Rock Spring.

springs to suit all tastes, from the concentrated artesian waters to the mild Saratoga Seltzer, which is used with wines, as the original Seltzer (Selters) from the spring of the late grand duke of Nassau has long been used. Hathorn's Spring is the strongest natural spring yet discovered in the county, while the Ballston Artesian Lithia Spring fur-

Analyses of some of the Springs and Artesian Wells of Saratoga Co., N. Y.

Compounds as they exist in solution in the waters.	In Saratoga.											In Ballston.		
	Star Spring.	High Rock Spring.	Seltzer Spring.	Pavilion Spring.	United States Spring.	Hathorn Spring.	Crystal Spring.	Congress Spring.	Empire Spring.	Geyser spouting well.	Glacier spouting well.	Ballston Artesian Lithia well.	Franklin Artesian well.	Condé-Dentonian well.
Chloride of sodium	398.361	390.127	134.291	459.903	141.872	509.968	328.468	400.444	506.630	562.080	702.239	750.030	659.344	645.481
Chloride of potassium	9.695	8.974	1.335	7.660	8.624	9.597	8.327	8.049	4.292	24.634	40.416	33.276	33.930	9.232
Bromide of sodium	0.571	0.731	0.630	0.987	0.844	1.534	0.414	8.559	0.266	2.212	3.579	3.643	4.665	2.368
Iodide of sodium	0.126	0.086	0.031	0.071	0.047	0.198	0.066	0.138	0.606	0.248	0.234	0.124	0.235	0.225
Fluoride of calcium	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.
Bicarbonate of lithia	1.586	1.967	0.899	9.486	4.817	11.447	4.326	4.761	2.080	7.004	6.247	7.750	6.777	10.514
Bicarbonate of soda	12.662	34.888	29.428	3.764	4.666	4.288	10.064	10.775	9.022	71.232	17.624	11.928	91.604	34.400
Bicarbonate of magnesia	61.912	54.924	40.339	76.267	72.883	176.463	75.161	124.757	42.953	149.343	193.972	180.602	177.868	158.318
Bicarbonate of lime	124.459	131.739	89.869	120.169	93.119	170.646	101.881	143.399	109.656	170.392	227.070	238.156	202.332	178.484
Bicarbonate of strontia	trace.	trace.	trace.	trace.	0.018	trace.	trace.	trace.	trace.	0.425	0.082	0.867	0.002	0.189
Bicarbonate of baryta	0.096	0.494	trace.	0.875	0.909	1.757	0.726	0.928	0.070	2.014	2.083	3.881	1.231	4.739
Bicarbonate of iron	1.213	1.478	1.703	2.570	0.714	1.128	2.038	0.340	0.793	0.979	0.647	1.581	1.609	2.296
Sulphate of potassa	5.400	1.608	0.557	2.032	trace.	trace.	2.158	0.889	2.769	0.318	0.252	0.520	0.762	trace.
Phosphate of soda	trace.	trace.	trace.	0.007	0.016	0.006	0.009	0.016	0.023	trace.	0.010	0.050	0.011	0.003
Biborate of soda	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.
Alumina	trace.	1.223	0.374	0.329	0.094	0.131	0.305	trace.	0.418	trace.	0.458	0.077	0.263	0.395
Silica	1.283	2.260	2.561	3.155	3.184	1.260	3.213	0.840	1.458	0.665	0.699	0.761	0.735	1.026
Organic matter	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.
Total per U. S. gal., 231 cu. in.	617.367	630.500	302.017	687.275	331.837	888.403	537.155	700.895	680.436	991.546	1,195.582	1,233.246	1,184.368	1,047.700
Carbonic acid gas	407.650	409.458	324.080	332.458	245.734	375.747	317.452	392.289	344.669	451.082	465.458	426.114	460.066	558.345
Density	1.0091	1.0092	1.0034	1.0095	1.0035	1.0115	1.0060	1.096	.....	1.0129	.....	1.0159	1.0135	1.0125
Temperature	52° F.	52° F.	50° F.	.....	.....	.....	50° F.	62° F.	.....	46° F.	.....	62° F.	52° F.	49° F.
Bases and Acids, as actually found in the Analysis, uncombined.														
Potassium	7.496	5.419	0.949	4.931	4.515	5.024	5.326	4.611	.....	13.003	.....	17.653	18.104	4.833
Sodium	160.239	163.216	61.003	182.084	57.259	202.058	132.006	162.324	.....	251.033	.....	299.005	286.221	263.769
Lithium	0.163	0.202	0.093	0.976	0.499	1.179	0.445	0.490	.....	0.720	.....	0.798	0.698	1.082
Lime	43.024	45.510	31.066	41.540	32.180	58.989	35.218	49.569	.....	58.901	.....	82.326	69.942	61.698
Strontia	trace.	trace.	trace.	trace.	0.009	trace.	trace.	trace.	.....	0.211	.....	0.430	0.001	0.094
Baryta	0.056	0.292	trace.	0.517	0.537	1.026	0.429	0.549	.....	1.190	.....	2.292	0.727	2.799
Magnesia	16.992	15.048	11.051	20.895	19.968	48.346	20.592	33.358	.....	40.915	.....	49.480	48.731	43.383
Protoxide of iron	0.191	0.598	0.689	1.040	0.289	0.456	0.824	0.137	.....	0.396	.....	0.639	0.651	0.929
Alumina	trace.	1.223	0.374	0.329	0.094	0.131	0.305	trace.	.....	trace.	.....	0.077	0.263	0.395
Chlorine	246.357	241.017	82.128	282.723	90.201	314.037	203.292	216.834	.....	352.825	.....	470.997	416.278	396.036
Bromine	0.443	0.568	0.489	0.767	0.656	1.188	0.322	6.645	.....	1.718	.....	2.829	3.623	1.869
Iodine	0.106	0.072	0.020	0.060	0.039	0.166	0.055	0.117	.....	0.298	.....	0.104	0.197	0.189
Fluorine	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	.....	trace.	.....	trace.	trace.	trace.
Sulphuric acid	2.483	0.739	0.256	0.934	trace.	trace.	0.992	0.409	.....	0.146	.....	0.230	0.350	trace.
Phosphoric acid	trace.	trace.	trace.	0.004	0.008	0.003	0.004	0.008	.....	trace.	.....	0.025	0.006	0.002
Boracic acid	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	.....	trace.	.....	trace.	trace.	trace.
Carbonic acid in carbonates	56.606	62.555	44.984	60.461	50.380	104.928	54.984	80.249	.....	112.880	.....	125.973	136.133	110.019
Carbonic acid, for bicarbonates	56.606	62.555	44.984	60.461	50.380	104.928	54.984	80.249	.....	112.880	.....	125.973	136.133	110.019
Silica	1.283	2.260	2.561	3.155	3.184	1.260	3.213	0.840	.....	0.665	.....	0.761	0.735	1.026
Organic matter	trace.	trace.	trace.	trace.	trace.	trace.	trace.	trace.	.....	trace.	.....	trace.	trace.	trace.
Water in bicarbonates	23.160	25.591	18.405	21.736	20.613	42.929	22.496	33.828	.....	46.183	.....	51.543	55.696	45.013
Oxygen in $KO(SO_3)$	0.196	0.148	0.051	0.187	.....	.....	0.199	0.082	.....	0.029	.....	0.018	0.070	
Oxygen in $LiO(HO)CO_2$	0.187	0.232	0.105	1.116	0.570	1.347	0.509	0.560	.....	0.821	.....	0.911	0.797	1.237
Oxygen in $NaO(HO)(PO_5)$	1.206	3.323	2.803	0.358	0.444	0.408	0.959	1.024	.....	0.785	.....	1.196	9.011	3.277
Oxygen in $2NaO.HO.PO_5$	.....	.....	.....	0.001	0.002	0.001	.....	0.002	.....	.....	.....	0.006	0.001	trace.
Total per U. S. gal., 231 cu. in.	617.367	630.500	302.007	687.275	331.837	888.403	537.155	700.895	.....	991.546	.....	1,233.246	1,184.368	1,047.700
Total residue by evaporation	537.600	542.350	238.970	602.080	260.840	740.550	459.670	588.818	.....	832.483	.....	1,055.730	992.540	892.670

nishes from its artesian tube the most concentrated water yet obtained. The peculiar excellence of the Congress Spring is due to the fact that it contains very much less iron than any other spring, and that it contains in the most desirable proportions those substances which produce its agreeable flavor and satisfactory medicinal effects; neither holding them in excess nor lacking in anything that is desirable in this class of waters.

In the following table are some partial analyses of nearly all the mineral springs of the county, which are sufficiently complete for comparison. The numbers represent grains in 1 U. S. gallon of 231 cubic inches:

Table showing the Total Quantities of Mineral Matter left by evaporation, and of some of the more important Constituents.

Spring.	Total solids as left by evaporation.	Chlorides of sodium and potassium.	All other solids left by evaporation; carbonates of lime, magnesia, etc.	Bicarbonate of lime ($CaO,HO,2CO_2$).	Bicarb. of magnesia ($MgO,HO,2CO_2$).	Bicarbonate of iron ($FeO,HO,2CO_2$).
Ballston Artesian Lithia Well	1,055.74	783.30	272.13	238.16	180.60	1.58
Franklin Artesian Well	992.54	693.27	299.27	202.33	177.87	1.61
Conde - Dentonian Well	892.67	654.70	237.97	178.48	158.35	2.29
Geyser Spouting Well	832.48	586.71	245.77	170.59	149.31	0.98
Hathorn's Spring	740.55	519.55	221.00	170.65	176.46	1.13
Hamilton Spring	611.71	411.00	200.71	144.81	104.80	1.80
Congress Spring	588.82	408.49	180.33	143.40	121.76	0.31
High Rock Spring	512.35	399.10	143.25	131.74	54.92	1.48
Washington Spring	353.23	215.00	138.23	110.23	40.56	2.49
Excelsior Spring	611.05	473.00	138.05	90.38	72.27	2.84
Pavilion Spring	602.08	467.56	134.51	120.17	76.73	2.57
Putnam Spring	354.79	220.50	134.27	110.72	60.01	3.97
Columbian Spring	353.08	219.00	134.08	104.89	78.05	3.26
Star Spring	537.60	408.05	129.55	124.46	61.91	1.21
Crystal Spring	459.67	336.79	122.88	101.88	75.16	2.04
Eureka Spring	280.16	171.00	119.16	94.02	63.75	3.36
United States Spring	260.81	150.49	110.35	93.12	72.88	0.71
Empire Spring	460.32	355.16	105.16	113.54	48.10	1.34
Seltzer Spring	238.97	135.62	103.35	89.87	40.34	1.70
Red Spring	155.53	73.50	82.03	79.80	27.84	2.51
Village Spring, Ballston	153.09	75.00	78.09	65.08	21.59	2.00

Chalybeates.—Almost all natural waters contain minute quantities of iron, generally in the form of bicarbonate. In the above analyses of the Saratoga waters are recorded from ½ of a grain to 3 grains of this compound of iron per gallon. All these waters are therefore chalybeates, but the properties of the iron are masked to a greater or less extent by the much larger quantities of other materials. Pliny employed tannic acid in the form of nutgall tincture, which forms ink with the iron, in testing mineral waters before the destruction of Pompeii and Herculaneum. In fact, these ferruginous waters are characterized by a styptic or inky taste, due to the iron which they contain.

Acid Waters.—It occasionally happens that springs are characterized by the presence of free mineral acids, such as sulphuric and hydrochloric. The Rio Vinagre, in South America, is supplied by such springs; and it is stated that this stream carries to the ocean daily an amount of acid equal to 82,720 pounds of oil of vitriol and 69,638 pounds of concentrated muriatic acid. There is a celebrated spring of this character in New York State, known as the Oak Orchard Acid Spring, an analysis of which is here presented:

Analysis of the Oak Orchard Acid Water, by Prof. Porter.

1 gallon contains:

Sulphuric acid	133.312
Proto-sulphate of iron	32.216
Sulphate of magnesia	8.491
Sulphate of lime	13.724
Sulphate of alumina	6.413
Sulphate of potash	2.479
Sulphate of soda	3.162
Chloride of sodium	1.432
Silicic acid	3.324
Organic matter	6.654
Total grains	211.207

Alum Waters.—In several localities waters occur charged to a greater or less extent with alum, which is a double sulphate of alumina and potassa. These waters frequently contain free sulphuric acid, and it is probable that they were all first charged with this acid, which, acting on feldspathic rocks or slates, has dissolved the alumina, potash, etc., forming the sulphates found in them as they issue at the surface. The Rockbridge Alum Spring and the Church Hill Alum Spring, in Virginia, are examples of this class.

Silicious Waters.—Almost all natural waters contain small quantities of silica, in the neighborhood of 1 grain in a gallon; but the waters of hot springs, especially those which contain alkaline carbonates, are largely charged with silica, and in the neighborhood of their outlets large masses of silicious tufa are formed. The water of the famous Geyser in Iceland contains 21 grains of silica in the gallon. There are wonderful geysers in California, and quite recently a region in Montana, on the Upper Yellowstone, has been explored in which from 1000 to 1500 hot springs occur. One of these, the Grant Geyser, throws a column of hot water 8 feet in diameter to a height of over 200 feet at regular intervals of thirty-two hours, while others are in almost constant operation.

Borax Waters.—Minute quantities of borax (biborate of soda) are found in many mineral waters—as, for instance, the waters of Saratoga—but in a few localities waters occur so heavily charged with this salt as to make it worth while to extract it for manufacturing purposes. Instead, however, of evaporating the waters to extract the borax which they contain, the borax-gatherers content themselves with collecting the crystals formed by natural evaporation along the margins and on the muddy beds of the borax lakes. For many years considerable quantities of borax, called tincal, were brought from a salt lake in Thibet. More recently California has been found to contain borax lakes of great size, in which occur enormous quantities of this valuable salt. No complete analysis of the waters of these lakes has yet been published, but according to G. E. Moore the water contains 535 grains of borax per gallon. Near the borax lake is situated a wonderful hot spring, from which, and perhaps from others of similar character, the borax of the lake has been derived. It is astonishingly rich in ammonia.

Analysis of a Borax Spring, California, by G. E. Moore.

	Grains in a gallon.
Chloride of potassium	trace.
Chloride of sodium	84.52
Iodide of magnesium	0.09
Bromide of magnesium	trace.
Bicarbonate of soda	76.96
Bicarbonate of ammonia, $NH_4O,2CO_2$	107.76
Biborate of soda, $NaO,2BO_3$	103.29
Sulphate of lime	trace.
Alumina	1.26
Carbonic acid (free)	36.37
Silicic acid	8.23
Total grains in 1 U. S. gallon	418.58

V. Water for Manufacturing Purposes.—For manufacturing purposes pond or river water is generally selected, not only because it can generally be obtained in unlimited quantities, but also because it is generally softer than spring-water. For many purposes the impurities of waters are often seriously objectionable. When used in stationary or locomotive boilers, impure water produces incrustations which often form a complete lining. As much as 1300 pounds of calcareous incrustation have been taken from the boiler of a single locomotive on the New York Central R. R. These incrustations are very poor conductors of heat. Their presence in boilers causes, therefore, a great waste of fuel. It is estimated by the French engineers that 45 per cent. of the fuel burned under locomotive boilers is lost owing to the non-conducting power of the incrustations. Furthermore, these scales prevent the contact of the water with the plates of the boiler, the metal becomes therefore overheated, and is rapidly burned out, making frequent repairs necessary. Boiler explosions are sometimes attributed to the presence of incrustations; the metal becoming very much overheated, causes the scale to crack, which permits the water to come in contact with the hot metal; a great quantity of steam being at once generated, the boiler is burst. These incrustations vary somewhat in character with the impurities of the waters by which they are produced. Their chief constituents are carbonate of lime, carbonate of magnesia, and sulphate of lime. The analyses on the following page of incrustations from locomotives on the New York Central R. R. were made by the writer.

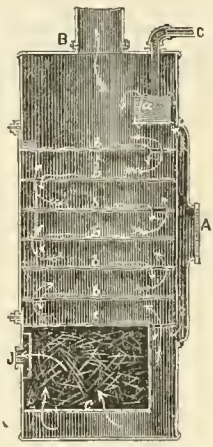
Various substances are employed to prevent the formation of these incrustations in boilers, some of which are very effective. Amylaceous, saccharine, and extractive matters tend to prevent the carbonates of lime and magnesia from forming a hard scale, causing them to separate as a loose mud, which can be easily washed from the boiler at convenient intervals. Potatoes, molasses, extractive matters, or substances which yield them, as logwood sawdust, are consequently employed with varying success. Astringent substances, which contain tannic acid, have a similar action. To this class belong catechu extract, oak sawdust, tan bark, etc. Solid particles, as sawdust, clay, chopped straw, etc., serve to diminish the formation of hard scale by presenting nuclei upon which the earthy carbonates are deposited. For the decomposition of sulphate of lime carbonate of soda or chloride of barium is employed. Sal-ammoniac is sometimes employed to convert the car-

Analysis of Boiler Incrustations.

Source.	Structure.	Thickness.	Sulphate of lime.	Carbonate of lime.	Basic carbonate of magnesia.	Oxide of iron and alumina.	Water.	Organic matter.	Silica.	Total.	
1. Stationary engine, boiler-shop, Syracuse, hydrant water	Compact and crystalline.	3-16ths inch.	74.07	14.78	9.19	0.08	1.14	undet.	0.65	99.91	Fair, average representatives of the usual incrustations.
2. *Stationary engine, machine-shop, Rochester, 10 mos., canal water, well water, 2 mos.	"	2 inches.	71.37	.....	.....	§ 26.87	.....	.....	1.76	100.00	
3. Locomotive, No. 211, frt., both roads, Syracuse	"	1-32d inch.	62.86	12.62	18.95	0.92	1.28	undet.	2.60	99.23	
4. Locomotive, surrounding a brace	"	1-4th to 1-3d in.	53.05	.....	.....	§ 42.16	.....	.....	4.79	100.00	
5. Locomotive, No. 127, frt., both roads, Syracuse	"	1-32d inch.	46.83	.....	.....	§ 47.85	.....	.....	5.32	100.00	
6. Locomotive, No. 202, frt., both roads, Syracuse	"	1-4th inch.	30.80	26.93	31.17	1.08	2.44	undet.	7.75	100.17	
Average	.....	.....	56.49	18.11	19.77	0.69	1.62	undet.	3.81		
7. †Stationary engine, Niagara Falls, river water	Friable and gran.	2 inches.	4.95	86.25	2.16	1.03	0.63	undet.	2.07	97.54	Exceptional incrustations, the only ones of their kind analyzed.
8. ‡Stationary engine, Townsend's Furnace, Albany.	"	1¼ inches.	0.88	93.19	2.84	0.36	0.15	1.96	0.62	100.00	
9. Locomotive, No. 122, Rochester to Buffalo	Powder.	.....	4.81	.....	.....	§ 92.27	.....	.....	2.92	100.00	
10. Stationary engine, Barhydt and Greenhalgh, Schenectady	"	.....	30.07	.....	.....	§ 61.69	.....	.....	8.24	100.00	

bonate of lime into soluble chloride of calcium, and thereby prevent its being deposited. The substances which I have enumerated are placed in the boiler from time to time and allowed to act there. An English chemist, Mr. Clark, proposed purifying the water beforehand by adding lime-water, on the principle of *similia similibus curantur*. The carbonate of lime in the water is held in solution by carbonic acid as a bicarbonate. The lime which Mr. Clark adds takes this extra carbonic acid, forming an insoluble carbonate, and at the same time precipitating the lime of the bicarbonate as insoluble carbonate. The magnesia present is also precipitated by the lime-water; but the sulphate of lime, which forms the hardest and most crystalline incrustations, is not removed by this process. The real objection to this process arises from the vast quantities of water required in practice. A locomotive consumes on the average about 45 gallons of water for every mile that it runs, and on the New York Central R. R. alone about 300 locomotives are employed. As at least twenty-four hours are required to enable the precipitated lime to settle from the water, enormous reservoirs or tanks would be required to contain a sufficient supply for a railroad. Dr. Frankland stated in his examination before the parliamentary committee on the London water bill that all the water supplied to Canterbury, Tring, and to the military hospital at Woolwich is purified by this process, at a cost of about $3 per million gallons for the lime.

Fig. 9.



Stillwell's Heater and Lime-Catcher.

A, steam enters the heater, and is divided into two currents; *B*, steam escapes from the heater; *C*, cold water enters; *E*, cock with which to regulate supply of cold water; *H*, door of heater; *J*, hot water leaves heater; *L*, glass water-gauge; *u*, overflow cup suspended on the end of cold water pipe; *b b b b*, removable shelves or depositing surfaces; *c*, filtering chamber, to be filled with any suitable filtering material. The feathered arrows indicate the course of the steam, and the plain arrows the course of the water. The bottom of the heater is provided with an opening for drawing off sediment collected there.

An excellent device has been patented by Stillwell to be used in connection with stationary boilers. It is simply a box containing a great number of horizontal shelves. The water for supplying the boiler passes through this, and the exhaust steam from the engine is also admitted to it. The exhaust steam causes the water to boil, and most of the lime which it contains in the form of bicarbonate separates as insoluble carbonate, lodging on the shelves or being caught by a filter of straw at the bottom of the box.

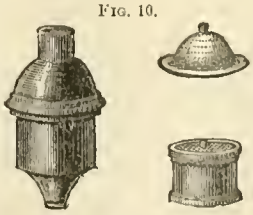
Great annoyance was formerly experienced by marine engineers whose boilers were fed with sea-water. Not only was there formed a very hard, strong scale of sulphate of lime, often an inch or more in thickness, but even the salt separated, sometimes entirely filling the spaces between the tubes. By noting the density of the water in the boiler with a hydrometer, and blowing out a portion of the concentrated sea-water from time to time, the engineer was able to prevent the separation of salt, but the separation of sulphate of lime could not be prevented. This became so great an evil, causing the very rapid destruction of the boilers, that the use of sea-water had to be abandoned. Marine boilers are now provided with condensers, by which the steam, after doing its work in the cylinder, is condensed to water again and returned to the boiler. A supply of fresh water is taken on board before leaving port, and is used over and over again until the vessel reaches her destination.

Often for washing or for cleaning cotton, wool, or other fabrics the impurities of water are a great objection; they destroy soap, and affect colors in dyeing; for sugar-refineries and in brewing the character of the water is of great importance. In fact, the highly-prized flavor of some of the English ales is attributed facetiously to the impurities in the water used.

Filtering Water.—Filtration is one of the simplest methods for purifying waters; its action is limited to the suspended impurities, such as mud, animal and vegetable substances, etc. Any porous material may be employed in the construction of a filter, the selection being generally governed by the magnitude of the operation. For city supplies, reservoirs are constructed which are provided with porous partitions, or so arranged that the water is obliged to percolate through beds of sand and gravel.

In many European cities filtering basins of great size are employed for filtering the entire water-supply. Filtering beds are constructed many feet thick, consisting of layers of large stones at the bottom, smaller stones above, and finally coarse sand at the top. Galleries arched with brick serve to receive the filtered water, which is then ready for distribution. The river-waters supplied to London, Liverpool, York, Dublin, Edinburgh, Lyons, Marseilles, Genoa, Leghorn, Berlin, etc., are thus purified. In this country the system of filtering river-water is being now introduced at St. Louis, Schenectady, and elsewhere. Many families now make use of rain-water, which is received in a cistern provided with a filtering partition.

Fig. 10.



The Triple Filter.

The sponge filter (Fig. 10) is a very simple filter, which has recently been devised for domestic use. It contains, in the first place, a little cup filled with coarse charcoal and sand, and provided with a network of wire gauze. Above that is

* A mass weighing 21 ounces, which had apparently filled the space between three tubes.

† A mass weighing 11 ounces, evidently detached from a tube.

‡ A mass weighing 16 ounces, evidently detached from a tube.

§ This number includes those belonging to the two preceding and the two following columns, as obtained by difference.

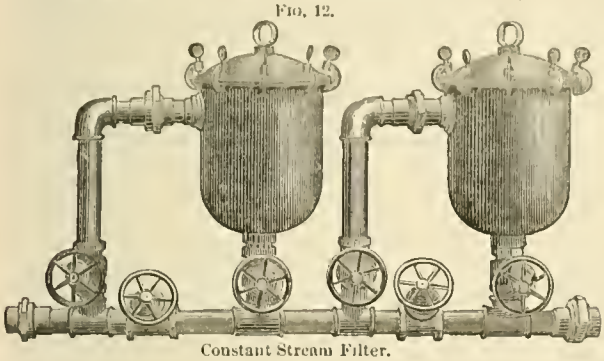
placed a common sponge, pressed firmly into its place, so that it entirely fills the space. This is encased in a little perforated cup and is placed over the charcoal vessel. The water which passes through this is therefore obliged to pass through the sponge, and then through the charcoal. Although it acts as a perfect filter, it does not seriously interrupt the flow. The advantage of this filter is, that when it becomes clogged and the flow of the water is impeded by the impurities separated, it is merely necessary to open it and take out the sponge, wash it, and return it to its place, and reverse the charcoal cup. Fig. 11 is a house filter without the sand and charcoal cup, containing the sponge only.

Fig. 11.

Hose and Basin-Cock Filters.

Filters are constructed on the same principle for use in manufacturing establishments. Fig. 12 represents one suitable for a large factory or hotel. As there are really two filters, either one may be cleansed without interfering

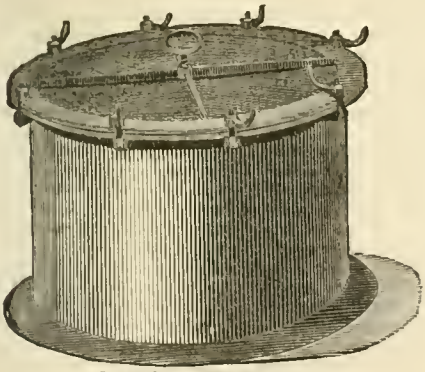
Fig. 12.



Constant Stream Filter.

with the flow of water through the other, as is seen by the arrangement of the cocks. Fig. 13 is a much larger filter, containing six chambers for holding sponges, each 6 inches in diameter, which is designed for paper-factories, where large quantities of water are used. Still larger filters are constructed upon the same principle, up to a capacity of 300 gallons of water per minute. The sponges in every case completely remove the animal, vegetable, and other

Fig. 13.



Steam Paper-Machine Filter.

suspended impurities. Another filter which is often attached to faucets in houses is the common sand filter. It is attached in the same way as the sponge filter, Fig. 11, and by and by, when it becomes clogged, it is merely necessary to reverse it, when the first glass of water passing through cleanses it. This does not permit so free a flow of water as the sponge filter, and, moreover, it is liable to become permanently obstructed by impurities.

Boiling Water.—Impurities of animal and vegetable origin are often rendered inert and harmless by simple boiling, and travellers in malarious countries consider this simple précaution a very efficient protection against some of the diseases peculiar to the localities.

Distillation.—Distillation is really the most effective method for purifying water, but it is only applicable in special cases. The analytical chemist, the photographer, and sometimes the pharmaceutist, are compelled to resort to distillation to obtain water sufficiently pure for certain of the operations incident to their respective professions. Almost all vessels are now provided with an apparatus by which sea water may be distilled for drinking purposes in case of a long voyage and deficient supply of fresh water. Distilled water must be thoroughly aërated to render it palatable and wholesome.

Other Methods of Purifying Water.—Charcoal has the property of purifying water contaminated by organic matters. On this account, water-casks are generally charred on the inside to the depth of an eighth of an inch or so, and it is a common practice, when rain-water cisterns become foul, to throw in a bushel or two of fresh charcoal. Permanganate of potassa, commonly called chameleon salt, is very effective in destroying organic matter in water. Travellers are advised to carry with them a small vial of the crystallized salt. A small particle added to a glass of water renders it pure, as in a few moments it oxidizes or burns up the impurities, which taken into the system might produce fever or dysentery. Running streams undergo purification by the oxygen which they absorb from the air. Very impure waters, when placed in casks on shipboard, frequently undergo a kind of fermentation by which the impurities are worked off and the waters rendered sweet and wholesome. This phenomenon has been noticed in the case of Thames water. Contact with iron, as when water is stored in iron tanks, effects a speedy purification. Filtration over magnetic oxide of iron is said to purify water very rapidly.

VI. Water for Domestic Purposes.—For domestic purposes the water of springs is generally selected, because it is cool and clear, having undergone a natural underground filtration; but, as already shown, spring water generally contains a larger quantity of dissolved impurities, hence it is generally harder than river or pond water. Ordinarily, wells receive their supply of water partly from springs and partly by drainage. They are therefore very liable to be contaminated with the soluble impurities of sewage, and frequently serve to disseminate special diseases, such as cholera and typhoid fever. Deep artesian wells, which bring water from deep-lying strata supplied from a distance, are free from organic impurities, though they often contain so much mineral matter as to give them medicinal qualities. This is the case with Dupont's artesian well in Kentucky. One of the most celebrated fresh-water artesian wells is that at Grenelle, a suburb of Paris. It is 1798 feet deep, cost $72,500, and supplies nearly 900,000 gallons daily. The water is received in a reservoir near the Pantheon, and distributed to the adjacent parts of the city. Numerous wells of this character have been bored in London into the chalk-beds, which are from 350 to 550 feet deep, and furnish very wholesome water. Recently, the tube or drive well has become quite popular. A simple iron tube or pipe is driven down through the soil, and in some cases a continual flow of water is obtained; otherwise, a pump is applied, but of course drainage water is obtained, though not to the same extent as in an open well. The drive well is, I believe, an American invention; it was extensively employed by the British army in Abyssinia. For the supply of waterworks of cities and large towns, ponds or rivers are resorted to as furnishing the purest water in sufficient quantities, though in a few cases artesian wells have been relied upon.

Characteristics of a Good Drinking Water.—The characteristics of a good drinking water may be enumerated as follows: Its temperature should be at least 10° lower than the temperature of the atmosphere, but it should not be much lower than 45° F. It should be free from taste, except, perhaps, a slight pungency from oxygen and carbonic acid, which is an advantage. Taste is, however, a poor guide. When one becomes accustomed to a certain water, pure water tastes flat by comparison: 50 grains of chloride of sodium in a gallon would hardly affect the taste perceptibly. A third requirement is freedom from smell. A smell should not be perceptible, even when a bottle is half filled with water, placed in a warm place for a few hours, and then shaken. It should be transparent; though it is not necessarily injurious if not transparent. Sometimes water

may contain peaty matter from swamps or vegetable matter from new reservoirs, which is not necessarily unwholesome. With regard to the total quantity of impurities admissible in good drinking water, the sanitary congress which met at Brussels decided that water containing more than 35 grains of impurity in 1 gallon is not wholesome, and that there should not be much more than 1 grain of organic matter. Thirty-five grains is a large quantity for city water, though well waters frequently contain more.

Effect of the Impurities contained in Water.—(1) *Mineral Impurities.*—The quality of the impurities is more important than the quantity. It is found that 5 or 6 grains of lime or magnesia render water unfit for the cooking of leguminous vegetables. On the other hand, it is a great advantage in making tea or coffee to use water of about 5 degrees of hardness—that is, containing about 5 grains of carbonate of lime or its equivalent in the gallon. A person of very nice taste can tell the difference in tea or coffee made with water in which the difference is not more than 2 to 3 grains of lime or magnesia to the gallon. It is on this account that certain wells have a great reputation as "tea wells." In olden times there were two or three such wells in New York. The fine flavor of the tea made with such water is due to the fact that the 5 or 6 grains of carbonate of lime prevent the water from dissolving the astringent matter contained in the tea, without interfering with the extraction of the theine and the other desirable constituents of the leaf. Magnesia in large quantities is objectionable, as are also lime salts. They are liable to cause dyspepsia. It is said that horses acquire a rough coat if supplied with water containing a large quantity of sulphate of lime. Goitre and cretinism are attributed to these impurities in the water; at least, the facts observed make this reference extremely probable. The goitre appeared in the Durham jail, afflicting a large proportion of the convicts. The spring water with which they were supplied was analyzed, and found to contain 77 grains of lime and magnesia salts per gallon. On substituting for this a water containing only 18 grains of these salts, it was found that the old cases rapidly improved, while no new cases made their appearance. In the limestone districts of England, Switzerland, and Central New York this goitre has been traced over considerable areas. At Goruckpoor in India, where the waters are quite calcareous, 10 per cent. of the adults are afflicted with goitre, and many of the children are cretins. Even the cats and dogs are said to be afflicted with cretinism, which is a kind of idiotic insanity. It is a curious fact that in Ireland, on the Waterford side of the Suir, where sandstones and slates prevail, goitre and cretinism are almost unknown, while on the Kilkenny side, where limestones abound, goitre is not uncommon. More recent investigations have shown that moderate quantities of these compounds are actually desirable; at least this is claimed by some of the most distinguished authorities in England, where the subject of water-supply for cities has been most carefully studied. Dr. Letheby has carefully examined the connection between the quantities of lime and magnesia salts contained in the waters used in 65 English and Scotch cities and towns and the average rates of mortality. For convenience of comparison the waters are rated according to their hardness, represented in grains per gallon of carbonate of lime or its equivalent in soap-destroying compounds:

Table showing Hardness of the Water-Supply, and the Death-Rate.

Hardness.	No. of towns.	Average death-rate per 1000.	Average hardness.
Over 10°.....	25	21.9	16.
10° to 6°.....	17	24.9	8.
6° to 2°.....	15	26.3	3.8
2° and under.....	8	28.5	1.3

It would certainly appear from these figures that waters containing earthy salts in considerable quantities are preferable to very soft waters. Even if this generalization of Dr. Letheby is not fully sustained, the old theory, which demanded the softest water possible, can hardly stand in opposition to these facts.

(2) *Organic Matter.*—The organic matter of a purely vegetable origin, such as occurs to the extent of 1, 2, or 3 grains per gallon in country springs and wells or in ponds and rivers, even when it contributes a tint of yellow to the water, is entirely harmless and unobjectionable. The nitrates, nitrites, and ammonia salts found in wells in densely-peopled towns are themselves harmless, but their presence proves the contamination of the water with the products of decomposition of animal refuse, and should always be viewed in the light of a warning of the presence of impending danger.

(3) *Animal Excreta.*—The product of the decomposition of animal matter in water is, however, by far the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character are often caused by an irruption of sewage into wells, either from a break in the sewer or cesspool or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich 31 out of 121 of the inmates were affected with typhoid fever. It was found upon investigation that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made. At Pittsfield, Mass., typhoid fever suddenly broke out in a large boarding-school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cesspool. At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and thus actually murdering the unfortunate victims with sewer poison. Dr. Stephen Smith describes an interesting case that came to his knowledge. He visited an old schoolmate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump-maker, they sent a man down to a neighboring spring to draw water, who, finding that it was not easy to dip the water of the spring from the shallowness of the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farmyards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa; after several days, typhoid fever in its worst form was ushered in. Of the entire family but two escaped an attack, and they did not use the water. It is a common saying in villages and towns that "There was health in the old houses, while there is death in the new." This is owing to the fact that when villages were first settled the houses were supplied with water from the springs on the hillside, while, as the dwellings multiplied in number, these sources of supply proving insufficient or too distant, wells were sunk in the valley, which of course received the drainage of the locality. Hence diseases such as typhoid and typhus fevers, diphtheria, etc., which were unknown to the early settlers, ultimately became prevalent. New York City, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water and the completion of the very perfect system of sewers. Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells and other impure water-supplies. At Exeter, England, in 1832, 1000 deaths occurred from cholera. A purer supply of water was then introduced from a locality 2 miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only 44 cases occurred, and in the cholera season of 1851 there was hardly a case. In London, in 1854, the water

supplied by the Southwark Co. contained much sewage, while that supplied by the Lambeth Co. was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water the deaths amounted to 130 in 10,000, while among those who drank the Lambeth water they amounted to only 37 in 10,000; 2500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848–49 the case was the reverse; the deaths from the Lambeth amounted to 125, while those from the Southwark amounted to 118 in 10,000. At that time the Lambeth Co. took their water from a point lower down the river. Another very striking instance occurred in London. The famous Broad street pump supplied water in one of the most fashionable localities of the West End. During the visitation of 1848–49 this pump killed 500 persons in a single week by disseminating cholera. The wealthy people of the West End went to Brompton, a fashionable summer resort, about 5 miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad street pump for tea water, and had brought the cholera with it. A curious case was that of an old spinster who had moved to Hampstead, 3 miles from the pump, but who sent her maid daily for a kettle of the highly-prized tea water. She and her maid were the only persons who suffered from cholera at Hampstead. A similar story might be told of an outbreak of cholera in a shanty village W. of Central Park, and another in a shanty village on the heights across the river. In both cases it was clearly shown that the cholera germs were distributed among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the 12th ward of Brooklyn, at the corner of Van Brunt street, from which over fifty families obtained their water-supply. In 1866 cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump-handle. From these facts it is seen that water aids in disseminating two of the most fatal diseases which affect the human race—the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866 there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe that at least three-fourths of these deaths might have been prevented had proper attention been paid to the purity of the water-supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage.

THE SPONTANEOUS PURIFICATION OF RIVER WATER.—While the animal matters which find their way into wells from cesspools and privies are capable of producing the fatal results to which we have called attention, it is now well settled that such matters are speedily oxidized and destroyed, and thus rendered harmless, when they flow into running streams, by the oxygen held in solution in the water. Dr. Alfred Taylor stated before the parliamentary commission that "organic matter in water is only offensive while in process of decay. When this operation is completed, it ceases to be offensive." Sewage which would poison an ordinary well becomes harmless in the running stream; and while the well is always open to suspicion, the river, though it drain populous districts, will nevertheless supply wholesome water. This subject has been most carefully studied in connection with the water-supply of London, and the following facts have been obtained from the official reports on the subject: The area of the Thames watershed, above the point at which the water companies take their supply, is 3676 sq. m., or 2,352,640 acres, while the population is about 1,000,000. There are three large cities, Oxford, Aylesbury, and Reading, each with a population of over 25,000. The cities next in size are Windsor, Guildford, and St. Alban's, containing from 7600 to 9500 inhabitants. Besides these there are thirty other towns, containing from 2000 to 7000 inhabitants each. The average for the entire area is 1 person to about $2\frac{1}{4}$ acres, or 272 to each sq. m. The rainfall in this area averages 27.2 inches, and it is estimated that one-third of this quantity flows down the Thames at Kingston. The average flow at Kingston for five years was 1,350,000,000 gallons daily, equivalent to 9 inches of rainfall. In very dry seasons the flow is reduced to 350,000,000 gallons.

There have always been alarmists who have excited the fears of the people of London with regard to the condition of the water-supply, and there are still those who believe that it is not safe to drink it. From time to time Parliament has caused committees to examine into its condition, and a royal commission has had the matter under consideration for several years. A few quotations from the reports of these bodies and from other sources will serve to show the opinions of those who are most entitled to respect. A special committee of the House of Commons considered the report of the royal commission of 1850 on the water-supply, and employed three of the most distinguished chemists of England to aid them in their investigation—Prof. Graham, master of the mint, Prof. W. Allen Miller, and Prof. Hoffman. The final verdict of the committee is embodied in the following sentence: "The Thames water is perfectly wholesome, palatable, and agreeable; uniform, plentiful, and safe in use." The chemical commission, composed of the chemists above mentioned, reported as follows: "As the main drain of a large and populous district, the Thames becomes at all seasons polluted by the sewage of several considerable towns and by the surface-drainage of manured and ploughed land; at the same time, we doubt whether the existence of organic contamination from town-drainage is at present perceptible in the Thames above the reach of the tidal flow (*i. e.* above London), or amounts to a sensible evil. The indefinite dilution of such matters in the vast volume of the well-aërated stream is likely to lead to their destruction by oxidation, and to cause their disappearance. The river may reasonably be supposed to possess, in its self-purifying power, the means of recovery from an amount of contaminating injury equal to what it is at present exposed to in its higher section (*i. e.* above London)." In 1867 another committee of the House of Commons inquired into the water question. After listening to the testimony of a number of the most competent experts they declared that "they were satisfied with both the quantity and quality of the water supplied by the river Thames." The water of the Lea they found "naturally not only wholesome, but comparing favorably with that supplied to other places."

While these extracts represent the general verdict in favor of the Thames water, there were still, and there are even now, a few who dissent from this opinion. The most prominent of these is Dr. Frankland, professor of chemistry at the Royal Institution. Dr. H. Letheby, the medical officer of health for the city of London, thus criticises his opinion: "In reply to your letter of the 5th instant I have to state that I cannot agree with Dr. Frankland that the water of the Thames, after receiving defecated sewage-water, is unfit for domestic use; for, after a large practical acquaintance with the subject as it is observed in the principal streams and rivers of England, I have arrived at a very decided conclusion that sewage, when it is mixed with twenty times its volume of running water, and has flowed a distance of 10 or 12 miles, is absolutely destroyed: the agents of destruction being infusorial animals, aquatic plants and fish, and chemical oxidation." Dr. Frankland seems to contradict himself; for in an article in the *Quarterly Journal of Science* of 1867, he says: "The population in the basin of the Thames above where water is taken is 1,000,000, the drainage of some 600,000 of whom is poured into the river; the sewage is so thoroughly oxidized that no trace of it can be detected in an unoxidized state. The average flow of the river at the point where the companies take their supply is 800,000,000 gallons daily. The sewage contained would be $\frac{2250}{1000000}$."

Report of the Royal Commission.—In 1869 the royal commission on the water-supply of the metropolis made their last report, which was published in a folio volume of 128 pp., and was accompanied by a volume of minutes of evidence of 488 folio pp. and an appendix of 144 pp., with numerous maps, etc. In this report they say: "But though for these reasons we believe that the organic contamination of the Thames is much less than is commonly imagined, still it would be sufficient to do great mischief were it not for a most beneficial provision of nature for effecting spontaneously the purification of the streams. Some of the noxious matter is removed by fish and other animal life, and a further quantity is absorbed by the growth of aquatic vegetation; but, in addition to these abstractions, important changes are effected by chemical action. The organic compounds, dissolved in water, appear to be of very unstable constitution and to be very easily decomposed, the great agent in this decomposition being oxygen, and the process being considerably hastened by the motion of the water. Now, as such waters always contain much air dissolved in them, the decomposing agent is ready at hand to exert its influence the moment the matter is received into the water; in addition to which the motion causes a further action by the exposure to the atmosphere, and when (as in the Thames) the water falls frequently over weirs, passes through locks, etc., causing further agitation and aëration, the process must go on more speedily and more effectually. The effect of the action of oxygen on these organic matters, when complete, is to break them up, to destroy all their peculiar organic constitution, and to rearrange their elements into permanent inorganic forms, innocuous and free

from any deleterious quality. This purifying process is not a mere theoretical speculation. We have abundant practical evidence of its real action in the Thames and other rivers."

Extracts from the Testimony before the Commission.—Testimony of Sir Benjamin Brodie, professor of chemistry in the University of Oxford: "Oxidization is constantly going on in the soil and in the river, and therefore there must be some point at which the perfect destruction or oxidation of its animal matter must take place. What I think is much more important still is another point—namely, the great dilution of the material; and I should rely upon the dilution quite as much, and more, than upon the destruction of the injurious matter. Supposing the sewerage of a large town, as Oxford, pouring into the river, there are numerous feeders and tributary streams to the river which effectively dilute the sewerage. The sewerage is gradually getting less and less, and therefore its noxious character diminishes, and ultimately disappears."

Testimony of Dr. Odling, professor of chemistry at the Royal Institution and at St. Bartholomew's Hospital: *Q.* "Has your attention been directed to the important principles of the self-purifying processes which are going on in the rivers running at a given velocity?" *A.* "Yes, it has." *Q.* "You will understand my question is not referring to sluggish waters, but to the rivers where the body of water would become exposed to the action of the atmosphere as it passes along?" *A.* "You may see in many rivers, even sluggish rivers, having sewerage discharged into them, that for a mile or two the appearance of the river is affected by the sewerage, but beyond a certain distance there is no recognizable effect at all; the weeds are perfectly clear and perfectly healthy."

Testimony of Dr. Miller, professor of chemistry in King's College, London: *Q.* "Are you of the opinion that water once contaminated with sewerage can never be considered a safe water afterward?" *A.* "I think experience is quite against that; I think it is safe; evidence shows that it is safe in the majority of instances. There may be cases in which danger is produced." *Q.* "Have you made any experiments upon the power of water, in a given course, to oxidize organic matter?" *A.* "I ascertained a remarkable result in 1859 upon the river. I took specimens of the water at Kingston, at Hammersmith, at Somerset House, at Greenwich, at Woolwich, and at Erith on the same day, and I examined the quantity of oxygen which the water contained at all those different points. I found the quantity of oxygen at Kingston was the normal or ordinary proportion; at Somerset House it was much diminished; at Greenwich the whole of the oxygen had disappeared; at Woolwich it was in much the same condition; at Erith it was very much improved, showing that this diminution of oxygen had been produced by the action of the water contaminated with the sewerage of the London district, and that as it passed lower down the oxygen was again absorbed from the air. And, again, it became diluted with a large volume of water from below, from other sources, the Lea, the Ravensbourne, and other tributaries, and in this manner the water had again become oxidized. I look upon this as a direct proof of the effect of oxygen in destroying those organic contaminations which are thrown into the river."

Testimony of Dr. Parkes, professor of military hygiene of the Army Military School at Netley: *Q.* "Have you observed in a case where sewerage has been discharged into a river that after running 3 or 4 miles the effect of the sewerage has been destroyed?" *A.* "Yes, we have that in the case of the Southampton water-supply. Some sewerage passes into the Itchen River, but it is quite destroyed by the time the water is distributed in Southampton; at least there is no detectable quantity." *Q.* "What is the distance?" *A.* "The distance is 6 or 8 miles. I could not undertake to state the distance in which water would purify itself in that way, but there is no doubt that it does purify itself, although in what distance, or in what time, or under what precise circumstances, I could not say."

Testimony of Mr. Leach, engineer to the Thames conservancy board: *Q.* "How soon, in your observation, is the effect of sewerage destroyed by its flow and admixture with the waters?" *A.* "At Windsor it is discharged into a most unfavorable point in the river, where there is little or no stream at ordinary times. The matter which is passed out of the drain floats about in the river there to a very great and very disgusting extent. Two miles, or even a mile below, I could see no traces whatever of the sewerage."

Testimony of Mr. Hawksley, vice-president of the Institute of Civil Engineers: "The great complaint of London water is not the quality of the water itself, so much as the polluted district through which it passes. That, I think, there is the greatest possible amount of misconception upon. There is a great deal of prejudice—not unnatural at all, but still amounting to prejudice—upon that question. I believe—in fact, I know—that the water of the Thames at Hampton is a very excellent water—very pure, very free from organic matter, and that what little organic matter there is, is of a very innocuous character." *Q.* "What quantity of water, as compared with the volume of sewerage, is necessary for the purpose of breaking up into its original elements the sewerage which has been discharged into it?" *A.* "Generally about 20 to 1. If the water flows rapidly and is very much disturbed, so as to be continually receiving fresh oxygen, a smaller quantity, even 12 to 1, will effect the process; if it proceeds very tardily, it may take a little more, but usually 20 to 1 is perfectly abundant." *Q.* "You remember, do you not, the original condition of the river at Leicester after receiving all the sewage of the town into it?" *A.* "Yes, perfectly well. At Leicester the water was as black as this ink; I do not mean to say that it was absolutely so thick, but looking at it in a mass it was as black as ink; nothing would live in it, and the smell was abominable; but by the time it got to Loughborough, 12 miles below, it was entirely restored to its pristine condition; you could stand on the bridge there and see the fish swimming among the beautiful reedy and other plants growing in the water, just as in the purest stream; you could see every pebble at the bottom. That is an instance of the effect of oxidation." *Q.* "The water has symptoms of returning purity, has it not, within 4 miles of Leicester?" *A.* "Yes, but not to the same extent as at Loughborough; the water was perceptibly impure, at the driest period of the year, down as far as Barrow; it could be just perceived there, but at Loughborough it was perfectly restored." "There is no such thing as a particle of fæcal matter put into the Thames at Oxford finding its way down to Hampton Court. It is all burnt up, in fact, by the combustion set up by the oxygen."

The Cholera Question.—It having been established, with some considerable degree of probability, that the wells in certain parts of London had aided in disseminating the cholera poison during the successive visitations of that disease to the metropolis, an opinion had gained credence that the water of the Thames had contributed in no small measure to swell the awful list of victims who died from that disease, especially the water supplied by the East London waterworks. Considerable testimony was therefore taken upon this point, the most important of which we will quote. Testimony of Dr. Robert Angus Smith, government inspector of alkali-works: "If the germs pass into the rivers, we do not know how far they may be carried. On the other hand, we do not know that they ever can be carried in pure water; the dissolved oxygen may destroy them, as it unquestionably does putrescent matters. A positive proof of their transmission in otherwise pure water is wanting. One might ask if a cholera germ in the water at Oxford would produce disease in London; and one might answer by asking if one cholera germ passing into the air at Woolwich would produce disease in Pimlico. This we do not know, but it seems probable that disease cannot be carried far by pure air, nor by water with much oxygen in it, which is equal to pure air. We are informed that the atmosphere is full of germs, but the evidence seems to be that it requires an unusual excess to attack us successfully; it seems to be a question of quantity."

Testimony of Dr. Letheby, medical officer of health to the corporation of London: *Q.* "Taking the case of the cholera disease and the discharges from the human body being mixed up with the sewage, do you consider that any germs of that disease would be carried down in water?" *A.* "At the present moment, we do not know what the germs of disease are; if the germs of the disease be decomposing matter, then I do not think that they would exist in the water; but if the germs of the disease be living matter, then it is possible that they may exist in the water; but as nobody, as far as I am informed, can tell us what the germs of cholera are, it would be premature for me or anybody to theorize as to the probability or the possibility of their existing in the water." *Q.* "You are aware that it has been alleged that the main cause of the cholera in the E. end of London was due to the water-supply; do you entertain that opinion? *A.* "No; I entertain the opposite opinion. It was a matter of duty with me to investigate the whole of the circumstances connected with the East London supply; in the first place, it was supplied to the hospital to which I am attached; in the next place, it was supplied to the eastern division of the city, where as officer of health it was my duty to look well into the matter; and in the third place, I had a general interest in it scientifically, apart from any official connection with the subject, and I was very desirous to ascertain whether or not the water had been in any way concerned in the propagation of the disease; I therefore investigated it very fully."

Q. "Do you think the present supply of water to the London people is wholesome water?" *A.* "I do—a thoroughly wholesome water."

In his report on the sanitary condition of the city of London for the years 1866–67, Dr. Letheby is much more explicit in his discussion of the cholera epidemic of 1866. He says on p. 26 *seq.*: "But difficult as the problem is, to determine the exact value of the several circumstances which influence the severity of the disease, and especially those which give to it its marked local intensities, enough has been ascertained to indicate its general habits, and to show that it fixes itself at low levels in proximity to tidal rivers, among dense populations that are living in ill-constructed houses that are filthy, badly ventilated, badly drained, and generally defective of sanitary provisions; and the inference is, that the actual agent of cholera, be it what it may, can only find congenial conditions for its full development in damp and impure air. The theory of Pettenkofer is, that the essential conditions for the active manifestations of the disease are a porous soil, charged with excrementitious matter, and having a certain degree of hydration, as happens when the subsoil water is just drawn off or is slowly retiring. All these conditions were singularly coincident with the localization of the disease in the eastern districts of London, for the soil is gravelly, and therefore very porous to air and water, and it is largely charged with excrementitious matters derived from the local tide-locked sewers. It is also remarkable that for some months before the outbreak of the disease the subsoil water had been gradually sinking in consequence of the drainage operations that were necessary for the construction of the main low level sewer and its branch to the Isle of Dogs. Now, according to Pettenkofer, it is exactly under these circumstances that a district is most liable to choleraic infection. Another theory which has been advanced to account for the local character of the outbreak is, that the water distributed to the infected districts was charged with choleraic matter; but, looking at all the facts of the case, it is clearly evident that while none of them are discordant with Pettenkofer's theory, a large number are in open and direct antagonism to the water hypothesis. In point of fact, it is necessary for the acceptance of such a speculation not only that some clear proof should be given of the actual pollution of the water with choleraic matter, but also that the time of the outbreak throughout the infected district was coincident with the distribution of such water, and that it did not notably fail to produce the disease wherever it was sent. It is likewise necessary to show that the disease was strictly confined to the area of such distribution, and that the use of other water was not accompanied with like severe results. The alleged pollution of the water rests upon a series of assumptions, many of which are in the highest degree improbable. Apart, however, from the improbabilities of these assumptions, it is a fact that the water which is said to have been thus polluted did not produce its effects in the several districts to which it was distributed in anything like uniformity of time or force. Suppose, by way of illustration, that alcohol or arsenic had become mixed with the water, and that on a certain day it was distributed to the public; we should expect to find that the action of the poison was not only manifested at the same time over the whole district of supply, but that it was confined to that district. Not so, however, with the water in question, for although it is not alleged to have been more than once polluted, yet the first effects in the several districts occurred at long intervals; and there were many places to which it was distributed where there was no sign of the disease, while others which did not receive the water were seriously affected. The dates of the outbreak of the disease in the districts supplied with the East London water were as follows: Bromley, June 27; Poplar and Bethnal Green, June 30; Shoreditch and Mile End, July 7; Whitechapel, Stepney, and St. George's-in-the-East, July 14; and the East London Union, July 28. A month, therefore, elapsed between the first outbreak of the disease in the several districts. It is, moreover, remarkable that, while it was so violent in many of the districts of supply, it was absolutely powerless in others. The death-rate, for example, of Bethnal Green was 63 per 10,000 of the population; Whitechapel, 78; Poplar, 85; and St. George's-in-the-East, 93; whereas the districts of Stamford Hill, Upper Clapton, Walthamstow, Woodford, Wanstead, Leytonstone, Buckhurst Hill, North Woolwich, and Silvertown were absolutely untouched by the disease, notwithstanding that they received the same water and at the same time. More remarkable still, there were places in the very heart of the cholera-field, and others close adjoining it, where the residents received the same suspected water and used it freely without suffering in the least degree. In the Limehouse School, around which the cholera was frightfully fatal, there were 400 children who drank the same water as their neighbors, and yet there was not even a case of diarrhœa among them. In the London Hospital, which is also in the heart of the cholera-field—for it is surrounded by the districts of Whitechapel, Bethnal Green, Mile End, Old Town, and St. George's in the East—there was an average resident population of 463 persons, and, although they drank freely of the unfiltered East London water, yet there was not a case of illness among them. Again, in the eastern division of the city of London, which adjoins the cholera-field, the suspected water was supplied to 161 houses, with a population of about 1732 persons, but except in one of these houses (20 Somerset street), which is on the boundary of Whitechapel, there was not a single death from cholera; and to verify this, I have obtained the addresses of all the persons who died in the cholera ward in Bishopsgate street. But, besides this, the disease was singularly fatal in places where the suspected water was never used. In Crown Court, Blue Anchor Yard, Whitechapel, where the water-supply is from the New River, the mortality was at the rate of 284 per 10,000. In Boar's Head Yard, of the same district, which is also supplied by the New River, the death-rate was 193 per 10,000; and indeed there are eighteen courts in Whitechapel where none of the East London water was used, and yet, out of an aggregate population of 4351 persons, there were 30 deaths from cholera, the mortality being at the rate of 69 per 10,000; that of the whole district being but 77. So that, on carefully examining the facts in their relation to the water theory, we find—(1) That there is no proof whatever of choleraic pollution of the water; (2) that there was no coincidence of time in the appearance of the disease in the several districts supplied with the suspected water; (3) that numerous districts receiving the same water, but situated at high level or placed beyond the cholera-field, were entirely exempt from the disease; (4) that even in the very heart of the cholera-field, there were places receiving and using the suspected water with impunity; (5) that other places not supplied with the water, but situated within the infected area, suffered equally with the neighborhood.

"I am far from wishing it to be thought that choleraic matter diffused through water will not produce disease—there is abundant evidence to show that it is often a prolific source of it—but I am anxious, in dealing with a question of so much public importance as the origin of the late epidemic, that none of the facts should be perverted, and that no hasty or ingenious hypothesis, without solid foundation, should take possession of the public mind. In the conduct of inquiries like this there should be a calm, a full, and a candid examination of the facts; we should endeavor to study the phenomena in a philosophical spirit, and apply to them the tests of sound induction; we should strive also to deduce from them such laws as will not only expose the nature of the malady, but will at the same time enable us to treat it successfully. Rash opinions, boldly asserted and tenaciously held, though they may force themselves on public attention, rarely lead to useful results; and while they have their hold on the popular mind they seriously hinder the progress of real knowledge."

These extracts are sufficient to indicate the opinions of the most eminent medical officers, chemists, and engineers who have considered the fitness of the waters of the Thames for supplying the people of London with wholesome water. The verdict of the commissioners, after carefully and conscientiously weighing all the testimony presented, is as follows: "The only point raised against the Thames water on the ground of organic contamination is of less positive character; it is said that water which has once been contaminated with sewage may still contain undecomposed organic matter, which, though inappreciable by the most delicate chemical tests, may still exercise prejudicial effects on the human system. The strongest form of this objection has reference to some opinions now prevalent, that certain forms of disease, such as cholera and typhoid fever, are propagated by germs contained in excremental matter: and it is conceived possible that when matter of this kind once gets into streams, these germs may escape destruction and long preserve their dangerous character. It is said that no process is known by which such noxious material can be removed from water, and therefore it is argued that water which has at any time been contaminated by sewage is henceforth unsuitable for domestic use. These opinions have been advanced by many eminent men of science; they are worthy of respectful attention, and ought to operate as a constant stimulus to the most searching examination of the state of the water, to the improvement of the modes and means of scientific analysis, and to the diligent collection of medical data as to the effect of the waters upon the public health. But we cannot admit them as sufficiently well established to form any conclusive argument for abandoning an otherwise unobjectionable source of water-supply; we are of opinion that there is no

evidence to lead us to believe that the water now supplied by the companies is not generally good and wholesome." This report was made in 1869, and has been before the British public in an accessible form, in all its details, nearly seven years, and its conclusions have been generally accepted. The most recent opinion is contained in a voluntary communication made by Dr. Alfred S. Taylor, the distinguished writer on chemistry, toxicology, and medical jurisprudence, to the secretary of the West Middlesex Water Co., under date of Mar. 7, 1872. He says, "Having during the last twenty-one years made analyses of the water supplied to my house by the West Middlesex Co., and compared it with numerous waters derived from rivers, springs, and lakes in England and Scotland, I can confirm Dr. Whitmore's general conclusion that the water is good in quality and perfectly wholesome. This opinion is not based merely on chemical analysis, but on twenty-one years' experience derived from its use for all domestic purposes."

The water of the Thames has been selected as the basis of discussion, not only because it had been more carefully studied than any other source of city supply, but because it may be considered an extreme case. Notwithstanding the fact that one-half the supply of London, a city of considerably more than 3,000,000 inhabitants, is obtained from it, while the river Lea furnishes nearly all the rest, London was said by Dr. Edwin Lankester, coroner of Middlesex, to be the *healthiest city in the United Kingdom*. Tours is supplied from the Cher; Lyons from the Rhone: Toulouse from the Garonne; Angers and Nantes from the Loire; Paris from the Seine, the Canal d'Ourcq, and the Marne; Berlin from the Spree; Hamburg and Altona from the Elbe. The last-named city, which is a suburb of Hamburg, takes its supply from a point 8 miles below, when the water has received the drainage of 230,000 people. Most of the above-mentioned rivers are among the largest streams in France and Germany, and flow through extensive and densely-inhabited districts, yet we have no reason to believe that there is any *permanent* defilement of the waters.

That there is generally no fear on the part of engineers and those having charge of water-supply in American cities is fully shown by the fact that many of our largest cities take water from rivers. Jersey City and Trenton and Hoboken are supplied from the Passaic; Philadelphia from the Delaware and Schuylkill; Washington from the Potomac; Cincinnati and Louisville from the Ohio; and St. Louis, New Orleans, and many other cities from the Mississippi.

THE POLLUTION OF STREAMS BY THE REFUSE FROM FACTORIES.—It is often suggested that the waters of our rivers are liable to become polluted to a dangerous degree by refuse chemicals from paper-factories, woollen mills, printworks, and chemical works. While this may undoubtedly be true in some densely-populated portions of England, where the factories are numerous and the streams very small, it is not probable that for years to come this source of pollution need be feared in this country. Our rivers are too large and our factories too much scattered, and the importance of turning all waste products to account is made imperatively necessary by the sharp competition which prevails among manufacturers. This latter point is well illustrated by our gas companies, who now derive an important revenue from the sale of their coal-tar and ammonia-water, offensive products which they formerly allowed to run to waste. The waste products of our most important industries are entirely harmless when diluted with large volumes of water. They consist chiefly of sulphuric and hydrochloric acids, lime, potash, soda, iron and alumina salts, chloride of lime, exhausted dyewoods, and soapsuds used in scouring wool. The more powerful form, when mingled, harmless salts, carbonates, sulphates, and chlorides, which are normal constituents of all river waters. The action of many of these products, if appreciable at all, will be to purify the waters by oxidizing or precipitating the matters derived from sewage. Salts of iron and alumina are especially efficacious in purifying waters. Alum is often used in the West for clarifying the muddy waters of the streams, a pinch being added to a barrel of the water, which on standing a few hours becomes clear and limpid. The possibility of objectionable pollution will depend in each case upon the ratio of the refuse matters to the quantity of water in the stream. Dr. Edward Smith, in his *Manual for Medical Officers of Health*, states that the contamination of streams by the refuse of factories prevails exceedingly in Yorkshire and Lancashire. The waters of the river Irwell, a small stream, present the differences in composition at their source and below Manchester shown in the preceding table.

Grains of Impurities in 1 Imperial Gallon.

Impurities.	At source.	Below Manchester.
Organic carbon	0.1009	0.8211
Organic nitrogen	0.0175	0.2324
Total nitrogen	0.0343	1.1536
Chlorine	0.8050	6.7410
Hardness	2.6040	16.0440
Total solids	5.4600	39.0600

The examination by the rivers pollution commission of fifteen samples of waters contaminated by the cotton and woollen mills in Yorkshire showed the following quantities in 1 imperial gallon which were thrown into the waters of the rivers:

Grains of Impurities thrown into each Imperial Gallon.

Organic carbon	45.3481
Organic nitrogen	7.2198
Nitrogen as nitrates and nitrites	0.0287
Ammonia	8.1529
Total combined nitrogen	14.0105
Chlorine	15.3580
Arsenic (computed as metal)	0.0077
Mineral matters *	332.3880
Total solids *	235.9000

"The commission gave a page in their report of 1871 to a fac-simile of a letter written with the water of the river Calder at Wakefield, which equals in depth of color that from a watered ink; and similar examples might have been made from the river water at Bradford."

A clearer idea can be obtained of the influence of factory refuse on river waters by comparing the quantities of chemicals used with the quantities naturally contained in the streams. The Croton water contains in 1 U. S. gallon of 231 cubic inches the following *normal* impurities:

Grains in 1 U. S. Gallon.

Soda	0.326
Potassa	0.097
Lime	0.988
Magnesia	0.524
Chlorine	0.243
Sulphuric acid (SO_3)	0.322
Silica	0.621
Carbonic acid	2.604
Organic and volatile matter	0.670
Total	6.395

One hundred million gallons of this water are used daily in New York, in which are contained the following quantities of the above-mentioned substances in pounds and in tons of 2000 pounds:

Impurities in 100,000,000 gallons of Croton Water.

Impurities.	Pounds.	Tons.
Soda	4,657	2.319
Potassa	1,385	0.692
Lime	14,114	7.038
Magnesia	7,485	3.742
Chlorine	3,471	1.735
Sulphuric acid	4,600	2.300
Silica	8,858	4.429
Carbonic acid	37,200	18.600
Organic and volatile matter	9,571	4.785
	91,341	45.640

As the average flow of the Croton River is 400,000,000 gallons daily, there are 365,428 pounds, or nearly 183 tons, of impurities carried to the ocean daily by a stream which does not receive any refuse from factories. The Thames at Kingston has an average flow of 1,250,000,000 gallons (imperial) daily, and the water contains—

Inorganic impurities	19.00 grains.
Organic and volatile impurities	1.68 "
Total per gallon	20.68 grains.

This is equivalent to 3,364,286 pounds, or 1682 tons of 2000 pounds, of inorganic matter daily: of this two-thirds, or 1121 tons, are carbonate of lime, and 271 tons are sulphate of lime.

At the Arnold Printworks, at North Adams, Mass., on the S. branch of the Hoosac, the following quantities of the most common chemicals were used daily: lime, $1\frac{1}{4}$ barrels; soda-ash, 200 pounds; sulphuric acid (H_2SO_4), 320 pounds. There were contained in the 43,200,000 gallons of water that flowed daily down the stream—

	Pounds.	Tons.
Lime	10,793	5.396
Soda (NaO)	2,050	1.025
Sulphuric acid (H_2SO_4)	1,715	0.857

Or, as combined—

	Pounds.	Tons.
Carbonate of lime	18,852	9.476
Carbonate of magnesia	10,342	5.171
Sulphate of lime	574	0.243

The Valley Bleachery on the Woonasquatucket River at Providence, R. I., consumed daily, sulphuric acid, 17 pounds; soda-ash, 3000; bleaching-powder, 1500.

The following table gives the most complete exhibit of

* These numbers are incredible, and can hardly be accepted as presented without further explanation.—C. F. C.

the character and quantities of chemicals, etc., consumed in a large factory; it shows the average daily consumption of materials of all kinds at the Atlantic De Laine Works at Providence, R. I., for the ten months from Jan. 1, 1870, to Oct. 29, 1870. The quantity of wool washed amounted to 1926 pounds per day. The flow of the stream was 36,000,000 gallons in twenty four hours.

Daily Consumption of Chemicals at the Atlantic De Laine Works.

Chemicals.	Pounds consumed.	Grains per gallon of water in river.
Sumac	291.41	0.05665
Hypernic wood	43.99	0.00855
Turmeric	73.33	0.01425
Logwood	144.05	0.02800
Fustic-wood	66.04	0.01283
Cudbear	63.91	0.01242
Madder	10.53	0.00204
Aniline colors	1.17	0.00022
Sulphate of iron	4.04	0.00078
Nitrate of iron	88.56	0.01721
Muriate of tin	29.09	0.00565
Stannate of soda	43.68	0.00849
Sulphate of copper	90.12	0.01751
Sulphate of soda	43.75	0.00850
Alum	23.74	0.00461
Cream of tartar	9.91	0.00192
Prussiate of potash	14.13	0.00274
Bichromate of potash	8.44	0.00164
Sulphuric acid	136.39	0.02651
Soap	90.12	0.01751
Total	1209.75	0.23508

Supposing all the materials used to have been allowed to run into this little stream, less than one-tenth the size of the Croton, the entire pollution would have amounted to less than $\frac{1}{4}$th grain per gallon. As a matter of fact, a large portion of these substances were fixed upon the goods and sent to market, while one-half the entire quantity consisted of dyewoods, which are chiefly composed of insoluble cellulose (sawdust and chips). It is not probable that the refuse from this factory added .05 of a grain per gallon to the water of the stream.

During the war it was feared that some attempt might be made to poison the Croton supply of New York. The following figures show how difficult the task would have been. To poison the 100,000,000 gallons supplied to the city in a single day with strychnine, supposing each pint of water to have received the smallest fatal dose of this alkaloid, $\frac{1}{12}$th grain, would have required 7285 pounds, or 3½ tons, of strychnine—a quantity not to be found in all the markets of the world. To procure such a quantity it would be necessary to order an extra supply of *Nux vomica* beans from the East Indies three or four years in advance to secure their collection by the natives. Supposing arsenic to have been selected, at the rate of 2 grains (the fatal dose) to the pint, 114 tons would have been required, with special means to secure its solution in the water.

Metallic Impregnations.—Water is frequently rendered impure by the metallic tubes used to conduct it. Organic matter, nitrates, nitrites, chlorides, etc., and in some cases even pure water, attack certain metals, causing them to dissolve.

Copper.—Cases of sickness have occurred caused by water drawn through copper pumps, copper having been actually detected in the water.

Lead.—Lead is by far the most common material used in the construction of service-pipes for water, and this metal is the one which is the most easily dissolved by water, and at the same time most poisonous in minute quantities, being a cumulative poison. A celebrated case occurred in the royal family of France at Claremont, where one-third of the persons who drank of the water were affected. This water contained only $\frac{1}{10}$th of a grain of lead in a gallon. As little as $\frac{1}{100}$th of a grain of lead to the gallon has been known to produce palsy in persons who habitually drank it. It is a great pity that the peculiar advantages of lead as a material for the manufacture of water-pipes are more than counterbalanced by the danger of lead-poisoning. When the Croton water was first introduced into New York, it contained considerable lime derived from the mortar of the recently-constructed aqueduct. This prevented, to a considerable extent, the action of the water on the lead pipes, and it was stated at that time that no lead was taken up by the Croton water; but as the lime of the mortar became carbonated, the water ceased to dissolve it and began to act upon the lead pipes. Examinations have recently been made of Croton water which had been in contact with lead for different lengths of time, under usually-occurring circumstances, of which the following are the results: (1) A gallon of Croton water from a lead-lined cistern, in which it had stood several weeks, was found to contain 0.06 grain of metallic lead. (2) A gallon of water which had remained six hours in the lead pipes of a private residence yielded 0.11 grain metallic lead, a considerable portion of which was visible to the eye in the form of minute white spangles of the hydrated oxycarbonate ($PbO,HO + PbO,CO_2$). (3) Water drawn from one of the hydrants of the School of Mines laboratory in the middle of the day, when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe. These results indicate the source of many hitherto unaccountable cases of lead-poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures for protection against this insidious cause of disease. Certainly, no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning, after the water has stood all night in the pipes. The habit of filling the kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous. The following case recently occurred in New York: An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead-poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them preparatory to boiling them. She had therefore used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead in experiment No. 2 in suspension, instead of solution, is an additional argument for the use of filters, though it will of course be useless to employ them unless they are frequently reversed, that they may be cleansed.

Substitutes for Lead.—Various substitutes have been suggested for lead, as, for instance, wrought iron, which generally makes the water rusty; galvanized iron, which is said to be objectionable on account of the zinc, which is readily taken up by the water, rendering it unwholesome, numerous cases of zinc-poisoning by these pipes having occurred in New England, where this pipe is much used; gutta-percha has been suggested, but it is not durable; brass is used to some extent, but is dangerous: Prof. Appleton of Brown University has found both copper and zinc in water supplied through a brass pipe; glass, porcelain, etc., have also been tried. None of these substances possess the peculiar flexibility, softness, and other desirable qualities of lead, which makes it so easy to cut and bend, and join and fit pipes of this metal. The problem, therefore, is to provide a pipe which shall possess all the good qualities of lead, and be free from the one great objection—namely, the danger of lead-poisoning from its use. This has been achieved by the invention of the *lead-encased block-tin pipe* or *tin-lined lead pipe*. This is essentially a pipe of pure tin surrounded by a lead pipe, to which it is firmly and perfectly united by an intervening alloy or solder composed of the two metals. The water comes in contact with the pure tin surface only, and cannot therefore be contaminated with lead. That tin is harmless it is hardly necessary to argue, as vessels covered with this metal are extensively used for culinary purposes throughout the civilized world. It has been argued that commercial tin contains arsenic; but if we can consume daily, with impunity, food which has been boiled and stewed in tin pans, notwithstanding the arsenic contained in the tin coating, we need have little fear of poisoning from the trace of arsenic which may possibly be present in the tin lining of this sanitary pipe. The tin-lined pipe fully realizes all that is desired as a service pipe for aqueduct water. Tested side by side with ordinary lead pipe, waters which take up from $\frac{1}{10}$th to $\frac{3}{10}$ths of a grain of lead per gallon from the lead pipe are not perceptibly affected by remaining for considerable lengths of time in the tin-lined pipe. It was at first thought that the expense of the tin would interfere with the introduction of this pipe, but it is

Fig. 14.

Joint with the Pipe attached.

Fig. 15.

Section of Jointed Pipe.

found in practice that the great strength of the tin makes it possible to reduce very materially the thickness of the

Fig. 16.

The Joint.

Fig. 17.

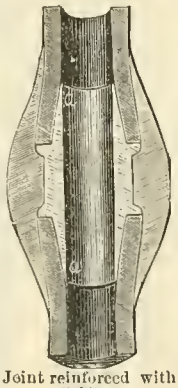
The Soldering Tongs.

Fig. 18.

The Expander.

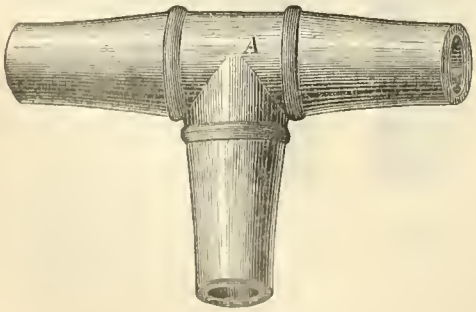
pipe, so that the tin-lined lead pipe need not weigh more than half as much to the cubic foot as lead pipe of the same calibre in order to possess an equal degree of strength. It has been stated that on exposing this pipe to water, galvanic action would take place, by which rapid corrosion would be produced; but Mr. Cassamajor has shown that as a matter of fact no such galvanic action occurs. When this pipe is used for bringing water from a well, it is of course important not to allow it to pass into the water, as the exterior pipe of lead would contaminate it as readily as though the tin were absent. In such case a few feet of block tin pipe should be used in the well to deliver the water to the tin-lined pipe. This pipe is not well adapted for hot water, as tin is very sensitive to heat. This is no objection, as the hot water from boilers should not be used for any purpose save washing. Some difficulty was at first experienced in making joints on this pipe; the plumbers were careless and heated the solder hotter than was necessary, and thereby melted the lining in the pipe. This difficulty has been obviated by the tinned brass joints which the foregoing figures illustrate. Fig. 16 is a joint ready for use, before the pipes are attached. It is composed of brass, heavily tinned within and without. The ends of the pipe are enlarged on the expander, Fig. 18, and after they have been carefully forced upon the conical ends of the joint, a union of the solder is effected by the application of the hot copper tongs shown in Fig. 17. Thus a simple, expeditious method has been devised for joining this pipe, which meets all the objections raised by the plumbers, except perhaps that they will have no excuse for charging for several pounds of solder for every joint. If one fears this joint is not sufficiently strong, it is very easy to cover it with a "wiped joint," as shown in Fig. 19. Fig. 20 is a T-joint with the pipe attached:

Fig. 19.



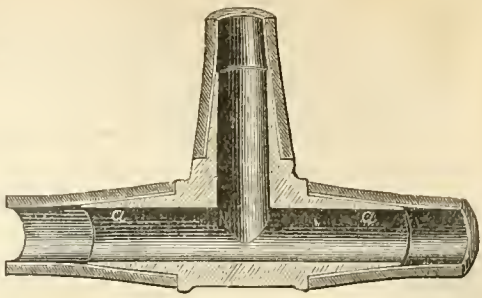
Joint reinforced with Solder.

Fig. 20.



T-joint with Pipe attached.

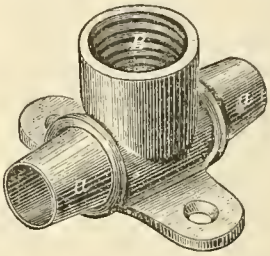
Fig. 21.



Section of a T-joint with Pipe attached.

Fig. 22 is a joint for the attachment of a faucet:

Fig. 22.



A Faucet Joint.

Every difficulty seems thus to have been met, so that we have reason to believe that the poisonous lead pipe will soon be generally replaced by this sanitary pipe, which possesses all its advantages without its dangers.

VII. Purity of City Waters.—*Impurities contained in 1 Wine Gallon of 231 Cubic Inches, expressed in Grains.*

City.	Source.	Inorganic matter.	Organic and volatile matter.	Total solids.
New York.....	Croton, average for 13 weeks, 1867 (C. F. Chandler)	3.90	0.66	4.56
New York.....	Croton, average for 3 months, 1868 (C. F. Chandler)	3.31	1.14	4.45
New York.....	Croton, average for 6 months, 1869 (C. F. Chandler)	4.11	0.67	4.78
New York.....	Croton, May 11, 1871 (C. F. Chandler)..	2 799	0.875	3.674
New York.....	Croton, average for 5 months, winter 1871–72 (E. Waller)	3.934	0 508	4.442
New York.....	Well, W. of Central Park (C. F. Chandler)	38.95	4.55	43.50
Brooklyn.....	Ridgewood, average for 3 months, 1869 (C. F. Chandler).....	3.37	0.59	3.92
Boston.....	Cochituate (E. N. Horsford).....	2.40	0.71	3.11
Philadelphia...	Fairmount, Schuylkill (E. N. Horsford)	2.30	1.20	3.50
Philadelphia...	Delaware (H Wurtz)	2.93	0.55	3 48
Albany.....	Hydrant (E. N Horsford).....	8.47	2.31	10.78
Troy.....	Hydrant (W. Elderhorst)	6.09	1 34	7.43
Utica.....	Hydrant (C. F. Chandler)	5.50	0.96	6.46
Syracuse.....	New reservoir (C. F. Chandler).....	12.13	1.80	13.93
Cleveland.....	Lake Erie (J. L. Cassels)	4.74	1.53	6.27
Chicago.....	Lake Michigan (J. V. Q. Blaney)	5.62	1 06	6.68
Rochester	Genesee River (C. F. Chandler)	12.02	1.23	13.25
Schenectady....	State street well (C. F. Chandler).....	46.88	2.33	49.21
Newark ..... Jersey City... Hoboken ..... Hudson City..	Passaic River (E. N. Horsford).....	4.58	2.86	7.44
Trenton.....	Delaware River (H. Wurtz).....	2.93	0.55	3.48
London	Thames (Dr. H. Letheby)....	15.55	0.83	16.38
London.....	Well, Leadenhall street (Dr. H. Letheby)	90.38	9.59	99.97
Dublin.....	Lough Vartry, new supply (Ardjohn and others)	1.77	1.34	3.11
Paris.....	Seine, above the city (Bussey, Wurtz, and Ville).....	7.83	1.00	8.83
Amsterdam	River Vecht (V. Baumhauer and Van Moorsel).....	14.45	2.13	16.58
Amsterdam	Deep well at the Keisergracht	64.55	4.38	68.93

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C. F. CHANDLER.

Water, Arrangement of, on the Earth's Surface. See CATARACTS, EARTH, and LAKE, by PROF. A. GUYOT, LL.D., and RIVERS, by ELISÉE RECLUS.

Wa'ter-Bed, a device invented by Neil Arnott, M. D., F. R. S., physician extraordinary to Queen Victoria, for the prevention of bed-sores upon the persons of bed-ridden patients. It is an ordinary bed, resting upon an under-bed of India-rubber cloth filled with water, and is in many cases extremely useful.

Wa'ter-Beetle, a name given to the representatives of two families of beetles which live in fresh waters—the Dytiscidæ and Gyrinidæ. These two families are very distinct from each other, and agree chiefly in that they have the body oval and depressed, the first ventral segments visible only at the sides, the legs of the second and third pairs flattened and fitted for swimming.

I. The Dytiscidæ have "the prothorax, with the epimera and the episterna, distinct; the prosternum compressed, produced behind, and fitting into a cleft or emargination of the metasternum;" the abdomen provided with only six ventral segments; the eyes two in number; and the "antennæ inserted under the front, behind the base of the mandibles, glabrous, polished, usually filiform," and 11- (rarely 10-) jointed; the legs all moderate and normally proportioned, ciliated with long hairs, and the posterior usually compressed, elongated, and formed for swimming; "posterior coxæ very large, usually oblique, contiguous at the inner margin. The insects thus distinguished are carnivorous, and are related to the Carabidæ, from which they differ almost only in the form of the posterior coxæ and the natatorial legs. The species, from their habits, are known under the name of diving beetles. The larvæ are long and cylindrical, and have large and flattened heads "armed with scissor-like jaws, by which they seize other insects or snip off the tails of tadpoles, while they are even known to attack young fishes, sucking their blood." They moult several times before attaining the pupa condition. "The body ends in a pair of long respiratory tubes, which they protrude into the air, though eight pairs of spiracles exist." They undergo their transformation on land, on which they creep preparatory to metamorphosis. The species are quite numerous: those of North America have been combined, by Dr. Leconte, under eighteen genera, which have been segregated into two sub-families—Haliplidæ and Dytiscidæ.

II. The Gyrinidæ are beetles "of an oval form, somewhat attenuated at their end, usually of a brilliant bluish-black color above, with the punctures reflecting a golden tint;" the prothorax has the prosternum short and carinated, and the episterna and epimera are distinct: the abdomen has seven segments; the eyes are four, and the upper and lower are both rounded: the antennæ are inserted under the sides of the front, behind the base of the mandibles, and are short and thick, with the third joint auriculate, the following ones indistinct, and the last elongate; the coxæ are small and globular; the "anterior legs very long, and received in oblique grooves of the pro- and mesosternal segments; tibiæ slender, with one terminal spur;" the middle and posterior legs are short, broad, and much compressed, with the tibiæ spurless; and the middle legs have the first joint large and triangular. The beetles of this family associate in groups, and are more generally known by their peculiar habits. In the proper season and place they abound, and move rapidly in whirl-like motion on the surface of the water, and, if disturbed, suddenly dive to the bottom. This habit of gyrating has obtained for them the name of "whirligigs." The larvæ have considerable resemblance to centipedes, having long respiratory filaments upon the sides of each segment which strikingly simulate feet. They undergo their transformation on land, as do the Dytiscidæ. (See Leconte's *Classification of the Coleoptera of North America*, etc.)

THEODORE GILL.

Water-Boatmen. See APPENDIX.

Wa'terboro', v., Colleton, S. C. P. 636.

Wa'terborough, p.-v. and tp., York co., Me. P. 1548.

Wa'ter-Buck, the *Kobus ellipsiprymnus*, a large and handsome antelope of South Africa, always found near rivers. It is a good swimmer and is exceedingly timid. It emits an intolerable odor, and its flesh is uneatable.

Wa'ter-Bug, the popular name of insects of the order Hemiptera. See ENTOMOLOGY, by PROF. S. TENNEY, A. M.

Wa'terbury, city and tp., New Haven co., Conn., on Naugatuck R. R., about 88 miles N. E. of New York, at its junction with New York and New England R. R., which has for the present its western terminus here. It is mostly built in a valley, through which flow Naugatuck and Mad rivers and several smaller streams, which furnish a large and well-developed water-power. Although a marketing centre for a great part of the surrounding country, a large portion of its capital is invested in manufacturing. Large quantities of rolled and sheet brass, tubing, lamp-burners and trimmings, silver-plated ware, pins, brass kettles, percussion-caps, clocks, buttons, suspenders, machinery, and almost every variety of article manufactured from metals, are produced here, and furnished to the mar-

kets of the country. There are 30 joint-stock corporations located here, with a united capital exceeding $6,000,000. Waterbury has 7 churches, 4 chapels, 2 national banks and 4 other banking institutions, a fine city hall containing court-rooms and offices for the town and city officials, a hall for public amusements capable of seating 1400 people, a free public library containing 18,000 volumes, with a fund of $200,000—a bequest to the city by the late Silas Bronson of New York, whose name it bears—several good hotels, a number of mercantile houses, and a large number of handsome private residences. The waterworks by which the city is supplied are among the finest in New England. It has an excellent fire department, a handsome park, abounds in pleasant drives, and has a beautiful cemetery (Riverside), located on the banks of the Naugatuck River about 1 mile from the city. It is well supplied with institutions of learning, among which are the high school, St. Margaret's (a diocesan school for young ladies), the Academy of Notre Dame (convent school), and the Waterbury English and Classical School for boys. It has 1 daily and 2 weekly newspapers, and is the fifth city in size and importance in the State. P. of city 10,826; of tp. 13,106.

ED. "AMERICAN."

Waterbury, p.-v. and tp., Washington co., Vt. P. 2633.

Wa'ter-Chestnut and **Water Chinquapin,** names for the SINGHARA NUT (which see) and for the seeds of other species of *Trapa*; also for the tubers of *Scirpus tuberosus*, a club-rush (Cyperaceæ) of China, much cultivated in tanks; also for the great seeds of various species of NELUMBIUM (which see). The above plants grow in the water, and several of them furnish considerable food-supplies in the countries where they are grown.

Water-Clock. See CLEPSYDRA.

Water-Closet. See PLUMBING, by DAVID PATERSON, and SEWER, by GEN. Q. A. GILLMORE.

Wa'ter-Color Painting. The substitution of water for oil as a medium of applying color to surfaces is not a modern discovery. In fresco-painting the principle was adopted as a method of applying color to plastered walls—an art that was practised by eminent Italian artists of the fifteenth century, and probably dates back to antiquity. In modern water-color the ordinary white drawing-paper is used, without chemical or other preparation. The pigments are the same as are employed in oil-painting, and are prepared in the same manner, only they are more manageable, and are capable, in some instances, of being made more effective; indigo and gamboge, for instance, being more brilliant and permanent under the water treatment. In the early stages of this art the solid cakes, being mixed with gum, hardened, and did not lend themselves to facile manipulation. The admixture of honey and glycerine with the colors, by keeping them soft, meets the requirement of the artist better. The use of moist colors, and of "Chinese white" as an opaque body-color, marks the chief difference between the older and the newer schools. The light is due to the whiteness of the paper, which, shining through the transparent colors, produces a mild brilliancy of effect. The artist in water-color needs in every respect the same training as the artist in oil, the only difference between them being that one uses water, the other oil, as a vehicle. In fact, the artist in water-color requires greater swiftness and certainty of touch, for the water dries immediately, and mistakes in drawing cannot be corrected or covered over, as on canvas: the lines and processes stand revealed. The artist is unable to slight or slur his work. The ease with which the painter in water-color throws off sketches and produces startling effects with a few masses of light and shade, or a few bold gradations of tone, deludes many into the belief that this is a light and trifling branch of art. The method, in fact, is remarkably well suited to sketching, owing to the lightness of the materials and the rapidity with which the paper dries; the luminousness of the paper likewise greatly assists the immediate, superficial effect. But finished painting in water-color demands skill of a very high order; great works come only from masters, and no master has exhausted, or even severely taxed, the resources of the method. The water-colorist claims for his branch of the art that while it is, equally with oils, adapted to all subjects—landscape, marine views, composition pictures, historical themes, architectural elevations, portrait—it offers peculiar advantage in depicting clouds and atmospheric effects. Another advantage he claims in the distinctness and separateness of the colors, which in oil-painting have a tendency to run together. This advantage also is due to the rapid drying of the colors, which fixes each before another can be applied. Greater care is needed on this account to prevent apparent roughness on the one hand and slovenliness on the other. From the old process, which consisted merely in staining paper, through the intermediate stage of excessive, opaque body-color, to the present point of the art, is a great stride. There is no reason to doubt that in course of time, with proper study, water-color painting will be held equally in esteem with oil. Its permanency seems to be unquestionable, though perhaps it is too early to pronounce a decided opinion on this point. The oldest paintings in oil, as we learn on good authority, date back no further than the time of John Van Eyck, who died in 1440. Not many are as old, and these, we are assured, will not bear comparison in brilliancy with the paintings executed in missals on parchment; therefore much earlier. Water-color paintings, not tinted drawings—which are very different things—have been known to retain their freshness and brilliancy for the space of ninety years, giving then no indications of weakness. The darkening of the paper on long exposure to the air may be avoided by protecting the surface with glass. This danger being averted, the colors in other respects may be trusted to hold their own with even more certainty than is the case with canvas painting. The authority quoted above (Fielding) says: "It is not, in our opinion, presuming too much to affirm that the water-colors of the present day, in which water only is used as a solvent, may, and most probably will, endure much longer than works done in oil according to our present mode, when the requisite care is given to them." The liability of paper to be torn renders the water-color painting less durable than the work on canvas, but this disadvantage reflects no disparagement on the method of applying color. True gems of art receive the greater care from being committed to fragile materials. The work that Vibert, Meissonier, Fortuny, do on paper will acquire additional value from the circumstance that it must be tenderly kept, and cannot be rolled up like canvas and thrown into a lumber-room. And this care will be bestowed the more readily as it is a peculiar property of the paper on which water-color pictures are painted to retain and give back light, as may be observed by the luminousness of water-colors at dusk, when oiled canvas rapidly darkens. But this fine quality of painting is secured only by great study, by repeated washings on and washings off, in order that the tints may partake of the granular surface of the paper. The process of water-color is in common use by sketchers, whose finished works are in oil. But as the capacities of it are understood, it is preferred by artists to oil-painting, many feeling what Michael Angelo expressed in regard to fresco-painting, that in comparison with it oil-painting was work for women and children. Societies of artists in water-color hold now a distinguished place among the schools of painting. The Belgian association, under the patronage of the king, is by some ranked first. In England there are two. The Society of Painters in Water-Colors, instituted in 1804, gave its eighty-sixth exhibition in 1876. Its president is Sir John Gilbert, A. R. A.; among its honorary members are W. E. Gladstone and John Ruskin; its membership includes names famous in oil-painting, and in the list of its associate exhibitors is Holman Hunt. The Institute of Painters in Water-Colors gave the same year its forty-second exhibition. Its membership comprises artists of distinguished merit: in the number of its honorary members we find Rosa Bonheur and John Millais, both of whom have done work, though not eminent, in water-color; of the thirteen lady members, one, Mrs. E. Murray, is well known here by her Spanish subjects, and Miss Elizabeth Thompson is famous as the painter of the *Charge at Balaclava* and *Quatre-Bras*. The variety in the subjects presented at the last exhibitions demonstrates the capacity of the style. The French have paid less attention to water-color than the English, though individual artists owe their fame to it—Vibert and Detaille, for example. Artists of the Spanish school find it admirably adapted to produce the gorgeous effects they aim at. In New York the American Society of Painters in Water-Colors was formed in 1867, and is already an established institution. Each annual exhibition shows advance on its predecessor in variety and quality of work. Artists of reputation are devoting themselves exclusively to it. The price of finished water-color pictures is rising as the demand for them increases.

O. B. FROTHINGHAM.

Water-Colors. See PAINT, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Wa'tercourse, in law, denotes any natural stream of water which flows in a constant current and between defined banks. It is distinguished, on the one side, from a mere torrent, whereby the accumulation of surface-water is carried off, perhaps always through the same channel or bed, but which soon becomes exhausted, and remains dry until the next supply from the rain or melting snow; and, on the other side, from a mere percolation of water through the substance of the soil, without being collected into a

distinct current running between ascertained banks, although such process may perhaps be constant. Watercourses are either navigable or not navigable. At the common law a navigable watercourse is one in which, and as far as, the tide ebbs and flows; all others are legally unnavigable. This rule arose from the fact that in England the tidal streams were the only ones actually navigable. In the U. S. the physical geography of the country is so different that a more reasonable doctrine has been established. Every stream which, in its natural condition or with no further artificial improvement than the removal of temporary obstructions, can be navigated by vessels adapted to commercial purposes, is legally navigable. The bed and stream of a navigable watercourse are under the control of the State and U. S. governments, subject to the common public right of fishing and transportation. If the river runs between or through two or more States, the final authority over it belongs to Congress by virtue of its power to regulate commerce among the States. If the river lies wholly within the territory of a single State, the jurisdiction over it, at least in the first instance, is held by the State government. The owners of land bordering upon a navigable watercourse do not own its bed, nor have they any greater rights to the stream than those possessed by the public at large, unless special privileges have been conferred by the State or the national government; as, for example, the building of wharves, the grant of a ferry franchise, or the right to erect a bridge. On the great navigable rivers flowing between or through two or more States, as the Ohio and the Mississippi, it seems to be settled that the authority to erect bridges must be obtained from Congress, since these structures, much more than ferries or wharves, tend to interfere with inter-State commerce. The law concerning unnavigable watercourses is very different. They are necessarily private property. The beds, as a general rule, belong to the adjacent riparian proprietors, who have also a right to use the water while flowing within their respective territories, but have not individually an actual property in it. The stream itself, in its natural flow and to its natural amount, is subject to a right of *user* by all the riparian owners as it passes by or through their several premises. If the same person owns the land abutting on both sides of such a watercourse, he owns also the entire bed lying between his opposite banks. When, however, the opposite lands are held by different riparian proprietors, their rights extend to the middle line or thread of the stream, each owning the half of the bed adjacent to his bank. This thread is determined by supposing a series of straight lines to be drawn across the stream always perpendicular to the opposite banks, and then causing each of these transverse lines to be bisected by another line which, following the sinuosities of the two banks, would always be found at the middle of the watercourse. If an island should form wholly on one side of this thread, it would belong to the proprietor or proprietors of the nearest bank opposite to whose lands it was situated; if it should form so as to be intersected by the thread of the stream, it would belong to the owners of the two opposite banks, the thread being the boundary separating their respective portions; and the same principle would apply if it should form opposite the lands of two or more adjacent owners lying upon the same side of the stream. If the stream should slowly change its course—that is, if the soil washed away from one side should be imperceptibly added to the other—the owner of the land thus augmented would acquire full property in the accumulation—which is technically termed "alluvion"—and his title would follow the gradual alteration in the bed and in the thread of the watercourse. A deed of land bounded upon one side or bank of an unnavigable stream conveys the bed to the middle line, unless the grantor by a special description limits the conveyance to the bank itself. It is of course possible for a riparian proprietor, owning the half or the whole of the adjacent bed, to sell and convey the upland without the bed, or the bed without the upland, but in such a case the description must clearly indicate the intent. (The other rights and powers of the riparian proprietors, and especially those relating to the use of the water for milling and other purposes, will be found in the article on RIPARIAN RIGHTS.) JOHN NORTON POMEROY.

Water-Cress. See CRESS.

Water-Cure. See HYDROPATHY, by R. T. TRALL, M. D.

Wa'terdown, p.-v., Wentworth co., Ont., Canada, 6 miles N. of Hamilton. Waterdown Station, on the Great Western R. R., is 2 miles distant. P. about 1000.

Wateree', tp., Kershaw co., S. C. P. 3657.

Wateree River is called **Catawba** in North Carolina above the mouth of Fishing Creek. In South Carolina it joins the Congaree, and forms the Santee River. It is navigable for steamboats to Camden, S. C.

Waterfall. See CATARACTS AND RAPIDS.

Water-Flea, a name given sometimes to species of ENTOMOSTRACA (which see).

Wa'terford, county of Ireland, province of Munster, bordering S. on the Atlantic, comprises an area of 721 sq. m., with 123,252 inhabitants, of whom 11,842 can neither read nor write; since 1851, 61,051 persons have emigrated. The surface is mountainous, several ranges from 2000 to 3000 feet high traversing it. Pasturage and dairy-farming are the principal occupations. Coal, iron, lead, copper, and marble are found. Copper-mines and marble-quarries are worked with success.

Waterford, town of Ireland, capital of the county of Waterford, on the Suir, near its mouth in the Atlantic, has a good harbor, with shipbuilding docks and a fine quay, to which vessels of 2000 tons burden can ascend and unload. It contains several fine streets, but also many wretched ones; has some good educational and benevolent institutions; manufactures glass, soap, ale, and spirits, and carries on a considerable trade with England, exporting large quantities of agricultural produce. P. 23,349.

Waterford, p.-v., Norfolk co., Ont., Canada, 8 miles N. of Simcoe, on the Canada Southern R. R., has a weekly newspaper and some manufactures. P. about 900.

Waterford, p.-v. and tp., New London co., Conn. P. 2182.

Waterford, tp., Fulton co., Ill. P. 451.

Waterford, tp., Clinton co., Ia. P. 1160.

Waterford, p.-v. and tp., Oxford co., Me. P. 1286.

Waterford, p.-v. and tp., Oakland co., Mich. P. 1362.

Waterford, p.-v. and tp., Dakota co., Minn. P. 331.

Waterford, p.-v., Marshall co., Miss. P. 10.

Waterford, tp., Camden co., N. J. P. 2071.

Waterford, p.-v. and tp., Saratoga co., N. Y., at the junction of Mohawk and Hudson rivers, on Champlain Canal and the Delaware and Hudson Canal Co.'s R. R. and Rensselaer and Saratoga R. R., and connects with Troy, 4 miles distant, by horse railroad and steam-ferry, and with Lake Champlain, 63 miles distant, by State canal. It has abundant water-power, and is a manufacturing point of some consequence. It has a bank, 1 newspaper, high schools, 5 churches, 5 hotels, paper-mill, flouring-mills, 3 knitting-mills, 2 stock-and-die factories, steam fire-engine works, Globe Ironworks, 2 straw-board mills, valve fire-hydrant and Dodge press works, soap and candle works, lampblack factory, veneering mills, brush-factories, nut-works, machine-shops, etc., besides numerous establishments on a small scale, the whole employing capital to the amount of $3,000,000. It has a volunteer fire department with 2 steam fire-engines. P. of v. 3071; of tp. 3631.
LEWIS CAULDWELL, ED. "ADVERTISER."

Waterford, p.-v. and tp., Washington co., O. P. 2046.

Waterford, p.-b. and tp., Erie co., Pa. P. of b. 790; of tp. 1884.

Waterford, p.-v. and tp., Caledonia co., Vt. P. 879.

Waterford, p.-v., Loudon co., Va. P. 419.

Waterford, p.-v. and tp., Racine co., Wis. P. of v. 545; of tp. 1580.

Water-Gas. See APPENDIX.

Wa'ter-Glass, the soluble silicate of soda or of potash, or of both, prepared for use by boiling silica with a caustic alkali under great pressure. It is used in fresco-painting, in dyeing cloth, and in making certain kinds of artificial stone and cement. It is sometimes used in surgery in making immovable bandages as a substitute for dextrine. It is also used in making cotton and linen goods fireproof. (See also GLASS.)

Water-Hen. See GALLINULE.

Water-Hog. See HYDROCHŒRIDÆ and CAPYBARA.

Wa'terhouse (BENJAMIN), M. D., b. at Newport, R. I., Mar. 4, 1754; studied medicine at London, Edinburgh, and Leyden, where he graduated 1780; began practice as a physician at Newport; was professor of the theory and practice of physic at Harvard 1783–1812; was at the same time professor of natural history at Brown University, Providence; from 1784 was the first lecturer on natural history in an American college; also introduced the study of mineralogy; obtained from Dr. Lettsom a valuable collection of minerals, and procured the establishment of a botanic garden; tested in his own family as early as 1799 Dr. Jenner's discovery of vaccination, and vindicated its value for several years by his writings, in opposition to public prejudice; was a frequent writer for the press in support of the doctrines of Jefferson; was appointed hospital surgeon U. S. army June 29, 1813; became post surgeon 1818, and was medical supervisor of the U. S. military

posts in New England 1812–25. D. at Cambridge, Mass., Oct. 2, 1846. Author of *Lectures on the Theory and Practice of Medicine* (1786), *Lectures on Natural History* (1810), *The Botanist* (1811), a novel, *The Journal of a Young Man of Massachusetts* (1816), an *Essay on Junius and his Letters* (1831), supporting the claims of Lord Chatham, and several other works.

Wa'terland (DANIEL), D. D., b. at Wasely, Lincolnshire, England, Feb. 14, 1683; graduated at Magdalen College, Cambridge, about 1703; became a fellow (1704) and master (1713) of that college; took orders in the Church of England; was appointed chaplain to George I. 1714; preached the Lady Moyer lectures at St. Paul's, London, 1720; became rector of Ellingham 1713, and of the united parishes of St. Austin and St. Faith, London, 1720; chancellor of York 1723; canon of Windsor 1727; vicar of Twickenham and archdeacon of Middlesex 1730; was highly distinguished as a Trinitarian controversialist. D. in London Dec. 23, 1740. He has been called "the last of the great patristic scholars of England," but his extensive knowledge of the texts of the Fathers was not sufficiently critical to have been of any avail in the great patristic controversies of the present century. Among his writings were controversial treatises on the *Divinity of Christ*, against Drs. Whitby and Samuel Clarke (1718–24), in vindication of the authority of Scripture, against Middleton and Tindal, and on the doctrines of the Eucharist and baptismal regeneration, against the laxer divines of the Anglican body; and a critical essay on the Athanasian Creed, which he traces to Hilary of Arles. Modern researches assign it to a much later period. A complete edition of his *Works*, accompanied by a *Memoir*, was published by Bishop Van Mildert (Oxford, 11 vols., 1823–28; 3d ed., 6 vols., 1856).

Wa'ter-Lil'y, a name appropriate to the beautiful blossoms of the water-plants of the genus *Nymphæa*, and also extended to *Nuphar* and *Nelumbium*. (See LOTUS.) One of the finest anywhere is the *Nymphæa odorata* of the U. S., often called pond lily.

Waterloo', village of Belgium, province of South Brabant, on the road from Charleroi to Brussels, at the southern outskirts of the Forest of Soignies, with 2935 inhabitants in 1871. Here and in the vicinity was fought, on June 18, 1815, the battle between the French under Napoleon on the one side, and on the other an allied English-Dutch-German army under Wellington and a Prussian army under Blücher, the loss of which battle finally broke Napoleon's power. With excellent skill Napoleon prevented the junction of the two armies, and on the 16th, while he attacked Blücher at Ligny and completely defeated him after five hours' fight, Ney engaged the nearest point of Wellington's position, Quatre-Bras, 7 miles distant from Ligny, and occupied by a division under the command of the prince of Orange. After despatching a corps of 34,000 men and 90 guns under Grouchy in pursuit of Blücher, who retreated northward, not eastward, Napoleon joined Ney at Quatre-Bras, which was still held by Wellington, but on learning the defeat of Blücher and his line of retreat, Wellington on the 17th drew back his whole army from the line of Quatre-Bras to that of Waterloo, followed by Napoleon, who, however, was prevented by the lateness of the hour and by the rain which poured in torrents from attacking him. On the morning of the 18th the two armies stood facing each other in battle-array, and occupying the two ridges running nearly parallel, and separated by a valley from 500 to 800 yards broad. The allied army numbered 70,000 men, with 13,500 cavalry and 159 guns—25,000 English, 17,500 Dutch, and the rest Brunswickers and Hanoverians. The French army numbered 72,000 men, with 15,000 cavalry and 240 guns. The salient points of the position of Wellington were, on the right wing, the château and forest of Hougomont; in the centre, the village of Mont St. Jean and the farm-house of La Haye Sainte; on the left wing, the farm-houses of La Haye and Papelotte. Wellington's head-quarters were at Waterloo, just behind Mont St. Jean, and Napoleon's nearly opposite, at Belle Alliance. At 11½ o'clock A. M. the battle was opened by the divisions of Jerome Bonaparte, Foy, and Bacheln attacking Hougomont. The forest was taken, but the buildings were still held by the English guard at 2 o'clock P. M. A little after noon the tips of the Prussian army began to show on the right flank of the French. Napoleon believed that he had completely incapacitated this army, and felt sure that, at all events, Grouchy's co-operation would keep him safe on this side. Nevertheless, at 1 o'clock P. M. he despatched Lobau with 10,000 men from his centre to operate against the Prussians. At 1½ o'clock he ordered Ney to break through the enemy's centre. Moving across the valley, or rather the ravine, Ney took La Haye Sainte, but was driven back with fearful slaughter by the English heavy cavalry under Picton and Ponsonby; he formed again behind the lines of Milhaud's cuirassiers, who massacred the English dragoons in the ravine, and retook the place at 3 o'clock. An attempt by Wellington, at 4 o'clock, to dislodge him be repelled, and, reinforced by the light cavalry of Milhaud and the heavy cavalry of Kellermann, he now threw himself on the lines of the English infantry, which he several times caused to waver, but which he could not break without the support of infantry. At the same time La Haye and Papelotte had been taken by the French on the left wing, and Lobau had driven the Prussians out of Planchenoit. At 7 o'clock, Napoleon ordered the guard to advance to the final attack on the enemy's centre, but at nearly the same moment the Prussians broke forth in great force from the Forest of Soignies, Wellington ordered his whole line to advance, and the French army, somewhat loose in its strategical disposition and hard pressed both in front and on the right flank, was thrown into disorder, repulsed with great slaughter at the principal points, seized by a panic, and finally driven into a wild flight. At 9½ o'clock, Wellington and Blücher met each other at Maison du Roi, in rear of Bello Alliance. The French loss was 30,000 men and 227 pieces; that of the allies about 23,000 men. CLEMENS PETERSEN.

Waterloo, county of the S. W. central part of Ontario, Canada. It is fertile and well cultivated, and is traversed by Grand Trunk Railway and several of its branches. Cap. Berlin. P. 40,251.

Waterloo, a suburb of Berlin, the county-seat of Waterloo co., Ont., Canada, has a large trade, good water-power, thriving manufactures, and 2 weekly newspapers. P. 1594.

Waterloo, p.-v., cap. of Shefford co., Quebec, Canada, on Stanstead Shefford and Chambly Railway, 42 miles N. W. of Stanstead Plain. It is the terminus of a wooden railway to the Huntington copper-mine, and copper and iron ores abound. It has a foundry, tannery, branch bank, and a weekly newspaper. P. 1240.

Waterloo, p.-v. and tp., Lauderdale co., Ala. P. 1186.

Waterloo, p.-v., cap. of Monroe co., Ill., on Cairo and St. Louis R. R., 22 miles S. of the latter city, has 4 churches, a fine public-school building, 2 newspapers, 2 denominational schools, 2 literary societies, 1 flouring-mill (the largest in the State), 2 lumber-yards, and 3 hotels. The county is strictly agricultural. The village is well paved, and the buildings mostly of brick. P. 1537.
J. F. GOTSHALL, ED. "ADVOCATE."

Waterloo, p.-v., De Kalb co., Ind., at the junction of Lake Shore and Fort Wayne Jackson and Saginaw R. Rs., has 7 churches, an elegant school building, 1 newspaper, and fine fair grounds. P. 1259.
C. K. BAXTER, ED. "PRESS."

Waterloo, tp., Fayette co., Ind. P. 671.

Waterloo, tp., Allamakee co., Ia. P. 747.

Waterloo, city and tp., cap. of Black Hawk co., Ia., on the Iowa division of Illinois Central and Burlington Cedar Rapids and Minnesota R. Rs., 93 miles W. of Dubuque, contains 13 churches, 3 public and 2 private schools, 2 banks and a private banking-house, 1 woollen and 3 large flouring mills, an agricultural-implement factory, several foundries, 1 cracker, 1 soap, and 2 carriage factories, 3 newspapers, and excellent water-power afforded by Cedar River, which runs through the place. P. of city, 4337; of tp. 458. MATT. PARROTT, ED. "IOWA STATE REPORTER."

Waterloo, tp., Lyon co., Kan. P. 657.

Waterloo, p.-v. and tp., Jackson co., Mich. P. 1229.

Waterloo, p.-v., cap. of Clarke co., Mo.

Waterloo, p.-v. and tp., cap. of Seneca co., N. Y., on the Auburn division of New York Central R. R., and on both sides of Cayuga and Seneca Canal, 58 miles E. of Rochester, has good schools, 1 bank, 2 newspapers, 2 woollen factories, an extensive yeast-factory, planing, saw, and grist mills, and 4 hotels. P. of v. 4086; of tp. 4469.
W. A. BURTON, ED. "OBSERVER."

Waterloo, tp., Athens co., O. P. 1695.

Waterloo, v., Violet tp., Fairfield co., O. P. 85.

Waterloo, v., Madison tp., Fayette co., O. P. 120.

Waterloo, p.-v. and tp., Laurens co., S. C. P. 2158.

Waterloo, tp., Grant co., Wis. P. 951.

Waterloo, p.-v. and tp., Jefferson co., Wis., on Milwaukee and St. Paul R. R., 25 miles E. of Madison, contains 5 churches, an academy, 1 newspaper, 3 hotels, 1 machine-shop, and 2 large flouring-mills. Principal business, farming and dairying. P. of v. 727; of tp. 1818.
E. F. CONKLIN, PROP. "JOURNAL."

Waterloo (Antoni), b. at Amsterdam in 1618; lived at Maarsen and Breukelen, near Utrecht, and died, poor and miserable, in the hospital of St. Hiob at Utrecht in 1662. His pictures, mostly landscapes, are few, but much valued for the truth and simplicity with which they represent nature. More widely known and as highly estimated are his drawings and engravings, 136 in number.

Wa'terman (Thomas Whitney), b. at Binghamton, N. Y., in 1821; studied at Yale College; travelled in Europe 1842–44, and was admitted to the bar in New York City 1848. Author of *Civil Jurisdiction of Justices of the Peace* (1849), *American Chancery Digest* (3d ed., 3 vols., 1853), *Principles of Law and Equity in the Granting of New Trials* (2 vols., 1855), *Digest of Decisions of Superior Court of Connecticut* (1858), and other legal treatises.

Wa'termelon, the fruit of *Citrullus vulgaris*, a trailing annual vine of the order Cucurbitaceæ, a native of Asia and Africa, extensively found wild on the plains of the latter continent, where some varieties or specimens of its fruit are bitter and poisonous. In this country, if the watermelon is grown near the colocynth, it will hybridize and acquire a bitter taste and poisonous qualities. Watermelons are largely grown in the U. S. for their cooling, watery pulp; many varieties are known. In warm climates sugar has been profitably made from watermelons.

Wa'ter-Meter, an automatic device for measuring and registering the flow of water. In populous districts, when the municipal authority assumes the duty of furnishing water to the inhabitants, it is usually supplied *ad libitum*, a certain rental being charged for the privilege of drawing all that is required. This system usually works very well for a few years; but the prudent habits prevailing when the supply is drawn from wells and cisterns soon disappear, and are often succeeded by habits of wanton and reckless wastefulness. When the Croton waterworks were undertaken, the quantity of water to be supplied was fixed, after elaborate calculation and inquiry, at 36 gallons per day for each inhabitant—an allowance which, at the present time, would, with reasonable economy, be found ample for all legitimate purposes. Nevertheless, the consumption of New York City now exceeds 90 gallons per day for each inhabitant. Most other great cities have had a similar experience, and the necessity of restraining this enormous waste by charges based upon the quantity of water actually used is daily becoming more apparent to all concerned in works for the supply of water.

Such a system of water-rates requires accurate means of determining the quantity drawn by each consumer. The device made use of must be capable of registering the smallest as well as the largest quantity deliverable. It must work under all pressures, from a few feet up to 200 or more. It must work for long periods without attention. It must not leak. It must be capable of standing idle, and even of remaining dry for longer or shorter periods, without losing its efficiency. It must offer but slight resistance to the flow of water. And, finally, since it must be applied in great numbers, must be furnished at a moderate cost. These requisites involve a combination of qualities not readily secured. About 200 patents are on record in the U. S. for water-meters, and an equal number in England, and although some of these are successful in a mechanical point of view, it must be admitted that a water-meter combining all that is essential to its general introduction is yet to be produced. The difficulty does not appear to lie in a lack of ingenuity to conceive of suitable combinations of mechanism; it lies rather in the lack, on the part of inventors, of mechanical skill, perseverance, and resources to pursue the idea to its consummation.

With a few unimportant exceptions all water-meters may be classed under the four following heads: (1) *Piston meters*, in which the water propels a piston in a cylinder, the piston by suitable connections opening and closing the valves and moving the registering mechanism. (2) *Fly meters*, in which the water acts by impulse upon vanes or floats attached to a wheel, the revolutions of which are registered by a train of clockwork. The quantity of water corresponding to a turn of the wheel is determined by experiment. (3) *Diaphragm meters*, in which the water is admitted alternately to the opposite sides of a flexible diaphragm. (4) *Rotary meters*, in which a series of vanes attached to an axis move in a corresponding circular chamber, fitting it as a piston does a cylinder.

Figs. 1, 2, 3, and 4 represent in detail a meter of the first-named type, made by Mr. H. R. Worthington of New York. It has two pistons or plungers, *a*, *b*, moving in separate cylinders. The piston *a* works the valve for the piston *b*, and *vice versâ*. Fig. 1 is a cross-section of the instrument; Fig. 2 a longitudinal section, showing the piston *a* with its cylinder and valve; Fig. 3 shows the valve worked by the piston *b*; Fig. 4 shows the connection which operates the registering mechanism. It will be noticed that the central part of each piston is diminished in diameter, and passes through a common chamber A. The water enters the meter at *c*, Fig. 1, and leaves it at *d*. In the bottom of the meter there are passages, sometimes crossing each other, leading from the valve of *a* to the cylinder of *b*—that is, each passage shown in Fig. 2 communicates with a passage marked by the same letter in Fig. 3. As drawn, the piston *b* has completed its stroke to the left, and moved its valve *w*. The water from the chamber A enters through the cylinder of *a* through the passages *g*, *g*, Figs. 2 and 3, and forces the piston *a* to the right. From the right of *a* the water escapes through the passage *k k* to the exhaust-passage *h*. The piston *b* rests till *a* has completed its stroke and moved its valve, opening communication between the chamber A and the left of *b* through the passage *m m*, and putting the right of *b* in communication with the exhaust by the passage *l l*. *o* is a circular

Fig. 1.

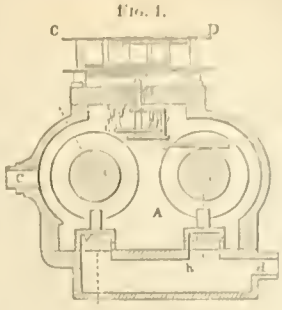
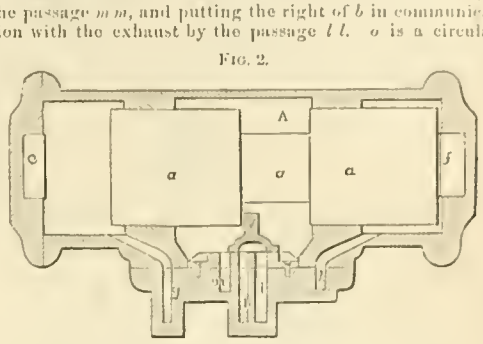


Fig. 2.



disk resting between the shoulders of the piston *b*. It is connected with a frame *r*, which hangs upon a pivot *s*, without being rigidly fixed to it. *n* is a ratchet-wheel fixed upon the same pivot. Every second stroke of the piston *b* advances this wheel one tooth by means of the pawl *q*. P is a pawl which prevents the ratchet-wheel from moving backward. The pivot *s* passes through a stuffing-box, and gives motion to a train of clockwork which shows the quantity of water consumed by means of hands on a dial-plate C D. *e* and *f* are rubber buffers which arrest the movement of the piston at each stroke. This machine is founded upon a sound mechanical principle, and has met with as large a measure of success as any meter yet introduced. Its cost is too high to warrant its general introduction. A great many different piston-meters have been constructed. They are generally provided with two pistons. Meters with a single piston have never worked satisfactorily. There is the same necessity for two that there is for an auxiliary piston in the direct-acting steam-pump.

Fig. 3.

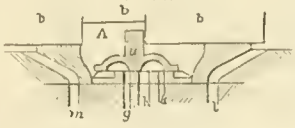


Fig. 4.

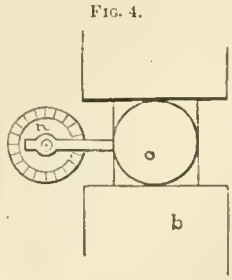


Fig. 5 is an example of the second type of water-meter. The figure represents an invention of James Boyle of Brooklyn, N. Y. A wheel with spiral vanes is turned by the direct impulse of the water, and gives motion to a train of clockwork by means of an endless screw. This style of meter is very simple and capable of being cheaply constructed—advantages which have led to considerable demand for it. Its operation, however, is not sufficiently certain. It does not positively measure the quantity of water, but gives indications which enable it to be inferred with more or less certainty. A very slight obstruction to its movement materially alters its indications. In fact, it may cease to register entirely without affecting the quantity of water delivered. The train of wheelwork necessarily moves in water, since a stuffing-box would cause too much resistance. It is consequently liable

to obstruction from anything floating in the water. The dial-plate must be observed through glass, and its indications are liable to be obscured by deposits.

Fig. 5.

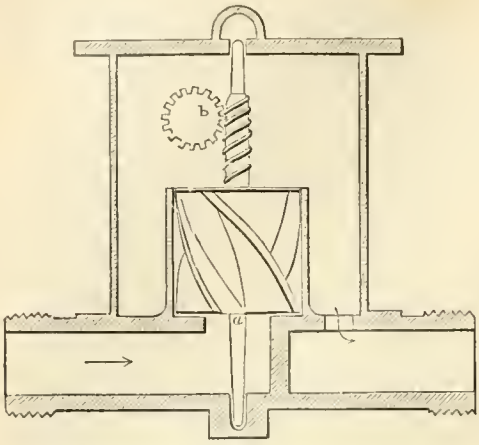
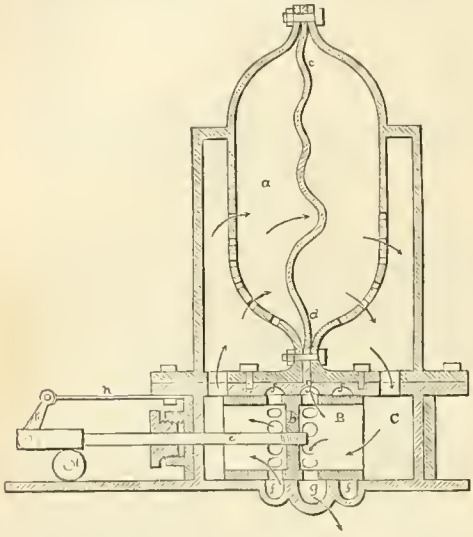


Fig. 6, a recent invention of Mr. Guthrie of Chicago, is one of the diaphragm meters. The water is measured in a

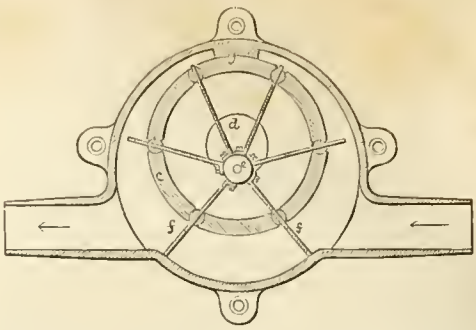
Fig. 6.



chamber *a*. The valve B is a hollow piston fitting a cylinder C. It is divided into two parts by a partition at the centre, *b*. It has a rod *e* passing through a stuffing-box, and giving motion to the registering mechanism, which is not shown. It is provided with a "knuckle-joint," consisting of the arm *k*, the spring *h*, and the roller *l*. The purpose of this arrangement is to ensure a sufficient travel of the valve. Around the interior of the cylinder C are three annular passages or grooves. Two of them, *f f*, *f f*, communicate with the supply-pipe; the other, *g g*, with the delivery-pipe. The valve contains two rows of orifices, as shown. The operation is as follows: The water is shown entering through the orifices in the left side of the valve from the passage *f f*, and passing into the chamber *a*. It moves the diaphragm *c d* to the right, causing the water to escape into the passage *g g*, as indicated by the arrows. When the chamber *a* is filled, the diaphragm being in contact with its right side, the pressure on the right of the valve in the chamber C ceases, and the valve moves to the right, bringing the right-hand orifices into communication with the supply, the left with the delivery. The reverse action then takes place, the water entering the chamber *a* from the right side, and passing to the delivery-pipe from the left. The defect most commonly met with in this class of meters is the rapid destruction of the diaphragm.

We come, finally, to meters of the fourth class, an example of which is given at Fig. 7. This particular form was patented in England about twenty years ago. It consists of a cylindrical drum *c* with vanes *f f*, the drum and vanes revolving on different centres. The drum revolves in contact with the chamber at *y*, and the vanes act as

Fig. 7.



pistons on a certain part of the circumference, entirely closing the passage. The vanes are attached to a series of small collars *e* on a spindle, an arrangement which admits of their moving with reference to one another. One of the collars is fixed to the spindle, which passes through a stuffing-box and moves the registering mechanism. The circle *d* is the hub on which the drum revolves. A kind of swivel-joint is introduced where the vanes pass through the drum. Many patents have been granted for rotary meters. In some cases the vanes are hinged to the drum, folding against it at the point of contact between the drum and its chamber, and being extended at other parts of the circumference. In some forms the vanes turn on pivots moving flatwise during a part of their revolution, and passing edgewise through a narrow passage during the remainder. No rotary meter has hitherto proved successful. J. P. Frizell.

Water-Mill. See Barker's Mill.

Water-Mole, a name given by the Australian colonists to the Ornithorhynchidæ (which see).

Water of Crystallization and of Constitution, in chemistry. Chemical changes may be divided into those which take place in the internal substance of a *homogeneous* body, with new distribution of the molecules and development or absorption of heat, and those which take place between two bodies, or within a *heterogeneous* mixture. The latter class always requires the intervention of some fluid medium which is capable of dissolving at least one of the two bodies and bringing it into chemical contact with the other. *Water* was ordained as the great natural promoter of such action upon the surface of our earth, being the medium of most of the chemical changes that are necessary to the progress and perpetuation of life of every kind, as well as that of the most numerous and important of the merely mineral transformations that have heretofore occurred, and that are now in progress, upon and within the earth's crust. In the course of the infinite variety of these chemical transformations, organic and mineral, it is found that a portion of the water concerned remains very often, in certain forms of combination, in the dry solid products, furnishing a class of chemical problems which have largely exercised investigators in this science, and with the correct solution of which, indeed, its hope of establishment as an exact science is closely knit up. Especially, as there can be no hesitation in asserting, is their solution entirely essential to the right understanding of the subjects of *saline constitution, acidity* and *basicity*, and *crystalline relations*.

It has long been the universal belief among all reasoning chemists that water which enters thus into combination with other bodies in chemical reactions does this in two distinct ways, being in one class of cases combined in such a way as to retain in a measure its identity and to remain susceptible of easy separation by heat, sometimes heat of a very gentle degree; this being what is usually known as *crystal-water*, or *water of crystallization*, because innumerable saline and other substances are liable to take it up into their crystals, and on losing it by heat these crystals often fall to powder, losing their previous crystalline structure. The other class of cases is that in which water enters into combination in such ways as manifestly to lose its identity altogether, and to become sometimes incapable of recovery again in the form of water by any direct or simple operation. Those who adhere to the idea that such water still retains, nevertheless, the H_2O molecule, have called it, in these cases, *water of constitution* or *constitutional water*. Such instances are characterized by great development of heat during the reaction, and usually either contraction or expansion of volume. The slaking of quicklime and the mixture of anhydrous sulphuric oxide with an equivalent of water are familiar examples of this heat-development; but in the first of these cases change

of volume is at least doubtful. (Taking Filhol's density-figures for both quicklime and slaked lime, the volume remains almost unchanged during the combination.) In the combination of anhydrous potash and baryta with water there appears to be expansion, and in the cases of soda and strontia, contraction; in all these cases, however, the temperature rising nearly or quite to incandescence.

In the instances just cited, of the compounds formed between *basic oxides* and water, many chemists have long believed that the water does not retain, in the compound, any trace of its original constitution—that there is no longer, in fact, any water present. The special school of speculative theorists, whose views chiefly prevail in the schoolbooks of the present day, regard this class of compounds as containing *hydroxyl*, OH, and must give to *slaked lime*, for example, the constitution $Ca(OH)_2$, while they arbitrarily split in two the molecules of the potash and soda compounds, calling them K(OH) and Na(OH).

The term "water of constitution," and the vague—indeed, entirely undefined—idea attached to it, have been widely applied also to water contained in acids, called also by some "basic water," this being the form into which water is supposed to pass when it combines with acidic oxides, the so-called "anhydrides." The case of sulphuric oxide above is one example, others being phosphoric pentoxide, arsenic pentoxide, selenious oxide, etc. In the case of phosphoric pentoxide it is a matter of *temperature* whether one molecule or three of water pass into the form of so-called "constitutional" or "basic" water; that is, whether monobasic or tribasic "phosphate of water" is formed. (See PHOSPHORIC ACIDS.) The hydroxyl school, in these cases also, imagine hydroxyl compounds to be formed. (See SALT-RADICALS.)

Of late years many attempts have been made by chemists of great eminence—conscious of the obscure state of our views on the subject of the condition of water in salts and so-called "hydrates"—to arrive at some knowledge which might clear up these questions. These inquiries have generally been directed to the search for some law governing the *thermic* changes that occur during reactions with water. Few have paid any attention to the other striking phenomena that occur—namely, the changes of *volume*. Among these few, however, has been an American chemist, F. W. Clarke of Cincinnati, who in 1874 made the first successful generalization regarding the volume of the water-molecule in the form of water of crystallization. (*Am. Jour. of Science*, 3, vol. viii. p. 428.) From the mean of the volumes of this constituent in 31 hydrated salts computed by him, Prof. Clarke found 13.76 for the molecular volume of crystal-water. The present writer finds that two of these cases (doubtfully low) being omitted, the remaining 29 give 13.829, which, multiplied by 1000, is manifestly the even cube of 24 = 13824. (See VOLUMES, MOLECULAR.) This fact, with a great multitude of others discovered by the present writer, has led him to the new view regarding crystal-water—that it is water which performs the part, in chemical combination, of a *compound radical* or elementoid group, and that it comes, therefore, directly under his new law of cubical condensation, which is explained in the article VOLUMES, MOLECULAR. The *molecular diameter* of crystal-water is therefore 24, and it may have the symbol H^{δ}_{24}. A few cases may be cited here—including some not in the list of Prof. F. W. Clarke—of salts which contain water of crystallization in this volume, 13.824 (or when multiplied by 1000 = 24^3), to add some further precision and strength to the generalization under the new aspect it assumes in connection with the geometric law of condensation. (For explanation of the special formulation and symbols here used reference must be had to VOLUMES, MOLECULAR.)

	Computed densities.	Experimental densities.
Borax, anhydrous.... $O_7.4^{B}_{20}.2^{Na}_{20}$	= 2.397	Favre and Valson, at 20°.....2.371
" crystals..... $O_7.4^{B}_{20}.2^{Na}_{20}.10^{H\delta}_{24}$	= 1.7166	Favre and Valson, at 20°.....1.711; Stolba.....1.7156; Mohs.....1.716
Lithium sulphate, anhydrous..... $O_4.^{S}_{24}.(^{Li\,Li}_{19\,20})$	= 2.226	(Kremers, 2.21).
Lithium sulphate, crystals..... $O_4.^{S}_{24}.(^{Li\,Li}_{19\,20}).^{H\delta}_{24}$	= 2.024	(Troost, 2.02).
Ammonium sulphate, anhydrous..... $O_4.^{S}_{24}.2^{Am}_{27}$	= 1.786	Schröder, 1.771; Kopp, 1.78
Mascagnite, native crystals..... $O_4.^{S}_{24}.2^{Am}_{27}.^{H\delta}_{24}$	= 1.71	Dana's *Mineralogy*, lowest, 1.72
Kupferite, mineral... $O_6.^{2Si}_{23}.^{2Mg}_{17}$	= 3.065	(Dana's *Mineralogy*, 3.08).
Picrosmine, " $O_6.^{2Si}_{23}.^{2Mg}_{17}.^{H\delta}_{24}$	= 2.756	Dana's *Mineralogy*, cleavable, 2.66
Zinc sulphate, anhyd. $O_4.^{S}_{24}.^{Zn}_{21}$	= 3.674	Playfair and Joule, 3.681
" " crystals $O_4.^{S}_{24}.^{Zn}_{21}.^{H\delta}_{24}$	= 2.011	Filhol, 2.046; Mohs, 2.036
Willemite, mineral.... $O_4.^{Si}_{23}.^{2Zn}_{22}$	= 4.001	Vanuxem and Keating, New Jersey, 4.0
Calamine, " $O_4.^{Si}_{23}.^{2Zn}_{22}.^{H\delta}_{24}$	= 3.528	Dana's *Mineralogy*, Altenberg, 3.49
Iron sulphate, anhyd. $O_4.^{S}_{24}.^{Fe}_{21}$	= 3.142	Playfair and Joule, 3.18
" " crystals $O_4.^{S}_{24}.^{Fe}_{21}.^{7H\delta}_{24}$	= 1.915	Bulgari, 1.907; Filhol, 1.901
Manganese sulphate, anhyd..... $O_4.^{S}_{24}.^{Mn}_{21}$	= 3.121	(Bolsker, at 14°, 3.1).
Manganese sulphate, crystals..... $O_4.^{S}_{24}.^{Mn}_{21}.^{2H\delta}_{24}$	= 2.051	(Pape, 2.020).
Lime sulphate (*anhydrite*)..... $O_4.^{S}_{24}.^{Ca}_{21}$	= 2.941	(Fuchs, 2.92).
Lime sulphate (*gypsum*)..... $O_4.^{S}_{24}.^{Ca}_{21}.^{2H\delta}_{24}$	= 2.313	Mohs, 2.31; Kenngott, mean of 15, 2.317

Instances are not very abundant, however, like these, in which a *precise* comparison can be made between the corresponding saline molecules, with and without crystal-water, for two reasons—one being that the number of cases in which densities have been determined of salts in these two forms is comparatively trifling; but another and much more influential reason is, that in dehydrating a crystalline salt a temperature is used sufficiently high, *as a general thing*, to produce a definite (allotropic) change in the diameter of the electro positive molecule.

Cases like the following are exceedingly numerous:

Chromium triselphate, anhydrous..... $O_{12}.^{3S}_{21}.^{2Cr}_{27}$	= 2.747	(Favre and Valson, 2.743).
Chromium triselphate, crystals..... $O_{12}.^{3S}_{24}.^{2Cr}_{28}.15^{H\delta}_{24}$	= 1.868	(Favre and Valson, 1.867).

The two chromium-molecules each shrinking one diameter during the application of heat.

It will be seen, therefore, that the study of molecular volumes lets in a surprising light upon the nature and functions of water of crystallization. Even more remarkable are the explanations it gives us of the nature of so-called "constitutional" and "basic water."

The new developments, while justifying the ideas of those who have doubted that water exists any longer, as such, in combination with both acidic and basic oxides in the so-called "hydrates," give no support to the hydroxyl-hypothesis. In the classes of compounds referred to (which should no longer be called *hydrates*) the radical molecule H_2O (which the writer proposes to call *hydor*) is broken up into its elements, and while the oxygen retains, as an elemental molecule, its unchangeable volume, 5184, the hydrogen also enters into the new compound on the same footing as the other elements present, assuming a cubical volume, and such hydrogen is basylic and *metalloidal*, being susceptible of replacement by a basylic metal. The new system, it should be remarked, involves also the conclusion that metallic oxides no longer exist, as such, in their saline compounds—a view which has also been held, speculatively, by the older school of salt-radicalists. (See SALT-RADICALS.) It is found, however, that there are no such radicals in existence as were held by that school under the names of *oxysulphion*, SO_4, *oxyphosphion*, P_2O_6, etc.; nor is there found any proof of the existence of the radicals invented by the more recent salt-radicalists, called *sulphuryl*, SO_2, *phosphoryl*, PO, *nitrosyl*, *nitryl*, etc. Indeed, the disproof of the existence of all these is positive if the geometric law of condensation be admitted, as it must be from the overwhelming mass of facts explainable only by this law. Examples will now be given of the true molecular structure of those few of the miscalled "hydrates," both *basic* and *acidic*, whose densities are as yet known. Though but a very meagre number of the basic class is known, yet these few exhibit remarkable parallelisms. They seem divisible into three *types*, characterizable by the diameters of their metal-molecules, which latter, by the *law of crateis* (see VOLUMES, MOLECULAR), rule, in this case, the more electro-positive hydrogen-molecules:

TABLE II.—*Basic (so-called) "Hydrates."*

Type 1 (these are all native mineral species).

Diaspore: Dihydrogen dialuminum tetroxide. ... $O_4.(^{H\,H}_{14\,15}).2^{Al}_{17}$	= 3.299	Shepard, Trumbull, Conn., 3.29.
Gibbsite: Hexahydrogen dialuminum hexoxide. ... $O_6.6^{H}_{16}.2^{Al}_{17}$	= 2.397	B. Silliman, Richmond, 2.387. $^{Al}_{17}$ is the corundum molecule.
Brucite: Dihydrogen magnesium dioxide. ... $O_2.(^{H\,H}_{16\,17}).^{Mg}_{17}$	= 2.388	Hermann, 2.36; Beck, 2.376
Manganite: Dihydrogen dimanganese tetroxide. ... $O_4.2^{H}_{17}.2^{Mn}_{17}$	= 4.358	(Rammelsberg, 4.335).
Limonite: ... $O_9.6^{H}_{17}.4^{Fe}_{17}$	= 3.905	(Bergemann, 3.908).
Goethite: Dihydrogen di-iron tetroxide. ... $O_4.2^{H}_{18}.2^{Fe}_{17}$	= 4.215	(Yorke, fibrous, 4.19).

Type 2.

Caustic soda: Disodium dihydrogen dioxide. ... $O_2.2^{H}_{17}.(^{Na\,Na}_{20\,21})$	= 2.136	(Filhol, 2.13).
Limonite, mineral species: Trihydrogen iron trioxide ... $O_3.3^{H}_{17}.^{Fe}_{21}$	= 2.708	(Church, 2.69).
Dihydrogen zinc dioxide... $O_2.(^{H\,H}_{18\,19}).^{Zn}_{21}$	= 3.063	(Filhol, 3.059).
Dihydrogen strontium dioxide. ... $O_2.2^{H}_{19}.^{Sr}_{21}$	= 3.641	Filhol, 3.635.
Dihydrogen lead trioxide... $O_3.2^{H}_{20}.^{Pb}_{21}$	= 6.297	(Wernicke, 7.267).

Slaked lime: Dihydrogen calcium dioxide	$\ldots O_2 \cdot {}_{20}^{2H}\,{}_{21}^{Ca}$	= 2.077 (Filhol, 2.078).
Dihydrogen dimanganese trioxide	$\ldots O_3 \cdot {}_{20}^{2H}\,{}_{21}^{Mn}$	= 2.573 (Wernicke, 2.564).
Tetrahydrogen dinickel pentoxide	$\ldots O_5 \cdot {}_{20}^{2}\left(\begin{smallmatrix}H\,H\\20\,21\end{smallmatrix}\right) \cdot {}_{21}^{2Ni}$	= 2.761 (Wernicke, 2.744).
Dihydrogen diantimony pentoxide	$\ldots O_5 \cdot \left(\begin{smallmatrix}H\,H\\20\,21\end{smallmatrix}\right) \cdot {}_{21}^{2Sb}$	= 5.283 (Blum and Delffs, 5.28).
Tetrahydrogen dicobalt pentoxide	$\ldots O_5 \cdot {}_{21}^{4H} \cdot {}_{21}^{2Co}$	= 2.48 (Wernicke, 2.483).
Dihydrogen barium dioxide	$\ldots O_2 \cdot {}_{21}^{2H}\,{}_{21}^{Ba}$	= 4.482 (Filhol, 4.495).
Dihydrogen bismuth trioxide	$\ldots O_3 \cdot {}_{22}^{2H} \cdot {}_{21}^{Bi}$	= 5.639 (Wernicke, 5.571).

Type 3.—Only one compound is as yet known of this type, this being—

Caustic potash $O_2 \cdot \left(\begin{smallmatrix}H\,H\\19\,20\end{smallmatrix}\right) \cdot \left(\begin{smallmatrix}K\,K\\24\,25\end{smallmatrix}\right) = 2.048$ (Filhol, 2.044).

It will be observed that the metal-molecules of Type 2 are four diameters larger than those of Type 1, while in the only known member of Type 3, K is also four diameters larger than Na of Type 2. Indeed, as remarked under VOLUMES, MOLECULAR, this difference of 4 or $4n$ diameters between corresponding K and Na compounds is general, these two alkali-metals, in almost all their compounds with the same elements, falling into different volumic types, the K-compound usually one type above the Na-compound.

Acidic (so-called) "Hydrates."—Meagre as is the list of the hydrogenated oxides of basylic metals, of known densities, that of the like compounds of acidogenic elements is even still more fragmentary, the number being but about ten in all, so few that little can be done in the way of satisfactory generalization from them. They may, however, so far as they go, be assigned likewise to two *types*, and each of these arranged in the order of the diameters of the basic hydrogen. Of Type 1 none are known; *carbon* and *boron*, which, in *elemental* crystals, belong to this most condensed type, expanding in their saline compounds four diameters up to Type 2.

TABLE III.—*Examples of Acidic Structure.*
Acids of Type 2.

Dihydrogen oxalate	$\ldots O_4 \cdot {}_{16}^{2H} \cdot {}_{20}^{2C}$	= 2.003 (Husemann, at 9°, 2.0).
Hexahydrogen borate	$\ldots O_6 \cdot {}_{18}^{6H} \cdot {}_{20}^{2B}$	= 1.514 (Favre and Valson, at 20°, 1.493)
Dihydrogen uranate	$\ldots O_4 \cdot \left(\begin{smallmatrix}H\,H\\19\,20\end{smallmatrix}\right) \cdot {}_{20}^{2U}$	= 5.931 (Gmelin's *Handbuch*, 5.926)
Tetrahydrogen diselenite	$\ldots O_8 \cdot 2\left(\begin{smallmatrix}H\,H\\20\,21\end{smallmatrix}\right) \cdot {}_{20}^{2Se}$	= 3.16 (Topsoe, 3.123. This one a little doubtful.)
Dihydrogen nitrate	$\ldots O_6 \cdot \left(\begin{smallmatrix}H\,H\\25\,26\end{smallmatrix}\right) \cdot {}_{20}^{2N}$	= 1.569 (Watts's *Dictionary*, 1.56)

Acids of Type 3.

Orthophosphoric acid: Hexahydrogen phosphate	$\ldots O_6 \cdot {}_{17}^{6H} \cdot \left(\begin{smallmatrix}P\,P\\21\,25\end{smallmatrix}\right)$	= 1.9 (Schiff, 1.88; Thomsen, 1.884)
Hexahydrogen hypophosphite	$\ldots O_4 \cdot {}_{19}^{6H} \cdot \left(\begin{smallmatrix}P\,P\\21\,24\end{smallmatrix}\right)$	= 1.502 (Thomsen, at 18.8°, 1.493).
Hexahydrogen phosphite	$\ldots O_6 \cdot {}_{19}^{6H} \cdot \left(\begin{smallmatrix}P\,P\\23\,24\end{smallmatrix}\right)$	= 1.669 (Thomsen, at 21.2°, 1.651).
Dihydrogen iodate	$\ldots O_6 \cdot {}_{19}^{2H} \cdot {}_{24}^{2I}$	= 4.857 (Ditté, at 0°, 4.869).
Oil of vitriol: Tetrahydrogen disulphate	$\ldots O_8 \cdot 4{}_{21}^{H} \cdot {}_{24}^{2S}$	= 1.816 (Marignac, at 0°, 1.853).
Tetrahydrogen diselenate	$\ldots O_8 \cdot 2\left(\begin{smallmatrix}H\,H\\22\,23\end{smallmatrix}\right) \cdot {}_{24}^{2Se}$	= 2.527 (Mitscherlich, 2.524).

To Type 3 may be added hydrochloric acid, which, in liquefied form, is

Dihydrogen dichloride $\ldots {}_{24}^{2Cl}\left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) = 1.2785$ (Watts's *Dict.*, at 10°, 1.27).

These are very nearly or quite all the *inorganic* acids whose densities in pure state are even approximately known as yet. Of the *organic acids*, those which contain homologen—at least those based upon one or more molecules of elemental carbon—may probably be regarded as belonging, to that extent, to Type 2. The molecule of *succinic acid*, one of the homologues of oxalic acid, may be constructed from its known density. It is—

Dihydrogen succinate $\ldots O_4 \cdot \left(\begin{smallmatrix}H\,H\\15\,16\end{smallmatrix}\right) \cdot {}_{20}^{2C} \cdot {}_{25}^{2Hm} = 1.561$ (Richter, 1.55; Husemann, crystals, at 9°, 1.552)

This special succinic acid, it will be seen, varies in its hydrogen from the oxalic acid given above, belonging therefore to another series of isomers.

One series of organic acids, the *fatty acids*, is well known, and some of the lower members of the *dominant* series of isomers are constituted as follows:

Dihydrogenformate	$O_{1\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{Hm}$	= 1.2113 (Kopp, at 0°, 1.2227).
" acetate	$O_{1\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{3Hm}$	= 1.0819 (Kopp, at 0°, 1.08005).
" propionate	$O_{1\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{5Hm}$	= 1.0133 (Pierre and Puchot, at 0°, 1.0147)
" butyrate	$O_{1\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{6Hm} \cdot {}_{25}^{Hm}$	= .9815 (Pierre, at 0°, .98165; Kopp, " .9866)
" valerate	$O_{1\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{8Hm} \cdot {}_{25}^{Hm}$	= .9511 (Kopp, at 0°, .9555).
" caproate	$O_{4\cdot 20}^{C} \cdot \left(\begin{smallmatrix}H\,H\\21\,25\end{smallmatrix}\right) \cdot {}_{26}^{9Hm} \cdot {}_{25}^{2Hm}$	= .9411 (Lieben, .9338; Lieben and Rossi, .9419)

Four more members of the series of fatty acids have likewise been computed.

One more acid, of organic origin, may be added; this is—

Dihydrogen sulphovinate $\ldots O_8 \cdot 4{}_{21}^{H} \cdot {}_{24}^{2S} \cdot 2\left(\begin{smallmatrix}Hm\,Hm\\27\,28\end{smallmatrix}\right) = 1.33$ (Watts's *Dict.*, at 16°, 1.317)

It may be observed that this contains the same hydrogen-molecules as oil of vitriol, being really a direct compound of the latter with *dihomologen* (ethylene), as before suspected, but now for the first time proved.

Relations of Water with Sulphuric Oxide.—The purposes of this article will be well met by a volumic discussion of the series of compounds formed by the addition of successive equivalents of H_2O to anhydrous sulphuric trioxide, SO_3, which will illustrate most of the principles above set forth:

(1) $S_2O_6 : \left(O_3 \cdot {}_{29}^{S}\right)^2 = 2.003$ (Buff, at 25°, 1.90814; Morveau, at 13°, 1.9546; Computing, at 0°, 2.005)

This is doubling the usually-assumed number of atoms in the trioxide—a proceeding which is, however, otherwise called for. Thus, for example, this brings the compound into series with the other oxides of sulphur:

S_2O_2...Hyposulphurous oxide.
S_2O_3...Unknown.
S_2O_4...Sulphurous oxide. (See VOLUMES, MOLECULAR. *Liquid*, ltis $O_4 \cdot \left(\begin{smallmatrix}S\,S\\32\,33\end{smallmatrix}\right)$)
S_2O_5...Dithionic oxide.
S_2O_6...Sulphuric oxide.

(2) Adding one H_2O, we get fuming or Nordhausen sulphuric acid, which is—

$\left(O_3 \cdot {}_{29}^{S}\right) \cdot \left(O_4 \cdot {}_{24}^{S} \cdot 2{}_{21}^{H}\right) = 1.913$ (Watts's *Dictionary*, 1.9).

The molecular changes here are the collapse of one ${}_{29}^{S}$ to ${}_{24}^{S}$, and the expansion of H_2 (in water) to $2{}_{21}^{H}$, the general resultant being a contraction of volume from 97882 to 93022, about 5 per cent. The reaction is violently explosive, and the heat reaches incandescence.

(3) Adding $2H_2O$, we get oil of vitriol, which is $O_8 \cdot 4{}_{21}^{H} \cdot {}_{24}^{2S}$, as shown in Table III. above, among acids of Type 3. This, which again contains double the number of atoms usually supposed, is in accordance with several of the best-known sulphates of dyadic metals. Thus, Filhol's heaviest density-figure for *gypsum* requires the molecular formula—

$O_8 \cdot {}_{24}^{2S} \cdot 4{}_{24}^{H\delta} \cdot \left(\begin{smallmatrix}Ca\,Ca\\23\,22\end{smallmatrix}\right) = 2.337$ (Filhol, 2.331).

Cœlestine is—

$O_8 \cdot {}_{24}^{2S} \cdot \left(\begin{smallmatrix}Sr\,Sr\\23\,22\end{smallmatrix}\right) = 3.992$ (Beudant, 3.96; Sterry Hunt, 3.96; Kopp, 3.962; Breithaupt, 3.973)

The heaviest *heavy spar* is—

$O_8 \cdot {}_{24}^{2S} \cdot \left(\begin{smallmatrix}Ba\,Ba\\25\,26\end{smallmatrix}\right) = 4.554$ (G. Rose, 4.5271).

One *anglesite* is—

$O_8 \cdot {}_{24}^{2S} \cdot \left(\begin{smallmatrix}Pb\,Pb\\24\,23\end{smallmatrix}\right) = 6.309$ (Mohs, 6.298; Filhol, 6.3)

Silver-sulphate contains the *melted-silver molecule*, being—

$O_8 \cdot {}_{24}^{2S} \cdot \left(\begin{smallmatrix}Ag\,Ag\\23\,22\end{smallmatrix}\right) = 5.438$ (Filhol, 5.41; Schroder, 5.425)

The only *cadmium-sulphate* yet known is—

$O_8 \cdot {}_{24}^{2S} \cdot {}_{24}^{2H\delta} \cdot \left(\begin{smallmatrix}Cd\,Cd\\30\,31\end{smallmatrix}\right) = 2.949$ (Buignet, 2.939);

and so on; showing that the usual formulæ of all sulphates must be doubled, in correspondence with the above view of sulphate of hydrogen.

(4) The next compound which is found definitely determinable is the *crystallizable*, or "glacial sulphuric acid," obtained by adding $4H_2O$ to S_2O_6, or $2H_2O$ to oil of vitriol. Its density when crystallized appears unknown, but when liquid it is—

$O_8 \cdot 4{}_{21}^{H}\,{}_{22}^{H\delta}\,{}_{23}^{H\delta} \cdot {}_{24}^{2S} = 1.799$ (Watts's *Dictionary*, 1.78; Otto, at 15°, 1.782; Kolb, 1.781; Wackenroder, at 8°, 1.781)

Two points are here illustrated. One is the fulfilment of the *law of engymmetry* (see VOLUMES, MOLECULAR), the two added hydor-molecules falling in between the H and the S molecules, into *plesymmetry** therewith. Another is that the contraction from the hydor-molecules in liquid water (which is $4{}_{26}^{H\delta}\,{}_{27}^{H\delta}$) is *four diameters*. The condensation in the formation of this compound is 10.22 per cent. It seems probable that when the density of the glacial acid *in solid form* shall be determined, it may be found to correspond to $O_8 \cdot 4{}_{21}^{H} \cdot {}_{24}^{2S} \cdot {}_{21}^{2H\delta} = 1.669$, at 28° F.

(5) Adding $2H_2O$ more, or $6H_2O$ altogether, we get

$O_8 \cdot 4{}_{21}^{H}\,{}_{22}^{H\delta}\,{}_{23}^{H\delta} \cdot {}_{24}^{2S} \cdot {}_{24}^{2H\delta} \cdot {}_{25}^{2S} = 1.673$ (Kolb, 1.652; Otto, at 15°, 1.652)

The plesymmetry is here carried to another step. The condensation from oil of vitriol is about 8 per cent.

(6) $2H_2O$ more give us—

$O_8 \cdot 4{}_{21}^{H}\,{}_{22}^{H\delta}\,{}_{23}^{H\delta} \cdot {}_{24}^{2S} \cdot {}_{24}^{2H\delta} \cdot {}_{25}^{2S} \cdot {}_{26}^{2H\delta} = 1.556$ (Kolb, 1.543);

still another plesymmetrical addition to the compound molecule.

* *Plesymmetry*, from πλησίος, "next," συν, "with," and μέτρον, "measure."

(7) The next $2H_2O$ are found to assume $\frac{H\delta H\delta}{25 \cdot 26}$, giving us—

$$O_8.{}^{H}_{22}.{}^{H\delta}_{22}.{}^{H\delta}_{23}.{}^{H\delta}_{23}.{}^{O^8}_{24}.{}^{O^{H\delta}}_{25}.{}^{O^{H\delta}}_{26} \quad 1.488 \left\{ \begin{matrix} \text{Kolb, } 1.476 \\ \text{Otto, } 1.4761 \end{matrix} \right\}$$

(8) With another $2H_2O$—

$$O_8.{}^{H}_{21}.{}^{H\delta}_{22}.{}^{H\delta}_{23}.{}^{H\delta}_{23}.{}^{O^8}_{24}.{}^{O^{H\delta}}_{25}.{}^{O^{H\delta}}_{26} \quad 1.426 \text{ (Kolb, 1.407).}$$

(9) With another $2H_2O$—

$$O_8.{}^{H}_{21}.{}^{H\delta}_{22}.{}^{H\delta}_{23}.{}^{H\delta}_{23}.{}^{O^8}_{24}.{}^{O^{H\delta}}_{25}.{}^{O^{H\delta}}_{26} \quad 1.397 \text{ (Kolb, 1.386).}$$

Above this point, so far as computations have been carried—which is up to $50H_2O$ in all—the condensation is always to $\frac{H\delta}{26}$. As it is a known fact that up to $60H_2O$ heat is still evolved, no doubt it is not until about this latter degree of combination with hydor that the cratetic influence of this compound of sulphur and oxygen upon hydor-molecules ceases, and further intermixed water begins to retain its free volume of 18000, instead of condensing to 17576, that of $\frac{H\delta}{26}$.

Acidity, Basicity, and Salinity.—The range of new volumic facts above set forth puts in a clear light some things previously obscure regarding the relations of acids, bases, and salts. The well-understood fact that no distinct line can be drawn between acids and bases becomes theoretically far more intelligible. Acidity and basicity are only relative terms. All the so-called "hydrates" alike contain replaceable hydrogen. Thus, zinc dissolves in solutions of caustic soda, replacing and expelling its elemental or metalloidal hydrogen, exactly as it does in dilute sulphuric acid. In one case we have—

$$Zn_2 + O_2.H_2.Na_2 = O_2.Zn_2.Na_2 + H_2;$$

in the other case—

$$Zn_2 + O_8.H_4.S_2 = O_8.Zn_2.S_2 + H_4.$$

It may also be remarked that oxygen salts—and in one mode of derivation also haloid salts—are products of a species of *double decomposition* between two hydrogenated oxides; the radical or hydor-molecules, which were broken up in the formation of these hydrogenated oxides, being reconstructed again, simultaneously with the saline molecule. Thus, sulphuric acid and caustic soda react as follows:

$$O_8.H_4.S_2 + O_4.H_4.Na_4 = O_8.Na_4.S_2 + 4H_2O;$$

and the two so-called "basic hydrates" of sodium and zinc thus react:

$$O_2.H_2.Na_2 + O_2\ H_2.Zn = O_2.Zn.Na_2 + 2H_2O.$$

To take a somewhat less simple case of the latter kind, in the solution of *gibbsite* in caustic soda:

$$O_6.H_6.Al_2 + O_2.H_2.Na_2 = O_4.Na_2.Al_2 + 4H_2O.$$

Finally, taking a case of two "hydrates," generally both ranked as acidic, the *oxalates* and *uranates* of hydrogen, we have, in the formation of uranic oxalate, the following reaction:

$$O_4.H_2.C_2 + O_4.H_2.U_2 + H_2O = O_8.C_2.U_2.3H_2O.$$

As Ebelmen has given us the *density* of the resulting compound in this case, we may write this reaction in volumic notation:

$$O_4.2^{H}_{16}.2^{C}_{20} + O_4.\left(\begin{matrix} H & H \\ 19 & 20 \end{matrix}\right).2^{U}_{20} + H_2O = O_6.2^{C}_{20}.3^{H\delta}_{74}.2^{U}_{29} = 3.013$$

(Ebelmen, 2.98).

(The expansion of volume during this transformation being enormous—*20 per cent.* of the initial volume—it is interesting to inquire whether any peculiar phenomena were observed. Reference to Ebelmen's original paper shows that this salt was precipitated from boiling concentrated solutions, and appeared first as a *viscous magma*, which *gradually* changed into sulphur-yellow granular crystals. The *time* required for this transformation proves either absorption or loss of internal energy, quite in accordance with the great volumic change. The expansion of the uranicum molecule through nine diameters—from Type 2 to Type 4—will be better understood when it is stated that in both the carbonate and the nitrate uranicum appears also to be of Type 4. The nitrate is—

$$O_8.2^{N}_{20}.6^{H\delta}_{24}.\left(\begin{matrix} U & U \\ 26 & 27 \end{matrix}\right) = 2.837 \text{ (Böcker, at 13°, 2.807).}$$

The carbonate is known only as a double salt with ammonium, which appears to have the molecule

$$O_{11}.2^{C}_{20}.\left(\begin{matrix} Am & Am \\ 27 & 28 \end{matrix}\right).\left(\begin{matrix} U & U \\ 29 & 30 \end{matrix}\right) = 2.804 \text{ (Husemann, 2.773);}$$

bringing it into serial relation with the oxalate above.)

(There is still another mode of combination of water (or the radical hydor) occurring in large classes of chemical compounds, differing, in typical character at least, from those of crystal-water, which will be found explained under the head of Woon-Spirit.) HENRY WURTZ.

Wa'ter-Ouzel, a name given to birds of the genus *Cinclus*, family Cinclidæ, formerly classed as Turdidæ or thrushes, and often called dippers. The European water-ouzel is *C. aquaticus* (or *Hydrobates cinclus*). North America affords a species, *C. mexicanus*, found chiefly in the Rocky Mountains. These remarkable little birds are excellent divers, and feed at the bottom of streams. It is commonly said that they have the power of walking upon the bottom of streams under water, but some good observers state that they do not in fact walk, but swim under water.

Water Plants. See AQUATIC PLANTS.

Wa'ter-Power. The term water power implies not only the existence of certain topographical features by which a continuous supply of water falling from one level to another is obtained, but also the employment of motors known as *water-wheels* and *water engines*, through the medium of which the energy of the falling water is transformed into useful work.

Water-privileges, as they are commonly called, exist on nearly all streams of any considerable magnitude, and in settled countries, where they have become developed or utilized by the construction of dams or otherwise, they are regarded as a kind of property having special value, depending on the quantity of water available and the height of fall. The quantity of water which flows yearly through a stream at a given point depends on the drainage-area of the stream above that point and the yearly rainfall over this area. Inasmuch as the rainfall is seldom the same in any two years, and is never distributed through the year in the same proportions in any two years, the quantity of flow of all streams varies not only in different days, weeks, and months of the same year, but also varies greatly in different years. Two methods of ascertaining approximately the average flow of a stream in different months may be followed. One is to determine its drainage-area from accurate maps or surveys, and then from recorded observations of the rainfall of the region to estimate the quantity of water which reaches the stream daily during each month. It will be found generally that the total amount which flows away from a watershed is 50 to 70 per cent. of the rainfall for the year, while the minimum *daily flow* for a month is many times less than the *average*, and the maximum many times greater. The least minimum, or minimum for one day, and the greatest maximum, are separated widely apart in quantity. Another, and perhaps the most usual, method of determining the flow of streams is by gauging. This ought to be done in such a way that the probable maximum and minimum flow for each week or month may be ascertained, and also the mean daily flow for the year. In either case it is usually found, especially in small streams, that on account of these variations of flow a storage-reservoir is necessary for water-powers, and a certain proportion between the capacity of such a reservoir and the number of square miles in the watershed is necessary if the full average daily flow for the year is to be secured. This proportion is seldom realized, on account of the expense attending the establishment of reservoirs; and the consequence is, that a vast majority of the improved water-powers of a country are subject to great fluctuations of supply. In wet seasons a large quantity of water runs to waste over the dams, and in dry seasons the supply is deficient, often requiring the stopping of mill machinery.

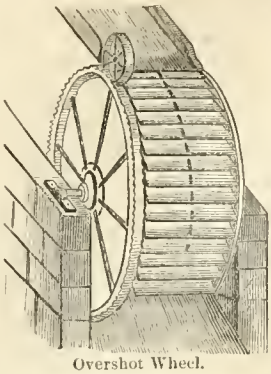
The quantity of power which any *privilege* will furnish depends not only on the quantity of water, but also directly on the available fall. When the available head and the quantity of water which flows are determined, the total *theoretical* energy of the water for a given time is found by multiplying the quantity of water in pounds which flows during this time by the available fall. This will give the energy expended in foot-pounds. If the time be 1 minute, and the number thus obtained be divided by 33,000, the theoretical horse-power of the waterfall will be given. Since no motor will realize a perfect efficiency, however, the actual horse-power is less than the theoretical. If we suppose the motor to utilize 75 per cent. of the available energy, the horse-power will be found by dividing the product of the height and weight of water which flows in 1 minute (in feet and pounds) by 11,000. It is very difficult, however, to estimate the horse-power of a water-privilege with exactness, as it must vary with the varying flow of water; nothing, in fact, being fixed but the fall. An approximate mean value only can be assumed.

The motors employed in connection with water-powers are known as water-wheels and water-engines; the latter being used, however, only for small powers and to a limited extent. Water-wheels are classed as over-shot wheels, breast wheels, undershot wheels, and turbines, the latter forming a distinct class of modern development, which has superseded to a great extent the other classes. The figures on the next page represent respectively the first three classes of water-wheels in their most perfect development.

The overshot wheel, though fast disappearing from use, has been one of the most valuable, as well as the most efficient, of water-wheels. It is applicable to all falls, from 12 to 60 feet. Its disadvantages are its large size where large power is developed; it must be protected or

housed in winter to prevent ice forming in the buckets; and the slow motion of the wheel and its great weight involve increased friction. It must be constructed generally on the spot where it is to be used.

Fig. 1.

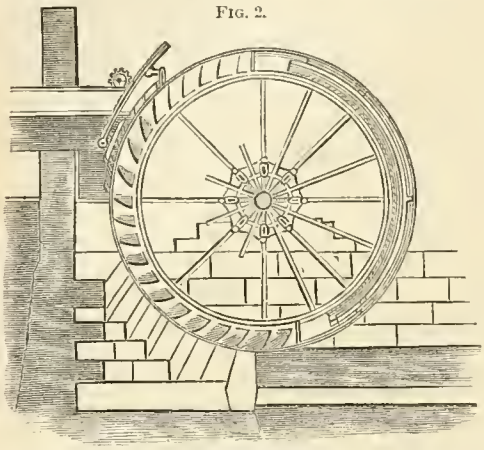


Overshot Wheel.

The breast wheel has advantages over the overshot wheel, especially for low falls, although many of the disadvantages hold true with respect to it, in its general features, that are found in the overshot wheel. The breast wheel is perhaps better adapted to varying streams, and is applicable to low falls, to which it would be impracticable to apply the overshot wheel.

Undershot wheels are adaptable to situations and circumstances where the mere force of a running current is to be made effective, and until they were improved by

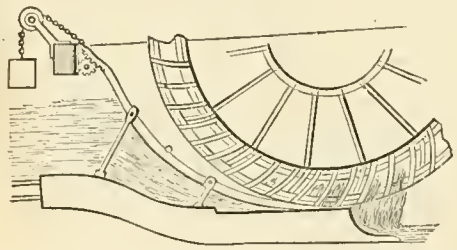
Fig. 2.



High Breast-Wheel.

Poncelet they were the most inefficient of all wheels. Poncelet introduced the curved buckets, by which a reactionary force is exerted on the wheel as well as an impulse, the

Fig. 3.



Poncelet's Undershot Wheel.

water entering the buckets without shock, and falling out with little horizontal velocity.

The efficiencies of these wheels, when constructed properly and under the most favorable conditions, are for the overshot wheel 7 to 8 per cent., for the breast wheel 7 per cent., and for the undershot wheel 6 per cent.

The *turbine* wheel is an old form of water-wheel, but its modern usefulness has been developed since Fourneyron invented the famous wheel which is still the type of one class of turbines. The distinguishing characteristic of all turbines is that the water before reaching the wheel proper is forced by the form of the casing or by fixed guiding channels into a whirling or vortex motion. Issuing from these fixed channels in nearly a tangential direction, it strikes the buckets or floats of the wheel, which revolve in the same direction, but which are curved backward with respect to the motion, so that if the *wheel* were also fixed as well as the guiding channels, the water would return on itself in direction, and would issue from the wheel in nearly a tangential direction, but with an opposite whirling motion from that which is given to it by the guide-blades. Owing to the rapid motion of the wheel, however, the water really leaves it in a direction perpendicular to the direction of its motion as it leaves the guide-blades. Nearly the whole of its living force having been imparted to the wheel, the water falls into the wheel-pit with little velocity, and is carried away by the tail-race. The water thus acts upon the wheel both by impulse and reaction. (For a description of turbine wheels see TURBINE.)

The great water-powers of Holyoke, Lowell, Lawrence, Manchester, and Birmingham in this country may be referred to as illustrative on a grand scale of the value of improved water-powers, while the mills scattered throughout nearly every populous district of civilized communities furnish examples on smaller scales everywhere. And yet the unoccupied and unimproved sites for valuable water-powers which still remain show that, compared with what may still be accomplished, a beginning only has been made in such improvements. W. P. TROWBRIDGE.

Waterproof Garments. See WATERPROOFING.

Wa'terproofing, the art of rendering textile fabrics, paper, and other substances impervious to water. This result is usually obtained either by applying an insoluble coating upon the surface, or by causing the formation of a compound that exerts a repellent action toward water in the pores of the article, often by means of double decomposition. The application of oil to leather and cloth, and of tar to tarpaulins, are familiar examples of waterproofing. One of the most important branches of this art is the application of India-rubber in the preparation of "mackintoshes" and other waterproof wearing apparel, in the manufacture of which a thick solution is made by treating the caoutchouc with spirits of turpentine, coal-tar, benzole, bisulphide of carbon, etc., which is spread out upon the fabric, and the whole passed between rollers, the coating and pressing being repeated until a layer of proper thickness and uniformity is obtained. (See INDIA-RUBBER, by PROF. C. F. CHANDLER.) In double waterproof fabrics two pieces of the cloth that has been treated in this manner are cemented together by passing them face to face between wooden rollers. A mixture of the flock of silk, cotton, or wool with liquefied caoutchouc is also applied to cloth that has previously been saturated with an ordinary waterproofing solution. In Sievier's process (patented 1835) a solution of India-rubber is first spread over the cloth, which is next treated with the same solution mixed with acetate of lead, litharge, sulphate of zinc, and gum-mastic. Nap is then fixed on the fabric by placing wool upon it and passing it between rollers. Another varnish for waterproofing goods is made by dissolving ¼ pound of India-rubber in ½ pound of oil of turpentine, and adding 6 pounds of boiled linseed oil and 1 pound of litharge. The disagreeable smell often adhering to fabrics treated by the preceding processes is removed by exposing them to the fumes of aromatic essences, such as lavender, verbena-root, etc. Potter's patent process (1835) for rendering cloth impervious to water consists in applying a solution of gelatine, alum, and soap on the wrong side of the fabric by means of a brush, and afterward washing and drying it. A similar but more recent method is to dissolve gelatine, castor-oil soap, and gum-lac in water, to add alum, and to apply the solution thus obtained. In Townsend's process two solutions are made by dissolving 20 pounds of British gum in 8 gallons of water, and 10 pounds of white soap in 8 gallons of boiling water; the solutions are next mixed; 1 pint of logwood-liquor is added, and the mixture boiled; 3 pounds of alum, dissolved in 1 gallon of water, are now added, and after being again boiled the preparation is applied to the cloth. The same inventor prepares waterproof fabrics by successively immersing them in a solution of 6 pounds of sulphate of zinc in 9 gallons of boiling water, then in the preceding mixture of gum and soap. Woollen and other goods are also rendered waterproof by first saturating them with a solution of soap, then with a solution of alum, or by successive immersions in solutions of gelatine and galls (tannic acid), whereby the same compound that is formed in the tanning of leather is produced. Ballard's process for waterproof clothing consists in simply impregnating the cloth with a mixture of solutions of acetate of lead and sulphate of alumina. In a similar process 2½ pounds of alum and sugar of lead are separately dissolved in 10 gallons of water, and the solutions mixed; the fabric is then immersed in the liquid, washed, and dried; for tweed cloaks one-half of this quantity of sugar of lead is sufficient, and the cloth is immersed separately in each solution. In another method, 8 pounds of oleic acid is dissolved in 6 quarts of alcohol, and 20 pounds of sulphate of alumina gradually added. The mixture is allowed to settle for twenty-four hours, and the supernatant liquid decanted; the sediment is then pressed into cakes, dried, and ground to a powder. When used for waterproofing silk or linen goods, 1¼ pounds of the powder is dissolved in 20 gallons of water, and the cloth dipped in the solution; for woollen goods, 1 pound of the

powder, dissolved in 20 gallons of water, is employed. Linen, canvas, etc., can also be made impervious to water by first dissolving 1 part of alum cake in 10 parts of water, then boiling 1 part of resin and 1 part of soda-crystals with 10 parts of water, separating the soap formed by adding ½ part of chloride of sodium, mixing it with an equal quantity of palm-oil soap, and dissolving the mixture in 30 parts of water; the fabric is immersed successively in the alum and soap solutions, and, after being rinsed in pure water, is dried. Berlin waterproof cloth is said to be prepared by saturating the fabric in a solution of sulphates of alumina and copper, and then dipping it successively in solutions of water-glass and resin soap. Cooley's process consists in rubbing the wrong side of the fabric with white wax until it acquires a slightly gray or white appearance. In France waterproof belting is made by first preparing a homogeneous paste of India rubber 106 parts, sifted saw-dust 175 parts, powdered sulphur 10 parts, slaked lime 25 parts, sulphate of alumina 125 parts, sulphate of iron 125 parts, and hemp tow 10 parts. This mixture is dried, and then dissolved in 4½ parts of spirits of turpentine or benzine, and the solution applied to the fabric, which, when dry, is passed between rollers, and is finally exposed for some time to the heat of a steam-bath. A metallic soap, adapted to the waterproofing of tents, etc., is made by dissolving ordinary soft soap in water, and adding a solution of sulphate of iron; the iron soap formed is washed, dried, and mixed with linseed oil. The qualities of this mixture are improved by the addition of India-rubber. Most of the above methods accomplish the waterproofing without destroying perviousness to air. Gloves, hats, umbrellas, etc., can be rendered impervious to water by coating them with a solution of 1 part of paraffine in 10 to 15 parts of naphtha or benzine. A process for protecting the fleece of live sheep from the action of water consists in first impregnating the fleece with a solution of alum, then treating it with a solution of soft soap; after this treatment the wool is said to remain perfectly dry, and to be improved for manufacturing purposes. Paper is rendered impervious to grease and water by immersing it, when unsized, in a solution of shellac in borax. The product obtained in this manner somewhat resembles parchment paper. The Japanese are said to prepare waterproof paper for the manufacture of umbrellas by treating it separately with solutions of bichromate of potassa and glue, the gelatine being thus rendered insoluble. The following preparations are employed in the waterproofing of leather, the ingredients being usually melted together and applied hot: Boiled linseed oil, mutton suet, beeswax, and resin; linseed oil, resin, white vitriol, saw-dust, and spirits of turpentine; beeswax, burgundy pitch, linseed oil, and turpentine; tallow, copaiba balsam, and naphtha; caoutchouc boiled with linseed or neat's-foot oil. According to Hager, a preparation made by dissolving 1 part of India-rubber in 5 parts of petroleum, and adding 20 parts of paraffine, 5 parts of oil, and 5 parts of tallow to the solution, also furnishes a good waterproof dressing for leather. J. P. BATTERSHALL.

Water-Ram. See HYDRAULIC RAM, by J. P. FRIZELL.

Wa'ter-Rat, or **Beaver-Rat,** the common name of the *Hydramys chrysogaster* of Tasmania, an animal resembling the muskrat in many particulars, and deriving its scientific name from the golden-yellow color of its belly, while the back is of a dark rich brown. It is an expert swimmer, frequents both salt and fresh water, is nocturnal in habit, and when eating supports itself upon the hind legs and tail.

Water-Rice. See RICE, INDIAN.

Wa'tershed. This word, like the science of physical geography, to which it belongs, is of German origin, and has been recently borrowed from the compound *Wasserscheide*, "division of the waters," though it might legitimately have been formed from the English elements, "water" and "shed," which originally meant to "divide." In fact, some geographers still use "divide" instead of "watershed." The latter word is preferable, because it is more specific, while at the same time it is quite as truly English as "divide," which we owe to a Latin source. The Romans employed *divergium* and *divortium* (generally in the plural) *aquarum*. Innocentius, an engineer of the time of Constantine, introduced *aquivergium*, and *aquiversium* is found in some mediæval authors. According to Marca (Marc. *Hisp.*, p. 61), *aiguches*, derived from one of these words, was used in the Limousin dialect, and the same writer gives *eauversant* as the proper French equivalent of *aquivergium*. *Eauversant*, if ever known, is now obsolete, and this great feature of geographical surface wanted a specific designation in scientific nomenclature until the recognition of the importance of flowing water as a formative geological agent led to the introduction of *Wasserscheide* and *watershed* into German and English, and of their equivalents *acquapendu*, *displuvio*, and *spartiacqua* or *spartiacque* into Italian. *Versant* is used in French for watershed, but is wanting in precision.

A watershed is a boundary of a hydrographical basin, or an imaginary line which runs along the ridge of separation between adjacent seas, lakes or river-valleys, and represents the limit from which the water of precipitation naturally flows in opposite directions into different basins. The watershed in perhaps most instances follows the line of highest elevation between the waters of whose basins it forms the drainage-limit, but to this rule the exceptions are numerous. The flow of water is determined at every point by the configuration and character of the ground *below*, not *above*, its own level, and it follows a descending surface wherever it finds it. The contour of a peak or a ridge higher than any other part of the chain to which it belongs may be such as to carry the drainage of its western slope, for example, around its flanks or its base to a point of discharge on its eastern side; the precipitation on the northern slope of a mountain-chain may be carried off to the S. by a transverse valley, as in S. E. Transylvania, where a territory of several thousand square miles, including the entire N. scarf of the Eastern Carpathians, is drained into the Danube by the Olto through the Rothenthurm Pass, which cleaves the Carpathians to their base; the rocky strata of a mountain whose external slope is to the S. may be inclined in the opposite direction, and may be so permeable by water as to absorb the rains of summer and conduct them by hidden interstratal channels to an outlet on the northern side; while the same surface in a frozen condition may send off to the S. the rains and melting snows of the winter season. The precipitation on extensive districts, too, is sometimes almost wholly received by caverns or porous and bibulous strata, which discharge into basins not superficially connected with those in which the waters have fallen. Thus, much of the Austrian province of Carniola is drained by cave-rivers which pass beneath the coast-range of mountains and empty into the Adriatic. In like manner the upper valleys of tributaries of the Tiber and the Garigliano send the excess of their rainfall into the Pontine Marshes by hidden channels passing under the Lepini chain, and feed springs which in wet weather gush in great volume from the S. W. flank of those mountains and swell the annual delivery of the Badino, the general emissary of the marshes, to 50 per cent. above the total precipitation in its geographical basin. Important systems of rivers not unfrequently originate in great plateaus lying far from any very lofty mountains, as in North America and in Africa, and the flow of such rivers may be so variable from inundations and other irregularly acting influences that a permanent and well-defined watershed can hardly be said to exist within their precincts. Especially is this the case in the marshes which often form in *clusas* or transverse mountain-valleys, where earth-slides, the deposits brought down by torrents, ice, beaver-dams, the growth of aquatic vegetation, or other local causes, may obstruct a watercourse, reverse its flow, and consequently displace a watershed. Like effects are sometimes produced by human action, as in the case of Barton Pond, of the Val di Chiana, and partially, but most signally, in the construction of the great Illinois Canal, which now serves as a new emissary for a portion of the waters of Lake Michigan. Indeed, almost all canals and aqueducts involve more or less derangement of natural watersheds. The hydraulic operations now going on at the Lake of Bienne in Switzerland have resulted in curious discoveries respecting ancient artificial interference with the discharge *régime* of that basin. The Romans had lowered the level of the lake by drawing off a portion of its waters into the river Aar by means of a tunnel half a mile long through the ridge on the eastern side which separated it from the valley of that river. This tunnel had been choked up and forgotten. The engineers of the present day have reversed the process, and by a deep cut, accidentally almost exactly coinciding with the line of the tunnel, turned the Aar into the lake, at the same time lowering the outlet of the latter, so as to depress the surface to the desired level, and recover much valuable land from the beds of the river and the lake.

The question whether a lake can have more than one natural outlet, which has been much discussed of late, is connected with this subject. Cases of this sort are certainly not frequent, and where they occur must generally be due to temporary causes, but the bifurcation of great rivers, and even their division at the heads of their deltas, which may often be regarded as substantially permanent in character, are analogous phenomena, as is also the dividing of glaciers, or rivers in congelation, several branches of which often issue from a single great snow-field through different valleys, and of course have separate

discharges. The Gries glacier, which fills and overtops a depression along the Gries *col*, sends streams, even without a division of its ice-current, to the Rhone on one side, and through Lago Maggiore to the Po on the other.

GEORGE P. MARSH.

Watershed of the Gulf of Mexico. This includes the entire portion of North America that slopes toward the basin at its foot and discharges its waters into the Gulf. Its boundary is convex from the Florida capes to the Isthmus of Yucatan, except the indentation made by the delta of the Mississippi. The Gulf is bounded N. by the U. S., lat. 30° 30′ N. being its most northerly extreme; E. by the Florida peninsula and straits and Cape Sable to Cardenas in Cuba, lon. 81° 20′ W.; S. by the Isle of Cuba to Cape San Antonio and the Caribbean Sea to Cape Catoche in lat. 21° 35′; thence it is bounded by the state of Mexico to the Rio Grande. Its most southerly point is 17° 32′ N., and its most westerly extreme is 97° 50′ W. The length of the basin is 1000 miles; its breadth from the mouth of the Mississippi to Cape Catoche is 535 miles, and from Matagorda or Corpus Christi to Tabasco is 750 miles. The total area covered by the Gulf is 590,000 sq. m., and, including all its bays, it may be reckoned at 600,000 sq. m. Into this basin there is poured the drainage of an area of 2,000,348 sq. m., computed, according to the most recent surveys, as follows:

The valley of the Mississippi	=	1,317,690 sq. m.
East of the same	=	139,999 "
West Louisiana and Texas	=	232,458 "
In the states of Mexico and Guatemala	=	310,200 "
		2,000,348 sq. m.

The valley of the Mississippi River occupies two-thirds of the watershed of the basin, lying almost wholly within the territory of the U. S. Indeed, the states of Mexico and Guatemala embrace only 310,200 miles, or about $\frac{1}{6}$th of the watershed, and a very small portion near the northern sweep of the Missouri River, where the Milk River touches the British possessions, lies beyond the dominion of the U. S. The delineated boundaries may be given as follows: Commencing at Cape Sable, the most southerly point of Florida, and passing through the Everglades to the E. of Lake Okechobee, and thence by nearly a right line, N. 20 W., for a distance of 540 miles, through Florida to Atlanta in the State of Georgia; and thence by a line, with a few deviations, bearing N. 47 E. 342 miles, along the divide between Tennessee and North Carolina, to Newbern in Virginia; and thence, with a very slight deviation to the westward, it follows the mountain-summit and boundary between Virginia and West Virginia, to Frostburg on the Maryland and Pennsylvania lines; and onward 240 miles to Gallatin near Altoona on the Pennsylvania Central R. R.; and thence, with a very zigzag line, it runs between the heads of the Alleghany and the Genesee and Cattaraugus till it touches within 10 miles of Lake Erie at Dunkirk; and thence to Erie in the N. W. angle of Pennsylvania; thence its trend is S. 70 W. 240 miles to Marion in Ohio, heading the Cuyahoga and Sandusky on the N. and the Muskingum and Scioto on the S.; thence the boundary trends W. about 70 miles to New Bremen and Fryburg in Ohio; thence, with a deflection to the N., to head the Wabash and Maumee; the course of the divide is N. 50 W. 150 miles to Carlisle, on the N. boundary of Indiana; thence nearly W., inclining S., the boundary nearly touches the S. end of Lake Michigan, heading off the two Chicago rivers, and hugs the shore of Lake Michigan up to Kenosha: thence with a northern bend, N. 21 W. 90 miles N. of Lake Horicon, and S. of Fond du Lac, in Wisconsin; thence W. 48 miles to Packwatree, in Marquette co., touching the waters of the Wisconsin River: thence N. 10 E. and then 10 W. 165 miles, with slight deviations, to the northern boundary of Wisconsin at Deer Lake: thence, with a bearing about 30 miles from and parallel to Lake Superior, N. 87 W. 138 miles to Elkton, S. W. of the S. W. extreme of the lake at Duluth; thence N. 17 W. 98 miles, between the St. Louis River, passing into Lake Superior, and the Mississippi, running S., and the Little Fork of Rainy River, emptying northward into the Lake of the Woods. This touches the most northerly waters of the Mississippi at Lake Pemidji; and thence, turning abruptly S. 75 W., its trend continues 100 miles to Red Lake and Wild Rice River, that run into the Red River of the North; thence, with a course S. 30 W. and deflections of 20 miles to W. and E., the watershed boundary continues 180 miles to the divide or portage between Lake Traverse and Big Stone Lake. This point is the head alike of the Red River of the North and the Minnesota, running S. into the Mississippi.

Here we find traces unmistakable of another state of relative level about the waters of the divide. These show that an enormous stream once swept through this gorge and emptied its waters through the Minnesota Valley. At an elevation of 40 to 60 feet from the present level of these small lakes and the marshes between them there are water-marshes on the cliffs of drifting currents running southward, worn into the rocks that rise 130 to 150 feet on either side of the lakes. These indicate a lifting up of the entire region, and the disruption of the barriers that made a lake of all the region N., W., and E. of them, and the discharge of the waters through the Mississippi River, perhaps at the expense of the Niagara and St. Lawrence. Lake Winnipeg and its attributes in the region round its basin were then an extensive fresh-water sea, now laid bare by the modern level and present geological dispositions. (See Gen. G. K. Warren's essay and report to the war department, 1874.) That the lake-region is tributary to the Gulf of Mexico is evident over all the extent of the lake-front down to Dunkirk on Lake Erie; in the proximity of the watershed boundary to the lakes and the lowness of the barrier.

To resume: Starting from the S. end of Lake Traverse, at an elevation of about 1000 feet above the sea, and with a bearing N. 54 W., it reaches the head of the Shyenne River at Fort Totten, about 180 miles. Fort Totten is on the Minni-wan-ke Lake, 5 miles N. of the Shyenne, which empties into the Red River. The watershed keeps S. of it, and runs thence W. 90 miles, and thence N. 47 W., 72 W., to the northern boundary of the U. S. near the source of the Mouse River, a tributary of Assiniboine—and White Earth and Muddy, running into the Missouri; thence from the Dakota line, keeping along the parallel of 49° for a distance of 210 miles, to where it deflects N. for 25 miles, to head the Milk River, a tributary of the Missouri; and it returns again at 170 miles farther on, where lat. 49° reaches the summit of the Rocky Mountains, 8574 feet above the sea. Its most northerly point is in lon. 112° W., and the most westerly point is in lon. 113° 50′. Here we bound the northernmost drainage of the watershed and the extreme western spring of the great valley of the Mississippi River. Thence the trend of the boundary is southward along the summit of the mountain, with a general course S. 20 E. 356 miles, taking in three great deflections—one W., the other E., and the third W., and a circuit of 200 miles to include the Wisdom River sources and the sources of Jefferson River, to Henry's Lake at the head of Red Rock fork of Jefferson River; thence, with a détour to the E., S., and N., to include Madison, the head of the Missouri, and exclude the Shoshone Lake, and include the great part of the National Park and the Yellowstone Lake. The boundary starts S. 40 E., and continues down the Wind River Range 370 miles to Long's Peak, 14,056 feet in elevation. This sweep heads the Yellowstone and Wind River and the waters of the Platte, running into the Missouri, into Mississippi River, into the Gulf, and the Snake River, running into the Columbia and the Pacific, and the Green River into the Colorado, drifting to the Gulf of California. Thence the course of the divide turns S. 12 W. 175 miles to Fort Plummer, on the S. border of Colorado. At the San Luis Park, on this line, 60 miles inside of the State of Colorado, the divergence takes place from the Mississippi Valley to the divide between the waters of the Colorado of the West and the Rio Grande. The San Luis is the name of the stream which heads the Rio Grande. The Arkansas departs from the same park and runs E., and the three rivers thence depart in widely different destinations. From Fort Plummer the boundary runs S. 35 W. through New Mexico, 145 miles to Fort Winnebago, in the Zuni Mountains; thence 16 E. to the Mimbres Mountains, and S. with the Mimbres to the southern line of New Mexico, to the San Florida Mountains. This point is 66 miles W. of El Paso, in lat. 31° 48′ N., T. 29–30, R. III. W.; thence the boundary leaves the United States S. 25 E. 348 miles through the arid regions of Chihuahua; thence S. 58 E. 210 miles through the deserts of Coahuila; thence S. 78 miles through Lac del Muerto and to Lake Parras; thence E., still in Coahuila, along parallel 25° N. to the line of Nuevo Leon—thus far, at least, the country is chiefly a desert from Middle New Mexico; thence S. 200 miles through Zacatecas, and, with a S. E. trend, 75 miles along the line between San Luis Potosi and Guanajuato; thence S. 12 W. 160 miles through the central portions of Mexico; thence E. 85 miles, still in the State of Mexico; thence S. 165 miles through Puebla into the centre of Oaxaca; thence S. 87 E. 240 miles to the boundary between Oaxaca and Chiapas; thence S. 45 E. 250 miles to the centre of Guatemala, and only 25 miles from the Pacific Ocean, and thence N. 24 E. through Guatemala, Campeachy, and Yucatan, 265 miles, to Cape Catoche on the Yucatan Channel or straits. The Gulf is bounded by running the line to Cape San Antonio, on the W. of Cuba, and with the watershed of that island to Cardenas, and thence across the Florida Straits to Cape Sable, the point of departure. These are the boundaries of the watershed of the Gulf of Mexico.

The *meteorology* and *physical features* of the watershed

are varied through all the extremes in this long boundary and this extensive area. Commencing at the Gulf itself, the precipitation of rain (in the absence of observations), varying with the latitude, must be taken as indicated by the observations upon the neighboring shores. We shall therefore assume the rainfall upon the Florida peninsula and the circuit of the Gulf—at Punta Rassa, 44.45 inches; at Jacksonville, 56.59; at Mobile, 51.50; at New Orleans, 68; at Galveston, 51.19; at Indianola, 45.32 inches—as the index to the rainfall upon the Gulf in their vicinity in 1873. Assuming this as a fair mean, we have 54 inches or 4.5 feet for the rainfall upon the Gulf. This reaches the vast sum of 75,270,680,000,000 cubic feet. Unlike the rainfall upon the land, no part of this contribution is absorbed, but it is re evaporated perhaps more than once before the winds bear it to the shore. This total is nearly equal to the entire amount discharged upon the Mississippi Valley, according to Humphreys and Abbot, though the area it falls on is less than one-half of that valley. And now let us examine into the causes of this deficit and the difference between the rainfall on different portions of the watershed. Attributing to the latitude and temperature all due influence, there is still an unexplained cause for the difference of precipitation on the land to the westward and northward of the Gulf of Mexico. If we draw a line from the western fundus of the Gulf across the watershed to the Red River of the north, about lon. 97° W., and take 50 miles of territory on either side of said line, we shall describe an area that bounds two distinct climates. That on the E. we shall denominate the *humid* or *fertile climate*, and that on the W. the *dry climate*. "The animals typical of their clime do not cross the boundary to reside E. of it. The mule-eared rabbit, the civet-cat, the Mexican hog among quadrupeds; the Mexican buzzard, the scissor-tail flycatcher, the prairie-hawk among birds; the cutting ant, the devouring grasshopper among insects; the spreading adder, the joint snake, the coachwhip snake, the tarantula, and the scorpion among reptiles,—these reside on the W. side of the line; while the trees are all of stunted growth except those growing upon the streams; the mesquite and cactus and the agave or American aloes grow in abundance." (Forshey's *Climate of Texas*, in the *Texas Almanac* for 1860.) The W. of this line is characterized by droughts and the necessity of irrigation to agriculture. In many districts farther W. the want of rain makes a positive desert; and this characteristic marks most of the watershed on the western border, through the U. S. and through the Mexican dominions down to Nuevo Leon in lat. 25°. The climate E. of the dry line is characterized by an abundance of rain and corresponding growth of vegetation. The forest trees are indicative of the exuberance of other growths—tall and of gigantic proportions. The Gulf is undoubtedly the grand reservoir and the S. wind the Aquarius for the watering of all North America to the N. and E. of the Gulf. The climates, dry and humid, are fixed by these dispositions. The rainfall is the result of the supply from the reservoir, and the supply depends on the reservoir and the transporting winds.

Table showing the Climates of North America and the Line of Demarcation along lon. 97°.

	Places.	Lon.	Lat.	Rain, inches.
		° ′	° ′	
Lat. 30±.	Savannah	81 08	32 02	63.14
	New Orleans	90 07	30 00	68.00
	Galveston	94 50	29 18	54.50
	Indianola	96 38	28 32	45.32
	Corpus Christi	97 27	27 47	30.82
	Fort McKavitt	100 00	30 50	23.27
Lat. 35±.	Huntsville	87 00	35 00	51.00
	Memphis	90 07	35 07	49.39
	Fort Smith	94 29	35 23	42.10
	Fort Arbuckle	97 09	34 27	38.57
	Santa Fé	106 10	35 41	19.83
Lat. 40±.	Morgantown	79 52	39 36	47.04
	Indianapolis	86 06	39 47	46.26
	Jefferson Barracks	90 15	38 28	41.95
	Fort Laramie	104 47	42 12	19.98
Lat. 45±.	Milwaukee	87 00	43 03	32.00
	Fort Ripley	93 00	45 00	27.00
	Fort Gaines	94 00	46 19	29.00
	Pembina	97 00	49 00	12.39
	Fort Benton	110 00	47 00	9.88

The basin of the Gulf charges the reciprocal of the trade winds, and sends them N. and E. to water all the earth. They obey a law which inclines them in the direction indicated, without mountain or other vicissitude obvious to man; and they sweep the entire Gulf front and the larger portion of the valley of the Mississippi, and spread in width to 1650 miles before they reach the northern limit of the watershed. They yield their burden of water and produce a fertility that will always sustain a dense population. No country is blessed with a more exuberant soil, or a more extended area of well watered territory.

The dry region, supposing it limited by 25° N. lat., contains an area of 933,000 sq. m.; and while this area too is watered by the Gulf, its supply is so limited, away from the immediate coast, as to show in its vegetation less and less of moisture to the farther summits of the mountains and to the positive arid deserts. The humidity was obtained in the region observed by the army meteorological observations prior to 1860; by the Smithsonian registers kept thence to the establishment of the signal service, and by the signal stations since 1872, together with many private observations. Taking ten of these stations, the average depth of rain is 18 inches over the entire dry region. The palpable falling off along the line of division, as at Leavenworth (lon. 95°), 35 inches of rain, Denver (lon. 105°), 14 inches, Breckenridge (lon. 96°), 28 inches, and Cheyenne (lon. 104°), 8.60 inches, is in proof of the hypothesis. The humid or fertile region contains about 1,067,151 sq. m. of territory, and the rainfall, as indicated by the mean of observations at twenty stations, is 17.5 inches, varying from 33 to 65 inches, according to latitude.

It follows from these views and observed facts that the rivers of the dry region have their mere freshets in the season of rains, and then run nearly dry in the summer season. Thus, the Rio Grande, the upper Red River, and the sources of the Arkansas and the Missouri in the summer season send but little water to the rivers that discharge into the Gulf. They are largely absorbed by the sandbars and drifts or evaporated by the sun. The corresponding rivers of the Mississippi Valley of the eastern slope keep flush during the whole season and furnish abundant supplies to the discharging river; so that the Mississippi River at Carrollton (upper New Orleans) discharges one-fourth its maximum delivery when it is within 3 feet of low-water mark. This is true of the rivers that feed the eastern Gulf, and so with the rivers of Texas that belong properly to the humid region. The discharge of the Mississippi River, as shown in the delta survey, by actual measurement, gives 19.5 trillions of cubic feet annually, omitting the Red River. This is but about 25 per cent. of the rainfall on the whole valley. The rest must be in part re-evaporated and carried by the winds beyond the valley, and in part absorbed. What portion of this water finds its way to the reservoir under the earth will never be known. But the fact that the geological strata dip toward the basin in nearly every part of the watershed, and that there exist subterranean streams wherever the earth has been penetrated, make it highly probable that a very large portion reaches the basin by these channels. An indefinite but large proportion of the surface of the earth is covered by the drift beds, and wherever these are cut by streams or accident or design, they are found pervaded by springs or streams of water, that persistently find their way down to the Gulf. This is particularly true of the whole Gulf-front E. of the Sabine River. The reservoir receives large acquisitions from recent rainfalls near the Gulf-front, both above and beneath the surface of the earth. This well accounts for the low degree of salt-saturation of the hither portions of the Gulf.

The Gulf of Mexico receives from the Caribbean Sea about as much as it discharges through the straits of Florida to the Atlantic Ocean. This is determined by the cross-sections and velocities of the straits of Yucatan and the straits of Florida. Hence, the Mississippi and other streams, visible and invisible, which enter the reservoir are therefore left to supply evaporation. The S. wind, as observed above, is the water-carrier for the whole area watered by the Gulf. This is manifestly much greater than the watershed, and yet the chief supply is to the lands that slope toward the basin, and this reciprocity is kept up through the centuries. This economy is nowhere on earth better balanced and preserved, and nowhere are its blessings more abundantly felt or more thoroughly appreciated.

C. G. FORSHEY.

Wa'tershield, a general name for the Cabombaceæ or Cabombeæ, a group of exogenous water-plants variously regarded as a separate natural order or as a sub-order of Nymphaeaceæ. The common species of the U. S. are *Brasenia peltata* and *Cabomba caroliniana*. The former has an extensive range in America, Asia, Australia, and even Africa.

Wa'ter-Spaniel, a name given to several breeds of the spaniel, distinguished by fondness for swimming. Water-spaniels have rather long, curled hair, which has an oily feel and turns water very well. They have often a peculiarly strong, unpleasant odor. They are extremely intelligent and affectionate, but are often slow and inactive, except when at work. Their chief use is as retrievers in shooting water-fowl. Comparatively few are of pure breed.

Waterspout. See STORMS, by PROF. A. GUYOT, PH. D., LL.D.

Waterstaat [literally, "disposition of the waters;" Fr. *état des eaux*] is the name of the corps of royal civil engineers of Holland—"engineers of the waterstaat." The corps, as organized in 1849, and partly reorganized since, consists of 2 inspectors, 5 engineers-in-chief of the first class, 6 engineers-in-chief of the second class, 13 engineers of the first, 15 engineers of the second, and 8 engineers of the third class, with 6 aspirant- (under-) engineers. The engineers of the waterstaat are originally selected by competitive examination from the civil engineers who, having made their studies at the Polytechnic School at Delft, are in possession of a certificate delivered by a commission of examination appointed by government. The corps has charge of the national hydraulic works; the protection of the country against the inundations and encroachments of the sea and the rivers; the improvement of rivers, harbors, canals, and dikes; the maintenance of highways and bridges; restoration by drainage of submerged areas (see HAARLEM LAKE, INUNDATIONS); and the construction of railroads. The waterstaat is placed under the superintendence of the secretary of state for the interior (*minister van rinnenlandsche zaken*). The state budget for the works of the waterstaat of Holland for 1876 amounts to 16,000,000 "gulden" (nearly $6,500,000). P. CALAND,
Inspector of the Waterstaat.

Waterston (ROBERT CASSIE), b. in Kennebunk, Me., in 1812; studied theology at Cambridge under Drs. Henry Ware and J. G. Palfrey; for five years had charge of a sailors' Sunday school; for six years was minister at large in Boston; for seven years was pastor of the church of the Saviour there; is author of a volume on *Moral and Spiritual Culture* (1842), which was republished in England and Ireland; of articles in the *North American Review*; of discourses, addresses, poems, and papers on questions of reform and education—subjects in which he took a cordial and intelligent interest. Was made an A. M. by Harvard College in 1844. O. B. FROTHINGHAM.

Water-Supply. See WATER, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Wa'terton (CHARLES), b. at Walton Hall, near Wakefield, Yorkshire, England, of an ancient and wealthy Roman Catholic family descended from Sir Thomas More; was educated at Stonyhurst College; displayed great fondness for natural history; spent many years in travels in Spain, Italy, the West Indies, and North and South America, visiting several times Demerara, British Guiana, where he had estates: published *Wanderings in South America*, etc. (1825), and *Essays on Natural History, chiefly Ornithology* (2 series, 1838–44), accompanied by his *Autobiography* with a view of Walton Hall, where he resided many years in the midst of a wood, where by prohibiting the use of firearms many rare birds and animals became domiciled. D. at Walton Hall May 26, 1865, and at his own desire was buried in his own wood with an imposing funeral ceremony devised by himself. *Lives* of Waterton have been published by Dr. Richard Hobson (1865) and Norman Moore (1871).

Wa'tertown, p.-v. and tp., Litchfield co., Conn. P. 1698.

Watertown, p.-tp., Middlesex co., Mass., on the Watertown branch of Fitchburg R. R. and upon Charles River, about 6 miles W. of Boston, contains several religious societies, a free public library, good schools, 1 bank, 1 newspaper, a street railway, an iron-foundry, and 1 paper-bag manufactory. Mount Auburn Cemetery is partly located within the limits of the town, and here is also an important U. S. arsenal. P. 4326. GEO. PHINNEY, ED. "PRESS."

Watertown, tp., Clinton co., Mich. P. 1297.

Watertown, tp., Sanilac co., Mich. P. 49.

Watertown, p.-v. and tp., Tuscola co., Mich. P. 684.

Watertown, p.-v. and tp., Carver co., Minn. P. 1241.

Watertown, city and tp., cap. of Jefferson co., N. Y., on Black River, a few miles from its entrance into Black River Bay in Lake Ontario, and on Rome Watertown and Ogdensburg R. R., is the terminus of two other branch railroads. The river, here 60 yards wide, is crossed by several bridges, and has here a fall of 24 feet, with a succession of rapids below, affording immense water-power, which is largely utilized for manufactories of woollen goods, paper, flour, machinery, iron utensils, farming implements, leather, and lumber. The city contains a U. S. arsenal, court-house, several fine churches, 3 national banks, and 5 newspapers. P. of city, 9336; of tp. 1373.

Watertown, v., partly lying in Trenton tp., Dodge co., and partly in Watertown tp., Jefferson co., Wis. P. of the part in Dodge co. 2186.

Watertown, city and tp., Jefferson co., Wis., was first settled in Dec., 1836. The territory within the corporate limits is about equally divided into two parts by Rock River, furnishing a valuable water-power, which runs a large amount of machinery. It is at the junction of Chicago and Northwestern R. R., extending north-eastward from that city to Marquette, Mich., with Chicago Milwaukee and St. Paul R. R., reaching north-westward from Chicago to Duluth. This makes the city the most convenient and important railway centre in Wisconsin. Its educational facilities are among the best and most liberal in the State. A graded system of union schools has for several years been in successful operation, with 4 large and commodious buildings, suitably furnished, in the different wards. Here is located the North-western University, a Lutheran institution, in a flourishing condition. More recently has been commenced the College of our Lady of the Sacred Heart, a Roman Catholic Seminary, well attended. It has 3 weekly papers—2 printed in the English language and 1 in the German. To sustain a population of nearly 10,000, and that rapidly increasing, a large amount of manufactures, all kinds of domestic industries, the usual mercantile business, the different trades, the mechanical and useful arts, and the learned professions must be carried on extensively, and this is the case, without going into an enumeration of particulars. The location of the city is beautiful, the ground gently undulating, and the place remarkably healthy. It is surrounded by one of the most thickly-settled, best-cultivated, and most fertile agricultural regions in the State—the rich garden of Rock River Valley. P. of city 5364; of tp., exclusive of city, 2222.
D. W. BALLOU, ED. "DEMOCRAT."

Water Valley, p.-v., Yalabusha co., Miss.

Wa'terville, p.-v. and tp., Marshall co., Kan., on the Central branch of Union Pacific R. R. and on the S. bank of Blue River, 100 miles W. of Missouri River, has 3 churches, an excellent graded school, 1 newspaper, 1 wagon and carriage and 1 soap factory, 1 bank, 2 fine water-powers, 2 grist and flouring mills, and 2 hardware stores. P. 1584. W. P. CAMPBELL, ED. "TELEGRAPH."

Waterville, p.-v., Kennebec co., Me., on Maine Central R. R. and on Kennebec River, 18 miles above Augusta, has 6 churches, a college and a classical institute, 4 banks, 1 newspaper, 2 hotels, a large cotton-mill, 1 door, sash, and blind factory, 1 lumber-mill, 1 shirt-factory, and 1 furniture establishment. P. 4852.
MAXHAM & WING, EDS. "WATERVILLE MAIL."

Waterville, p.-v. and tp., Le Sueur co., Minn. P. 798.

Waterville, tp., Grafton co., N. H. P. 33.

Waterville, p.-v., Sangerfield tp., Oneida co., N. Y. P. 1182.

Waterville, p.-v. and tp., Lucas co., O. P. 1609.

Waterville, p.-v. and tp., Lamoille co., Vt. P. 573.

Waterville, tp., Pepin co., Wis. P. 835.

Waterville School District, v., Waterbury tp., New Haven co., Conn. P. 426.

Wa'tervliet, p.-v. and tp., Berrian co., Mich. P. 1674.

Watervliet, tp., Albany co., N. Y. P. 22,609. It contains several large villages, the most important of which are WEST TROY and GREEN ISLAND (which see).

Water-Wheel. See WATER-POWER, by PROF. W. P. TROWBRIDGE, A. M.

Wa'terworks. Though the term *waterworks* is ordinarily understood to refer to constructions and appliances, it is proposed here to include under that head the entire subject of the collection, preservation, and distribution of water for domestic purposes.

The sources of water are discussed in WATER and RAINS. To obtain more than the minimum flow of a stream, storage reservoirs must be constructed of a capacity proportioned to the quantity desired. To ascertain the capacity of the reservoirs, it is desirable to have a record of the rainfall at the locality, or sufficiently near it, embracing a long series of years. Then, having ascertained by experiment what portion of the rainfall may be expected to reach the streams, we can compute the total yield of the drainage-basin for each year, and, deducting the quantity to be consumed, we find the greatest quantity that must be in store at any time in order that there may be no deficiency in the driest seasons. Such a calculation for a series of past years may be applied with confidence to the future. It is possible to provide storage sufficient to utilize the entire yield of the drainage-basin, but the excessive cost and the lack of suitable sites for such reservoirs usually make this impracticable. The most that is ordinarily attempted is to utilize a quantity equal to the average flow of the driest year. Experience has shown that to accomplish this the reservoirs must be capable of containing about four months' supply.

That is, suppose we find the minimum yield for a sufficiently long series of years to be 14.68 inches of water, which is equivalent to about 700,000 gallons per day per square mile, the reservoirs should be sufficient to deliver 700,000 gallons per day for each square mile of drainage-ground during a period of about five months. This is a reservoir capacity of 85 million gallons per square mile of drainage-ground. In some European systems of waterworks an attempt is made to economize the flow of the three driest known consecutive years. For this purpose the reservoir capacity must be equal to about six months' supply. The average rainfall of the three driest consecutive years of a long series is usually represented very closely by the general average rainfall diminished by one-sixth. Where, for instance, the average rainfall of a series of years, thirty or more, is 48 inches, the average of the three driest consecutive years will be about 40 inches. Assuming 20 inches collectible, this would be about 952,000 gallons daily per square mile. The reservoirs must be sufficient to contain six months' supply at this rate—viz. about 174 million gallons per square mile of drainage-ground. To economize the total yield of the drainage-ground, we should require a reservoir capacity equal to the average flow of from nine to eighteen months—that is, in the case just supposed, from 313 to 627 million gallons per square mile of drainage-ground. The reservoir capacity of several British systems of waterworks is given below in millions of gallons per square mile of drainage-ground. The facts are given in Mr. Bateman's evidence before the London water-supply commission, report of 1868–69: Manchester, 117; Liverpool, 233; Dublin, 123; Glasgow, Loch Katrine district, 115; Glasgow, Gorbal's district, 252. The gallon spoken of in this paper, unless otherwise stated, is the U. S. standard gallon, 231 cubic inches, being 58,373 Troy grains at the maximum density. A cubic foot contains 7.48 gallons.

Considerable amounts of water are sometimes obtained from deep wells by pumping. A considerable part of the supply at Liverpool is pumped from wells in the sandstone formation underlying the region. The entire supply of the neighboring city of Birkenhead, which contains over 50,000 inhabitants, is, or was recently, obtained in that way. The Kent Company, supplying a part of London, obtains its entire supply, and the New River Company a part of its supply, from deep wells in the limestone. The Liverpool wells in some cases communicate with tunnels for collecting the water. According to Mr. Thomas Duncan, engineer to the Liverpool waterworks, there were four wells in use there in 1868, furnishing from 35 to 43 million imperial gallons per week. There were formerly seven, from which about the same quantity was pumped. He affirms that the hardness of the water increases with pumping. The Green Lane well when first opened (about 1855) showed 4½° of hardness; in 1868, 7°. The yield of this well had diminished about one-tenth. Mr. G. F. Deacon, borough and water engineer of Liverpool, says in his report for 1875 that the quantity of water derivable from each well without lowering its level is decreasing at the rate of about 2 per cent. per annum. He says: "Near Bootle an additional well was sunk, and the yield of that station was increased from 621,660 to 1,462,000 gallons per day. But in consequence of this increase the level of a well 3½ miles off fell off 4 feet, and its yield diminished." The depths of the wells belonging to the New River Water Co. are given as follows by Mr. James Muir, their engineer: Depth of the well and bore together at Amwell End, about 390 feet; the Amwell Hill well, 260 feet; the Cheshunt well, 172; the Hampstead Heath well, 458; and the Hampstead Road well, 237. He gives the yield of the Amwell Hill well as 2,400,000, and the Amwell End well 2,500,000, imperial gallons per day.

Consumption.—The purpose to which the water-supply of towns is applied may be embraced under three general heads—viz. (1) Watering, including the sprinkling of streets and grounds, the extinguishing of fires, and the flushing of sewers where this is practised; (2) manufactures; (3) domestic uses. In large cities the first item rarely amounts to more than 5 per cent. of the total consumption. It is greater in suburban districts, being sometimes as high as 20 per cent. during the hot weather. The second item is from 5 to 20 per cent. of the total in commercial cities, and may be as much as 33 per cent. in towns devoted mainly to manufacturing. In English manufacturing towns it is said to be from one-fourth to three-sevenths of the total consumption. The third division embraces the manifold uses and waste of water in the domiciles of the people. The following table, showing the present consumption of the principal American cities, is taken from the Cincinnati waterworks report for 1875, being compiled by the engineer, Mr. Americus Warden. It is believed to be correct, though it is not clear in every case what kind of gallons is intended. New York gallons are generally used by towns in the State of New York. There are 7.8125 New York gallons in a cubic foot. The consumption is given in gallons per day per inhabitant:

TABLE I.

New York	90	St. Louis	60
Detroit, Mich	88	Boston	60
Chicago	80	Philadelphia	56
Hartford, Conn	80	Toledo, O	54
Reading, Pa	75	Cincinnati	53
New Haven, Conn	75	Baltimore	50
Albany, N. Y	70	Lowell, Mass	44
Springfield, Mass	66	Cleveland, O	43
Buffalo, N. Y	64	Providence, R. I	39
Brooklyn, N. Y	60	Milwaukee, Wis	25

The consumption of St. Louis for 1875 is given by the engineer, Mr. Whitman, as 42 U. S. gallons; that of Chicago for same year, by Mr. Chesbrough, as about 90 U. S. gallons. The consumption of Lowell in 1875 was 34 gallons per head daily. Mr. Warden's figures refer to an earlier year. Table II. gives some facts as to the consumption in several British towns. The consumption of some other European cities at a late date was as follows: Berlin, 26 U. S. gallons per head daily; Hamburg, 21½; Paris (1867), 34; Bordeaux, 45.6; Marseilles, 49; Lyons, 22; Dijon, 62¾. Probably the greatest consumption of water on record in modern times was reached in Boston in 1860, being 97

TABLE II.

Town.	Population supplied in 1868.	Consumption in U. S. gallons per head.	
		Total.	Domestic.
Glasgow	511,000	63.6	54.
Manchester	600,000	27.0	18.
Edinburgh	206,117	43.2	36.
Liverpool	600,000	31.2	21.9
Bradford	203,000	36.	
Newcastle-on-Tyne	200,000	33.6	25.2
Wolverhampton	60,000	22.8	20.4
Halifax	50,000	54.	
Birkenhead	52,826	40.8	37.8
Chester	31,301	30.7	28.9
Parts of London	(1866) 2,827,660	37.6	
Parts of Liverpool	(1875) 234,000	.....	19¾

gallons. According to Rozat de Mandres (see *Annales des Ponts et Chaussées*, 1858, ii. semestre), the quantity supplied to ancient Rome amounted, at one time, to nearly 400 U. S. gallons per day for each inhabitant. The enormous discrepancies in the daily consumption, varying as it does from 20 to near 100 gallons, reveal one of the most serious evils in the administration of waterworks—viz. the wanton waste of water. How much water is really necessary for all rational household purposes it is perhaps not easy to say, though undoubtedly the lowest amount given above is ample. A very careful investigation of this subject was made in 1852 by the medical officers of London. The following quantities, excluding waste, were found to be ample: for houses with good cisternage, water-closets, and baths, containing 15 or 20 rooms, 15 or 16 U. S. gallons daily per head; for second-class houses, 9 gallons; the poorest class of houses, 5 gallons; workhouses, 4 to 7. Although the supply was intermittent, water being discharged at certain hours of each day into reservoirs provided by the consumers, it cannot be supposed that these quantities were less than necessary for health and reasonable convenience. The principal causes of waste of water are defective fittings, mains, and reservoirs, carelessness of consumers, and imperfect protection of pipes from frost, which in cold weather necessitates great waste to prevent freezing. Observations are often made to ascertain the quantity of water wasted, by noting the flow in the latter part of the night, when no legitimate consumption is taking place. Observations of this kind recently made at Cincinnati indicate a loss of one-third the total supply. The city engineer of Quebec states in his report for 1872–73 that he has observed seven-eighths as much water flowing to the city at three o'clock in the morning as at noon. The engineer of the Liverpool waterworks states that where no measures are taken to prevent waste, it is no uncommon thing for 70 gallons to be wasted out of every 100 supplied, leaving but 30 applicable to the legitimate uses of the consumer. Similar statements are made by most officers of waterworks who give their attention to this subject.

In America the tendency is to accept this waste as inevitable, and to increase the supply as fast as the consumption overtakes it. In some English towns determined efforts have been made to restrain waste, and these efforts have been attended with such success as to show that the evil is by no means beyond control. In the city of Norwich, which is supplied by a private company, the daily consumption was some 40 imperial gallons per head. In 1859 the company obtained an act of Parliament authorizing them to prescribe the nature in detail of all fittings and pipes, and the work in connection therewith, and to

interdict the use of any existing fittings and pipes which in their judgment might tend to waste. In a few years, by stringent enforcement of these provisions, the daily consumption was reduced to 15 imperial gallons per head with constant service. The imperial gallon contains 10 pounds of water at 62° F., being 6.23 gallons to the cubic foot. The low rate of consumption in Manchester, as given in Table II., is due to the enforcement of similar regulations. The low consumption of parts of Liverpool in 1875 was brought about also by a rigorous system of inspection and enforcement of ordinances concerning waste. Mr. G. F. Deacon, borough and water engineer of Liverpool, has prepared a very interesting paper, which is printed in the minutes of proceedings of the Institution of Civil Engineers for 1875, in which he details the measures taken to restrain waste. The city has been divided into a number of districts, in each of which the aggregate consumption is measured by meters. The nightly indications of these meters show which districts are most in need of inspection. No premises are entered unless waste is observed. Inspections to detect waste are made at night after all legitimate consumption has ceased. The inspector applies his wrench or key to the street stopcock controlling the service-pipe which supplies the premises, and nearly closes the cock. Then, applying his ear to the key, the passage of a very minute quantity of water can be detected. If waste is observed, the house is entered in the daytime, the fittings carefully inspected and defects pointed out, which the owner is required to remedy. Previous to the adoption of these measures the city had been on intermittent service. At one time in 1865 water was only furnished for three hours per day. Constant service was restored for a short time in 1873 as an experiment. It appeared that its maintenance would require a daily supply of 33½ imperial gallons per head. The results of these inspections were surprising. In a large district the consumption was reduced to 12 imperial gallons per head. In a district containing 2134 persons it was reduced to 6 or 7. In 1875 the constant service had been restored to nearly the entire town, with a consumption much less than had formerly been required with intermittent service. It is conceded that only the most stringent legal provisions, and the most ample authority on the part of water-officers for their enforcement, can avail to restrain the wasteful tendencies of consumers.

I have dwelt somewhat fully upon this point, as it appears to me that cities sometimes commit an error in projecting and executing great works for additional supplies of water—well knowing that of every three gallons, two are destined to be wasted, and knowing also that the existing supply is ample for all the legitimate uses of the next generation—instead of addressing themselves to the less ambitious and agreeable task of restraining waste.

Constructions.—The multifarious applications of water in a city require a considerable pressure in the distributing pipes. This is secured in two ways: (1) by adopting a natural source of water at a sufficient elevation; (2) by pumping. The most obvious classification of the systems of water-supply is that of gravitation systems and pumping systems. The configuration of the ground is rarely such as to furnish a source sufficiently elevated and sufficiently near capable of supplying the requisite quantity at all seasons of the year. Gravitation systems, therefore, commonly involve storage reservoirs. Where pumping is resorted to, recourse can usually be had to sources whose minimum yield is sufficient. Such a source, however, is liable to be highly charged with sediment in times of flood, and also to contamination from sewage and other sources. We accordingly find that pumping systems commonly involve arrangements for purification. The principal elements of a gravitation system are—(1) the drainage-grounds; (2) the storage reservoirs; (3) the conduit; (4) the distributing or service reservoirs; (5) the distributing pipes. The pumping system commonly lacks the feature of storage reservoirs, and has in addition the pumping establishment and force main, and ordinarily arrangements for filtering or otherwise purifying the water. There are, however, pumping systems with storage reservoirs, of which Brooklyn, N. Y., is an example, and there are gravitation systems in which the water is subjected to filtration, as in the case of Dublin, Ireland. There is also a system recently applied in many small cities and villages which dispenses with service reservoirs. Storage reservoirs are described under RESERVOIR.

The conduit or aqueduct conveys the water from the source to the distributing reservoir in or near the city. In extensive works it is ordinarily of masonry, not being intended to be entirely filled. It is built to a nearly level grade, having only sufficient inclination to give motion to the water. Intervening ridges are cut down or pierced by tunnels. Valleys are crossed by embankments of earth or earth and masonry combined, or by rows of arches. In crossing deep valleys or rivers the masonry of the aqueduct is sometimes interrupted, and the water flows in iron pipes, which descend into the valley and rise and re-enter the aqueduct on the opposite side. In the ancient aqueducts, where, from the limited knowledge of iron-working, such expedients could not be adopted, these crossings required ranges of arches supported by piers of enormous height, constituting the most remarkable monuments of ancient civilization. (See AQUEDUCT.) Small conduits are often made of earthenware pipe. The best earthenware pipes, and particularly the celebrated Scotch pipes, are made from very pure clay mined at great depths, the clays found near the surface of the ground not being found so suitable. The pieces are moulded by hydraulic pressure, and are covered with a vitreous glazing which renders them impermeable to water. The glazing is applied during the burning of the pipe by covering the fires with a layer of common salt moistened with water. The salt is volatilized, and the moisture contained in it is vaporized by the intense heat. The chlorine of the salt combines with the hydrogen of the vapor, and passes off as chlorohydric acid. The sodium of the salt combines with the oxygen of the vapor, becoming soda, which enters into chemical combination with the material of the pipe at the surface, forming a silicate of soda and alumina. These pipes are made in lengths of 2 or 3 feet. The smaller sizes are put together with sockets. Each piece has an enlargement at one end into which the next piece enters, and the joint is made tight by hydraulic cement. The larger sizes are put together with sleeves, which are narrow rings encircling the pipe at each joint, the space between the inside of the sleeve and the outside of the pipe being filled with hydraulic cement. The thickness of earthenware pipes should be about one-twelfth of the diameter. Such pipes have been made as large as 48 inches in diameter. Conduits have been made of wood, but such are not to be recommended. For the first year or two they impart a disagreeable taste to the water, and if not entirely filled with water at all times they decay rapidly. The portions of a conduit subjected to pressure are sometimes made of wrought iron lined with brickwork or cement.

A long and large aqueduct should be provided with gates and discharge-sluices at intervals of a few miles, in order that any section may be emptied for repairs without wasting the entire contents of the aqueduct. It is stated that access to the Croton aqueduct for repairs involves the wasting of some 220 million gallons of water.

A pumping system usually has a conduit, not essentially different in construction from that required in a gravitation supply, though it ordinarily forms a much less important feature of the system. Its purpose is to convey the water from the source to the pump-well, which can usually be located so as not to require a great length of conduit. In waterworks for cities located on the shores of the great lakes, and drawing their supply therefrom, the conduit forms a very important feature. The water cannot be taken from any point near the shore, as it is there liable to be contaminated by sewage and turbid from the action of waves. To procure water free from the latter source of impurity, the conduit must extend a long distance into the lake, as it is only in water of considerable depth that the waves cease to act upon the bottom. A solid structure built into the lake would require the strength and solidity of a breakwater, and even in that case would not be sufficiently permanent and free from settlement to serve as the foundation of an aqueduct. The method adopted at Chicago and other lake cities has been to extend a tunnel under the bottom of the lake to the desired point. The tunnel recently finished for the supply of Cleveland, O., is 6660 feet long and about 5 feet diameter inside. It has a lining of brick about 8 inches thick. It extends from a shaft 67 feet deep sunk at the margin of the lake to a shaft 90 feet deep, from the surface of the water, at a point in the lake where the water is about 36 feet deep. In order to sink the latter shaft, an enormous crib of timber was floated into the proper position, and sunk upon the bottom by loading it with stone. The crib was of pentagonal form, measuring 54 feet on each side, and rising about 12 feet above the surface of the water. It is surmounted by a beacon and a keeper's dwelling. Through an opening in the centre of this crib a large iron tube was let down, and its extremity forced into the bottom. The water was then pumped from the tube, and the earth excavated from the inside, the tube being sunk or extended as the work proceeded. From the bottom of this shaft the tunnel was commenced, and continued toward the shore till it met a similar tunnel excavated from the shore shaft. Great difficulties were encountered in the prosecution of this work. Volumes of inflammable gas sometimes entered the tunnel, driving out the workmen and endangering their lives by

explosions. Several lives were lost from that cause. On different occasions strata of quicksand and other treacherous material were encountered, necessitating the abandonment of portions of the completed tunnel and its reconstruction in more secure ground. The work was commenced in Aug., 1869, and completed in Mar., 1874, at a cost of about $320,000, which is a little more than $18 per linear foot.

The first tunnel built in this country for the supply of water was the one at Chicago, made in 1861 to 1867, under the direction of Mr. E. S. Chesbrough, the engineer for the city, who may be regarded as the originator of this method of procuring a supply of water from lakes. This tunnel is about 2 miles long, and was excavated substantially as above described, though from the more uniform character of the bottom fewer difficulties were encountered than in the Cleveland tunnel. (See TUNNEL, CHICAGO.) A similar tunnel has recently been completed at Buffalo, N. Y. For Milwaukee, Wis., the supply is drawn through a flexible iron pipe 3 feet in diameter, extending about two-fifths of a mile into Lake Michigan, to a point where the water is 18 feet deep. A crib of pilework protects the mouth of the pipe, and a pilework bridge extends from the crib along the line of pipe to the shore.

Distributing or Service Reservoirs.—The supply of water is liable to too many contingencies to be entrusted to a pipe or conduit reaching from the source of supply to the point of consumption. It is always considered judicious, where the topographical conformation admits of it, to provide a reservoir at an elevation corresponding to the pressure required in the distributing pipes. At this reservoir the works of supply terminate and the works of distribution commence. Its contents constitute a reserve to be drawn upon in the event of an interruption of the supply from accident or for repairs. The height of the reservoir above the general level of the town is not always subject to control. The points suitable for such a structure are usually limited in number, and their acquisition is often beset with difficulties. An elevation of from 100 to 150 feet is usually sufficient for all purposes of domestic supply; and a greater height than 150 feet is not desirable, unless all fittings are made to conform to the increased pressure, as the leakage is increased, and the velocity with which the water moves in the service pipes often causes them to burst when outlets are suddenly closed. Where fire-engines are to be dispensed with, a greater elevation is necessary, as will be noticed further on. Many towns situated on undulating ground have more than one reservoir—a low one for the lower districts, and a high one for the higher. The town of Brighton, England, has four "zones of distribution," with a reservoir for each, the highest being 480 feet above the level of the sea.

In localities where land is not too expensive, reservoirs are usually built entirely of earth. The most suitable site for the construction of a reservoir is an eminence composed of gravel containing such a proportion of clay as to admit of being consolidated by pressure. This is called "binding gravel." The embankments forming the sides of the reservoir are formed of this material very carefully compacted by heavy rollers and by the wheels of vehicles. Such embankments ought to have a slope of 2 base to 1 perpendicular, so that an embankment 25 feet high, assuming it to be 15 feet wide on the top, should be 115 feet wide at the bottom. They are further secured from filtration by a central core or an inner lining of puddle, which is an artificially-prepared mixture of clay and gravel in such proportions as to be impermeable to water without being liable to crack when dry. Ledges and abandoned stone-quarries have sometimes been chosen as sites for reservoirs, with usually very unsatisfactory results. The rock should always be covered with a thick layer of puddle. The inner slopes of the embankments are usually paved with heavy stone resting on a layer of pebbles or broken stone. This is necessary on account of the waves to which all bodies of water are liable, which would otherwise injure the banks and render the water turbid. Reservoirs in thickly-settled parts of towns are generally built of masonry, and are sometimes covered to prevent contamination of the water by dust and smoke. All reservoirs in London within five miles of St. Paul's are required by law to be covered, unless the water is subjected to filtration after leaving the reservoir. In open reservoirs the water should not be less than 20 feet deep when full, as vegetation is active at a depth much less than this when exposed to the sun. Impurities sometimes affect the surface, while the water remains good at the bottom, and *vice versâ*, for which reason engineers are accustomed to construct reservoirs so that the water can be drawn from the bottom or otherwise at pleasure. They should also be so arranged that the water will have a circulation through the whole extent of the reservoir, the outlet being at the opposite side from the inlet.

In a pumping system the pipe leading from the pumps to the reservoir is called the force-main. It is usually made a little stronger than other pipes sustaining the same pressure, under the impression that it is liable to greater shocks from the pulsations due to the action of the pumps, though, in reality, there is probably no part of the system of pipes liable to less violent pulsations than the force-main, especially where, as is the universal practice, it is in free communication with an air chamber.

Where, from lack of a suitable eminence or from economical considerations, no reservoir is constructed and the water passes from the pump directly into the distributing pipes, a stand pipe is often employed to prevent the pulsations due to the action of the pumps from extending to all parts of the distributing system. A stand-pipe is simply a vertical pipe communicating with the force main, and rising to a height greater than that corresponding to the pressure in the distributing pipes. It sometimes consists of two pipes communicating with one another at their summits. In this case the pump acts under a constant pressure, the water being all raised to the same height and flowing from one pipe to the other. In the case of a single pipe the water oscillates according to the varying consumption and speed of the pumps. To support the pipe and protect it from frost, a tower of masonry is constructed which forms usually a very striking feature of the works. The tower sometimes serves also as the chimney of the engine-house. The works lately completed at Milwaukee, Wis., contain both a reservoir and stand-pipe. The motive which led to the construction of the latter I have not been able to learn.

A system of waterworks recently introduced into many small cities, and strongly pressed upon the attention of all towns contemplating the construction of waterworks, may, with propriety, be noticed in this place. It dispenses with both stand-pipes and reservoirs. An automatic device regulates the speed of the pumping machinery according to the pressure in the mains. It is called the "Holly System," from Mr. B. Holly of Lockport, N. Y., the patentee of this and other appliances, and an officer of the company which manufactures the pumping machinery. It is claimed that this system maintains a pressure sufficient for domestic purposes at all times, and on the occurrence of a fire the pressure can in a few minutes be raised to a point which will enable the latter to be controlled by streams from the hydrants without the use of fire-engines. In fact, many towns, upon the adoption of this system, have disposed of their movable engines and rely altogether upon hydrants for controlling fires. A fire-alarm, to give notice at the pump-house of the occurrence of a fire, is a part of the system. The maintenance of a pressure in the distributing pipes sufficient to deal with fires without the use of movable engines is no new thing. Mr. J. F. Bateman, an eminent hydraulic engineer of England, says in evidence before the commission of 1867 on the water-supply of London: "Where you have pressure enough, you can do without fire-engines." Again: "In almost all cases where I am engineer the fire-engine has been discontinued. The water is obtained direct from the mains almost instantaneously, and the fire-engines are only used as omnibuses to carry the men and their apparatus." And again, in answer to the question, "And with a system of constant supply do you see any difficulty in introducing a system like that in London?" he answers, "None whatever." Mr. B. thinks 200 feet a sufficient pressure to allow of the disuse of fire-engines: Capt. Shaw, chief of the London fire brigade, would have 300 feet. At Brighton, England, there are no engines and no fire department. Fires are there managed entirely by the police. In none of these places, however, so far as I can learn, are reservoirs dispensed with. It is claimed for the Holly system, as an advantage over reservoirs sufficiently elevated to deal with fires, that it works under the high pressure only so long as the fire lasts, while for ordinary purposes it works under a very moderate pressure. This would certainly be a substantial advantage if the pumps worked with the same relative economy in the one case as in the other. This system recommends itself by its low first cost as compared with a reservoir system, and by the prospect which it offers of dispensing with fire-engines. Many disadvantages, however, generally become apparent in the course of a few years. The necessity of keeping the machinery in readiness for fires at all hours of the day and night, with the requisite number of men in attendance, makes the pumping much more expensive than in the reservoir system. A committee of the municipal government of Yonkers, N. Y., who visited several towns in 1871–72 to ascertain the relative merits of pumping machinery, report the cost of pumping at Columbus, O., by the Holly system at $67.60 per million gallons pumped under a pressure equivalent to something less than 100 feet head. A committee of the American Society of Civil Engineers, who collected data of the cost of

pumping in 1875, report the cost by the Holly system at from $14.10 to $39.81 per million gallons raised 100 feet, the average being $27.04. At Kalamazoo, Mich., the cost is said to have amounted to the enormous sum of $109.56. It is but fair to state that the trustees of the waterworks at Columbus, O., in their report for 1875, put the cost of pumping at $15.04 per million gallons—a surprising reduction from the former figures. The average cost of pumping 1,000,000 U. S. gallons 100 feet high by the ordinary methods in New England is about $12. In this figure, as well as those given by the New York Society of Engineers, interest on the cost of machinery is not included.

The omission of a reservoir from a system of water-supply is at variance with the practice of mankind in all analogous cases. No great permanent demand is supplied without reservoirs and dépôts of supply. The demand for food, merchandise, and necessaries of all kinds requires elevators, magazines, and warehouses. Financial wants require banks and treasuries, which are reservoirs of money. The demand for learning cannot be satisfied without colleges and libraries, which are reservoirs of knowledge. No commodity passes directly from its source to its ultimate destination. Such a supply is exposed to too many contingencies. Simplicity and efficiency require the business of collection and transmission to be separate from the business of distribution, that the former may not be under the necessity of accommodating itself to all the capricious fluctuations of the latter. In applying the direct system in connection with a filtering gallery, the latter will require to be considerably larger than would otherwise be necessary, in order to meet the extraordinary demands of a fire. In such a case it will usually be found that nothing is gained in first cost by the omission of a reservoir. Where it is desired to provide for an increased pressure in the event of a fire, with a moderate pressure at other times, it will usually be found preferable to construct a small reservoir at a great elevation, to be put in communication with the distributing system during fires, and shut off at other times. There are, nevertheless, circumstances—such as abundant supply of good water near at hand, lack of suitable elevations for reservoirs, and high rate of interest—which might justify the adoption of the direct system.

The distributing system embraces the network of pipes through which the water is conveyed from the reservoir or other central point to all parts of the town. The pipes lying in the common streets and thoroughfares are called mains: those leading from the latter to the premises of consumers are called service-pipes. Distributing mains of wood, lead, stone, earthenware, and asphaltum have been used at various times. The water of London was once distributed in wooden and lead pipes. The water from Jamaica Pond was distributed in Boston in wooden pipes before the introduction of the supply from Lake Cochituate. Fragments of these wooden pipes are now often met with in excavating the streets. Wooden pipes, formed of the trunks of straight trees, bored through from end to end, are still employed for conveying water under slight pressure, as in the supply of farm-buildings. Pipes formed of natural stone, artificially hollowed out, were laid down in considerable quantity in London, and also in Manchester, England, in the early part of the present century. The result in each case was a disastrous failure. A pipe of sheet iron, coated internally and externally with hydraulic cement, has been extensively used in America within the last fifteen years. The cement, while it remains intact, preserves the iron very effectually from rusting. These pipes are joined together by means of sleeves of the same material, the void spaces being filled with cement. The cement used in these joints gives such a degree of rigidity to the line of pipes that any settlement of the ground causes cracks. The separation of the cement from the iron at any point is followed by a rapid corrosion of the pipe. This kind of pipe has, in many cases, given satisfaction, though it cannot be said to have justified the expectations once entertained of it. It has frequently failed in connection with the Holly system of pumping. This is notably the case at Canton, O., and Binghamton, N. Y. Cast iron, notwithstanding grave defects, is by far the most reliable and satisfactory material for distributing mains. The most serious defect of cast-iron pipe is the facility with which the metal is acted on by water. The inner surface becomes covered with tubercles or protuberances, sometimes of such size as to diminish the effective diameter of the pipe by as much as an inch and a half, or even two inches. In small pipes this action sometimes goes to the extent of closing them entirely. A 3-inch pipe is often so choked that one cannot see through it from end to end. Wrought iron is attacked more energetically than cast. The gray variety of cast iron is more readily oxidated than the white. A large proportion of carbon or graphite in the iron accelerates the action. The development of tubercles proceeds most rapidly in the softest and purest waters, the Boston pipes being more rapidly fouled than those of Philadelphia or New York. No method of preventing this action has been discovered, but it may be delayed for many years by a process commonly ascribed to Dr. R. Angus Smith. This consists in immersing the pipe in a bath of coal-tar, both the pipe and tar being heated to a temperature of from 300 to 500° F. The pipe remains in the tar some thirty minutes, and on being removed and allowed to cool a very fine coating is found on the surface of the pipe. This resists the action of the water for a long time, but the tubercles usually appear in the course of ten or twelve years, sometimes much sooner. Pipe thus prepared imparts a slightly tarry taste to the water at first, but it disappears in a year or two. Cast-iron pipes are also liable to another kind of deterioration in certain soils, arising from the action of matters contained in the soil upon the exterior of the pipe. The iron undergoes a remarkable change, being reduced to a substance resembling plumbago. The mud of salt-water marshes has this action upon iron in a remarkable degree. Long lines of pipe laid in this material in Boston have been entirely destroyed in the course of fifteen or twenty years. In some places a crowbar, or even a knife, could be thrust through the pipe, and it could be cut with a knife. After exposure to the air for some time it becomes harder. The pitch coating is thought to be a protection against this kind of decay, but for greater security the pipe should be imbedded and covered with unobjectionable material. Cast-iron pipes are made in lengths of from 9 to 12 feet. For the purpose of joining them together, one end of each pipe has an enlargement called the bell; the unenlarged end is called the spigot. The inside diameter of the bell is some three-fourths of an inch greater than the outside diameter of the spigot. The spigot of each pipe enters the bell of the preceding pipe to the depth of three or four inches, and the void space is filled with melted lead, which, as it shrinks somewhat in cooling, is tightened by a hammer and calking-iron.

Pipes are usually cast in vertical moulds with the bell downward. A more uniform thickness is thus secured than by casting them horizontally. Pieces of peculiar form, called branches, are required where two lines of pipe communicate with one another. Curved pieces are required for changes of direction in a line of pipe. Pipes usually communicate at all street-crossings. This intercommunication gives a great number of routes by which the water may approach any point in case of fire. Hydrants are inserted at intervals of some 200 feet in the more compact parts of towns, 300 or 400 feet apart in the more sparsely-peopled districts. Valves or stop-gates are introduced, so as to divide the whole system into a great number of small sections, any one of which can be isolated from the rest for the purpose of repairs without interrupting the supply to other districts. Rivers and other bodies of water are crossed by pipe provided with a sort of ball-and-socket joint, by means of which the pipe adapts itself to the inequalities of the bottom.

Lines of pipe which cross summits of ground are provided at such points with air-cocks, to allow the air enclosed at the summit to escape. Air lodges at such points when the pipe is filled after having been emptied for any cause. Air is also, under some circumstances, disengaged from the water itself, and accumulates at the summits of pipes. Natural water always contains a certain quantity of air, or rather of the gases constituting air. A cubic foot of water in contact with air, at any pressure whatever, is capable of absorbing $\frac{46}{1000}$ths of the oxygen and $\frac{25}{1000}$ths of the nitrogen contained in a cubic foot of the air. In a steam-pump air is often drawn into the suction-pipe by accident or design, and the water takes up a larger portion of the gases than it can contain at a diminished pressure. These are accordingly disengaged as the water rises in the force-main. In the Holly system of pumping, in which every pipe is a force-main, the summits are very liable to be filled with air.

The depth to which pipes are covered varies with the climate. In different parts of England from 2 to 3 feet is considered to afford sufficient protection from frost. Regulation No. 10 of the Metropolitan water act of 1871 is: "Every pipe hereafter laid, etc., . . . shall, when laid in open ground, be laid at least 2½ feet below the surface." At Manchester, Eng., 3 feet is the prescribed depth. In the severe climate of the Northern States much greater depths are required. In Boston pipes are now covered to a depth of 5 feet. In New England generally the depth is from 4½ to 6 feet, and this latter is not always sufficient. The winter of 1874–75 was a very severe test of water-pipes. Upward of 2½ miles of pipe, 4 to 20 inches in diameter, were frozen in Boston; more than 1000 service-pipes were frozen. At Buffalo, N. Y., 3½ miles of street-mains were

destroyed by frost; they were relaid in trenches 6 feet deep, which was thought sufficient; the reports do not indicate the depth at which they were frozen. At Dayton, O., where, as in many Western towns, waterworks were constructed without much regard to past experience, the pipes were covered to a depth of only 3 and 3½ feet. The effect of frost during the winter named was such as to seriously threaten the total cessation of the water-supply; many streets were cut off from water. Says the report of 1875: "Long lines of pipe were met with where scarcely a joint was found perfect, and to repair such required the uncovering of the entire pipe." "From the 13th to the 25th of Feb. at least 200 fire hydrants, out of the 272 in use, were frozen up." Also: "The damage done to the pipe-work was no larger in proportion than that experienced by our sister cities." In St. Paul, Minn., 7 and 7½ feet are found sufficient. In the adjacent city of Minneapolis, which has a very loose gravelly soil, the pipes are laid 8 feet deep, and give great trouble from freezing. In Montreal the authorities are content with a depth of 6 feet, though much trouble is experienced from frost. We find from the reports that during the winter of 1873–74, 362 service-pipes were frozen, and there were 397 cases of the freezing of hydrants. In Quebec the pipes are laid 8 and 10 feet deep.

For conveying the water from the mains to the premises of consumers another order of pipes is required, called service-pipes. These are generally from ½ to 1½ inches in diameter. They are most commonly composed of lead, or of wrought iron prepared in various ways to resist corrosion. In a mechanical point of view lead pipe has peculiar fitness for this use. It is procurable in any desired length, easily attached to mains and fittings, easily divided and bent to suit the various situations. These advantages have led to its employment for service-pipes more than any other material, notwithstanding the oft-repeated warnings of chemists that it is liable to impart poisonous qualities to the water. Concerning the extent to which lead pipe may be used for this purpose without danger the opinions of chemists are conflicting. It is generally conceded that the softest waters act with greatest vigor upon lead. Hard waters acquire the power of corroding it when containing organic impurities. This explains why the most frequent cases of lead-poisoning have occurred with well waters. The action of water on lead is thought to be accelerated by the access of air. Pipes which are filled and emptied alternately are considered more liable to corrosion than when kept constantly full. For pipes not exceeding 100 feet in length it is probable that lead may be used, under almost any conditions, with but a very remote chance of injury; the danger increases with the length. For conveying water from a spring or pond to buildings at a distance lead should not be employed. A service-pipe of wrought iron, lined internally with hydraulic cement, has been much used of late, and appears to be eminently well fitted for the purpose. The most important precaution to be observed in the introduction of service-pipes is to secure protection from frost. The pipe usually passes from the main directly into the cellar. In houses having open areas, it is hardly possible to secure sufficient depth. The pipe is usually provided with a cock just inside the cellar wall, by which the water can be shut off and discharged from the portion within the cellar, as city cellars are rarely frost-proof. Freezing usually takes place at or near the cellar wall. For this reason the pipe is often so made that it can be separated at this point and thawed out by injecting hot water through a long small pipe. A service-pipe should, by preference, enter at the sunny side of a house, as the ground freezes less deeply there. (See also PLUMBING and SEWER.) J. P. FRIZELL.

Wathena, p.-v., Doniphan co., Kan.

Wat'kin (Sir EDWARD WILLIAM), b. at Manchester, England, about 1815; was trained to the mercantile business by his father, with whom he became a partner; was one of the directors of the Manchester Athenæum 1839–40, and organized its celebrated literary soirees in Free Trade Hall; was one of the founders of the Manchester *Examiner* 1845; became director and manager of several important railroads, especially the Intercolonial of Canada; visited the U. S. and Canada on railway business 1851 and 1861; became president of the Grand Trunk Railway of Canada; was influential in securing the confederation of British North America, for which he was knighted 1868; and has been prominent in Parliament as a supporter of reforms in financial legislation.

Wat'kins, tp., Dent co., Mo. P. 816.

Watkins, p.-v., cap. of Schuyler co., N. Y., at the head of Seneca Lake, on Northern Central and Syracuse Geneva and Corning R. Rs., 22 miles N. of Elmira, has 5 churches, an academy, 2 public libraries, 2 newspapers, 2 banks, 3 iron foundries, 2 carriage factories, 1 flouring and 2 planing mills, and 6 hotels. It is chiefly noted for its famous Watkins Glen, a great scenic wonder which is visited by tourists from all parts of the country. It has also fine mineral springs. P. 2639. L. M. GANO, Ed. "EXPRESS."

Watkins (THOMAS), M. D., b. in Maryland in 1780; graduated at St. John's College 1798, and at the Philadelphia Medical College 1802; commenced practice at Havre de Grace, Md.; removed to Baltimore, where he edited the *Medical and Physical Recorder* 1809; was surgeon in the army during the war of 1812–15; edited at Philadelphia, with his brother-in-law, Stephen Simpson, the *Portico* (4 vols., 1816–20); was assistant surgeon general of the U. S. 1818–21, and fourth auditor of the treasury 1824–29. D. at Washington, D. C., Nov. 11, 1855. He translated from the French Bichat's *Physiological Researches upon Life and Death* (Philadelphia, 1809), and from the Spanish Louis de Onis's *Memoir upon the Negotiations between Spain and the U. S. which led to the Treaty of 1818* (Baltimore, 1822).

Watkins Glen, one of the most picturesque spots in America, is a ravine extending several miles S. W. from the head of Seneca Lake, in the township of Dix, Schuyler co., N. Y., deriving its name from the neighboring village of Watkins, the county-seat. It is bordered by perpendicular rocks from 200 to 300 feet high, through which a small stream has formed its channel, falling over several lofty and wildly-beautiful cascades. Among the principal objects of interests are Glen Alpha, the Cathedral, the Well, and Rainbow Fall, which have become extensively known through stereoscopic pictures and articles in illustrated periodicals, and are annually visited by from 30,000 to 50,000 visitors.

Wat'kinson (DAVID), b. at Lavenham, Suffolk, England, Jan. 17, 1778; educated under the direction of the celebrated Mrs. Barbauld; came to the U. S. with his parents, and settled at Middletown, Conn., 1795; was trained to commercial pursuits at New York; commenced business as a merchant in partnership with his brother William at Hartford 1800, and retired with a handsome fortune 1811. D. at Hartford Dec. 13, 1847. By his will he gave $40,000 to the Hartford Hospital, an equal sum for the establishment of a juvenile asylum, and $100,000 to the Connecticut Historical Society for the formation of a library now known as the Watkinson Library. Several other public charities also received handsome bequests.

Wat'kinsville, p.-v., cap. of Oconee co., Ga. P. 613. Oconee county was organized since the census of 1870.

Wat'ling's Island, one of the Bahamas, in the West Indies, in lat. 23° 56′ N., lon. 74° 28′ W. It is uncertain whether San Salvador or Watling's Island was the first land in the New World seen by Columbus.

Wat'onwan, county of S. Minnesota, drained by Watonwan River and traversed by St. Paul and Sioux City R. R.; surface rolling, soil productive. Staples, wheat, oats, and hay. Cap. Madelia. Area, 432 sq. m. P. 2426.

Wato'pa, tp., Wabashaw co., Minn. P. 460.

Wat'ronsville, p.-v., Juniata tp., Tuscola co., Mich. P. 213.

Watse'ka, p.-v., cap. of Iroquois co., Ill., at the junction of Chicago Danville and Vincennes and Toledo Peoria and Warsaw R. Rs., 82 miles S. of Chicago, has excellent schools, 2 newspapers, 2 banks, and 2 mills. P. 1551.
OTTO H. WANGELIN, Ed. "IROQUOIS TIMES."

Wat'son, p.-v. and tp., Effingham co., Ill. P. 1066.

Watson, tp., Allegan co., Mich. P. 1220.

Watson, p.-v., Nishnabatona tp., Atchison co., Mo. P. 75.

Watson, p.-v. and tp., Lewis co., N. Y. P. 1146.

Watson, tp., Lycoming co., Pa. P. 280.

Watson (ELKANAH), b. at Plymouth, Mass., Jan. 22, 1758; was apprenticed to John Brown, the distinguished merchant of Providence, by whom he was sent to Cambridge in 1775 with a supply of powder for the American army; was entrusted in 1777 with a considerable sum of money to be invested in the Southern States in cargoes for European markets; kept a journal of his travels to the South, which is valuable as containing the best extant account of the principal American cities at that period; went to France Aug., 1779, as bearer of despatches to Franklin; opened a commercial house at Nantes; lost most of his property 1782; visited England, Holland, and Flanders; passed four years in North Carolina, and settled at Albany, N. Y., in 1789, where he resided until 1807; was an active promoter of education, agriculture, and the improvement of the Hudson navigation; conceived the project of the interior canals of New York; resided at

Pittsfield, Mass., 1807–16: founded there the Berkshire Agricultural Society: returned to Albany 1816, in which year he organized the first agricultural society in New York; visited Michigan, and descended the St. Lawrence to Montreal with a view to the projected canal to unite the lake region with the seaboard; made another visit to Europe, and settled in 1828 at Port Kent, Essex co., where he d. Dec. 5, 1842. He was a frequent contributor to periodicals on agricultural and other topics, and published *A Tour in Holland in 1784* (Worcester, 1790), *History of the Rise, Progress, and Existing Condition of the Western Canals in the State of New York, Sept., 1788–1819* (Albany, 1820), and *Rise, Progress, and Existing State of Modern Agricultural Societies* (1820); and his son, Winslow Cossoul Watson, edited in 1856 a very valuable autobiographical work, *Men and Times of the Revolution, or Memoirs of Elkanah Watson*, etc. A pamphlet was published by Col. Robert Troup as *A Vindication of the Claim of Elkanah Watson to the Merit of projecting the Lake Canal Policy* (Geneva, 1821).

Watson (Henry C.), b. at Baltimore, Md., in 1831; early removed to Philadelphia, where he was editorially connected with the *North American*, the *Evening Journal*, and other newspapers; edited Hugh Murray's *The United States of America*, with additions and corrections; wrote several volumes of hunting adventures; assisted John Frost in some of his historical works, and ultimately settled in California, where he became editor of the Sacramento *Union*. D. at Sacramento in 1869. Author of *Camp-Fires of the Revolution* (1851), *Nights in a Blockhouse* (1852), *The Old Bell of Independence, or Philadelphia in 1776* (1852), *The Yankee Tea-Party, or Boston in 1773* (1853), *Lives of the Presidents of the U. S.* (1853), *Heroic Women of History* (1853), *The Camp-Fires of Napoleon* (1856), and various other historical compilations.

Watson (Henry Cood), b. in London, England, in 1816; belonged to a family of musical celebrity, his father being the leader of the orchestra at Covent Garden Theatre, and his sisters being well-known oratorio-singers; inherited a fine voice, and displayed as a child great musical ability; made his *début* at the first performance of Weber's opera *Oberon* at the Covent Garden Theatre in Nov., 1829; subsequently achieved considerable success in London as a composer and musical critic; came to the U. S. 1840; became art-critic on the staff of the *New World*, in which he published some notable poems; became connected with the *Musical Chronicle* 1843; contributed to the *Ladies' Glee-Book* and the *Masonic Manual*; wrote on general subjects for the columns of the *Evening Mirror* and the *New Family Magazine*; became art and musical critic to the New York *Albion* 1844; was associated with Charles F. Briggs and Edgar A. Poe in founding the *Broadway Journal* 1845, a short-lived but brilliant and ably-conducted periodical; was the chief founder of the New York Philharmonic Society, of the American Musical Fund Association, and of the Vocal Society, afterward called the Mendelssohn Union; was associated with William Vincent Wallace and Carlos D. Stuart in organizing the famous Mendelssohn concert at Castle Garden: wrote the libretto for Wallace's opera *Lurline* (1854); started in 1855 *The Musical Guest*, a monthly magazine, separate editions of which were devoted respectively to sacred and to operatic music; published in its columns many of his own compositions; was for several years previous to 1861 editor-in-chief of Frank Leslie's *Illustrated Newspaper* and *Ladies' Magazine*; founded in 1862 the *Art Journal*, and became in 1863 the successor of William Henry Fry as musical critic of the New York *Tribune*, both which positions he filled with eminent versatility, extent of knowledge, and critical acumen until his death, in New York City Dec. 2, 1875. He was buried in Greenwood Cemetery. H. L. Stuart.

Watson (Hewett Cottrell), b. in England in May, 1801; educated at the University of Edinburgh; became an intimate friend of George and Andrew Combe; edited for several years the *Phrenological Journal*, and subsequently devoted himself to British botany. In an early pamphlet, *The Statistics of Phrenology* (1836), he substantially anticipated Darwin's theory of the origin of species. Author of *Outlines of the Geographical Distribution of British Plants* (1832; new ed. 1835), *The New Botanist's Guide to the Localities of the Rarer Plants of Great Britain* (2 vols., 1835–37), *The London Catalogue of British Plants* (6th ed. 1867), *Cybele Britannica, or British Plants and their Geographical Relations* (4 vols., 1847–59), and of a *Supplement* (1863) and a *Compendium* (1870) of the same work.

Watson (James Craig), LL.D., b. in Elgin co., C. W., Jan. 28, 1838, of American parents, who soon afterward settled in Michigan; graduated at the University of Michigan, 1857; became teacher of mathematics there, and assistant at the observatory; was appointed professor of astronomy 1859, of physics and mathematics 1860; has been director of the observatory since 1863; has discovered eighteen asteroids; went to Iowa 1869, and to Sicily 1870, to observe eclipses of the sun, and in 1874 was the head of the very successful American expedition which observed the transit of Venus at Peking, China. For his various astronomical discoveries he was in 1870 awarded the gold medal of the French Academy of Sciences. He has contributed to many scientific journals, has prepared various astronomical charts, and is author of *A Popular Treatise on Comets* (1860) and *Theoretical Astronomy, relating to the Motions of the Heavenly Bodies revolving around the Sun in accordance with the Law of Universal Gravitation, with Numerical Examples and Auxiliary Tables* (1868).

Watson (J. C.), U. S. N., b. Aug. 24, 1842, in Kentucky; graduated at the Naval Academy in 1860; became lieutenant in 1862, lieutenant-commander 1866, commander in 1874; served in flag-ship Hartford at battles of New Orleans and Mobile Bay, and at passage of the Vicksburg, Port Hudson, and Grand Gulf batteries, and handsomely mentioned in the official despatches. Foxhall A. Parker.

Watson (John), M. D., b. at Londonderry, Ireland, Apr. 16, 1807; came to the U. S. in childhood 1810; settled in New York City 1818; graduated in medicine at the New York College of Physicians and Surgeons 1832; was on the surgical staff of New York Hospital 1832–33; was a physician of the New York Dispensary 1833–35; was an attending surgeon there 1839–62; founded with Dr. H. D. Bulkley an infirmary for cutaneous diseases, known as the Broome Street School of Medicine, 1836; was one of the founders of the New York Medical and Surgical Society, the American Medical Association, and the New York Academy of Medicine, of which latter he was several years president. Author of several professional treatises.

Watson (John Dawson), b. at Sedburgh, Yorkshire, England, May 20, 1832; studied art at the Manchester School of Design and at the Royal Academy, London; obtained distinction as an illustrator of books and magazines and by his water-color paintings illustrative of British life and character.

Watson (John Fanning), b. in Burlington co., N. J., June 13, 1779; was trained to the mercantile business in Philadelphia; became a clerk in the war department 1798; was afterward engaged in business in New Orleans, where in 1804 he was contractor of subsistence for the U. S. troops; was for several years thereafter a bookseller in Philadelphia; was cashier of a bank at Germantown 1814–47; afterward treasurer of a railway company, and was an indefatigable collector of antiquarian and historical data concerning the city of Philadelphia. D. at Germantown Dec. 23, 1860. Author of *Annals of Philadelphia* (1830), revised and enlarged in the 4th ed. with an *Appendix* to 1857 (20 Nos. in 2 vols., 1857–58), *Historic Tales of Olden Time concerning the Early Settlement and Advancement of New York City and State* (1832), *Historic Tales of Olden Time concerning the Early Settlement and Progress of Philadelphia and Pennsylvania* (1833), and *Annals and Occurrences of New York City and State in the Olden Time* (1846). He was engaged upon a new edition of the latter work (left unpublished) at the time of his death. A *Memoir* by Rev. Dr. Benjamin Dorr was read to the Historical Society of Pennsylvania Feb. 11, 1861.

Watson (John Forbes), M. D., b. in England about 1830; received a careful scientific and medical education; became a surgeon in the Bombay army; was appointed reporter to the Indian government on the products of India; is a member of many scientific societies in India and in England; has contributed largely to their *Transactions* and to periodicals, and is a leading authority upon Oriental ethnology and natural history. Author of *A Classified List of Contributions from the Indian Museum, London, to the New Zealand Exhibition* (1865), *Textile Manufacture and the Costume of the People of India* (1867), *An Index to the Native and Scientific Names of Indian and other Eastern Economic Plants* (1868), *The Food-Grains of India, Food and its Influence on Man*, and with John William Kaye is editor of a valuable series of photographs entitled *The People of India* (vols. i. and ii. 1868), to consist of 8 vols.

Watson (John Selby), b. in England about 1815; graduated at Trinity College, Dublin, 1838; took orders in the Church of England 1839; held several parochial charges, and was for many years head-master of the proprietary grammar school at Stockwell, Surrey. Author of *Lives* of George Fox (1860), Richard Porson (1861), Sir William Wallace (1861), Bishop Warburton (1863), and

John Wilkes and William Cobbett (1870); published 2 vols. of poems (1844 and 1861); edited *Sallust* (2 vols., 1865–66) and the *Prometheus Vinctus* of Æschylus (1870), and translated for Bohn's "Classical Library" Lucretius, Sallust, Florus, Velleius, Paterculus, Justin, Cornelius Nepos, Eutropius, Xenophon, Quintilian, and portions of Cicero.

Watson (Malbone F.), b. at New York June, 1840; graduated at the U. S. Military Academy May 6, 1861, when appointed second lieutenant of 1st Cavalry; transferred to the 5th Artillery May 14; served with his battery throughout the Virginia Peninsular campaign, also at Manassas and Antietam, and at Fredericksburg, Chancellorsville, and Gettysburg in command of battery, losing his right leg at the latter battle. For gallantry at Gaines's Mill he was brevetted captain, and major for Gettysburg. In Nov., 1863, he was assigned to duty at West Point as assistant professor of French, and in Sept., 1868, was placed on the retired list.

Watson (Musgrave Lewthwaite), b. at Hawkdale, near Carlisle, England, 1804; educated at Raughton School; spent several years in a law-office; went to London 1824; studied sculpture in private, aided by the friendly counsel of Flaxman; spent several years (1825–28) at Rome; became an assistant to Chantrey, whom he soon left on account of his haughty manners, and to Behnes, whom he aided in his statue of Dr. Babington; was employed by New College, Oxford, to execute from Chantrey's models the fine group of Chancellors Eldon and Stowell now in the library of University College; made statues of Queen Elizabeth (for the Royal Exchange), Flaxman, Allan Cunningham, Nelson, *Hebe and Iris*, a bas-relief of the *Burial of Sarpedon*, a statuette of Chaucer, and the model for the bas-relief of the battle of St. Vincent for the Nelson Column in Trafalgar Square, London. D. in London Oct. 28, 1847. Unsuccessful in winning fortune or fame during life through his sturdy independence of character, his works have since been admitted to rank high in British art. (See his *Life and Works* (1866), by Dr. H. Lonsdale, with photographic illustrations.)

Watson (Richard), D. D., F. R. S., b. at Heversham, near Kendal, Westmoreland, England, in Aug., 1737; received his early education from his father, who was master of a grammar school at that place; graduated at Trinity College, Cambridge, 1759; obtained a fellowship there 1760; took orders in the Church of England; became professor of chemistry 1764; one of the head-tutors of Trinity 1767; regius professor of divinity at Cambridge, and rector of Somersham 1771; prebendary of Ely 1774; archdeacon of Ely and rector of Northwold, Norfolk, 1780; rector of Knaptoft, Leicestershire, and bishop of Llandaff 1782. D. at Calgarth Park, Westmoreland, July 4, 1816. Author of *An Apology for Christianity* (1776) and *An Apology for the Bible* (1796), in the form of letters addressed respectively to Edward Gibbon and to Thomas Paine, and distinguished by courtesy, candor, and no small learning, though written from a point of view long since substantially abandoned by writers on Christian evidences. He also published *Chemical Essays* (5 vols., 1781–87; 7th ed. 1800), *Sermons on Public Occasions* (1788), *Miscellaneous Tracts on Religious, Political, and Agricultural Subjects* (2 vols., 1815), and other works; edited a *Collection of Theological Tracts, selected from Various Authors* (6 vols., 1785; 2d ed. 1791), which were thought to favor Socinian opinions, and left an interesting autobiography, published by his son (1817).

Watson (Richard), b. at Barton-upon-Humber, Lincolnshire, England, Feb. 22, 1781; acquired a good knowledge of Latin and Greek in childhood; was apprenticed to a carpenter at the age of fourteen; joined the Methodists at the age of fifteen; was by them authorized to preach, and, having been released from his indentures, devoted himself to the ministry; printed at the age of nineteen an *Apology for the People called Methodists*; was ordained 1800; soon afterward joined the Methodists of the New Connection, but returned to the Wesleyan body 1812, and became secretary of its missionary society 1817. D. in London Jan. 8, 1833. He was for some time editor of the Liverpool *Courier*, and was author of *Theological Institutes* (6 parts, 1823–28), *The Life of the Rev. John Wesley* (1831), *A Biblical and Theological Dictionary* (1831), *An Exposition of the Gospels of Matthew and Mark* (1833), and other theological treatises, collectively republished, accompanied by *Memoirs of his Life and Writings* (13 vols., 1834–37) by Rev. Thomas Jackson. His *Institutes*, *Dictionary*, *Sermons*, *Catechisms*, and *Life of Wesley*, which are esteemed standard authorities among the Methodists, were edited with notes, etc., by Rev. Dr. Summers at Nashville, Tenn., and the *Institutes* were also edited, with an *Analysis*, by Rev. John McClintock.

Watson (Robert), LL.D., b. at St. Andrew's, Scotland, about 1730; educated at the universities of St. Andrew's, Glasgow, and Edinburgh; became a minister of the Church of Scotland; professor of logic, rhetoric, and belles lettres in the college of St. Salvador at St. Andrew's, and in Nov., 1777, principal of the united college of St. Leonard and St. Salvador, and minister of the church and parish of St. Leonard's. D. at St. Andrew's Mar. 31, 1781. Author of a *History of the Reign of Philip II., King of Spain* (London, 2 vols., 1777; 8th ed. 1839), a work designed as a continuation as well as an imitation of Robertson's *Charles V.*, and translated into French, Dutch, and German, but become obsolete since the publication of Prescott's book on the same subject. He also left an unfinished *History of the Reign of Philip III.* (1783), which was completed for the benefit of his family by William Thomson, LL.D. Both works have been republished in the U. S. (New York, 1818).

Watson (Thomas), D. D., b. in England about 1520; educated at St. John's College, Cambridge, of which he became fellow and master 1553; took orders in the Church of England; was appointed dean of Durham 1553, and bishop of Lincoln 1557; was preacher to Queen Mary; refused to take the oath of supremacy to Elizabeth, identifying himself thenceforward with the Church of Rome, and was imprisoned many years until his death, at Wisbeach Castle Sept. 25, 1582. He was regarded as "the chief superior of the English Roman Catholic clergy." Author of an admired but unpublished Latin tragedy entitled *Absolon*, of *Two Notable Sermons before the Queenes Highnes concerninge the Reall Presence* (1551), and *Holsome and Catholyke Doctryne concerninge the Seven Sacramentes* (1558).

Watson (Thomas), b. in London, England, about 1557; educated at Oxford University, where he was distinguished for his Latin and English verses; studied law in London, probably at one of the inns of court; spent some time in Paris with members of the Walsingham family; settled in London, and acquired a high reputation by his pastoral and amatory poems, which rivalled in popularity those of his friends Spenser and Sidney, and was a favorite with the aristocratic literary circles around Queen Elizabeth. D. in 1592. Author of a translation of Sophocles' *Antigone* into Latin (1581), *Ekatompathia, or Passionate Centurie of Love* (1582), *Meliboeus, sive Ecloga in Obitum Domini Francisci Walsinghami* (1590), *The Tears of Fancie, or Love Disdained* (1593), and many other poetical works, some of which have utterly perished. The three last named were carefully edited by Edward Arber in his *English Reprints* (1870), with an introduction in which he claims for Watson a very high place among English poets, notwithstanding the oblivion into which he had fallen.

Watson (Thomas Henry), b. in England Nov. 1, 1839; gained three silver medals of the Royal Academy for architectural designs 1860, and the gold medal 1861 for his design of an exchange; was awarded the first annual travelling studentship of the Royal Academy Dec., 1863, and the Soame medallion of the Royal Institute of British Architects Mar., 1864. In 1871 he was chosen president of the Architectural Association.

Watson (Sir William), M. D., F. R. S., b. in London, England, in 1715; educated at Merchant Taylors' School; was apprenticed to an apothecary; became eminent for his attainments in botany, physics, and chemistry, and especially for his researches upon electricity, for which he obtained the Copley medal and received honorary degrees from two German universities; was chosen one of the physicians of the Foundling Hospital 1762, and was knighted 1786. D. in London May 10, 1787. He contributed to the medical and scientific periodicals, and published *Experiments and Observations on Electricity* (1745), *Electricity applied to Tetanus* (1763), *An Account of Experiments in Inoculating the Small-Pox* (1768), and other works.

Watson (Winslow Cossoul), son of Elkanah, b. at Albany, N. Y., Dec. 22, 1803; was author of *A General View and Agricultural Survey of the County of Essex*, a *Treatise on Practical Husbandry* (1854), *A Pioneer History of the Champlain Valley* (1863), and a *History of Essex County and Military Annals of Ticonderoga and Crown Point, etc.* (1869), besides occasional addresses and contributions to religious and other periodicals.

Wat'sontown, p.-v., Northumberland co., Pa., on Philadelphia and Erie R. R. and on the W. branch of Susquehanna River, 22 miles S. of Williamsport, contains 4 churches, 1 bank, a town-hall, 1 newspaper, 1 tannery, car manufactory, 3 hotels, 2 saw and 2 planing mills, and a match-factory. P. about 2500.

John J. Auten, Ed. "Record."

Wat'sonville, p.-v., Pajaro tp., Santa Cruz co., Cal. P. 1151.

Watt (Gregory), son of James, b. at Birmingham, England, in 1777: educated at the University of Glasgow; went for his health to Cornwall, where he resided in the house of the mother of Humphry Davy, then a youth, with whom he formed a warm friendship; was admitted at an early age as a partner in the Soho firm; was engaged in scientific researches on the Continent 1801–02, and published an account of his remarkable experiments upon the laws of crystallization as exemplified in the cooling of 700 pounds of melted basalt. D. Oct. 16, 1804.

Watt (James), LL.D., F.R.S., b. at Greenock, Scotland, Jan. 19, 1736; manifested in childhood great mechanical ingenuity, having constructed an electrical machine at the age of fourteen; spent some time at Glasgow 1754–55, learning to make mathematical instruments; practised this trade at London 1755–56; returned to Glasgow; was appointed instrument-maker to the university; studied French, German, and music; constructed an organ; obtained the friendship of Adam Smith and other eminent men; began about 1758 a series of experiments on steam as a motive-power, along with his friend Robison, afterward professor of natural philosophy in Glasgow; constructed a model high-pressure steam-engine 1761, a second much-improved model 1765, a third 1768; took out a patent Jan., 1769 (see Steam-Engine); occupied himself for some years with land-surveying, the engineering of the Forth and Clyde and the Caledonian canals, building bridges, improving the navigation of the Clyde and the harbors of Glasgow and Greenock; became in 1773 a partner with Matthew Boulton, founder of the famous Soho works, near Birmingham, where in 1775 they began the manufacture of steam-engines, which were rapidly improved by the addition of new features; invented also a micrometer, the copying-press, and a method of warming houses by steam; visited Paris 1786; introduced into England on his return Berthollet's process of bleaching with chlorine; obtained, after long years of vexatious litigation, the recognition of his title to his principal inventions; acquired a comfortable competence; purchased an estate at Heathfield 1790; trained up his two sons to the business of the Soho firm, of which they became members; retired from business 1800; invented a flexible iron pipe for carrying water across the Clyde; was chosen a fellow of several learned societies, corresponding member of the Institute of France, and foreign associate of the French Academy of Sciences, and spent his closing years in prosperity, surrounded by friends to whom he was endeared by his admirable moral, social, and intellectual qualities. D. at Heathfield Aug. 25, 1819. He was buried beside Boulton in Handsworth church, a statue by Chantrey was erected in Westminster Abbey by national subscription, and a copy in bronze stands in front of the Manchester Infirmary. (See J. P. Muirhead's *Origin and Progress of the Mechanical Inventions of James Watt* (3 vols., 1854) and *Lives* by Muirhead (1858), Smiles, and Lord Brougham.)

Porter C. Bliss.

Watt (James, Jr.), b. at Glasgow, Scotland, Feb. 5, 1769; became proficient in the natural sciences; was secretary of the Manchester Literary and Philosophical Society; resided at Paris several years from 1789; manifested his sympathy with the French revolution until the excesses of the Jacobins changed his sentiments, when he was denounced as an enemy and obliged to flee to Italy; returned to England 1794; became a partner in his father's manufacturing firm, of which he ultimately became the head, and made important improvements in steam-engines to adapt them to the requirements of ocean navigation. D. at Aston Hall, near Birmingham, June 2, 1848.

Watt (Robert), M. D., b. in Ayrshire, Scotland, in 1774; was in early life a farm-laborer and cabinetmaker; studied at Glasgow University 1793–97; was licensed to practise surgery and pharmacy 1799; resided as a surgeon at Paisley 1799–1810; removed to Glasgow in the latter year, and lectured there on surgery with great success, becoming physician to the Glasgow Infirmary and president of the faculty of physicians and surgeons of that city. D. at Glasgow Mar. 12, 1819. Author of several medical treatises and of an important work, *Bibliotheca Britannica, or a General Index to British and Foreign Literature* (Edinburgh, 4 vols. 4to, 1821–24), published after his death by his two sons, who had aided him in the work—John, who d. 1821 at the age of twenty, and James, who d. 1829, aged twenty-six. The work was purchased by Archibald Constable & Co. for £2000, for which bills were given, but the failure of that great publishing house deprived the family of Dr. Watt of its whole fortune, and Miss Watt, the last surviving child of the bibliographer, died at Glasgow in a workhouse in 1861.

Watteau' (Antoine), b. in Valenciennes in 1684; struggled with poverty in youth; practised scene-painting, coarse engraving, and designing: was roused to emulation by paintings by Rubens in the Luxembourg; attempted historical art, but was soon led by natural genius to the field where he made himself distinguished. Possessing a light touch, an eye for brilliant and harmonious color, a graceful fancy, and a refined taste, he described court and popular life in the reign of Louis XIV., balls, masquerades, *fêtes champêtres*, pastoral scenes, with landscapes, gardens, groups of people and animals, with admirable freshness, brilliancy, and point. The popularity of his style created many imitators, who, however, came far short of his excellence. Though his health was broken and he died young (in 1721), he left numerous pieces, which are preserved, for the most part, in Paris. O. B. Frothingham.

Wat'eusac, tp., Prairie co., Ark. P. 660.

Wat'erson (Henry), b. in Washington, D. C., Feb. 16, 1840; owing to his defective eyesight was educated almost entirely at home; began his journalistic career at a very early age as a dramatic and musical critic; in 1858 became editor of the *Democratic Review*, and at the same time contributed to the *States*, a journal of liberal opinions published at Washington; went in 1861 to Tennessee, and drifted into the rebellion, doing casual duty in the Confederate army till the close of the war, except a year spent in editing the *Rebel* at Chattanooga; when the war closed, assumed the editorship of the Nashville *Banner*, remaining there until a year later, when he succeeded George D. Prentice as editor of the Louisville *Journal*; in 1868 the *Journal* was consolidated with two other newspapers, and became the *Courier-Journal*, with Mr. Watterson as part owner and editor-in-chief. He is married and has a family. He was in 1876 elected to Congress. J. B. Bishop.

Wat'erstown, tp., Grant co., Wis. P. 580.

Wat'tle-Bird, the *Anthochæra carunculata*, so named from the large wattles on its neck. It is a honey-eater of Southern Australia, of large size and bold, active habits, living on the honey and insects it obtains from the flowers of the *Banksias*, which cover the waste lands of that region. It has a loud, disagreeable note. The yellow wattle-bird, *A. inauris*, is a gregarious bird of that continent, of some importance for the excellent oil which it abundantly affords.

Wat'tle-Tur'key, a name sometimes applied to the brush-turkey or *Tallegalla Lathami* of Australia. (See Brush-Turkey and Megapodidæ.)

Wattrelos', town of France, department of Nord, has large oil-mills and cotton-spinning factories. P. 12,315.

Watts, tp., Perry co., Pa. P. 725.

Watts (Alaric Alexander), b. in London, England, Mar. 16, 1799; became a teacher at Putney and at Manchester; published a successful volume of *Poetical Sketches* (1822); was successively editor of the Leeds *Intelligencer*, the Manchester *Courier*, and the London *Standard*; founded and conducted for ten years the *United Service Gazette* 1833–43; consumed his property by six chancery suits with his partner in that enterprise; edited a series of annual volumes, *The Literary Souvenir* (1825–35); published his selected poems, *Lyrics of the Heart* (1851), and received in 1853 a pension of £100 per annum. D. at Kensington Apr. 5, 1864.—His wife, a sister of B. B. and J. H. Wiffen, was a poetess of some repute.

Watts (Frederick), b. at Carlisle, Pa., May 9, 1801; graduated at Dickinson College 1819; was admitted to the bar 1824; was reporter of the supreme court of Pennsylvania 1831–45, publishing 20 vols.; became president of the Cumberland Valley R. R. 1845; was appointed president-judge of the ninth district 1849; was distinguished as a scientific farmer; was one of the projectors of the Agricultural College of Pennsylvania and president of its first board of trustees 1854, and became in 1871 commissioner of the department of agriculture at Washington.

Watts (George Frederick), R. A., b. in London, England, in 1820; early achieved considerable success as a portrait and historical painter; gained at the Westminster Hall competition of 1843 one of the three highest prizes of £300 by his cartoon of *Caractacus*; studied in Italy 1844–46; obtained in the Westminster Hall competition of 1845 a prize of £500 for his *Echo* and *Alfred the Great*, which were purchased for the new Houses of Parliament, in which he was subsequently commissioned to execute the fresco *St. George overcoming the Dragon*, from Spenser (1853); painted at the W. end of the new hall at Lincoln's Inn a large design in fresco representing the great lawgivers of ancient and modern times (1861), but has of late years confined himself chiefly to portrait-painting, rarely exhibiting at the Royal Academy.

Watts (Henry), F. R. S., b. in England about 1825; received a thorough scientific education, partly in Germany; became a professional chemist at London, where he has lec-

tured on that subject; translated Gmelin's *Handbook of Chemistry* (9 vols., 1848–55) and A. Wurtz's *History of Chemical Theory from the Age of Lavoisier to the Present Time* (1869); is editor of the *Quarterly Journal* of the Chemical Society and of the standard *Dictionary of Chemistry* (5 vols., 1863–68), to which two *Supplements* have since been added (1871 and 1875).

Watts (Henry M.), b. at Carlisle, Pa., Oct. 10, 1805; graduated at Dickinson College; was admitted to the bar at Pittsburg 1827; served as deputy attorney-general, and subsequently as U. S. district-attorney, at Philadelphia; sat some years in the legislature; took an active part in politics, and was minister to Austria 1868–69.

Watts (Isaac), D. D., b. at Southampton, England, July 14, 1674, son of a nonconformist schoolmaster, by whom his early education was directed; studied at the Southampton free school and at Rev. Thomas Rowe's dissenting academy in London; became a private tutor at Stoke Newington 1696; was assistant minister 1698 and pastor 1702 of the Mark Lane Independent congregation, London; was forced by ill-health in 1712 to retire from the active work of the ministry, and having gone on a visit to his friend, Sir Thomas Abney, at Theobald's, Newington, was persuaded to remain there indefinitely as a guest, and so continued for thirty-six years until his death, Nov. 25, 1748. He was buried in Bunhill Fields, was of diminutive size and somewhat deformed in person, and was never married. He had a high reputation as a preacher, and was much beloved for his cheerfulness, his wit, and his truly philosophical traits of character. Author of *Logic, or the Right Use of Reason in the Inquiry after Truth* (1725), *The Improvement of the Mind* (1741), and many volumes of religious and educational treatises, but is best remembered by his *Psalms and Hymns*, which have ever since contributed largely to the services of song in nearly all branches of English-speaking Protestant denominations. "He was," says Montgomery, "almost the inventor of hymns in our language." Monuments have been erected to his memory in Abney Park and Westminster Abbey, a statue by Chantrey was dedicated at Southampton 1861, and the foundation of a memorial hall was laid there May 6, 1875. His *Complete Works* were edited by Drs. Jennings and Doddridge (6 vols., 1751), and biographical sketches have been written by Dr. Johnson, Milner, and Southey.

Watts (John), b. in New York City Apr. 5, 1715; was one of the wealthiest land-proprietors of the colony; married Ann, daughter of Stephen De Lancey, July, 1742; was for many years a representative in the assembly and a member of the council 1757–75; was one of the original founders and trustees of the New York Society Library 1754; presented its first clock to the New York Exchange 1760; was the first president of the New York City Hospital 1760; was the most trusted adviser of his brother-in-law, Gov. James De Lancey, and in 1775 withdrew to England on account of his loyalty to the Crown. D. in Wales in Aug., 1789. His property was confiscated, but a considerable portion was granted to his sons Robert and John July 1, 1784.—His daughter Ann married Capt. Kennedy, who became earl of Cassilis.

Watts (John), son of the preceding, b. in New York City in 1749; was the last royal recorder of New York City; was three times Speaker of the New York assembly; member of Congress 1793–96; judge of Westchester co. 1802–08; was the chief founder of the Leake and Watts Orphan House, New York, to which he made a munificent donation. D. in New York Sept. 3, 1836. He married his cousin, Jane De Lancey, and was grandfather of Gens. Philip Kearny and John Watts de Peyster.

Watts (John S.), b. in Boone co., Ky., Jan. 19, 1816; graduated at Indiana University; studied law, and was admitted to the bar in Indiana; was twice elected a prosecuting attorney; served in the legislature; was appointed by Pres. Fillmore associate justice of New Mexico; subsequently practised his profession in that Territory; was elected a delegate in Congress 1860; took an active part in raising troops for the Union armies, and was appointed by Pres. Johnson in 1868 chief-justice of the supreme court of New Mexico.

Watts (Robert), M. D., b. at Fordham, N. Y., in 1812; graduated at Columbia College 1831, and in medicine at the New York College of Physicians and Surgeons 1835; was appointed, while still an undergraduate, lecturer on anatomy at the Vermont Medical College; became in 1838 professor of anatomy there, and also in the medical college at Pittsfield, Mass.; occupied the chair of anatomy in the New York College of Physicians and Surgeons from 1839 until his death; was one of the founders of the New York Pathological Society, and for several years its presiding officer, and was from 1859 an attending physician of the Nursery and Child's Hospital. D. at Paris, France, Sept. 8, 1867. He edited Harrison's *Manual of Anatomy*, and contributed largely to medical periodicals.

Watts (Thomas), b. in London, England, in 1811; manifested in childhood a wonderful aptitude for the mastery of languages; was conversant at the age of twenty with Russian, Hungarian, and several Slavonic and Scandinavian tongues; visited the British Museum to prosecute researches in the literatures of those languages; found no books in Russian or Hungarian, and but few in the Scandinavian tongues; drew attention to this deficiency in articles published in the *Mechanic's Magazine* (1836–37); was appointed in 1837 an assistant in the library of the British Museum; became assistant keeper of the printed books and superintendent of the new reading room 1857, and was keeper of the printed books from Aug., 1866, to his death, at London Sept. 9, 1869. Under his auspices the Museum collections of Slavonic and Scandinavian literature became the largest outside the several countries where the languages are spoken, and the collections of Americana and of foreign literature generally were raised from insignificance to comparative completeness. Mr. Watts left no great publication as a monument of his surprising abilities, and was best known as the author of contributions to the quarterlies and to the *Transactions* of learned societies, and of some 150 biographies of Scandinavian, Hungarian, Russian, and Polish celebrities in Knight's *Cyclopædia*, and of the *Sketch of the History of the Welsh Language and Literature* (1861) in the same work.

Watts (Thomas Hill), b. in Butler co., Ala., about 1820; was member of the State legislature 1842–45; moved to the city of Montgomery, and was again elected to the legislature 1851–53; was now regarded as among the most prominent of the leaders of the Whig party in his State, and was run as a candidate for the office of Presidential elector on the Bell-Everett ticket in 1860; was strongly opposed to the policy of secession, but when Alabama passed her ordinance withdrawing from the Union, he cast his fortunes with her people; first entered the Confederate military service as colonel of a regiment, but after the battle of Shiloh (Apr., 1862), where he greatly distinguished himself, resigned to take the position of attorney-general in Pres. Davis's cabinet. This position he also resigned in 1863, to fill the office of governor of his State, to which he had been elected; was deposed from this office, which he filled with great ability, under the Reconstruction policy of the Federal government. He still (1876) resides in Montgomery, pursuing the practice of law.

Alexander H. Stephens.

Watts (William), b. in England in 1753; became an eminent line engraver. D. Dec. 7, 1851. He published *The Seats of the Nobility and Gentry, in a Collection of the most Interesting and Picturesque Views* (84 plates, 1779–86), *A Collection of Colored Views in the Turkish Provinces, with Descriptions in French and English* (1801–05), and a fine collection of views of the city of Bath.

Watts'burg, p.-b., Erie co., Pa. P. 286.

Wat Tyler's Insurrection, a celebrated episode of the reign of Richard II., king of England. During the minority of that monarch the government was in the hands of his ambitious uncles, the dukes of Lancaster and of Cambridge, both married to Spanish princesses, through whom they laid claim to the crown of Castile. The expenses attending their foreign projects and the lingering war with France having exhausted the ordinary revenues, the Parliament assembled at Northampton imposed a poll or capitation tax (Nov. 5, 1380) on each male or female above the age of fifteen years; which was rigorously enforced, and became the occasion of disturbances in several places. At Dartford, in Kent, a laboring-man, one Walter or Wat, known as "the Tiler" from his occupation, struck dead a tax-collector, whom he accused of gross insult to his daughter, early in June, 1381, and calling his neighbors to shield him from punishment, soon found himself at the head of a considerable multitude; and the excitement spreading over the nine south-eastern counties, a march against London was determined on for the redress of grievances. A vast mob, usually said to have numbered 100,000, reached Blackheath, near London, June 12, 1381, took possession of the southern portion of London, burned the duke of Lancaster's palace (June 13), plundered a portion of the city, seized the Tower, put to death the lord treasurer, Sir Robert Hales, and the archbishop of Canterbury (June 14), destroyed the Savoy Palace, the archbishop's palace, and the priory of St. John's, Clerkenwell, and advanced to Smithfield (June 15), where they were met by some of the authorities, with the young king at their head. In the parley which ensued the arrogance of Wat was so great that Sir William Walworth rushed upon him, and killed him on the spot. Richard displayed great presence

of mind in a situation of great danger; he declared to the excited mob that he would be their leader, and actually conducted them out of the city. On the following day they were attacked by Sir William Knollys, dispersed, and their leaders mercilessly punished.

Wau'beck, p.-v., Maine tp., Linn co., Ia. P. 222.

Waubeck, p.-v. and tp., Pepin co., Wis. P. 360.

Waucon'da, p.-v. and tp., Lake co., Ill. P. 1120.

Waucul'la, tp., Sedgwick co., Kan. P. 209.

Waugh (Alexander), D. D., b. at East Gordon, Berwickshire, Scotland, in 1754; received a good education; was an influential minister of the Scotch Secession Church, officiating at its principal London church in Wells street from 1782 until his death, Dec. 14, 1827. A *Memoir, with Selections from his Epistolary Correspondence, Pulpit Recollections, etc.* (1830), was published by Rev. James Hay and Rev. Henry Belfrage, D. D.

Waugh (Edwin), b. at Rochdale, Lancashire, England, Jan. 29, 1817; educated at the commercial academy of that place; was apprenticed to a bookseller and printer; worked at his trade as a journeyman nearly ten years; was then appointed secretary to the Lancashire public school association for the promotion of a national plan of secular education; filled that post five years, and has since devoted himself entirely to literature, having by his cultivation of the dialect of his native county won the designation of "the Lancashire poet." Author of *Sketches of Lancashire Life and Localities* (1855; 4th ed. 1869), *Poems and Lancashire Songs* (1859; new ed. 1870), *Rambles in the Lake Country and its Borders* (1862), *Tufts of Heather from the Lancashire Moors* (1864), *Home Life of the Lancashire Factory-Folk* (1866), and other works. A selection from his poems appeared under the title *Poesies from a Country Garden* (2 vols., 1865).

Waukec'hon, p.-v. and tp., Shawanee co., Wis. P. 315.

Wauke'gan, city and tp., cap. of Lake co., Ill., on Chicago and North-western R. R., 35 miles N. of Chicago, on a bluff 80 feet above and overlooking Lake Michigan, with a wide beach separating the town from the lake. Waukegan is the location of valuable mineral springs; among the most celebrated are the Glen Flora, the Magnesia, and the McAllister group. The natural beauty of its location, its springs, its salubrity, its nearness to Chicago, and convenient railroad facilities have made it a favorite place of residence for many Chicago business-men, and a pleasure resort for many families. The lumber, brick, tanning, flour, and fishing interests are considerable. The town contains a national bank, 2 weekly newspapers, 9 churches, public schools, a commercial college, St. Albertus Academy, 4 hotels, society libraries, a public park, waterworks supplied from an artesian well, and a volunteer fire department. Its principal manufacturing establishments are a pump-factory, scaleworks, agricultural works, a woollen-factory, machine-shops, a wood-working establishment, 1 sash and blind factory, 1 brewery, 4 carriage-factories, and a table-factory. Waukegan was settled in 1838. Pop. of city, 4507; of tp. 507. Partridge Bros., Pubs. "Gazette."

Wauke'sha, county of S. E. Wisconsin, drained by Fox and Bark rivers, and traversed by Chicago Milwaukee and St. Paul R. R.; surface level, with alternate prairie and woodland, and numerous small lakes; soil fertile. There are flour-mills, saw-mills, limekilns, and manufactories of agricultural implements, carriages, and saddlery. Live-stock, especially sheep, numerous. Staples, wheat, Indian corn, oats, hay, wool, and dairy products. Cap. Waukesha. Area, 576 sq. m. P. 28,274.

Waukesha, p.-v. and tp., cap. of Waukesha co., Wis., on Chicago Milwaukee and St. Paul R. R., 20 miles W. of Milwaukee, is the principal watering-place in Wisconsin, and is noted for the efficacy of its springs for kidney and liver complaints. Waukesha contains the Wisconsin State industrial school for boys, also Carroll College, 2 banks, 3 newspapers, 6 hotels, an iron-foundry, 1 woollen manufactory, extensive lime and building-stone quarries, flouring-mills, 1 brewery, and a boot and shoe manufactory. Pop. of v. 2633; of tp. 3877. H. M. Youmans, Ed. "Freeman."

Wau'kon, p.-v., cap. of Allamakee co., Ia., 18 miles from Mississippi River, in the centre of a rich farming district, contains 5 churches, an excellent graded school, 1 newspaper, several wagon-factories, a public library, 2 hotels, 1 fanning-mill, 1 bank, and a narrow-gauge railway. Principal business, farming and trade in agricultural machinery. P. 809. E. M. Hancock, Ed. "Standard."

Wauman'da, p.-v. and tp., Buffalo co., Wis. P. 1138.

Waupac'a, county of Central Wisconsin, intersected by Waupaca and Embarras rivers, having Weyauwegan Lake in its S. part, and traversed by Wisconsin Central and Green Bay and Lake Pepin R. Rs.; surface undulating, much of it being covered with dense forests, which furnish large quantities of lumber. There are flour-mills, saw-mills, tanneries, and manufactories of agricultural implements, carriages, iron castings, and woollen goods. Staples, lumber, wheat, Indian corn, oats, and wool. Cap. Waupaca. Area, 648 sq. m. P. 15,539.

Waupaca, city, cap. of Waupaca co., Wis., on Wisconsin Central R. R., 135 miles S. W. of Milwaukee, has 5 churches, good schools, excellent water-power, several mills, factories, and foundries, and 1 newspaper; city chartered in 1875. P. 2042. C. M. Bright, Ed. "Republican."

Waupon'see, tp., Grundy co., Ill. P. 720.

Wau'pun, v., partly in Dodge co., Wis. P. of part of v. in this co. 1101.

Waupun, p.-v. and tp., Fond du Lac co., Wis., 68 miles N. W. of Milwaukee, on Chicago Milwaukee and St. Paul R. R., has 6 churches, 2 banks, 2 newspapers, 4 hotels, 2 carriage-factories, and pump and windmill works. It is surrounded by a fine farming country, and is connected with the Chicago and North-western R. R., 2½ miles distant, by two lines of stages. P. of v. 924; of tp. 2161.
J. W. Oliver, Ed. "Leader."

Waure'gan, p.-v., Windham co., Conn.

Wau'sau, p.-v. and tp., cap. of Marathon co., Wis., on Wisconsin Valley R. R. and on Wisconsin River, has 6 churches, a fine school-house, 2 public halls, 2 banks, 3 newspapers, 2 wooden-ware factories, 2 machine-shops, several hotels, and 5 large saw-mills. Principal business, lumbering and farming. P. of v. 1349; of tp. 1797.
V. Ringle, Ed. "Wisconsin River Pilot."

Wau'seon, p.-v., Clinton tp., and cap. of Fulton co., O. P. 1474.

Wausha'ra, county of Central Wisconsin, drained by Fox, Pine, and White rivers; surface undulating and well wooded, soil fertile. Staples, wheat, Indian corn, oats, lumber, wool, and dairy products. Cap. Wautoma. Area, 648 sq. m. P. 11,279.

Wauto'ma, p.-v. and tp., cap. of Waushara co., Wis., 22 miles from Berlin, the nearest railroad station, has 2 churches, a graded school, 1 newspaper, 2 hotels, 3 wagon-shops, and 1 flouring-mill. P. 801.
W. S. Monroe, Ed. "Waushara Argus."

Wauwato'sa, p.-v. and tp., Milwaukee co., Wis. P. 3689.

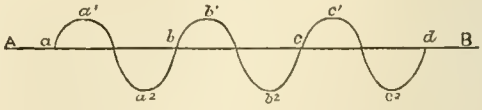
Wauze'ka, p.-v. and tp., Crawford co., Wis. P. 923.

Wave. See Waves, by J. P. Frizell, C. E.

Wave'land, p.-v., Montgomery co., Ind., on Logansport Crawfordsville and South-western R. R., 37 miles N. E. of Terre Haute, has 3 churches, 1 college and a graded school, 1 bank, 2 newspapers, 2 hotels, and 1 mill. Principal business, farming and stock-raising. P. about 1300.
M. C. McCormick, Ed. "News."

Wave-Lengths. In the undulatory theory, light is supposed to be propagated in space by means of waves. A particular ray of light may be considered as perfectly defined when its state of polarization, its wave-length, and its intensity are known. The simplest case is that of a ray consisting of a succession of plane waves—that is, of waves in which the vibrations of the particles of the ether take place in the same plane. Such a ray is said to be plane-polarized, and in such a ray the length of a wave is defined to be the distance measured along the axis of the ray between two nearest successive particles which at any given instant are in the same states of displacement and motion. Thus, in Fig. I, A B represents the axis of a ray—that

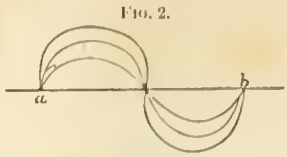
Fig. 1.



is to say, the direction in space in which the light moves. The plane of the paper is the plane of vibration. Particles a and b are in the same states of *displacement* with reference to the axis A B, since both are *on* the axis. They are also in the same states of *motion*, since b is just beginning to execute its nth vibration when a has completed its $(n+1)$th vibration, and the two are moving in the same direction: $a_1 b_1$, $b_1 c_1$, $a_2 b_2$, $b_2 c_2$ are in like manner, by definition, wave-lengths. Our definition also applies to the cases of elliptically and circularly polarized rays. In these the particles of the ether revolve in ellipses or in circles, the planes of which are at right angles to the axis of the ray. It is easy to see that a ray might pass from one state of polarization to another without changing the lengths of its

component waves. The intensity of the light at any point depends upon the extent of the vibrations of each particle of the ether at that point. This extent is termed the *amplitude* of the vibration, and the intensity corresponding to a given wave is proportional to the square of the amplitude of the vibrations. Thus, in Fig. 2 we have with the same wave-length several different degrees of intensity.

FIG. 2.



From the above it appears that the wave-length is the only invariable characteristic of a ray of light, since it is not affected by changes in the intensity or in the state of polarization. It has become usual to denote the wave-length by the letter λ, and to express it in decimals of a millimètre, the millionth of a millimètre forming a convenient unit. When a ray of light passes from an optically less to an optically more dense medium, the wave-lengths of the component elementary rays are shortened. If the elementary rays differ in wave-length, the waves will be shortened in precisely the same ratio. In like manner, the waves are lengthened in the same ratio when the rays pass from a more to a less dense medium. Hence, it is necessary to define optically the medium in which the light is moving, and for this purpose it is theoretically best to give the wave-length when referred to motion *in vacuo*. But in practice the wave-length in air is usually given as more convenient, small changes in the pressure and temperature of the air having an insensible influence in changing the lengths of the waves. (For the method of determining wave-lengths experimentally we must refer to the article UNDULATORY THEORY OF LIGHT.) The earliest accurate measurements are those of Fraunhofer. More recently, elaborate measurements have been made by Ditscheiner, Van der Willigen, Mascart, and Ångström. The results of the last-named observer are the most numerous and most entitled to confidence. When the wave-lengths of a sufficient number of standard spectral lines have been determined with precision, those of intermediate lines may be determined by interpolation. Thalen has employed for this purpose the method of comparison first given by the writer of this article, and has in this manner very greatly extended the results of Ångström. Normal maps of the spectrum are those in which each characteristic ray is laid down upon a scale according to its wave-length. The first extended map of this kind was given by the writer in 1867. It contained 108 spectral lines, and was based partly upon the measurements of Ditscheiner and partly on the older measurements of Ångström. The splendid map of Ångström appeared in 1869. It contains about 800 lines, and is the now universally-recognized standard.

The most accurate information which we possess at present in regard to the wave-lengths of the spectral lines of the elements is contained in the following tables. Table I. contains the results of Ångström's direct and absolute measures, but the unit is taken as the millionth instead of the ten-millionth of a millimètre, and only two decimals are given. In addition, the writer has completed, as far as possible, the comparison with Kirchhoff's well-known chart by filling up the numbers in Column I, left very incomplete by Ångström. Column K. contains, therefore, the number of the spectral line upon Kirchhoff's chart; Column λ the corresponding wave-length; Column S. the symbol of the element of which the line is characteristic; and Column R. remarks as to the character of the lines. Telluric lines are represented by the symbol Aq.

The wave-lengths of the ultra-violet rays have been determined by Mascart. The corresponding spectral lines have not yet been identified with those of any of the elements, and they consequently possess but little interest. The shortest wave-length accurately measured is that of the line R in the ultra-violet portion of the spectrum. For this we have λ = 317.75-millionths of a millimètre, but rays of shorter wave-length have by special artifices been rendered visible. The longest wave yet measured is that corresponding to the limit of sensible rays of heat; for this we have, according to Fizeau, λ = 0.001940.

TABLE I.

K.	λ.	S.	R.	K.	λ.	S.	R.	K.	λ.	S.	R.
A	760.40	Aq		1352.7	544.44	Fe			476.17	Mn	
a	718.47	Aq		1362.9	542.90	Fe and Ti			475.35	Mn	
	718.25			1389.4	540.49	Fe			472.67	Fe	
B	686.71	Aq		1390.9	540.33	Fe and Ti		2249.7	471.38	Ni	
641.0	671.72	Ca		1421.5	537.06	Fe	Very strong.	2264	470.24	.....	Unknown.
C	656.21	H		1397.5	536.91	Fe	Strong.		466.72	Fe and	
	651.58	Aq		1451.8	533.93	Fe	Double.		466.64	Ti	
	649.51	Aq		1462.8	532.74	Fe	Double.		465.41	Cr	
	649.42	Fe		1466.8	532.35	Fe			461.28	.....	Unknown.
731.7	646.20	Ca			529.67	Ti			461.08	Fe	
736.9	644.93	Ca		E	526.96	Ca and Fe			458.09	Ca	
740.9	643.84	Ca		E	526.87	Fe			457.16	Ti	
	643.01	Fe		1527.7	526.59	Fe			456.49	.....	Unknown —double.
	641.06	Fe		1528.7	526.47	Ca					
756.9	639.93	Fe	Very strong.	1569.6	523.22	Fe		2467.0	454.90	Ti	
	633.62	Fe		1577.2	522.64	Fe and Ti	Triple—very strong.		453.56	Ti and Ca	Double.
	627.71	Aq		1601.4	520.78	Cr			453.33	Fe and Ti	
	627.63	Aq		1604.4	520.54	Cr			452.81	Fe	
815.0	626.43	Fe		1606.4	520.39	Cr Fe			452.21	Ti	
	624.56	Fe			520.18	Fe			450.05	Ti	
831	622.99	Fe		b_1	518.31	Mg			449.38	Fe	Strong.
819.7	619.07	Fe		b_2	517.22	Mg		2606.5	445.41	Ca Mn	
860.2	616.85	Ca		b_3	516.85	Ni and Fe		2638.5	443.46	Ca	
863.9	616.14	Ca		b_4	516.69	Mg and Fe		2653.0	442.51	Ca	
874.3	614.08	Ba		1693.8	513.88	Fe		2670.0	441.48	Fe Mn	
876.5	613.68	Fe			510.72	Fe		2686.4	440.43	Fe	Strong.
877	613.58	Fe		1748.9	509.92	Ni	Double.	2721.0	438.28	Fe	Very strong.
884.9	612.13	Ca		1749.6					434.01	H	
894.9	610.19	Ca		1752.62	509.83	Fe			432.52	Fe	
	607.78	Fe		1775.8				G	430.73	Fe	
	606.47	Fe Ti		1776.5	507.93	Fe Ni	Four rays.		427.13	Fe	Very strong —double.
931.4	602.32	Fe		1777.5					426.00	Fe	
	602.09	Mn		1778.5					425.05	Fe	
	601.93	Fe			506.45	Fe Ti			424.98		
	597.48	Fe		1833.5	504.13	Ca Fe		g	422.64	Ca	Very strong.
	591.33	Fe		1834.5	501.03	Ca Fe			420.16	Fe	
D_2	589.51	Na			501.78	Fe			419.80	Fe	Double.
D_1	588.91	Na			501.16	Fe			419.11	Fe	
1029.4	585.66	Ca			500.51	Fe	Double.		418.67	Fe	Double.
1096	576.20	Fe		1961	495.69	Fe	Very strong —double.		415.57	Fe	
	570.85	Fe							415.38	Fe	
	568.15	Na and Fe		1989.5	493.35	Fe Ba	Double.		414.31	Fe	Double.
1174.2	565.77	Fe		1990					413.39	Fe	Several rays.
	562.34	Fe		2005.2	491.99	Fe			413.15		
1207.3	561.46	Fe	Strong.	2007.2	491.82	Fe		h	410.12	H	Very strong.
1217.8	560.18	Fe		2041.3	489.10	Fe			407.67	One Ca	Double.
1221.6	559.77	Fe		2042.2	489.02	Fe			407.10	Fe	Very strong.
1221.7	559.36	Ca		2058	487.76	Ca			406.29		
1231.5	558.57	Fe		2066.2	487.14	Fe			404.51		
	557.18	Fe		2067.1	487.06	Fe			403.29	Mn	Three rays.
1280	552.75	Mg	Strong.	F	486.07	H			402.95	Mn	
	550.06	Fe			482.29	Mn			400.49	Fe	Strong.
1337.0	546.24	Fe		2157	479.18	Co Ti		H	396.81	Ca and Fe	Very broad.
1343.5	545.48	Fe	Very strong.		478.27	Mn		H_1	393.30		
1351.1	544.61	Fe and Ti									

TABLE II.—*Wave-Lengths of the Metallic Lines according to Thalen.*

In these tables the first column, headed "Color," gives the colored space in which the line is found. Column λ gives the wave-lengths in millionths of a millimètre. Column I. gives the intensity of the line upon a scale of 5, the number 1 indicating the greatest intensity. Under column R. the character of the ray is given, *b* signifying a broad line; *bb*, a very broad line; *n*, a nebulous line; *bn*, a line which is broad and nebulous, etc. The limits of the colors are those assigned by Listing. The following metals were examined in the metallic state: K, Na, Mg, Al, G, Co, Ni, Zn, Cd, Pb, Tl, Bi, Cu, Hg, Ag, Au, Sn, Pt, Pd, Os, Sb, As, Te, In. The other metals were examined, for the most part, in the form of chlorides. Column K. gives the corresponding number of the line on Kirchhoff's scale, as determined by the writer of this article.

POTASSIUM.

Color.	λ.	I.	R.	K.
Yellow..	582.9	1		
	580.2	1		
	578.25	1		
	535.35	2	*b*	
Green...	533.85	2	*b*	
	532.25	2		
Blue.....	482.70	3	*b*	
Indigo..	430.95	4		

SODIUM.

Color.	λ.	I.	R.	K.
Orange.	616.00	2		
	615.42	2		
	589.50	1	D_2	1002.8
	588.90	1	D_1	1006.8
Yellow..	568.72	3		
	568.14	3		
Green...	515.48	3		
	515.25	3		
	498.25	4	*n*	

LITHIUM.

Color.	λ.	I.	R.	K.
Red.....	670.52	1		
Orange.	610.20	3		
Blue.....	460.27	1	*b*	

CÆSIUM.

Color.	λ.	I.	R.	K.
Green...	497.15	1		

RUBIDIUM.

Color.	λ.	I.	R.	K.
Orange.	629.65	1		
	620.40	2		
	616.00	3		
	607.00	3		
Blue.....	477.60	4		
	456.95	5		
Indigo..	455.10	5		
Violet...	420.20	2	*b*	

BARIUM.

Color.	λ.	I.	R.	K.
Red.....	652.60	3		
	649.60	1	.....	718.7
	648.30	3		
Orange.	644.90	3		
	634.30	3		
	614.06	1	.....	874.3
	610.99	3	.....	890.2
	606.20	3		
	601.80	3		
	599.15	3		
	597.10	3	.....	964.5
	590.45	5		
Yellow.	585.25	1	.....	1031.8
	582.70	3	.....	1050
	580.85	5		
	580.35	5		
	577.95	3	.....	1083
	553.42	1	.....	1274.2
	551.84	3	.....	1287.5
	542.50	3	.....	1371.4?
Green...	493.34	1	.....	1989.5
Blue.....	489.93	2	.....	2031.1
Indigo..	455.34	1	*b*	
	452.44	3		
Violet...	416.55	2		
	413.05	1	*b*	

STRONTIUM.

Color.	λ.	I.	R.	K.
Red.....	655.00	4		
	650.15	2	.....	717.5
Orange.	640.70	1	.....	753.8?
	638.70	3		
	638.00	4		
	597.05	5		
Yellow.	585.00	5		
	554.00	3	.....	1269.5
	553.35	2	.....	1274.7
	552.25	2	.....	1286.0
	550.35	2	.....	1301
	548.50	3	.....	1317
	548.00	1	.....	1320.6
Green...	525.60	2	.....	1539
	523.85	1	.....	1562
	522.85	3	.....	1578.5
	522.55	3	.....	1582
	522.35	3		
	496.75	4		
	496.15	2		
Blue.....	487.60	3		
	487.20	3		
	483.15	3		
	481.20	3		
	478.35	3		
	474.05	3		
	472.10	3		
	460.75	1	*b*	

STRONTIUM (continued).

Color.	λ.	I.	R.	K.
Indigo..	430.53	1	*b*	
Violet...	422.63	3		
	421.53	1	*bb*	
	416.10	3		
	407.85	1	*b*	

CALCIUM.

Color.	λ.	I.	R.	K.
Red.....	649.80	2	.....	717.8
	649.21	1	.....	720.1
Orange.	646.85	2	.....	731.7
	646.17	1		
	644.90	2	.....	736.9
	643.81	1	.....	740.9
	616.83	2	.....	863.9
	616.12	1		
	612.12	1	.....	884.9
	610.17	2	.....	891.9
	585.65	3	.....	1029.3
Yellow..	560.17	4	.....	1217.8
	560.02	3	.....	1219.2
	559.72	3		
	559.34	2	.....	1224.9
	558.90	4	.....	1235
	558.76	1		
	588.08	4		
	534.86	2	.....	1443.5
Green...	526.94	2	E	1522.7
	526.45	3	.....	1528.7
	526.34	4	.....	1530.2
	526.12	5	.....	1532.5
	526.08	5	.....	1533.1
	518.82	3	.....	1627.2
	504.12	2	.....	1832.8
Blue.....	487.74	3	.....	2058?
	484.81	4		
	483.18	5		
	481.16	4		
	460.75	4		
	458.53	4		
	458.08	4		
	457.83	4		
Indigo..	453.55	5		
	453.42	5		
	453.21	5		
	445.52	5	.....	2606.5
	445.40	1		
	443.53	5	.....	2653
	443.45	1		
	442.50	1		
	440.77	5		
	440.70	5		
	440.57	5		
	439.30	4		
	438.94	4		
	438.47	4		
	437.91	4		
	431.80	2	.....	2855.2?
	430.65	3		
	430.23	1	.....	2864.7
	429.85	3	.....	2869.7
	428.94	2		
	428.25	2		
	427.45	5		
	427.15	5		
	425.39	5		
	424.98	4		
	424.75	5		
Violet...	423.75	5		
	423.30	5		
	422.63	1	*bbb*	
	421.53	2		
	419.25	5		
	418.85	4		
	414.30	4		
	413.15	4		
	409.80	5		
	409.55	5		
	409.18	5		
	407.70	3	H_1	
	396.80	1	H_2	
Ultra violet	393.28	1		

MAGNESIUM.

Color.	λ.	I.	R.	K.
Yellow..	552.74	1		
Green...	518.30	1	b_1	1634.1
	517.20	1	b_2	1649
	516.67	1	b_4	1655.9
Blue.....	470.35	3	*bn*	
	458.65	3	*bn*	
Indigo..	448.10	3	*bn*	

ALUMINUM.

Color.	λ.	I.	R.	K.
Orange.	637.10	3		
	634.45	3		
	624.40	2	*b*	

ALUMINUM (continued).

Color.	λ.	I.	R.	K.
Orange.	623.40	2	*b*	
Yellow..	572.25	1		
	569.55	1		
	559.25	4	*n*	
Green...	565.65	1		
Blue.....	466.20	1		
Indigo..	452.95	3	*b.n*	
	451.10	3	*b.n*	
	547.85	4	*b.n*	
Ultra violet	396.10	2	*b*	
	394.30	2	*b*	

GLUCINUM.

Color.	λ.	I.	R.	K.
Blue.....	457.20	3		
Indigo..	448.85	3		

ZIRCONIUM.

Color.	λ.	I.	R.	K.
Orange.	634.35	3		
	631.00	3		
	614.05	1		
	613.25	3		
	612.70	1		
Yellow..	538.45	4		
	534.95	3		
Green...	519.05	3		
Blue.....	481.50	1		
	477.10	1		
	473.85	1		
	470.95	1		
	468.65	1		
Indigo..	449.75	4		
	449.45	4		
	444.30	4		
	438.00	4		
	437.00	4		
	436.00	4		
	424.20	4		
	424.15	4		
Violet...	422.85	4		
	420.95	4		
	420.90	4		
	415.50	2		
	414.90	2		

YTTRIUM AND ERBIUM.

Color.	λ.	I.	R.	K.
Orange.	643.40	2		
	623.55	5		
	622.35	5		
	621.80	2	Er	
	619.90	4		
	619.00	2		
	617.90	3		
	616.40	3		
	614.80	2	Er & Yt	
	613.15	1		
	611.25	5		
	610.60	5		
	609.40	5		
	608.80	5		
	607.15	4		
	605.30	4		
	603.80	3		
	601.90	3		
	600.30	2	Er & Yt	
	598.80	2		
	598.25	4	Er	
	597.10	1	Er & Yt	
Yellow..	570.65	4		
	566.10	1	*b*	
	564.60	4		
	564.15	4		
	562.95	2		
	560.40	4		
	559.40	4		
	558.80	4		
	558.05	2		
	557.60	4		
	556.75	4		
	555.55	3	Er	
	554.40	3		
	554.25	3		
	552.70	1		
	552.20	4		
	550.90	3		
	550.20	4		
	549.65	2		
	547.90	4		
	547.75	5		
	547.60	2	Er	
	547.35	4		
	546.80	5		
	546.55	1		
	543.70	4		
	540.15	1		

YTTRIUM AND ERBIUM (c.).

Color.	λ.	I.	R.	K.
Yellow..	535.25	4	Er	
Green...	534.55	4		
	533.50	3		
	528.75	4		
	566.90	4		
	526.40	4		
	526.10	4		
	523.90	4		
	520.50	2	Er & Yt	
	520.00	2		
	519.50	4		
	513.45	5		
	512.65	4		
	512.10	2		
	511.75	3		
	508.70	1	Er & Y	
	498.15	4		
	497.10	4		
	493.50	4	Er *b*	
Blue.....	490.00	1	Er & Yt	
	488.25	1		
	485.40	1		
	484.50	5		
	484.20	5		
	483.90	5		
	482.20	4		
	478.50	3	Er	
	476.05	4		
	467.40	4		
	464.30	2		
Indigo..	450.50	4		
	442.20	2		
	439.70	4		
	437.40	1	Er & Yt *b*	
	435.75	3		
	430.95	1	*b*	
Violet...	423.65	3		
	422.70	5		
	417.65	2	*b*	
	416.70	3		
	414.25	3		
	412.70	3		
	410.25	3		

THORIUM.

Color.	λ.	I.	R.	K.
	569.85	5		
	564.00	5		
	553.70	3		
	544.60	3		
	537.45	3		
	491.90	3		
	486.35	3		
	439.25	3		
	438.15	1		
	428.10	1		
	427.75	2		
	427.25	3		

IRON.

Color.	λ.	I.	R.	K.
Red.....	648.98	3	.....	721.1
Orange.	639.90	1	.....	756.9
	630.03	3	.....	798.5
	624.54	2		
	622.97	2		
	619.05	2	.....	849.7
	613.56	2	.....	877
	606.45	2	.....	912.1?
	602.30	3		
	601.91	4		
	600.75	4		
	600.21	4		
	598.62	4		
	598.42	4		
	598.28	4		
	597.61	4		
	597.46	4		
Yellow..	576.19	3	.....	1096.1
	570.83	3		
	568.14	3		
	566.15	3		
	565.76	1		
	565.44	3		
	562.32	3	.....	1200.6
	561.45	1	.....	1207.3
	560.17	1	.....	1217.8
	559.72	1		
	559.12	2		
	558.56	1	.....	1231.3
	557.49	2	.....	1239.9
	557.17	1	.....	1242.6
	556.85	2	.....	1245.1
	550.59	3		
	550.05	3		
	549.66	3		
	548.68	3		

IRON (continued).

Color.	λ.	I.	R.	K.
Yellow..	545.47	1	.....	1343.5
	544.59	1	.....	1352.7
	542.88	1	.....	1367
	540.48	2	.....	1389.4
	540.31	2	.....	1390.9
	539.61	2	.....	1397.5
	539.23	3	.....	1401.6
	538.23	3	.....	1410.5
	537.05	1	.....	1421.5
	536.90	3	.....	1423
	536.65	3	.....	1425.1
	536.40	3	.....	1428.2
	536.19	4		
	535.21	4		
	531.86	4		
Green...	531.02	2	.....	1450.8
	533.92	2	.....	1449.4
	532.73	1		
	532.31	2	.....	1466.8
	531.59	2	.....	1473.9
	530.65	3		
	530.15	3	.....	1487.7
	528.26	2	.....	1506.3
	528.09	3	.....	1508.6
	526.93	1	} E	1522.7
	526.85	1		1523.7
	526.58	2	.....	1527.7
	526.24	4		
	523.21	1	.....	1569.6
	522.62	1	.....	1577.2
	520.76	3		
	520.37	3		
	520.15	4		
	519.41	3		
	519.17	2	.....	6222.3
	519.05	4	.....	1623.1
	517.41	4	.....	1650.3
	516.83	3	b_3	1653.7
	516.67	2	b_4	1655.6
	516.16	4	.....	1662.8
	513.86	2	.....	1693.8
	510.70	3		
	506.41	4		
	505.10	2		
	504.91	2	.....	1867.1
	504.12	3		
	504.01	3		
	500.52	4		
	500.20	5		
	499.33	5		
	499.03	4		
	498.83	5		
	495.67	1	*s*	1961.2
	492.31	3	.....	2001.6
	491.98	1	.....	2005.2
Blue	491.82	2	.....	2007.2
	489.04	1	.....	2041.3
	487.74	3	.....	2058
	487.13	2	.....	2066.2
	487.05	2	.....	2067.1
	485.92	4	.....	2082
	478.86	5		
	478.58	5		
	470.94	5		
	470.83	5		
	470.65	5		
	469.08	3		
	465.34	3		
	463.20	3		
	461.06	3		
	460.26	4		
	459.19	3		
Indigo..	452.80	3		
	441.47	1	*ss*	2670
	440.42	1	*ss*	2686.4
	438.28	1	*ss*	2721
	434.31	3		
	432.52	1	*s*	
	431.46	3		
	430.72	1	G	2854.7
	429.85	4		
	429.39	4		
	428.60	4		
	427.13	1		
	426.00	2		
	425.05	1		
	424.98	1		
	424.75	4		
Violet...	423.55	3		
	423.30	3		
	422.68	5		
	422.17	5		
	421.83	5		
	420.99	5		
	420.35	2		
	419.80	1		
	419.12	2		
	418.72	1		
	418.67	1		
	418.13	4		
	417.70	4		
	415.38	3		
	415.15	4		
	414.86	4		
	414.31	1		

IRON (continued).

Color.	λ.	I.	R.	K.
Violet..	413.39	2		
	413.15	1		
	411.78	2		
	407.10	1		
	406.29	1		
	404.50	1		
	400.47	3		

MANGANESE.

Color.	λ.	I.	R.	K.
Orange	602.07	1		
	601.56	1		
	601.25	1		
Yellow.	551.56	5		
	544.30	5		
	541.95	3		
	541.24	3		
	540.65	5		
	539.96	4		
	539.35	4		
	537.66	3		
	535.90	4		
Green..	534.02	3		
	525.41	4		
	523.36	4		
	519.52	4		
Blue	482.28	1		
	478.26	1		
	476.58	5		
	476.47	1		
	476.15	1		
	476.07	5		
	475.34	1		
	473.80	3		
	472.90	3		
	472.60	3		
	470.87	3		
Indigo.	450.35	5		
	450.12	2		
	449.82	2		
	449.52	5		
	449.10	5		
	448.95	3		
	447.89	5		
	447.24	2		
	447.05	2		
	446.40	3		
	446.15	3		
	446.10	3		
	445.98	5		
	445.77	3		
	445.73	4		
	445.70	5		
	445.55	5		
	445.62	4		
	445.52	3		
	445.20	5		
	445.04	3		
	443.64	3		
	443.53	5		
	441.47	2		
	428.05	3		
	426.50	3		
	425.82	3		
Violet..	423.48	1		
	422.70	1		
	408.35	3		
	408.30	5		
	407.96	3		
	406.29	5		
	405.44	3		
	404.81	3		
	404.05	3		
	403.39	5		
	403.28	5		
	403.17	3		
	402.94	2		
	398.80	5		

CHROMIUM.

Color.	λ.	I.	R.	K.
Yellow.	540.90	2	.....	1385.7
Green ..	531.25	5		
	534.10	5		
	531.80	5		
	531.30	5		
	529.66	5		
	529.61	5		
	527.43	4		
	526.34	4		
	525.41	4		
	524.63	4		
	520.76	1	.....	1601.4
	520.52	1	.....	1604.4
	520.37	1	.....	1606.4
	492.40	4		
Blue	465.39	4		
	464.64	4		
Indigo.	449.52	4		
	438.18	4		
	436.92	4		
	435.91	4		
	435.18	2		
	434.44	2		
	433.82	2		
	433.75	2		

CHROMIUM (continued).

Color.	λ.	I.	R.	K.
Indigo.	433.68	3		
	428.94	1		
	427.46	1		
	425.39	1		

COBALT.

Color.	λ.	I.	R.	K.
Orange	614.25	3	.....	873
	612.12	3	.....	884.9
	600.35	2	*b*	
Yellow.	518.24	4		
	515.20	3	.....	1316
	514.30	3	.....	1351.5
	536.80	3	.....	1424
	536.25	5	.....	1429.8
	535.95	5	.....	1433
	535.24	3	.....	1438.9
	535.12	3	.....	1440.2
Green...	534.26	5	.....	1448.7
	534.21	5	.....	1449.4
	527.96	3	*d*	1510.3
	526.72	5	.....	1525
	526.58	3	*d*	1527.7
	523.44	5	.....	1566.5
	523.00	5	.....	1572
	521.20	5	.....	1596
Blue.....	486.70	1	.....	2071.3
	483.90	1	.....	2103.3
	481.35	1	.....	2132.3
	479.17	1	.....	2157
	477.87	1	.....	2171.5
	474.85	4		
	458.08	4		
Violet...	453.05	4	.....	2493.6

NICKEL.

Color.	λ.	I.	R.	K.
Orange	617.57	3	*b*	856.8
	611.53	4		
	610.75	4	.....	891.7
	589.20	1	.....	1005
	585.65	4	.....	1029.3
Yellow.	547.59	3	.....	1324.8
Green...	517.56	5	.....	1643
	516.83	5	.....	1653.7
	515.51	5	.....	1672.2
	514.57	5	.....	1684?
	514.20	5	.....	1690
	513.68	5	.....	1697?
	511.49	5	.....	1727.3
	509.97	5	.....	1748.9
	509.85	5	.....	1749.6
	508.06	5	.....	1775.8
	507.97	5	.....	1776.5
	503.46	3	.....	1842.2
	501.65	3	.....	1868.4
	498.33	5	.....	1920.2
	497.96	5	.....	1925.8
	493.51	3	.....	1987.5
Blue	491.76	3	.....	2008.1
	490.39	3		
	487.29	1	.....	2064.7
	486.53	1	.....	2073.5
	485.47	1	.....	2086.9
	483.02	5	.....	2115.0
	482.84	5		
	478.58	2	.....	2164
	475.50	5	.....	2199.2
	471.37	1		
	464.70	5		
Indigo.	440.17	5		

ZINC.

Color.	λ.	I.	R.	K.
Yellow.	636.25	1	.....	771.8
	610.20	1	.....	896
	602.25	2		
	589.35	2	.....	1004
	581.60	4		
	575.60	5		
	574.50	5		
	560.80	4		
Green..	557.75	4		
	556.30	4		
	546.55	4		
	543.60	5		
	533.60	5		
	524.95	4		
	523.30	4		
	515.85	4		
	512.10	4		
	507.40	4		
	501.80	4		
	497.10	4		
	492.38	1	*b.b.n*	2000.5
Blue	491.12	1	*b.b.n*	2018?
	487.80	5		
	486.50	5		
	480.97	1		
	472.14	1	.....	2240?
	467.95	1	.....	2291.8?

CADMIUM.

Color.	λ.	I.	R.	K.
Orange	646.60	3	*b*	730.5?
	643.80	1	.....	740.9?
	605.65	5		
	600.35	5		

CADMIUM (continued).

Color.	λ.	I.	R.	K.
Orange	595.75	5	*n*	
	594.30	5	*n*	
Yellow.	579.00	5		
	568.70	4		
	548.90	5		
	547.10	4		
	537.80	1		
Green...	533.75	1		
	530.45	5		
	515.30	4		
	508.50	1	.....	1769.5
Blue.....	479.90	1	.....	2118
	467.68	1	....	2294.5
Indigo.	441.55	2	....	2667.7

LEAD.

Color.	λ.	I.	R.	K.
Red.....	655.60	1		
Orange	615.20	3	....	735?
	605.90	5		
	604.00	3	*b*	
	600.90	5	.....	944
	600.15	3	*b*	
	589.50	5		
	587.40	3	*b*	
	585.65	1		
Yellow.	577.90	5		
	560.70	1	*b*	1213
	551.60	2	*b*	1266
	552.35	4		
	537.20	1	*b*	1119.5
Green...	527.45	5		
	520.65	5		
	520.10	3		
	518.90	5		
	516.30	4		
	504.50	2	*b*	1826
	500.45	3		
Blue	480.20	5	*n*	
	479.65	5	*n*	
	476.00	4	*b*	
	457.30	5		
Indigo.	440.15	5		
	438.65	1	*b*	2714
	424.60	1	*b*	

THALLIUM.

Color.	λ.	I.	R.	K.
Orange	594.75	3		
Yellow	560.80	5		
	549.00	5		
	541.25	4	*n*	
	536.00	4		
	534.95	1	*b*	
Green..	515.25	2	*n*	
	508.50	4		
	507.85	3	*n*	
	505.30	3		
	498.15	3	*n*	
	494.55	4		
Blue.....	489.20	4		
	473.55	3	*b*	

BISMUTH.

Color.	λ.	I.	R.	K.
Orange	659.90	4		
	649.25	3		
	612.90	2		
	605.65	2		
	605.00	4		
	603.85	4		
	586.15	2		
Yellow.	581.60	3		
	571.65	2		
	565.50	4		
	555.30	4		
	545.00	2	*b*	
	539.65	4		
Green...	527.00	2	*b*	
	520.80	1	*b*	
	520.10	4	*n*	
	514.35	1	*b*	
	512.35	1	*b*	
	509.00	5	*n*	
	507.75	4	*n*	
	499.30	1		
	497.00	5		
Blue	490.50	4		
	479.65	4		
	475.25	5		
	473.00	5		
	472.20	1		
	470.50	5		
	469.15	4		
	456.00	2		
Indigo.	433.95	4		
	432.75	4		
	430.20	3	*b*	
	425.95	2	*b*	
Violet...	411.90	4	*b*	
	408.45	4	*b*	

COPPER.

Color.	λ.	I.	R.	K.
Orange	637.97	2		
	621.83	5		
Yellow.	578.13	2	.....	1081.8
	570.04	1		

COPPER (continued).

Color.	λ.	I.	R.	K.
Yellow..	529.20	2	.....	1497.3
	521.71	1	.....	1588.3
	515.26	1		
	510.49	1		
	501.14	4		
	495.55	3	*n*	
	493.25	3	*n*	
	491.15	3	*n*	
	470.30	3		
	465.07	3	.....	2329.5
	427.50	3		

MERCURY.

Color.	λ.	I.	R.	K.
Orange.	615.10	1		
	588.80	2		
	587.10	4	.....	869.2
Yellow..	578.95	1		
	576.80	1	.....	1092.5?
	567.80	2	.....	1157
	559.50	3		
	546.05	1	*b*	1338
	542.60	2	.....	1369
	536.45	4	*n*	
Green...	527.85	5	*n*	
	521.70	5	*n*	
	520.60	4	*n*	
	513.10	4	*n*	
	495.80	3		
Blue.....	491.60	4		
	435.80	1	*b*	
Violet...	407.85	3		
	404.70	3		
	398.20	4		

SILVER.

Color.	λ.	I.	R.	K.
Orange.	603.60	5	*n*	
Yellow..	565.60	4	*n*	
	564.50	4	*n*	
	562.55	4	*n*	
	562.25	2	*b*	
	561.05	4	*n*	
	559.00	4	*n*	
	556.80	4	*n*	
	555.65	5	*n*	
	555.15	2		
	552.20	4	*n*	
	548.65	5	*n*	
	547.00	2	.....	1330
	546.40	1	.....	1335
	542.35	3	*n*	
	541.10	5	*n*	
	540.15	2	*b*	
Green...	529.90	3		
	520.87	1	.....	1600
Blue	487.40	2		
	466.65	4		
Indigo..	447.50	4		

GOLD.

Color.	λ.	I.	R.	K.
Orange.	627.65	2	.....	809.5
	596.00	3	.....	967.0
	595.50	3	.....	969.6
Yellow..	583.60	1	.....	1042.5
Green...	523.00	1	.....	1572
Blue	479.20	3	.....	2157

TIN.

Color.	λ.	I.	R.	K.
Orange.	645.20	1	*b*	736
Yellow..	579.80	1	*b*	
	563.00	2		
	558.85	1	*b*	
	556.25	1	*b*	1250
	536.85	5		
	534.75	4		
Green...	533.20	2	*b*	
	528.95	5		
	522.40	4		
	510.05	3	.....	1748
	502.10	5		
	492.30	4		
Blue	485.80	3		
	458.45	2		
Indigo..	452.40	1	*b*	

PLATINUM.

Color.	λ.	I.	R.	K.
Orange red.	652.20	3	.....	709.3
	596.35	3	.....	965.5
Yellow..	584.50	4		
	583.70	4		
	580.60	4		
	547.80	4		
	547.55	4	.....	1325.7
	538.95	3		
	536.75	2		
	530.15	1	.....	1488.2
	522.60	2	.....	1576.8
	519.80	4		
	505.95	2	.....	1806.1
Blue	487.90	4	.....	2057?
	485.15	4		
	480.30	4		
Indigo..	455.18	2	*b*	
	449.82	2		
	444.20	4		
	438.94	4		
	432.70	4		

PALLADIUM.

Color.	λ.	I.	R.	K.
Orange	612.90	5		
Yellow.	569.40	3	.....	1146.2
	566.80	3	.....	1164.9
	565.10	4		
	564.00	4	.....	1185.6
	561.80	3		
	554.60	3	.....	1264.6
	554.20	3	.....	1269?
	539.40	2	.....	1407
	536.15	4	.....	1430.1
Green..	534.50	4	.....	1447
	531.20	4	.....	1477
	529.50	1		
	525.70	4		
	523.35	2	.....	1566.5
	520.80	4	.....	1601.4
	516.30	1	.....	1660
	511.65	2		
	511.00	2	.....	1732.9
Blue.....	487.45	3	.....	2062
	481.70	3		
	478.70	3	.....	2162
Indigo.	447.35	3		
	427.80	5	*b*	
Violet..	421.25	2		

CERIUM.

Color.	λ.	I.	R.	K.
Yellow.	565.40	5		
	560.00	5		
	556.40	5	.....	1249.9
	551.10	2		
	547.20	3	.....	1329.1
	546.70	4	.....	1332.4
	546.30	5	.....	1336.2
	540.85	2	.....	1385
	539.25	2	.....	1401.7
	535.20	1	.....	1438.9
Green..	533.00	3	.....	1460.9
	527.30	1	.....	1517.9
	519.05	4	.....	1623.1
	518.70	3	.....	1629.2
	516.10	5		
	507.90	3	.....	1775.5
	507.20	4	.....	1784.5
	497.00	5	.....	1938.8
Blue.....	471.35	2	*b*	
	462.80	1		
	462.40	5		
	460.55	5		
	459.40	3		
	458.25	5		
	457.85	5		
	457.25	1		
	456.45	5		
	456.20	1		
	456.05	2	*b*	
Indigo.	453.95	2		
	452.75	2	*b*	
	452.65	1		
	452.30	2		
	448.60	5		
	448.25	5		
	447.90	5		
	447.15	2		
	446.70	5		
	446.25	5		
	445.95	1	*b*	
	444.85	3	*b*	
	444.35	3		
	442.80	2		
	441.90	2		
	441.00	5		
	439.85	5		
	439.15	2		
	438.55	2		
	438.20	2		
	436.50	5		
	429.60	1	*b*	
	428.90	1	*b*	
	418.55	3	*b*	
	416.50	4	*b*	
	414.90	4	*b*	
	413.65	4		
	413.25	4		
	412.70	5		
	412.40	5		

DIDYMIUM AND LANTHANUM.

Color.	λ.	I.	R.	K.
Orange	634.60	5	Di	
	629.25	5	Di La	
	597.35	5		
	596.35	5		
Yellow.	580.55	5	.....	1064.5
	579.70	5		
	579.00	4	.....	1075.6
	576.80	5	.....	1092.1
	550.00	3	.....	1303.4
	545.40	2		
	538.10	3		
	537.65	3		
Green..	533.90	4		
	533.75	3		

DIDYMIUM AND LANTHANUM (continued).

Color.	λ.	I.	R.	K.
Green...	530.30	2	*b*	1486.8
	Di & La			
	527.00	4	*b*	1519.4
	525.75	5		
	525.20	4	Di	1541.4
	523.35	4		
	522.50	5		
	521.10	4		
	520.35	4		
	518.75	1		
	518.20	1		
	517.70	4		
	515.70	4		
	514.40	4		
	513.05	3	Di	
	512.25	3	.....	1716.6
	511.40	3	.....	1728.8
	505.55	5		
	499.95	4	.....	1895.2
	496.80	4		
	495.00	4		
	493.40	4	.....	1988.6
	492.00	1	.....	2003.8
Blue.....	490.00	1	.....	2031?
	488.25	1	Di & La	
	486.00	4	.....	2081
	485.75	4		
	482.30	4		
	481.10	4	.....	2136.8
	480.20	4		
	474.70	3		
	474.15	3	.....	2214.5
	473.90	5	.....	2217.8
	470.25	3		
	469.10	1		
	467.10	2		
	466.80	2		
	466.35	1		
	466.10	2	*b*	
	465.45	1	*b*	
	461.95	1		
	461.35	2		
	455.90	2	*b*	
Indigo.	452.50	2	Di & La	
	452.15	1		
	443.00	1	*b*, Di & La	2646.2?
	435.45	4		
	433.50	1		
	429.55	2	*b*, Di & La	
	428.75	2		
	426.80	2		
	426.25	1	Di & La	
Violet..	423.70	1		
	421.70	4		
	419.60	4		
	419.25	4		
	414.15	4		
	412.35	4		

URANIUM.

Color.	λ.	I.	R.	K.
Orange	591.30	3		
Yellow.	561.90	3		
	557.90	3		
	556.25	3		
	552.70	1		
	550.90	3		
	549.35	1		
	548.15	1		
	547.95	1		
	547.70	1		
	547.45	1		
	538.40	3		
Green...	502.70	3		
Blue.....	473.10	3		
	472.30	3		
Indigo.	451.30	2		
	447.25	1		
	439.35	3		
	437.40	3		
	436.20	1		
	434.05	1		

TITANIUM.

Color.	λ.	I.	R.	K.
Orange	655.57	1		
	654.28	5		
	626.02	2		
	625.74	1	*b*	
	622.09	3		
	621.41	3		
	612.52	2		
	609.74	3		
	609.04	2		
	608.32	3		
	606.45	2		
	599.87	2		
	597.80	1		
	596.53	1		
	595.18	1		
	592.15	3		

TITANIUM (continued).

Color.	λ.	I.	R.	K.
Orange	591.89	3		
	589.90	1		
	586.53	1		
Yellow.	573.80	3		
	571.40	4		
	570.15	5	*n*	
	568.85	2		
	567.90	3		
	567.44	1		
	566.15	1		
	564.70	4		
	564.30	1		
	562.90	5	*n*	
	559.72	5	*n*	
	556.46	3		
	551.34	1		
	551.18	1		
	550.28	2		
	548.89	2		
	548.68	3		
	548.02	2		
	547.65	3		
	547.33	3		
	547.05	4		
	544.80	3		
	544.58	4		
	542.86	2		
	542.50	3		
	541.79	4		
	540.86	2		
	540.31	3		
	539.61	2		
	538.02	3	*b*	
	536.88	2		
	535.05	2		
Green...	533.68	1		
	529.85	3		
	529.67	1		
	529.55	3		
	528.78	4		
	528.28	1		
	527.15	4		
	526.72	4		
	526.50	2		
	526.29	4		
	525.96	4		
	525.50	4		
	525.10	4		
	524.63	2	*b*	
	523.85	2	*b*	
	522.60	3		
	522.30	1	*b*	
	521.75	4		
	520.95	1	*b*	
	520.55	3		
	520.05	3		
	519.23	1		
	518.83	2		
	518.51	3		
	517.30	2		
	515.32	3		
	515.12	2		
	514.70	3		
	514.45	2		
	512.86	1		
	512.66	4		
	511.99	1		
	511.30	2		
	510.86	4		
	510.24	4	*b*	
	508.65	2	*b*	
	507.65	4	*b*	
	507.18	4	*b*	
	506.55	4		
	506.44	1		
	506.13	3		
	505.23	3		
	504.34	3		
	503.92	2		
	503.80	2		
	503.56	1		
	502.48	3		
	502.38	3		
	502.12	3		
	501.94	2		
	501.53	2		
	501.33	1		
	501.22	4		
	500.66	1		
	500.10	4		
	499.88	1		
	499.03	1		
	498.83	3		
	498.10	1		
	497.78	3		
	497.52	4		
	497.22	5		
	496.77	5		
	496.45	5		
	494.70	5		
	493.72	2		
	492.75	2		
	492.50	4		
	492.08	3		
	491.90	3		

TITANIUM (continued).

Color.	A.	I.	R.	K.
Blue.....	494.32	3		
	491.13	3		
	490.39	1		
	489.93	2		
	488.45	1		
	487.30	4		
	486.90	2		
	486.75	2		
	485.50	2		
	484.80	3		
	484.00	2		
	483.50	4		
	481.95	2	*b*	
	480.43	1		
	479.75	4		
	479.16	2		
	477.90	3		
	475.85	1		
	475.70	1		
	474.18	2		
	472.28	2		
	470.90	2		
	469.80	2		
	469.06	2		
	468.15	2		
	466.65	2		
	465.60	1	*b*	
	464.40	1		
	463.88	1	*b*	
	462.90	3		
	462.30	2		
	461.67	2		
	457.15	1	*b*	
	456.32	2		
	455.53	3		
Indigo..	455.18	3		
	454.89	1	*b*	
	454.35	3		
	453.55	1	*bb*	
	453.20	1	*bb*	
	452.61	1		
	452.19	3		
	451.75	3		
	451.15	3		
	450.07	1	*b*	
	449.61	2	*b*	
	448.10	3	*b*	
	446.85	1		
	445.75	2		
	445.50	2		
	445.25	2		
	444.95	2		
	444.65	2		
	444.30	1	*b*	
	442.68	1	*b*	
	441.78	2	*b*	
	441.10	3		
	440.30	3		
	439.85	3		
	439.30	1	*b*	
	433.75	1		
	432.35	2	*b*	
	432.00	5		
	431.80	5		
	431.35	5		
	431.25	5		
	430.75	5		
	430.50	2		
	429.90	1	*b*	
	429.50	5		
	429.38	5		
	429.07	2	*b*	
	428.70	5		
	428.20	5		
	427.30	5		
	426.30	2		
Violet...	423.65	2		
	418.50	3		
	417.10	1	*b*	
	416.30	1	*b*	

TUNGSTEN.

Color.	A.	I.	R.	K.
Yellow..	580.50	4		
	573.30	3		
	564.80	4		
	553.15	5		
	551.30	1		
	549.15	2		
Green...	522.30	1		
	507.05	3		
	506.80	3		

TUNGSTEN (continued).

Color.	A.	I.	R.	K.
Green..	505.30	1		
	501.40	3		
	500.70	3		
	498.10	1		
Blue.....	488.75	2		
	484.20	1		
	468.05	5		
	466.05	5		
	465.95	5		
Violet..	430.20	3		
	429.50	3		
	426.90	3		

MOLYBDENUM.

Color.	A.	I.	R.	K.
Orange	602.90	1		
	588.75	1		
	585.65	2		
Yellow.	579.10	3		
	575.00	3		
	568.75	3		
	564.90	4		
	563.10	4		
	556.90	1		
	554.00	5		
	553.15	1		
	550.50	1		
	536.00	4	*b*	
Green..	497.90	5		
Blue.....	486.75	4	*b*	
	482.95			
	481.80			
	475.75			
	473.05			
	470.65			
Indigo.	453.60	4		
	447.50	4		
	443.35	4		
	441.15	4		
	438.05	4		
	432.60	4		
	427.75	3	*b*	

VANADIUM.

Color.	A.	I.	R.	K.
Orange	624.05	3		
	613.41	4		
	611.90	1		
	610.95	4		
	608.90	1		
	608.00	4		
	603.90	1		
Yellow.	578.60	4		
	572.50	1		
	570.60	4		
	570.25	3		
	569.75	2		
	566.80	3		
	562.60	3		
	562.25	3		
	541.40	3		
	540.10	4		
Green..	524.00	3		
	523.30	3		
	519.50	4		
Blue.....	519.15	4		
	488.10	3		
	487.45	3		
	486.40	4		
	485.10	5		
	484.30	3		
	483.15	5		
	459.30	3		
	458.50	4		
	457.90	5		
	457.60	5		
Indigo.	445.90	2	*b*	
	440.75	1	*b*	
	440.60	4		
	440.05	5		
	439.50	3		
	438.90	2		
	438.40	1		
	437.90	1	*b*	
	435.25	5		
	434.05	5		
	433.25	5		
	432.95	5		
	431.00	5		
	429.70	4		
	429.25	5		
	428.35	5		

VANADIUM (continued).

Color.	A.	I.	R.	K.
Indigo.	427.70	5		
	427.20	4		
	426.85	4		
Violet.	419.00	3		

OSMIUM.

Color.	A.	I.	R.	K.
Indigo.	442.20	4		

ANTIMONY.

Color.	A.	I.	R.	K.
Orange	630.15	2	.....	798.1
	624.45	4		
	620.90	4		
	619.30	4		
	615.50	4		
	612.85	1		
	607.80	1		
	605.10	4		
	600.35	1		
	597.95	4	.....	957.2
	590.90	2	*b*	991?
	589.35	2	*b*	997.1?
Yellow.	579.15	1		
	563.80	2	.....	1189.0?
	560.70	5		
	556.70	2	*b*	1247
	546.35	3	*b*	1334
	537.90	3	*b*	
	537.15	5		
	535.25	5	*n*	
Green..	524.15	3	*b*	
	520.80	5		
	517.70	3	*n*	
	514.10	4	*n*	
	511.25	4	*n*	
	503.60	5		
	494.85	2	*b*	
Blue.....	487.75	3	*b*	
	483.50	4	*n*	
	478.60	4	*n*	
	493.45	4		
	471.10	2	*b*	2252?
	469.10	3	.....	2254?
	459.15	3	*b*	
Indigo.	435.20	2	*b*	
	426.50	3	*b*	

ARSENIC.

Color.	A.	I.	R.	K.
Orange	616.95	2		
	611.00	2	*b*	890.5
	602.15	4		
Yellow.	565.10	2	*b*	
	555.80	2	*b*	
	549.80	3	*b*	1304.5
Green..	533.15	3	*b*	1460.5

TELLURIUM.

Color.	A.	I.	R.	K.
Orange	643.70	1		
	604.60	3		
	601.25	3		
	597.30	1		
	593.50	2		
	585.65	4		
Yellow.	585.20	4		
	582.50	4	*n*	
	580.55	4	*n*	
	578.10	3		
	575.50	1		
	574.10	5		
	570.65	1		
	564.70	1		
	561.60	4		
	557.40	2		
	548.80	3		
	547.75	3		
	544.75	2		
	540.85	4		
	536.60	3		
Green..	531.00	3		
	529.90	5		
	521.70	2		
	517.20	5		
	515.20	3		
	513.30	5	*n*	
	510.45	3		
	503.50	4		
Blue....	489.50	5	*n*	
	486.65	4	*n*	
	483.20	5	*n*	
	478.50	5	*n*	
	460.35	4		

INDIUM.

Color.	A.	I.	R.	K.
Indigo.	453.15	2	*bbn*	
	450.95	1		
Violet.	410.10	1	*b*	

AIR.

Color.	A.	I.	R.	K.
Red.....	660.20	3		
	656.18	1	*c*	
	647.35	3		
Orange	617.05	3	*b*	
	594.90	4		
	594.15	1	*b*	
	593.20	1		
	592.95	4		
Yellow.	576.70	1		
	574.50	4		
	571.40	3		
	568.55	3	*b*	
	567.80	1		
	567.45	3		
	566.60	1		
	554.90	1		
	554.10	3		
	553.10	1		
	553.00	3		
	549.50	2		
	547.90	3		
	546.15	4		
	545.30	4		
	535.10	5		
Green..	533.95	5		
	532.00	5		
	518.95	4		
	518.45	5		
	517.80	4		
	517.20	5		
	501.50	1	*b*	
	502.50	2		
	501.60	3		
	501.00	3		
	500.65	4		
	500.50	1	*b*	
	500.20	1	*b*	
	499.35	3		
	498.70	3		
	494.10	4		
	492.40	4		
Blue.....	490.60	4		
	489.55	4		
	480.30	1		
	478.80	1		
	477.90	1		
	471.20	4		
	470.65	2		
	469.80	2		
	467.50	4		
	466.15	4		
	464.90	2		
	464.20	1		
	464.00	3		
	463.05	1	*b*	
	462.10	2		
	461.30	2		
	460.65	2		
	460.10	2		
	459.60	3		
	459.05	3		
Indigo.	444.65	1	*b*	
	443.20	3	*bn*	
	441.80	1		
	441.45	1		
	436.80	4	*n*	
	435.05	3		
	434.75	1		
	434.60	3		
	433.30	3	*bn*	
	431.90	2		
	431.65	2		
Violet..	423.00	2	*bn*	
	418.95	3		
	418.45	3		
	415.50	5	*n*	
	414.90	5	*n*	
	413.70	4	*bn*	
	412.30	3		
	407.55	3		
	407.40	3	*n*	
	407.15	3	*n*	
	406.95	3	*n*	
	404.00	4		
	399.50	4		

W. GIBBS.

Wave-Line. See WAVES.

Wa'vellite, an interesting mineral species, a *hydric alumina-phosphate*, named after its discoverer, Dr. Wavell, who first recognized it in Devonshire, England, at the beginning of this century. It occurs near Bellows Falls, N. H., at the Washington Mine, Davidson co., N. C., and in York and Chester cos., Pa. It is found usually in radiated spheroidal masses; of white or light colors; translucent; harder than calcite, approaching fluor; crystal-system, right-rhombic. Dana assigns to it the formula $O_{19}P_4Al_6.12H_2O$. The density of the Devonshire mineral, according to Haidinger, is 2.337. Städeler, however, analyzed a Hungarian variety, which gave D. = 2.356 and composition $O_{19}P_4Al_6.11H_2O$. Wavellite is one of the phosphates, having so small a molecular volume that the writer argues from this the existence of a type of orthophosphates with an enormously-condensed phosphorus-molecule. (See VOLUMES, MOLECULAR.) Wavellite does not, however, present such convincing evidence of this as several other species, such as *pseudomalachite*, *plumbogummite*, *hitchcockite*, the *vivianites*, the *turquoises*, and others.

HENRY WURTZ.

Waverley Novels. See SCOTT (Sir WALTER).

Wa'verly, p.-v. and tp., Morgan co., Ill., on Jacksonville North-western and South-eastern R. R., 30 miles S. W. of Springfield, contains 6 churches, an excellent graded school, 2 banks, and 1 newspaper. P. 2463.
W. T. LAKIN, ED. "TIMES."

Waverly, p.-v., Washington tp., cap. of Bremer co., Ia. P. 2291.

Waverly, p.-v. Baltimore co., Md.

Waverly, p.-v. and tp., Van Buren co., Mich. P. 1234.

Waverly, p.-v. and tp., Martin co., Minn. P. 253.

Waverly, p.-v., Middleton tp., Lafayette co., Mo. P. 887.

Waverly, tp., Lincoln co., Mo. P. 1339.

Waverly, p.-v., Tioga co., N. Y., on Erie R. R., 256 miles W. of New York City, and near the junction of Lehigh Valley, Geneva Ithaca and Athens, and Southern Central R. Rs. with the Erie, contains 6 churches, a union high school, 3 banks, an opera-house, 3 newspapers, 5 hotels, and several manufacturing establishments. Large quantities of butter and grain are marketed here. P. 2239.
O. H. P. KINNEY, ED. "ADVOCATE."

Waverly, p.-v., cap. of Pike co., O., 29 miles N. of Portsmouth, on Ohio Canal, was laid out in 1829, and contains 5 churches, a large union school-house, 2 banking-houses, 2 newspapers, 2 saw, 2 planing, and 2 flouring mills, 2 furniture factories, 1 tannery, and a brickyard. Principal business, farming and stock-raising. P. 1202.
S. F. WETMORE, ED. "REPUBLICAN."

Waverly, p.-v., Luzerne co., Pa., on the Delaware Lackawanna and Western R. R., 9 miles from Scranton, Pa.

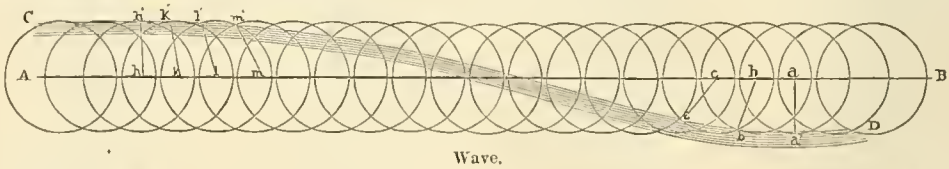
Waverly, p.-v., cap. of Humphreys co., Tenn. P. 207.

Waverly, tp., Sussex co., Va. P. 945.

Waves. Water is distinguished from solid bodies by its mobility—that is, by the freedom with which its elementary particles move with reference to one another. It results from this mobility that a disturbance communicated to particles of water at any point becomes the occasion of disturbance to contiguous particles, and through these to particles more remote, propagating itself in this manner to great distances in the form of oscillatory movements called *waves*.

The physical characters of waves are familiar to all. A stone dropped into standing water is followed by a series of circular ridges, spreading till they reach the shore or become so indistinct as to escape observation. We never remain long near any extended body of water without observing its surface ruffled by a series of ridges and furrows in rapid motion, usually toward the shore. Upon the great ocean the phenomenon presents itself on a grander scale. The crests of the waves attain at times a height of 30 feet, and thus move with the velocity of a railroad passenger train. During our first sea-voyage, upon observing such liquid hills approaching the vessel with such a velocity, it is difficult to divest ourselves of the impression that the latter is in danger of being shattered to fragments. Yet it receives but a moderate shock, and is lifted with a movement which, to the voyager who is accustomed to it, is not even unpleasant. Were the mass of water moving with the velocity of the wave, the effect upon vessels would be disastrous, as is readily seen in the rapidity with which a stranded vessel is broken up when exposed to the full force of the waves. The character of the wave is here so changed by the shelving ground that the water has a rapid movement. In a body of water the movement of any particle is controlled by the proximity of other particles. No particle can move without occasioning a movement of other particles, and it can only move in such a manner as is consistent with the movement of the entire mass. This condition determines the path in which each particle moves. It moves in a closed orbit around its position of rest, returning to the same position at regular intervals. Of this fact we may satisfy ourselves by observation. If we note the effect of waves upon a small body floating in the water, we shall see that the latter is not carried along by the wave. On the contrary, its position is but slightly altered. When the crest of the wave passes the body, it moves a short distance in the direction of the wave-motion; when it is in the hollow of the wave, it moves slightly in the opposite direction. If we observe a float which gradually sinks in the water, we shall find that these movements are not confined to the surface, but extend as deep as our observation reaches. The particles of water move forward rising and sinking, and return sinking and rising, describing a closed orbit; but whether this orbit is circular or elliptical cannot be learned by observation. Mathematicians who have investigated this subject find that in water of very great depth the orbit of each elementary particle is an exact circle whose centre is in the position occupied by the particle when at rest. These circular orbits are greatest at the surface of the water, being there equal in diameter to the height of the wave. They diminish rapidly farther down, so that when the water at the surface has a movement of 20 feet, causing waves 20 feet high from trough to crest, it has at a depth of 50 feet a movement of only 7 feet, and at a depth of 200 feet a movement of not more than 4 inches.

The figure below shows how the circular movements of the different particles of water conspire to produce the undulations of the surface which we call waves. A B is the surface



Wave.

of the water when at rest. The circles are the orbits of the particles at the surface, which are supposed to be in motion in a direction opposite that of the hands of a clock. The particle h', whose position of rest is h, is at the highest point of its orbit; the next particle to the right, k', whose position of rest is k, is slightly past the summit of its orbit, and farther to the right each particle is in a little more advanced position than the one preceding. The particle a', whose position of rest is a, is at the lowest point of its orbit. The surface of the water at the instant under consideration is represented by the curved line C D, h' being the highest point or crest of the wave, a' the lowest point or trough of the wave. The motion continuing, the crest advances toward the left, and when the particle h' has reached the lowest point of its orbit, that point becomes the trough of the wave, and a', having then reached the highest point of its orbit, is the crest of the succeeding wave. The horizontal distance between the crests of two consecutive waves is called the length of the wave. If we consider the particles of water which, when at rest, lie all in the same vertical line, constituting a vertical filament of water, these all arrive, during wave-motion, at the summits of their orbits at the same instant. The orbits diminish in diameter downward, so that at a depth of a few hundred feet the movement practically ceases. The lower part of the filament remains immovable, and its upper part bends like a stalk of wheat in a field under the action of the wind. When the crest of the wave coincides with the filament, the latter is erect and elongated. It then bends in the direction of the wave's motion, and returns to its erect position when the trough of the wave passes. It is then shortened and thickened. It then bends in the direction opposite to that of the wave's motion, and so on.

The form of the wave is cycloidal, but it is not the common cycloid, which is a curve traced by a point on the circumference of a circle rolling upon a straight line. Were this the case, the height of the wave would bear the same proportion to its length that the diameter of a circle bears to its circumference; whereas there is not necessarily any definite relation between the height and length of the wave. In the same system of waves we always find the same relation between the height and the length. But a slight change in the direction or intensity of the wind gives rise to a different system in which a different relation exists. Different systems of waves often occur at the same time. It is a matter of common observation at the seashore that at intervals a wave occurs much higher than the preceding. This arises from the coincidence of two waves belonging to different systems. To the same cause is due the "seas" which break over the decks of vessels, carrying away everything not securely fastened.

The velocity of a wave depends upon its length. To find this velocity when the length is known, we first find the radius of a circle whose circumference is the length of the wave. Designate this radius by r, the velocity is the same that a heavy body would acquire in falling freely through a height equal to one-half r. To find the radius of the orbit of a particle at a given depth below the surface, divide the given depth by r, and find the number of which this quotient is the natural logarithm. Divide r by this number, and the quotient will be the radius sought. Waves in deep water usually arise from the action of the

wind, and their motion when unobstructed is in the same direction as the wind to which they owe their origin. How powerfully the wind acts in acceleration of the molecular movements to which waves are due will appear upon a little reflection. The elevated part of the wave is fully exposed to the action of the wind, and here the particles of water are moving in the same direction as the wind. The trough of the wave, in which the particles are moving in the opposite direction, is mainly screened from the action of the wind by the neighboring crest. When the wind begins to blow while the water is smooth, it might appear difficult to understand how it can originate waves, since the wind would seem to exert a uniform pressure upon all parts of the surface. The wind, however, never acts with a perfectly uniform and steady pressure. There is always enough of inequality to cause a ruffling of the surface, and the minute waves, once formed so as to present a surface to the direct action of the wind, are rapidly increased in magnitude. They continue to increase until they have attained a velocity nearly equal to that of the wind.

The tendency of waves is to form in long lines at right angles to the direction of the wind. This tendency is the more marked in proportion as the expanse of water is unlimited and the wind unvarying in force and direction. We rarely, however, have an opportunity to observe the phenomenon of waves in its entire simplicity. Under the most favorable circumstances the eye can follow the wave longitudinally but a very short distance. Neither, if we fix our eye upon the crest of a wave and endeavor to follow its movement, can we trace it to any great distance before it disappears and a new wave arises. The more common case is a system of waves caused by a local wind, crossed in different directions by other systems originating in distant parts of the ocean, and by waves reflected from the shore, the whole often forming a tumultuous commotion of waters, in which scarcely any law of movement can be recognized. This shows that different simple movements of the elementary particles may coincide and superpose themselves upon one another in all conceivable ways.

The preceding refers to waves in deep water—that is, water so deep that the bottom exerts no influence upon the movements of the elementary particles. These move in precisely the same manner as though the depth were infinite. Hence, the preceding is called, for distinction, the theory of waves in water of infinite depth. In water of moderate depth the proximity of the bottom exerts an influence the more marked in proportion as the depth is less. Where the depth is considerable, this influence manifests itself in a slight horizontal movement of the water at the bottom. As the depth diminishes, this horizontal movement increases, until finally, at slight depths, the particles have the same horizontal movement at the bottom as at the surface, while the vertical movement is greatest at the surface and diminishes to nothing at the bottom. The particles thus move in orbits which are often nearly circular at the surface, and become more and more flattened toward the bottom, where they are simply straight horizontal lines. The movements of the elementary particles in shallow water were very attentively studied by Hayen. He used for this purpose a trough about 4 inches in width and height and 12 feet long. He inserted glass plates in the sides to enable him to observe the movements of small visible particles suspended in the water. The waves were created by the movement of a metallic plate nearly equal in size to the cross-section of the trough, placed at one end of the latter and moved by clockwork. It was adjusted so that the movement of the top could be greater than that of the bottom in any desired proportion, from the case in which the bottom was stationary to that in which it had the same movement as the top. He found that whatever movement was communicated to the water, no difference was discernible between the horizontal movements of the particles at the top and those at the bottom at a distance of 4 feet from the plate. The most important difference between waves in infinite depth and those in finite depth is, that in the former the velocity with which the wave travels appears to have no relation to the depth, depending solely upon the magnitude of the wave; whereas in the latter the velocity depends upon the depth, being, according to the most trustworthy observations, equal to that velocity which a heavy body acquires by falling freely a height equal to half the depth, measured from the top of the wave.

J. Scott Russell, an English marine engineer, made very extended and valuable researches upon the subject of waves. These researches were undertaken at the instance of the British Association for the Advancement of Science, and the results are detailed in a provisional report made to the Association in 1837, and published in its *Transactions* for 1837, and a more complete report in 1844. The following is given as summary of results in the report of 1837: (1) The existence of a *great primary wave* of fluid, differing in its origin, its phenomena, and its laws from the undulatory and oscillatory waves which alone had been investigated previous to the researches of Mr. Russell, has been confirmed and established. (2) The velocity of this wave in channels of uniform depth is independent of the breadth of the fluid, and equal to the velocity acquired by a heavy body falling freely by gravity through a height equal to half the depth of the fluid, reckoned from the top of the wave to the bottom of the channel. (3) The velocity of this primary wave is not affected by the velocity of impulse with which the wave has been originally generated; neither does its form or velocity appear to be derived in any way from the form of the generating body. (4) This wave has been found to differ from every other species of wave in the motion which is given to the individual particles of fluid through which the wave is propagated. By the transit of the wave the particles of the fluid are raised from their places, transferred forward in the direction of the motion of the wave, and permanently deposited at rest in a new place at a considerable distance from their original position. There is no retrogradation, no oscillation; the motion is all in the same direction, and the extent of the transference is equal throughout the whole depth. Hence, this wave may be descriptively designated *the great primary wave of translation*. The motion of translation commences when the anterior surface of the wave is vertically over a given series of particles; it increases in velocity until the crest of the wave has come to be vertically above them; and from this moment the motion of translation is retarded, and the particles are left in a condition of perfect rest at the instant when the posterior surface of the wave has terminated its transit through the vertical plane in which they lie. This phenomenon has been verified up to depths of five feet. (5) The elementary form of the wave is cycloidal; when the height of the wave is small in proportion to its length, the curve is the prolate cycloid; and as the height of the wave increases, the form approaches that of the common cycloid, becoming more and more cusped until at last it becomes exactly that of the common cycloid with a cusped summit; and if by any means the height be increased beyond this, the curve becomes the curtate cycloid, the summit assumes a form of unstable equilibrium, the summit totters, and, falling over on one side, forms a crested wave or breaking surge. (6) A wave is possible in forms of channel where the depth is not uniform throughout the whole breadth. The full consideration of this subject is reserved for the next report. It appears, however, that when the difference between the depth of the sides is considerable, one part of the wave will continue during the whole period of propagation in the act of breaking, so as to show that in these circumstances a continuous wave is impossible. In other cases the ridge of the wave rises so much higher on the shallower part of the fluid as to produce a given velocity without exceeding the limits of equilibrium: and in these cases the wave becomes possible, and the velocity appears to coincide closely with that which we obtain by supposing the wave resolved into vertical elements, each having the velocity due to the depth, and then integrating. . . . In the sloping or triangular channel the velocity is that due to one-third of the greatest depth. In a parabolic channel the velocity is that due to three-eighths or three-tenths of the greatest depth, according as the channel is convex or concave. (7) The height of a wave may be indefinitely increased by propagation into a channel which becomes narrower in the form of a wedge, the increased height being nearly in the inverse ratio of the square root of the breadth. (8) If waves be propagated in a channel whose depth diminishes uniformly, the waves will break when their height above the surface of the level fluid becomes equal to the depth at the bottom below the surface. (9) The great waves of translation are reflected from surfaces at right angles to the direction of their motion, without suffering any change but that of direction. (10) The great primary waves of translation cross each other without change of any kind, in the same manner as the small oscillations produced on the surface of a pool by a falling stone. (11) *The waves of the sea* are not of the first order; they belong to the *second or oscillatory order* of waves. They are partial displacements at the surface, which do not extend to considerable depths, and are therefore totally different in character from the great waves of translation, in which the motion of displacement of the particles is uniform to the greatest depth. The displacement of the particles of the fluid in the waves of the sea is greatest at the surface, and diminishes rapidly downward. There are generally on the surface of the sea several co-existent classes of oscillations of varying direction and magnitude, which by their union give the surface an appearance of irregularity which does not exist in nature. (12) When waves of the sea approach a shore or come into shallow water, they become waves of translation, and, obey-

ing the laws already mentioned, always break when the depth of the water is not greater than their height above the level. (13) Waves of the sea do not move with the velocity due to the whole depth of the fluid. . . . (14) A circumstance frequently observed when the waves break on the shore has been satisfactorily accounted for by the examination of the constitution of the waves of the sea. It has been frequently observed that a certain wave is the largest of a series, and that these large waves occur periodically at equal intervals, so that sometimes every third wave, every seventh, or every ninth wave is the largest. Now, as there are almost always several co-existent series of waves, and as one of these is a long gentle "underswell," propagated to the shore from the deep sea in the distance, while the others are short and more superficial waves generated by a temporary breeze of [or] reflections from a neighboring shore, so it will follow that when the smaller waves are one-third, or one-seventh, or one-ninth, or in any other given ratio to the length of longer ones, those waves in which the ridges of the two series are coincident will be the periodical large waves; and if there be three systems of coexistent waves, or any greater number, their coincidences will give periodical large recurring waves, having maxima and minima of various orders. (15) *The tide-wave* appears to be the only wave of the ocean which belongs to the first order, and appears to be identical with the great primary wave of translation; its velocity diminishes and increases with the depth of the fluid, and appears to approximate closely to the velocity due to half the depth of the fluid in the rectangular channel, and to a certain mean depth, which is that of the centre of gravity of the section of the channel. It is, however, difficult to determine the limits within which the tide-wave retains its unity; where portions of the same channel differ much in depth at points remote from each other, the tide-waves appear to separate. (16) The tide appears to be a compound wave, one elementary wave bringing the first part of flood tide, another the high water, and so on; these move with different velocities according to the depth. On approaching shallow shores, the anterior tide-waves move more slowly in the shallow water, while the posterior waves, moving more rapidly, diminish the distance between successive waves. The tide becomes thus dislocated, its anterior surface rising more rapidly and its posterior surface descending more slowly than in deep water. (17) A tidal bore is formed when the water is so shallow at low water that the first waves of flood tide move with a velocity so much less than that due to the succeeding part of the tidal wave as to be overtaken by the subsequent waves, or wherever the tide rises so rapidly, and the water on the shore or in the river is so shallow, that the height of the first wave of the tide is greater than the depth of the fluid at that place. Hence, in deep water vessels are safe from the waves of rivers which injure those on shore. (18) The identity of the tide-wave and of the great wave of translation shows the nature of certain variations in the establishment of ports situated on tidal rivers. Any change in the depth of the rivers produces a corresponding change on the interval between the moon's transit and the high water immediately succeeding. It appears from the observations in this report that the mean time of high water has been rendered 37 minutes earlier than formerly by deepening a portion of about 12 miles in the channel of a tidal river, so that a tide-wave which formerly travelled at the rate of 10 miles an hour now travels at the rate of nearly 15 miles an hour. (19) It also appears that a large wave, or a wave of high water of spring tides, travels faster than a wave of high water of neap tides, showing that there is a variation on the establishment, or on the interval between the moon's transit and the succeeding high water, due to the depth of the fluid at high water, and which should, of course, enter as an element into the calculation of tide tables for an inland port derived from those of a port on the seashore. The variation of the interval will vary with the square root of mean depth of the channel at high water.

J. Scott Russell's completed report was published in the report of the British Association for 1844. He states that he had in the interim devoted his available time to these researches, and had confirmed and extended the results previously published. He had extended his inquiries to what he calls the negative wave of translation, being a wave which is propagated not as a ridge, but as a cavity in the surface of the water. He gives the following summary of his conclusions on this subject:

"The characteristics of this species of wave of the first order are—(1) That it is negative or wholly below the level of repose. (2) That it is a wave of translation, the direction of which is opposite to the direction of transmission. In other words, the movement of the fluid particles is in one direction, that of the wave in another. (3) That its anterior form is that of the positive wave reversed. (4) That the path of translation is nearly that of the positive wave reversed. (5) That its velocity is, in considerable depths, sensibly less than that due by gravity to half the depth reckoned from the lowest point, or the velocity of a positive wave being the same total height. (6) That it is not solitary, but always carries a train of secondary waves.

"It is important to notice that the positive and negative waves do not stand to each other in the relation of companion phenomena. They cannot be considered in any case as the positive and negative portions of the same phenomena, for the following reasons: (1) If an attempt be made to generate or propagate them in such a manner that the one shall be companion to the other, they will not continue together, but immediately and spontaneously separate. (2) If a positive wave be generated in a given channel, and a negative wave behind it, the positive wave, moving with the greater velocity, rapidly separates itself from the other, leaving it far behind. (3) If a positive wave be generated and transmitted behind a negative wave, it will overtake and pass it. (4) Waves of the secondary class, which consist of companion halves, one part positive and the other negative, have this peculiarity, that the positive and negative parts may be transmitted across and over each other without preventing in any way their permanence or their continued propagation. It is not so with the positive and negative waves of the first order. (5) If a positive and negative wave of equal volume meet in opposite directions, they neutralize each other, and both cease to exist. (6) If a positive wave overtake a negative wave of equal volume, they also neutralize each other and cease to exist. (7) If either be larger, the remainder is propagated as a wave of the larger class. (8) Thus, it is nowhere to be observed that the positive and negative wave coexist as companion phenomena.

"These observations are of importance for this reason, that it has been supposed by a distinguished philosopher that the positive and negative waves might be corresponding halves of some given or supposed wave."

The following results of observations obtained by Mr. Walker, the harbor-master at Plymouth, are given by Scott Russell:

No.	Wave-length, feet.	Velocity, feet per second.	Velocity, miles per hour.	Height, feet.	Remarks.
I.	110.5	20.2	11.9	2¾	A fresh breeze blowing.
II.	175.	34.3	20.3	2½	Waves not easily traced.
III.	302.	37.	21.9	4	High seas overtake small ones.
IV.	345.	37.	21.9	4½	These waves came down channel.
V.	306.	37.	21.9	4½	Long, low swell.
VI.	408.	41.2	24.2	4½	Small waves merged in large ones.
VII.	442.	41.8	24.7	27	Height of waves correctly measured; they break in 5 and 6 fathoms of water.
VIII.	450.	44.7	26.5	?	Strong S. W. wind.
IX.	460.	46.	27.2	?	Waves running high and breaking.
X.	345.	46.	27.2	5	Long, low swell.
XI.	394.	38.3	22.7	5	Waves generated by wind of preceding day.
XII.	345.	41.5	24.5	4	Waves crowd near the beach.
XIII.	306.	36.8	21.6	Irregular.	Shifting wind.
XIV.	460.	42.5	25.2	Regular.	Easterly winds.

The above results apply to a depth of 40 to 50 feet. Russell also found in a depth of—

50 to 60 fathoms,	a velocity of	13.5	miles	per	hour.
53	"	"	20	"	"
60 to 70	"	"	17	"	"
34 to 40	"	"	17½	"	"

In a depth of 51 fathoms the waves produced by a steam vessel had a height of about 20 inches, were 12 feet apart from crest to crest, and moved at the rate of a little less than 3 miles an hour. These results show that in waves which do not affect the water to the bottom the velocity has no relation to the depth. The following are the velocities with which the tide-wave was found to ascend the Frith and river Clyde:

In a depth of	240 to 360	feet,	80	miles	per	hour.
"	"	"	25	"	20	"	"
"	"	"	5	"	8.1	"	"
"	"	"	15	"	15	"	"

In these results the velocities are approximately proportional to the square roots of the depths.

A series of experiments upon waves was made in 1859 by M. Bazin, an officer of the French corps of engineers. This officer had previously been entrusted with the duty of investigating some of the laws of flowing water, and upon the termination of that task extended his researches to the subject of waves, availing himself of the arrangements provided for his preceding experiments. He had a perfectly straight and regular channel about 6½ feet wide, in which he was able to observe the movement of the wave for any desired length. The bottom was inclined at the rate of about 1½ feet in 1000; which gave him an opportunity of observing the effect of the diminishing depth upon the velocity and form of the wave. For the case of isolated waves, stations were established at distances of 60 to 65

feet, at which the time of the passage of the wave was noted. A few results of these observations are given below. They refer to positive waves—that is, to those which are wholly above the general water level. These were generated by the sudden admission of a certain volume of water into the canal.

No. of points of observation.	Depth of water before the passage of the wave, feet.	Height of the wave, feet.	Velocity of the wave, feet per second. Observed.	Velocity of the wave, feet per second. Calculated.	Remarks.
1	2.24	0.39			
2	2.16	0.30	8.70	9.04	
3	2.04	0.30	8.88	8.77	
4	1.95	0.30	8.26	8.58	
5	1.85	0.33	8.67	8.44	
6	1.75	0.36	8.68	8.30	
7	1.64	0.36	8.32	8.13	
8	1.55	0.36	8.12	7.93	
9	1.46	0.39	7.80	7.78	The wave did not break until a little past the 13th point of observation.
10	1.35	0.39	7.85	7.60	
11	1.45	0.39	7.54	7.59	
12	1.12	0.43	7.46	7.38	
13	0.80	0.52	6.69	6.80	

No. of points of observation.	Depth of water before the passage of the wave, feet.	Height of the wave, feet.	Velocity of the wave, feet per second. Observed.	Velocity of the wave, feet per second. Calculated.	Remarks.
1	2.08	0.39			
2	2.00	0.46	8.81	8.90	
3	1.88	0.52	8.64	8.84	
4	1.79	0.62	9.43	8.80	
5	1.69	0.62	8.04	8.73	
6	1.59	0.62	7.62	8.53	
7	1.48	0.62	9.00	8.33	
8	1.39	0.62	7.65	8.13	
9	1.30	0.62	7.99	7.95	
10	1.19	0.62	7.57	7.74	The wave broke between the 12th and 13th points of observation.
11	1.29	0.56	7.46	7.66	
12	0.96	0.62	7.46	7.41	
13	0.64	0.36	7.13	6.51	

The wave travelled about 100 feet before passing the first point of observation. Here it moved as a perfectly symmetrical undulation, unaccompanied by any other wave. As the depth diminished, the height of the wave increased, and its velocity diminished as indicated by the figures; the front of the wave became steeper, till finally it broke into a mass of foam, and, resolving itself into a number of smaller waves, pursued its course. It generally broke before the depth became equal to the height of the wave, not fully verifying Scott Russell's law in that respect. The velocity of the wave is computed according to the law announced by Scott Russell, and agrees very well with observation. If too much water was admitted, the entire mass did not continue together as a single wave. The superfluous water was thrown off, and formed one or more separate waves. Experiments were made upon negative waves, generated by suddenly withdrawing a quantity of water from the channel. This differed from the positive wave in this respect—it could not be generated singly. It was always accompanied by a series of oscillatory waves. Its velocity, however, contrary to the view expressed by Scott Russell, was very nearly the same as that acquired by a heavy body in falling freely a height equal to one-half the depth of water reckoned from the lowest point of the wave. Bazin found that these waves were propagated according to the same law in moving as in still water, due allowance being made for the velocity of the current. The negative wave diminishes and decays much more rapidly in still water than the positive wave; which latter has, according to Scott Russell, a remarkable longevity. This observer found that a wave of this description 6 inches in height was only diminished 1 inch by travelling 700 feet. Another, starting with a height of 6 inches, was 2 inches high after a journey of 3200 feet. Both the negative and positive waves diminish much more rapidly in moving than in still water.

The *breaking* of a wave occurs when the conditions under which it finds itself do not admit of the necessary movements of the fluid particles. The movement of a wave in water of diminishing depth is the most common case. Another is the case above noticed of the solitary wave, which, when formed of a magnitude greater than corresponds to the depth of the channel, spontaneously separates itself into two or more smaller waves. When a wave originating in deep water rolls toward a shoaling beach, the water constituting the top of the wave is moving, at any given instant, toward the shore—that at the bottom in the opposite direction. This results from the circular movement of the fluid particles. This movement ceases at the instant of breaking, and the upper part of the wave moves forward toward the shore, while the lower part moves backward. This movement extends nearly to the shore, the great volume of water set in motion by the breaking waves moving toward the shore upon the surface, and returning at the bottom. This action constitutes the "under-tow" which often proves dangerous to surf-bathers.

Waves always approach the shore in a direction nearly at right angles to the general line of the shore, whatever be the direction of the wind. This arises from the fact that if the wave approach in a direction inclined to the shore, the end nearest to the shore moving in shallow water is retarded, tending to swing the wave round into a direction at right angles to the shore. At a distance of 2 or 3 miles from the shore the waves usually move in the direction of the wind.

When the shore rises perpendicularly out of deep water, the waves do not break. They simply oscillate, rising a little higher at the shore than elsewhere, and are reflected, forming a new system of waves running in the opposite direction. It is said that vessels can lie off such a shore in the heaviest storms without danger. This fact is sometimes turned to account in the construction of breakwaters, which have latterly been made as perpendicular walls. In water so deep that the waves do not break, this form is well calculated to withstand their action. In shallow water, or where, as sometimes happens, the action of the waves and shore-currents is such as to deposit a bank of gravel or sand at the foot of the breakwater, causing the waves to break, their action is very destructive.

Earthquakes are sometimes accompanied by waves of formidable proportions, inundating shores ordinarily high above the reach of the tide. During the earthquake which destroyed the city of Lisbon in 1755 a wave 40 feet high rolled upon the shore. An Englishman residing there named Chase records in his journal that shortly after this wave, ships at anchor in the deep river Tagus were observed resting on the ground. The wave was followed by two others of nearly the same height. A wave 60 feet in height reached Cadiz on the same occasion. The sea rose 20 feet in the Antilles, where the tide rarely exceeds 2 feet. Similar phenomena have been observed to accompany South American earthquakes. Humboldt relates that at Callao he saw a series of waves 10 or 14 feet high in the midst of a dead calm, which he supposed to originate in submarine earthquakes.

The force of waves as they break upon a shelving beach, and the circular movement of the water is transformed into a forward movement, is terrific. Constructions designed to withstand the force of waves tax to the utmost the resources of engineering. Thomas Stevenson relates that during the construction of the lighthouse at Barra Head, one of the Hebrides Islands, he saw the waves move a stone measuring 500 cubic feet. The breakwater at the French port of Cherbourg is composed of an immense bank of loose stone, protected in parts by blocks of concrete measuring 700 cubic feet each. The bank is surmounted by a wall about twenty feet high. During the storm of Dec. 25, 1836, stones weighing nearly 7000 pounds were thrown over the top of this wall, while many of the enormous concrete blocks were moved, some of them as much as 60 feet, and two of them were turned over. Hagen relates that in the harbor of Cette, during the storm of Aug. 20, 1857, a block of concrete measuring 2500 cubic feet, which must have weighed 125 U. S. tons, was moved upon its bed something over 3 feet. Thomas Stevenson constructed an instrument for the direct measurement of the force of waves. He found that during the heaviest storms the force exerted by the waves of the Atlantic upon a solid surface exposed to their action is upon an average 611 pounds per square foot during the summer months, and 2086 pounds during the winter months. The greatest pressure observed was 6083 pounds per square foot.

A remarkable phase of wave-movement, alluded to by Scott Russell as the "tidal bore," is occasionally presented upon tidal rivers. The advent of the flood tide is preceded and announced by a wave, sometimes of formidable dimensions, which runs up the river. The French book of sailing directions for the Indian Seas (*Instructions nautiques sur les Mers de l'Inde*) gives the following description of this phenomenon upon the Hoogly, one of the mouths of the Ganges: "The bore is first perceived at Diamond Bank, below the port of the same name; it afterward becomes more apparent at the point of Hoogly, several leagues farther up, where it encounters a strong resistance on account of the sudden turn of the river toward the W.; thence it ascends past all the principal sandbanks as far as the city of Hoogly, which is 70 miles farther up, and it occupies four hours in traversing this distance; ordinarily, it moves at the rate of 20 miles an hour. Upon the sandbanks contiguous to the shores of the river the bore occasions an elevation of the water amounting sometimes to 12 or 15 feet, and advances with a great noise, announcing the commencement of the flood. It sweeps away all floating

bodies which it encounters on its passage, and swamps any small craft found in shoal water. By day it is visible at a great distance. Its approach is indicated at night by the noise; then all boats lying in shoal water move promptly to attain a greater depth, where they are safe. Where the wave does not break, it simply causes an agitation of the water. At Calcutta there is a good depth near the shore, and all craft do not leave the shore when the bore approaches. Those on board throw a line ashore, and haul their craft as high as possible when lifted by the bore, which has been seen to attain in a single instant the height of an ordinary tide. Europeans should be prudent in crossing the river at night at low tide near the period of the moon's conjunction, this being the epoch at which the bore most commonly arrives. They should keep in deep water, as, if it should arrive while they are stranded or in shoal water, they incur the greatest dangers."

Says Bazin: "The mascaret (bore) occurs with great violence upon the river Amazon. According to La Condamine, it is between Matupa and the North Cape, in that part where the channel of the river is choked with islands, and principally opposite the mouth of the Awawary, which enters the Amazon on the N. side, that the phenomenon manifests itself with the greatest power. During the three days nearest the full and new moon the tide, instead of requiring six hours to attain its full height, reaches it in a few minutes; not unaccompanied, however, with accidents which deserve notice. Afar off, at a distance of 1 or 2 leagues, a great noise is heard, which announces the approach of the *pororoca*, the name by which this impetuous wave is known to the Indians. As it approaches, the noise augments, and then an enormous wave appears 12 or 15 feet in height; afterward a second, then a third, sometimes also a fourth, which follow each other without interruption, and which occupy the entire width of the channel. This wave advances with prodigious rapidity, overturning everything which it encounters. La Condamine has observed it overturn tall trees and great masses of earth. . . . The canoes of the Indians and other vessels must remain in deep water as the only means of escaping the fury of the bore. . . . La Condamine, without going into great details with regard to the bore, says that he has observed it in many places, and finds that it is only accompanied with destructive effects when, confined in a narrow channel, it encounters upon its passage a sandbank or an elevation of the bottom which presents an obstacle, and never under other circumstances, and that it ceases immediately beyond the bank when the channel becomes deeper or considerably enlarged."

The bore also occurs upon the Seine and the Dordogne in France, where it is known as the *mascaret*. It is also recognizable by close inspection upon several smaller rivers. It has been observed with great interest upon the Seine by the French engineer officers. It only occurs at the period of high or spring tides. The first wave has a height of 7 or 8 feet. It is followed in rapid succession by four or five smaller waves, and after their passage the water is found to have risen 4 or 5 feet above low tide. Those who have studied the subject give the following explanation of this remarkable phenomenon: At the period of dead low water the river is very low, and is flowing rapidly toward the sea. To better understand what occurs, we may conceive the rise of the tide to take place by a series of sudden jumps at regular intervals. That is, instead of supposing the tide to rise uniformly at the rate of say 1 foot in 12 minutes, let us consider what would take place if it were to rise suddenly 1 inch each minute. The first rise would move up the stream as a kind of wave, leaving a little deeper water behind than before it. The second would move a little faster than the first, both on account of the increased depth, and also by reason of the slightly-diminished current. It accordingly very soon joins the first, and both advance as a single wave. Every successive wave, for the same reason, moves a little faster than the preceding, and all join the initial wave. Now, though the rise of the tide does not take place by perceptible sudden jumps, as supposed, it nevertheless does consist of a great number of very small increments of depth, and the influence of each successive increment of depth moves up the river faster than that of the preceding, so that all are concentrated into one grand wave. Where there is sufficient depth for the development of wave-motion, the bore does not break. In shoal water it breaks continually, and it does not, like other waves, exhaust itself by breaking, as its power is continually renewed.

For the convenience of those who would like to pursue the subject of waves further the following sources of information are indicated. The labors of Newton, Laplace, Bernouilli, and La Grange need not be particularized. They are interesting only as a part of the history of the subject. To Franz Gerstner is due the credit of having first solved the problem of wave-movement upon the assumption of a finite displacement of the fluid particles. His essay is contained in the *Transactions* of the Royal Bohemian Scientific Society (*Abhandlungen der kgl. Gesellschaft der Wissenschaften*) for 1802. It was also separately printed at Prague in 1804, and is likewise contained in Gilbert's *Annalen*, vol. xxxii., as well as in Webers' *Wellenlehre*. This latter was published by the brothers Ernst Heinrich Weber and Wilhelm Weber at Leipsic in 1825. It is entitled *Wellenlehre auf Experiment gegrundet* ("Theory of Waves founded upon Experiment"). Scott Russell's researches, as already mentioned, are contained in the *Reports* of the British Association for 1837 and 1844. The most complete theoretical exposition of the subject is Prof. G. B. Airey's essay entitled *Tides and Waves*, contained in the *Encyclopædia Metropolitana*, vol. v. of "Mixed Sciences." It is here treated in a thoroughly scientific manner and in the utmost generality, presupposing very high mathematical attainments on the part of the reader. Prof. Airey affirms that his formulas agree as well as could be expected with the results of Scott Russell's experiments, but this assertion is emphatically denied by the latter. Hagen's researches upon this subject are contained in the *Transactions* of the Royal Academy of Sciences of Berlin (*Abhandlungen der königl. Akademie der Wissenschaften zu Berlin*) for 1861. They are also embodied in substance in his great work, *Handbuch der Wasserbaukunst* ("Handbook of Hydraulic Architecture"), part 3, vol. i. He extends and verifies Franz Gerstner's theory of waves in deep water, and presents a theory of his own for waves in shoal water, founded upon the experimental studies already spoken of. Hagen is at once an engineer of extensive experience and observation, a skilful experimenter, and an acute mathematician. These qualities are nowhere more conspicuous than in his treatise on waves. His conclusions as to waves in shallow water are somewhat at variance with those of Scott Russell and other experimenters. The memoir of Bazin, from which the preceding citations are made, is contained in the *Mémoires présentés par divers Savants à l'Institut Impérial de France* (Paris, 1865). The work is in two parts, the first relating to the flow of water in channels, the second to waves.

J. P. FRIZELL.

Wavre, town of Belgium, province of Brabant, on the Dyle, has some breweries, tanneries, paper-mills, and cotton-spinning factories. P. 6083.

Wawagan'da, tp., Orange co., N. Y. P. 1900.

Wawa'ka, tp., Noble co., Ind. P. 252.

Wa'warsing, tp., Ulster co., N. Y. P. 8151.

Wax [Ger. *Wachs*; Fr. *cire*; Lat. *cera*]. Wax is a generic term given to several substances chemically unlike, but resembling each other in the physical properties so familiar in the wax of bees. We speak of animal wax, vegetable wax, and mineral wax, although the last-named substance is chiefly paraffine. The vegetable world furnishes numberless wax-like bodies, only a few of which have been carefully examined, almost every plant, in fact, secreting a wax-like substance, especially in the seeds or in the fruit. The animal kingdom furnishes (1) the typical beeswax; (2) a kind of insect wax from the Orinoco and Amazon valleys, known as Andaquies wax; (3) Chinese wax, formerly supposed of vegetable origin; and (4) SPERMACETI (which see).

Beeswax.—This is the wax of which bees form their cells. It is an animal secretion, formed by bees even when confined to a diet of pure sugar. Formerly, it was believed that the bee found the wax ready formed in plants, and merely elaborated it. This opinion is not sustained by the facts. Common beeswax is of a yellow color, has an agreeable and peculiar smell, feels a little greasy, but more sticky, and moulds readily under the warmth of the fingers. Light bleaches it if exposed in thin sheets. It then becomes white wax, and is somewhat less fusible than before. A mixture of potassium bichromate and sulphuric acid also bleaches wax. Nitric acid and chlorine also bleach it, but the substitution-product formed by the action of chlorine gives off irritating vapors of hydrochloric acid in burning the candles formed of such wax. If wax is agitated with dilute sulphuric acid—2 parts of water to 1 of acid—in presence of some fragments of nitrate of sodium, enough nitric acid is set free to destroy the feeble yellow color of the wax, and thus bleach it without injury. It is worth remembering, in this connection, that Gay-Lussac in his attempts to bleach wax by chlorine discovered one of the important laws of modern chemistry—that of *substitution*—by virtue of which chlorine, etc., may replace hydrogen in the constitution of organic bodies without a change of the typical form. What we find is often better than what we seek. Beeswax is formed from honey and adhering impurities by melting and

stirring with water, which dissolves the traces of honey; the heavy solids fall to the bottom, and the wax forms a cake on the top of the water.

Bleached wax fuses at about 145° F. It is insoluble in water, but dissolves readily in oils, fats, and essences. By Lewy's analysis it contains carbon 80.2 per cent., oxygen 6.4 per cent., and hydrogen 13.4 per cent. It consists essentially of three substances, separable from each other by alcohol—(1) *myricine*, insoluble in boiling alcohol, and consisting chiefly of myricyl palmitate, $C_{16}H_{31}(C_{30}H_{61})O_2$; (2) *cerotic acid*, which is dissolved by boiling alcohol, but crystallizes out again on cooling; this was formerly called cerine when obtained in an impure state, $C_{27}H_{54}O_2$; (3) *ceraline*, which remains in solution in cold alcohol. The proportions of myricine and cerotic acid differ considerably in wax from different places. A wax from Ceylon, Brodie found quite free from cerotic acid, while in a wax from Surrey in England he found 22 per cent. of this acid. Myricine, the portion of beeswax insoluble in boiling alcohol, is the source of myricyl alcohol, $C_{30}H_{62}O = C_{30}H_{61}.(OH)$, the highest known member of the series, $C_nH_{2n+2}O$. Pure myricylic alcohol is a crystalline substance having a silky lustre. When heated, it partly sublimes unaltered, and is partly resolved into water and melene, $C_{30}H_{60}$.

By destructive distillation, alone or with lime, beeswax gives off a little water, with acetic acid, propionic acid, and then a body known as *wax-butter*, which forms on cooling a white buttery mass composed mainly of solid hydrocarbons, cerotene, and melipene. By further heat a more fluid oil is obtained, called wax-oil, leaving behind a coaly residue. Hydrocarbon gases and carbon dioxide are given off during this distillation, but no acroleine. By long boiling with potash or soda imperfect saponification of the acids of wax ensues, the soapy body floating on the water, and being decomposed by acids, with liberation of myricine.

The uses for wax are numerous and important. Its property of preserving tissues and preventing mould or mildew were well known to the ancients, who used cerecloth for embalming, and wax for encaustic painting, as in the wall-pictures of Pompeii. Wax candles and tapers play an important part in the processions and ceremonies of the Roman Catholic Church. Wax is used by the manufacturers of glazed ornamental and wall papers and on paper collars and cuffs for polishing the surfaces. It is used in varnishes and paints, and for the "stuffing" of wood which is to be polished, as for pianos, coachwork, fine furniture, and parquette floors. Electrotypers and plasterers use wax in forming their moulds. Wax is an important ingredient in preparations for covering surfaces of polished iron and steel to prevent rust. Combined with tallow, it forms the coating of canvas and cordage to prevent mildew, as in sails, awnings, etc. Artificial flowers consume much wax, and, despite the introduction of paraffine, ceresine, and mineral wax, its use appears to be extending.

The product of wax in the U. S. is stated by Mr. N. M. Hoge of New York (communication to the writer) to be 20,000,000 pounds annually, and increasing, worth in money at least $6,000,000. Of this, about $700,000 are exported, and about $1,200,000 worth of honey also goes abroad. About 70,000 persons in the U. S. cultivate bees, the average number of hives to each cultivator being 28, or about 2,000,000 hives in all. Each hive yields a surplus of about 22 pounds of honey. The total product of honey and wax is worth at present in the U. S. nearly $15,000,000. The invention of the movable-comb hives by Rev. S. L. Langstroth in 1852; of the honey-extracting machine, which throws the honey from the cells by centrifugal force, leaving the comb in a condition to be used again by the bees; and, lastly, the ingenious production of artificial combs in a machine constructed by Dr. John Long, that turns out combs with cells rivalling, if not excelling, the natural product, are all important American improvements in apiarian culture which add largely to the economy of this industry, yet in its infancy. As the honey-bee is said to consume three-fourths of its time in producing comb at the very time when the honey-harvest is at its best, it is evident that Dr. Long's invention of artificial combs must be a great economy in the collection and storing of honey; but it is not so clear how the stock of wax is to be kept up unless man deceives the bee by using "mineral wax" in the formation of the artificial comb; and this product, as we shall presently see, is not true wax, but a natural paraffine. There is no wax imported into the U. S. The U. S. duty on foreign wax is 20 per cent.

Under STEARIC ACID, wax candles were referred to WAX. A word or two may suffice for this industry. To form wax candles, wicks of twisted (not plaited) Turkey cotton are suspended from a ring or hook over the caldron of melted wax, and the workman pours over them a stream of wax from a ladle, revolving each in succession to equalize the flow of the wax over the surface, until about one-third the intended size is obtained, when, after cooling, the same operation is repeated until the candles are about half size. While still warm they are then removed from the hooks, and rolled between two marble slabs to give them a cylindrical form and straightness. The upper end of the candle is now formed by cutting down the wax to a metal tag which covered one end of the wick. The candles are then suspended again on the hook, changing ends, and the operation of basting and rolling repeated until the desired size is attained. The lower ends are then cut off to an even length. Large wax candles, used at church altars, are formed up from thin slabs of wax by rolling them over the wick and finishing as before. Wax tapers are made by a sort of wire drawing process, the wicks, wound on a drum, being drawn through the molten wax at a regulated temperature, passing through graduated holes to size the tapers, and thence to a cooling drum.

Andaquies Wax (*cera de los Andaquies*) is a peculiar wax produced by a little bee called *caveja* by the Tamas Indians, of the Rio Coquetta on the plains of Orinoco, above the Magdalena River. These insects build on the same tree numerous combs, each of which yields from 100 to 250 grammes of yellow wax, about 3 to 8 oz. Troy, which, purified by boiling water, has a slightly yellowish color and melts at about 170° F. It contains C. 81.66, H. 13.55, O. 4.78 = 99.99. Lewy found in it three different bodies—viz. myricyl palmitate, about 50 per cent., fusible at about 162° F.; cerosine, fusible at 176° F., about 45 per cent.; and an oily matter, about 5 per cent. These principles are separated by alcohol as in case of ordinary beeswax.

Vegetable Wax.—The most familiar body of this class is the "bayberry wax," so called, from *Myrica cerifera*, a very abundant American species, the wax of which was carefully investigated by Moore (*Sill. Jour.* (2), xxxiii. 313), as already referred to in a former article. Other species of *Myrica* or *Myristica* furnish like products; *e. g.* in French Guiana the *M. ocoba*, *M. officinalis*, and *M. sebifera* furnish the *ocuba wax*, which, according to Sigaud (*Comptes rend. de l'Acad.*, xxii. 1321), grows on a fruit the size of a musket-ball, the nut covered with a thick crimson skin which dyes water of a fine purple. The wax is separated by boiling water, and swims on the surface. It is used for candles in the country where it is found; 3 parts by weight of this wax are obtained from 16 parts of the nuts. *Bicuiba Wax* is another body of the same sort from *M. bicuhyba*, of the origin of which little appears to be known. The composition of these two varieties of wax is C. 74.16, H. 11.25, O. 14.58 = 100. Both dissolve in boiling alcohol, and melt at 98.7° and 95° F., respectively.

Carnahuba Wax is the product of a palm (*Corypha cerifera*) growing in N. Brazil, and especially in the province of Ceara, forming a thin layer on the surface of the leaves. It scales off easily from the cut leaves when dried in the shade, and is readily fused and moulded into candles. It is soluble in boiling alcohol and in ether, and on cooling shows a crystalline structure. It melts at 185° F., and is very brittle and readily powdered. It contains, according to Lewy, C. 80.33, H. 13.07, C. 6.60 = 100.00. *Chinese Wax* is a dazzling white wax produced by the sting of *Coccus* on the leaves of certain plants. It crystallizes like spermaceti, which it resembles; melts at 180° F.; dissolves in alcohol, and yields cerotic acid and cerylene, $C_{27}H_{54}$, by dry distillation. It is used in China to make candles. *Japan Wax* is palmatine. Bleached carnahuba wax is employed for tempering other candle-stock of a lower melting-point, and was exhibited by Wagenmann of Vienna in the Austrian department of the Philadelphia Exposition as prepared for that purpose.

Fossil Wax (*Ceresine*). Under the so-called "fossil wax" are several distinct mineral hydrocarbons of the general formula C_nH_{2n}, belonging to the ethylene series—one especially of which (ozocerite) has lately assumed considerable economic importance as a substitute for beeswax, which in many physical properties it much resembles. The fossil paraffines are—(1) *Urpethite*, from Urpeth colliery (*Johnston*), melting at 102° F., sp. gr. 0.885, and soluble in cold ether; adheres to the fingers and stains paper. (2) *Hatchettite*, from Scotland (*Johnston*), a soft wax, sp. gr. 916–983, pearly, glistening, yellowish in color, greasy to the feel; melts at 115° F., dissolves very sparingly in cold ether and boiling alcohol, crystallizing as it cools from the hot ethereal solution. (3) *Ozocerite* (ozokerite); the original mineral was from Slanik in Moldavia, and was wholly soluble in ether; that from Boryslav in Galicia is insoluble in cold ether, but largely so in hot ether. Its sp. gr. is 0.944, and melting-point 140° F. (4) *Zietrisikite*, like the last named in nearly all physical characters, as hard as beeswax or harder; melts at 194° F., has a density of 0.9–0.946, and is distinctly separated from ozocerite by its almost complete insolubility in ether. It occurs at Zietrisika in Moldavia in large masses. Taking a mean differ-

ence in the melting-points of these several natural products as 57° F., and commencing with a variety of paraffine distilled from bituminous shale of Autun, as examined by M. Laurent, which melted at 91.4° F., was very soluble in ether and insoluble in alcohol, and consisted of C. 85.745, H. 14.200, and including an intermediate product obtained from the Urpeth mineral by Johnston, and which we call "Johnston's *third*," we shall have the following melting-points for the series—viz. urpethite, 91.4°; batchettite, 116.6°; ozocerite, 141.8°; Johnston's *third*, 167°; zietrisikite, 192.2° F. The boiling-points of ozocerite and zietrisikite are respectively above 400° and 572° F.

It is asserted by some chemists that this series of fossil wax does not afford paraffine, as found in nature, but that this body is a product of transformation of the native hydrocarbons in the process of manufacture, just as petroleum is changed in part to paraffine during the process of distillation of the crude oil.

It is evident that there are great possibilities connected with this series for very important application in the arts of a class of substances resembling beeswax in many physical properties, and surpassing it in the range of temperature and permanence of constitution. The so-called "ceresine wax"—a senseless tautology—is a trade-term applied to the purified ozocerite (named from ὄζειν, to "smell," and κηρός, "wax," in allusion to its odor) from Drohobicz and Boryslav in Galicia, and at Gresten in Austria. Since 1872 deposits of this mineral, in connection with the coal-measures, have been extensively explored, and the ozocerite industry has attained already large proportions. In the Centennial Exposition (1876) were four exhibitors of the products of this industry—Messrs. Paul Dobel, engineer at Boryslav; the chartered first Austrian ceresine manufactory, H. Ujhely & Co. at Stockerau near Vienna (represented by Messrs. Thurber & Co., New York); Gustavus Wagenmann, Vienna, and J. C. & J. Field, London. All these show the crude and melted mineral as brought into commerce, with purified product in white blocks, candles, wreath-tapers, Christmas-lights, cobbler's wax, thread wax, floor wax, etc., in interesting variety and great beauty. The establishment of Wagenmann has three buildings devoted to ozocerite manufacture, and is capable of working up 2,500,000 kilogrammes (nearly 6,000,000 pounds) of raw wax. In the establishment of Messrs. Ujhely & Co. are 400 persons occupied in various departments of the ceresine manufacture, aided by five steam-engines. The crude product, freed by fusion from sand, clay, and other impurities, is of a deep-brown color, with a greenish tint, has a sp. gr. of 0.940 to 0.990, exhales a naphtha-like odor, and in hardness, fracture, and plasticity greatly resembles beeswax. It is very combustible, burning with a pure rich flame of high illuminating power. It dissolves with difficulty in oil of turpentine. It is purified and bleached by means of Nordhausen sulphuric acid, which attacks only the foreign bodies in the ozocerite, leaving the colorless hydrocarbon untouched. It is used for all purposes for which beeswax is employed, and by its higher melting-point is capable of uses to which the former is not adapted. It is said not only to retard, but entirely prevent, rancidity in ointments—a most valuable quality. We have already suggested in the former part of this article that it may be used perhaps in Dr. Long's apparatus for producing artificial comb-cells for bees' use. No deposit of ozocerite has yet been found in the U. S. If zietrisikite, with its high melting-point, could be found in abundance, it has capabilities which have never yet been available in any hydrocarbon. Possibly we may find in ozocerite or zietrisikite the long-sought material for a standard candle for photometric measurement, which no existing candle has yet supplied. B. SILLIMAN.

Waxahatch'ie, p.-v. and tp., cap. of Ellis co., Tex. P. 2478.

Wax Figures were held in high repute at Rome from an early period, owing to their employment in the religious ceremonies in honor of ancestors, images of those who had filled curule offices being placed in the vestibules of their descendants. From about 300 B. C. these images were cast from moulds, and gradually took high rank as works of art. This employment of wax, on the decay of the Roman religion, was transferred to the worship of the saints, and the industry has flourished in Italy to the present time, the most celebrated artists having been Verrochio and Orsino.

Wax'haw, p.-v. and tp., Lancaster co., S. C. P. 960.

Wax Modelling is a branch of plastic art at present in low esteem, yet in former times Michael Angelo and other artists of the first rank in Germany and Italy produced excellent ceroplastic figures, many of which still exist. In some cases the wax was covered with clay or plaster, and then melted out, the mould thus formed being used in casting a bronze figure—technically, *cire perdue*.

Wax-Myrtle. See BAYBERRY.

Wax'-Palm, a name given to various wax-producing palms, especially to *Copernicia cerifera* (see CARNAHUBA PALM and WAX), and *Ceroxylon andicola* of the Andes.

Wax'-Plant, the popular name of *Hoya carnosa*, a climbing greenhouse shrub of the Asclepiadaceæ or milk-weed family, a native of the East Indies, deriving its name from the wax-like appearance of its clustering white flowers.

Wax'wing, an English name for the species of the genus *Ampelis*, and so applied because the wings have their tertial and secondary feathers provided with small plummet-like red appendages simulating red sealing-wax. The genus belongs to the great passerine group, and by most recent authors has been taken as the type of a peculiar family (Ampelidæ). The bill is rather short, depressed at base, with the culmen decurved at tip; the nostrils linear, and partially concealed by the extension of the frontal feathers; the head has a well-developed crest of soft blended feathers; the wings are long and narrowed, the tail even; the predominant color is a silky brownish, which grades into "vinaceous" anteriorly and ashy posteriorly above; the head has on each side a black stripe extending from the nasal region through the eye backward beneath the crest, and a black patch on the chin, with a white streak between them on the side of the lower jaw. Three species are known: (1) the *Ampelis garrulus* (Northern or Bohemian waxwing), of the northern parts of both continents; (2) the *Ampelis cedrorum* (common cedar-bird), of the U. S. and North America generally; and (3) the *Ampelis phœnicopterum*, of North-eastern Asia. The species appear to prefer as food berries of various kinds, but they also devour worms and insects, and in confinement the cedar-bird is "very fond of apples, bread soaked in milk, and almost any kind of soft food." (*Brewer.*) THEODORE GILL.

Waxwork, a plant. See CELASTRACEÆ.

Waxy Degeneration, a diseased condition of the tissues of the living body, in which parts of organs are changed into the substance known as lardaceine, or "animal amyloid," a peculiar albuminoid substance, which some have tried to identify with the glycogene of the liver. Though an albuminoid, it has reactions somewhat like those of starch. It takes a deep-brown red from iodine, dissolves in warm water, cannot be melted, swells but does not dissolve in sulphuric acid, and does not dissolve in ether. It is apparently isomeric with albumen (*Friedrich* and *Kekulé*). It has often been confounded with true starch, with which it is sometimes associated. Organs seriously affected by waxy degeneration, when cut, have a half-transparent look. It has been detected in the brain, nerves, spleen, liver, kidneys, muscles, arteries, bones, glands, adventitious tissues, cancers, and in various other situations. Rickets, syphilis, pulmonary consumption, diabetes, chronic kidney disease, and malarial and mercurial poisoning are among the conditions with which it is associated. It is seldom or never detected during life. The treatment naturally is for the disease with which it is associated. Some cases of obscure and undiagnosticated ill-health doubtless arise from this degeneration. Not much that is definite can as yet be said of the causes and treatment. In suspected cases the patient is to be put into the best hygienic conditions, and untoward symptoms should receive attention. This degeneration was first recognized in 1854 by Gairdner and Sanders of Edinburgh, and soon after, quite independently, by Virchow.

Way [Ang.-Sax. *weg*], in law, is classed among the incorporeal hereditaments as a servitude or easement, and is the right held by one or more individuals of passing and repassing in a given direction between fixed termini over the land belonging to another private owner. Although the term is sometimes applied to a highway, this is an incorrect use of it; for while a "highway" is the space along and over which the entire public may travel, and is always under the control of the public authorities, a "way" is the private *right* enjoyed by particular persons, and the burden thereby resting on the land of some proprietor, rather than the path or course along which the right must be exercised. A right of way may exist in three different forms: (1) It may be, and generally is, an easement—that is, it is annexed or appurtenant to one specific tract called the dominant estate, and is exercised over another defined parcel of land termed the servient estate. (For a full description of easements see the article EASEMENT.) (2) It may be enjoyed by the inhabitants of a particular village or hamlet to go and come to and from a designated point. This species is quite frequent in England, but can hardly be said to exist in the U. S., unless perhaps in connection with some of the oldest New England villages. (3) It may be an entirely personal servitude, conferred upon some particular individual, not by virtue of his owning land, but as a privilege belonging to himself alone, which cannot be

transferred, and which necessarily must end at his death. (See article SERVITUDE.) In respect to the nature and amount of the use permitted, the Roman law divided the general right into three grades—*iter*, for foot passengers only; *actus*, for passage on foot, with horses, vehicles, or cattle; and *via*, which included all the former uses, together with that of drawing heavy burdens, and also involved the notion of a distinct path or roadway of ascertained width. Although these names are not found in our law, the right may exist in these several degrees. A way may be acquired in three different modes.—(1) By the express terms of a deed, as when the owner of the servient estate by means of a grant charges his land with the easement, and also when an owner conveys a part of his land, and reserves a right of way over it in favor of the tract which he retains. (2) By prescription, or a long-continued user under a claim of right, the period having generally been fixed by statute at twenty years. (See article PRESCRIPTION.) (3) Of necessity. A way of necessity arises when A, being owner of land, conveys a portion thereof to B, so surrounded by other tracts that B is entirely cut off from access to any highway. Under such circumstances B has of necessity a right of way appurtenant to his parcel over the remaining land of A to a convenient highway, although the deed of conveyance was silent upon the subject. J. N. POMEROY.

Way (ALBERT), F. S. A., b. at Bath, England, in 1805, son of a wealthy and philanthropic clergyman, Rev. Gregory Lewis Way of Stanstead Park, Surrey; received his early education at home; graduated at Trinity College, Cambridge, about 1826; settled at London; devoted himself to archæological pursuits; became in 1843 president of the Society of Antiquaries, to whose *Proceedings* he contributed largely; seceded from that society, with a number of others, on account of differences among its members, and founded the Archæological Institute of Great Britain and Ireland, to whose interests he devoted his subsequent efforts, and was an efficient promoter of local antiquarian societies. He married in 1844 his cousin Emmeline, youngest daughter of the first Lord Stanley of Alderley. He edited for the Camden Society the *Promptuarium Parvulorum sive Clericorum; Lexicon Anglo-Latinum Princeps* (3 vols., 1843), valuable as supplying the most authentic record of the English of the fifteenth century, and corrected, enlarged, and brought out Sir S. R. Meyrick's work on *Ancient Armor* (2d ed., 3 vols., 1844). D. at Cannes, France, Mar. 22, 1874.

Way Cross, p.-v., cap. of Ware co., Ga.

Way'land, p.-v. and tp., Middlesex co., Mass., on Massachusetts Central R. R., 16 miles W. of Boston, has 4 churches, good graded schools, several boot and shoe factories, and a public library. The first free public library in the U. S. was established here. P. 1240.

T. A. MERRILL.

Wayland, p.-v. and tp., Allegan co., Mich. P. of v. 585; of tp. 1963.

Wayland, tp., Chariton co., Mo. P. 674.

Wayland, tp., Steuben co., N. Y. P. 2553.

Wayland (FRANCIS), D. D., LL.D., b. in New York City Mar. 11, 1796, of English parents; graduated at Union College 1813; studied medicine and commenced practice at Troy, but having joined the Baptist church 1816, devoted himself to the ministry; studied theology one year at Andover; was tutor in Union College 1817–21; pastor of the First Baptist church at Boston, Mass., 1821–26; became president of Brown University Feb., 1827, having previously filled for some months the professorship of mathematics and natural history in Union College; retired from the presidency 1855, and was for fifteen months (1857–58) acting pastor of the First Baptist church at Providence, and was highly distinguished as a pulpit orator. D. at Providence Sept. 30, 1865. Author of several volumes of sermons and addresses, *Elements of Moral Science* (1835), *Elements of Political Economy* (1837), *Limitations of Human Reason* (1840), *Thoughts on the Collegiate System of the U. S.* (1842), a work which led to the adoption of the voluntary system at Brown University in 1849; *Christianity and Slavery* (1845), being a discussion by correspondence with Dr. Richard Fuller; *Elements of Intellectual Philosophy* (1854), *Life of Rev. Adoniram Judson, D. D.* (2 vols., 1853), *Notes on the Principles and Practices of Baptists* (1856), *Letters on the Ministry* (1863), and other works. His *Life* was written by his sons Francis and H. L. Wayland (2 vols., 1867).

Wayland Dépôt, p.-v., Steuben co., N. Y.

Wayles'burg, tp., Bartholomew co., Ind. P. 101.

Waymansville, p.-v., Jackson tp., Bartholomew co., Ind. P. 55.

Way'mart, p.-b., Wayne co., Pa. P. 567.

Way'mouth, or **Weymouth** (GEORGE), b. in England about 1570; became distinguished as a navigator, and explored the Atlantic coasts of North America in the employ of Sir Ferdinando Gorges; entered the Penobscot and Kennebec rivers, and carried to England several Indians from that region.

Wayne, county of E. Georgia, bounded N. E. by Altamaha River, intersected by the Santilla, and traversed by Atlantic and Gulf, Brunswick and Albany, and Macon and Brunswick R. Rs.; surface level, soil sandy, with large pine forests. Staples, Indian corn, sweet potatoes, and rice. Cap. Jesup. Area, 594 sq. m. P. 2177.

Wayne, county of S. E. Illinois, intersected by Little Wabash River, and traversed by Springfield and Illinois South-eastern R. R.; surface generally level, soil fertile. There are flour-mills, saw-mills, woollen-mills, and carriage factories. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, hay, tobacco, wool, and dairy products. Cap. Fairfield. Area, 720 sq. m. P. 19,758.

Wayne, county of E. Indiana, bordering on Ohio, drained by Whitewater River and its affluents, and traversed by the Whitewater Canal and several railroads; surface undulating, soil fertile. There are saw-mills, flour-mills, tanneries, and manufactories of agricultural implements, carriages, iron castings, machinery, and linseed oil. Live-stock numerous. Staples, Indian corn, wheat, oats, tobacco, wool, and dairy products. Cap. Richmond. Area, 420 sq. m. P. 34,048.

Wayne, county of S. Iowa, bordering on Missouri and drained by the S. fork of Chariton River; surface undulating, soil fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, wheat, oats, hay, wool, and dairy products. Cap. Corydon. Area, 510 sq. m. P. 11,287.

Wayne, county of S. Kentucky, bordering on Tennessee, and bounded N. and E. by forks of the Cumberland River; surface hilly, with much bituminous coal and iron; soil along the streams fertile. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, tobacco, and wool. Cap. Monticello. Area, 570 sq. m. P. 10,602.

Wayne, county of S. E. Michigan, bordering on Lakes Erie and St. Clair, drained by Rouge and Huron rivers and their branches, and traversed by several railroads, which centre at Detroit. The surface is level or gently undulating; soil very fertile, with excellent limestone and several sulphur springs. There are more than 1000 manufacturing establishments of various kinds, the greater portion being in Detroit. (See DETROIT.) Live-stock is abundant on the farms outside of the city. Staples, manufactured articles, Indian corn, oats, wheat, wool, and garden and dairy products. Cap. Detroit. Area, 600 sq. m. P. 119,038.

Wayne, county of S. E. Mississippi, bordering on Alabama, intersected by Chickasawha River, and traversed by Mobile and Ohio R. R.; surface undulating, soil sandy. Staples, cotton, Indian corn, and sweet potatoes. Cap. Waynesborough. Area, 790 sq. m. P. 4206.

Wayne, county of S. E. Missouri, watered by Bigwater, Castor, and St. Francis rivers; surface undulating; soil tolerably fertile in some parts, swampy in others, but scantily timbered. Swine and sheep are the principal live-stock. Staples, Indian corn, tobacco, and wool. Cap. Greenville. Area, 750 sq. m. P. 6068.

Wayne, county of N. E. Nebraska, drained by affluents of Elkhorn River; surface undulating, soil fertile. Cap. La Porte. Area, about 450 sq. m. P. 182.

Wayne, county of N. W. New York, lying on Lake Ontario, intersected by Clyde River, and traversed by Erie Canal, and by New York Central, Lake Ontario Shore, and other railroads; surface undulating, soil generally fertile. Iron ore and gypsum abound, and there are several saline and sulphur springs. There are about 600 manufacturing establishments, among which are flour-mills, saw-mills, planing-mills, tanneries, agricultural implements, carriages, cooperage, iron castings, machinery, and essential oils and essences, especially of peppermint. Live-stock, especially cattle and sheep, numerous. Staples, oats, Indian corn, wheat, barley, potatoes, wool, hay, and dairy products. Cap. Lyons. Area, 572 sq. m. P. 47,710.

Wayne, county of E. North Carolina, intersected by Neuse River, and traversed by North Carolina, Atlantic and North Carolina, and Weldon and Wilmington R. Rs. The surface is level, much of it being covered by pine forests; soil sandy. Swine are the chief live-stock. Staples, cotton, lumber, tar, pitch, and turpentine, Indian corn, and sweet potatoes. Cap. Goldsborough. Area, 720 sq. m. P. 18,144.

Wayne, county of N. E. Ohio, drained by Walhonding River and other streams, and traversed by Pittsburg Fort

Wayne and Chicago, Cleveland Mount Vernon and Delaware, and Atlantic and Great Western R. Rs.; surface undulating, soil very fertile. There are saw-mills, planing-mills, flour-mills, tanneries and currying establishments, and manufactories of agricultural implements, carriages, iron castings, machinery, and woollen goods. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Wooster. Area, 660 sq. m. P. 35,116.

Wayne, county of N. E. Pennsylvania, bordering on New York, bounded E. by Delaware River, drained by the Lackawaxen and other streams, and traversed by Delaware and Hudson Canal and by Erie R. R. The surface is hilly, in some parts mountainous, and not well adapted for tillage. There are many tanneries and saw-mills, and manufactories of agricultural implements, carriages, and iron castings. Cattle and sheep are numerous. Staples, hay, wool, oats, potatoes, and dairy products. Cap. Honesdale. Area, 720 sq. m. P. 33,188.

Wayne, county of S. W. Tennessee, bordering on Alabama, bounded N. W. by Tennessee River and drained by Buffalo River and other streams; surface hilly, soil fertile, and abounding in iron ore. There are saw-mills, flour-mills, and many tanneries and currying establishments. Swine and cattle are the chief live-stock. Staples, cotton, Indian corn, wool, tobacco, and dairy products. Cap. Waynesborough. Area, about 700 sq. m. P. 10,209.

Wayne, county of S. W. West Virginia, bordering on Kentucky and on Ohio, from which it is separated by Ohio River. The surface is hilly, mostly covered by forests, with much bituminous coal and iron ore. Sheep and swine are the chief live-stock. Staples, Indian corn, tobacco, and wool. Cap. Wayne Court-house. Area, 415 sq. m. P. 7852.

Wayne, p.-v. and tp., Du Page co., Ill. P. 1019.
Wayne, tp., Allen co., Ind. P. 1742.
Wayne, tp., Bartholomew co., Ind. P. 1836.
Wayne, tp., Fulton co., Ind. P. 1131.
Wayne, tp., Hamilton co., Ind. P. 1398.
Wayne, tp., Henry co., Ind. P. 3318.
Wayne, tp., Huntington co., Ind. P. 804.
Wayne, tp., Jay co., Ind. P. 1526.
Wayne, tp., Kosciusko co., Ind. P. 3664.
Wayne, tp., Marion co., Ind. P. 3738.
Wayne, tp., Montgomery co., Ind. P. 1418.
Wayne, tp., Noble co., Ind. P. 1236.
Wayne, tp., Owen co., Ind. P. 1333.
Wayne, tp., Randolph co., Ind. P. 3220.
Wayne, tp., Starke co., Ind. P. 606.
Wayne, tp., Tippecanoe co., Ind. P. 1801.
Wayne, tp., Wayne co., Ind. P. 3734.
Wayne, p.-v. and tp., Henry co., Ia. P. 1258.
Wayne, tp., Jones co., Ia. P. 1178.
Wayne, tp., Mitchell co., Ia. P. 305.
Wayne, tp., Monroe co., Ia. P. 655.
Wayne, tp., Doniphan co., Kan. P. 2070.
Wayne, p.-v. and tp., Kennebec co., Me. P. 938.
Wayne, tp., Cass co., Mich. P. 999.
Wayne, p.-v., Wayne co., Mich. P. 833.
Wayne, tp., Bollinger co., Mo. P. 630.
Wayne, tp., Buchanan co., Mo. P. 803.
Wayne, tp., Passaic co., N. J. P. 1521.
Wayne, tp., Steuben co., N. Y. P. 891.
Wayne, tp., Adams co., O. P. 1169.
Wayne, tp., Ashtabula co., O. P. 817.
Wayne, tp., Auglaize co., O. P. 1011.
Wayne, tp., Belmont co., O. P. 1700.
Wayne, tp., Butler co., O. P. 1694.
Wayne, tp., Champaign co., O. P. 1729.
Wayne, tp., Clermont co., O. P. 1690.
Wayne, tp., Clinton co., O. P. 1267.
Wayne, tp., Columbiana co., O. P. 766.
Wayne, tp., Darke co., O. P. 1983.
Wayne, tp., Fayette co., O. P. 1336.
Wayne, tp., Jefferson co., O. P. 1564.
Wayne, tp., Knox co., O. P. 1658.
Wayne, tp., Monroe co., O. P. 1252.
Wayne, tp., Montgomery co., O. P. 1160.
Wayne, tp., Muskingum co., O. P. 1508.
Wayne, tp., Noble co., O. P. 796.
Wayne, tp., Pickaway co., O. P. 790.
Wayne, tp., Tuscarawas co., O. P. 1132.
Wayne, tp., Warren co., O. P. 2905.
Wayne, p.-v. and tp., Wayne co., O. P. 1714.
Wayne, tp., Armstrong co., Pa. P. 2028.
Wayne, tp., Clinton co., Pa. P. 701.
Wayne, tp., Crawford co., Pa. P. 1464.
Wayne, p.-v. and tp., Erie co., Pa. P. 1295.
Wayne, tp., Greene co., Pa. P. 1563.
Wayne, tp., Lawrence co., Pa. P. 1040.
Wayne, tp., Mifflin co., Pa. P. 1453.
Wayne, tp., Schuylkill co., Pa. P. 1546.
Wayne, b., Wayne co., Pa. P. 476.
Wayne, tp., Lafayette co., Wis. P. 1056.
Wayne, p.-v. and tp., Washington co., Wis. P. 1710.

Wayne (Anthony), b. at East Town, Chester co., Pa., Jan. 1, 1745; educated at the Philadelphia Academy; became a surveyor and an intimate friend of Franklin; was agent of a land company in Nova Scotia 1765–66; married and settled on a farm in Chester county 1767; was elected to various county offices; was a member of the Pennsylvania convention and of the legislature of 1774; served on the committee of safety 1775; raised in September of that year a regiment with which he took part in the campaign against Canada; became colonel Jan. 3, 1776; was wounded at the battle of Trois Rivières, at which he was highly distinguished; was afterward in command of the fortresses of Ticonderoga and Mount Independence, garrisoned by five regiments, until May, 1777; was commissioned brigadier-general Feb. 21, 1777; joined Washington in New Jersey; commanded a division at the battle of Brandywine, Sept. 11, being stationed at Chadd's Ford to oppose the passage of the river by Knyphausen; fought all day and effected a successful retreat at sunset; took command of a flying detachment of 1500 men for the purpose of harassing the British rear, but was surprised at Paoli (close to his own homestead) by superior numbers on the night of Sept. 20, and lost 53 men; was acquitted of blame by a court-martial held at his own request; led the American right wing at the battle of Germantown, Oct. 4; made a raid within the British lines in the winter of 1777–78, capturing numerous horses and cattle and abundance of forage; contributed by his skilful manœuvres to the victory of Monmouth June 28, 1778; led the attack at the storming of Stony Point on the night of July 15–16, 1779, considered the most brilliant feat of arms of the whole war (see Stony Point); was wounded in the head; received from Congress a vote of thanks and a gold medal; acquired the sobriquet of "Mad Anthony Wayne," and became the favorite popular hero; exhibited much address in suppressing a mutiny of the Pennsylvania line at Morristown Jan., 1781; joined La Fayette in Virginia Jan. 7; made with a part of a brigade a daring attack upon the whole British army at Green Spring or Jamestown Ford July 6, and by a bayonet-charge disconcerted a projected manœuvre against La Fayette; was present at the surrender of Cornwallis; defeated the British and Indians in Georgia May and June, 1782; took possession of Charleston, S. C., after its evacuation Dec. 14; retired to his farm in Pennsylvania after the war; served in the Pennsylvania assembly 1784–85, and in the convention that ratified the U. S. Constitution; was appointed major-general Apr. 2, 1792, and took command of an expedition against the Western Indians, whom he defeated at Fallen Timbers, or Maumee Rapids, Aug. 20, 1794; concluded with them the treaty of Greenville 1795, and while on his return homeward d. at Presque Isle (now Erie, Pa.) Dec. 15, 1796. His remains were removed in 1809 to Radnor church, near Waynesborough, Pa., where a monument was erected by the Pennsylvania Society of Cincinnati July 4, 1809. His *Life*, by Gen. John Armstrong, is in Sparks's series, and his *Regimental Orderly Book* was printed at Albany in 1859. Porter C. Bliss.

Wayne (James Moore), LL.D., b. at Savannah, Ga., in 1790; graduated at Princeton 1808; became a lawyer and politician at Savannah; sat in the legislature; presided over two constitutional conventions; was mayor of that city 1823, judge of the superior court of Georgia 1824–29, member of Congress 1829–35; was an efficient debater, an advocate of free trade, and an active supporter of the policy of Pres. Jackson, by whom he was appointed an associate justice of the Supreme Court of the U. S. Jan. 9, 1835, and gave especial attention to admiralty jurisprudence. D. at Washington, D. C., July 5, 1867.

Wayne Court-house, p.-v., cap. of Wayne co., West Va.

Waynes'boro', p.-b., Franklin co., Pa., about 50 miles S. W. of Harrisburg, has 7 churches, a graded school, steam-engine and boiler works, grain separator works, 1 sash and door factory, 2 hotels, 1 tannery, a medicine manufactory, and 1 newspaper. P. 1345.

W. Blair, Ed. "Village Record."

Waynesboro', p.-v., cap. of Wayne co., Tenn., about 100 miles S. W. of Nashville, contains 1 church, good schools, 1 newspaper, and 2 hotels. Large deposits of iron ore exist in the county. Principal business, farming. P. about 350.

Thos. F. Warren, Ed. "Wayne Co. Citizen."

Waynesborough, p.-v., cap. of Burke co., Ga.

Waynesborough, p.-v., cap. of Wayne co., Miss.

Waynesborough, p.-v., South River tp., Augusta co., Va. P. 536.

Waynes'burg, v., Auburn tp., Crawford co., O. P. 63.

Waynesburg, p.-v., Sandy tp., Stark co., O. P. 425.

Waynesburg, p.-b., cap. of Greene co., Pa., on Waynesburg and Washington R. R., 45 miles S. of Pittsburg, contains 7 churches, Waynesburg College, a fine town-hall, 1 bank, 3 weekly newspapers, 1 extensive carriage-factory, 1 foundry, 2 lodges of Masons and 1 of Independent Order of Odd Fellows, and several planing and flouring mills. The town was laid out in 1796. P. 1272.

W. T. H. Pauley, Ed. "Messenger."

Waynes'field, tp., Lucas co., O. P. 2015.

Waynes'ville, p.-v., Wayne co., Ga.

Waynesville, p.-v. and tp., De Witt co., Ill. P. 970.

Waynesville, p.-v., Wayne tp., Bartholomew co., Ind. P. 104.

Waynesville, p.-v., cap. of Pulaski co., Mo.

Waynesville, p.-v. and tp., cap. of Haywood co., N. C. P. 1543.

Waynesville, p.-v., Warren co., O., on Little Miami R. R. and River, 38 miles E. of Cincinnati, has 6 churches, an excellent graded school, 2 banks, 1 newspaper, a town-hall, fine water-power, and several mills. P. 745.

Drew Sweet, Ed. "Gazette."

Wayn'flete, or **Wainfleet** (William of), otherwise called **William Patten** or **Barbour,** b. at Waynflete, Lincolnshire, England, about 1405; educated at Winchester and at Oxford University; became head-master of Wykeham's school at Winchester 1429; was appointed by King Henry VI. first master of his newly-founded college at Eton 1442; became provost of Eton Dec., 1443; succeeded Cardinal Beaufort in the bishopric of Winchester 1447; founded Magdalen Hall, Oxford, 1448; converted it into a college with a liberal endowment 1456; also founded a free school in his native town; was lord high chancellor to Henry VI. during the disastrous years 1456–60, resigning three days before the battle of Northampton, and was generously treated by the victorious Yorkists. D. Aug. 11, 1486, and was buried in a magnificent chapel in Winchester cathedral.

Waywode, a Slavic word meaning "leader in war," was first applied simply to the military commanders, but afterward also to the governors of the provinces, and used in Poland, Hungary, Transylvania, Moldavia, and Wallachia. It has since been superseded by another title, also of Slavic origin—*hospodar.*

Wayzeta, p.-v., Hennepin co., Minn.

Wea, p.-v. and tp., Tippecanoe co., Ind. P. 1251.

Wea, p.-v. and tp., Miami co., Kan. P. 1324.

Weak'-Fish, a name given to the *Cynoscion regalis* (*Otolithus regalis* of old writers), one of the most common fishes along the eastern coast of the U. S. It belongs to the family Sciænidæ, and has as associates several other species, mostly peculiar to the southern coast of the U. S.—viz. *C. thalassinus, C. nothus,* and *C. carolinensis.* These species are all distinguished by their elongated subfusiform shape, the prominence of the lower jaw, and the armature of the upper one with canine teeth; the dorsal fin has nine or ten spines, and the anal fin one small spine. The weak-fish is distinguished by its color, which above is pale-brownish, with a decided greenish tinge, and grading below into silvery; on the back and sides are irregular vermicular blotches disposed in an oblique direction, tending forward and downward; the ventral and anal fins are yellowish, the others neutral. It generally averages between one and two feet in length, and is found along the entire eastern coast S. of Cape Cod, but is most common in the warmer waters. It confines its habitat to the sea, and does not ascend into the fresh waters. It is rather a voracious fish, and readily seizes the hook, but its mouth is easily torn, and to this characteristic (weakness of mouth) the name refers.

Theodore Gill.

Weak'ley, county of N. W. Tennessee, bordering on Kentucky, drained by tributaries of Obion River, and traversed by Nashville Chattanooga and St. Louis R. R.; surface level, soil fertile. Swine are the chief live stock. Staples, tobacco, Indian corn, and wheat. Cap. Dresden. Area, 550 sq. m. P. 20,735.

Weale (John), b. in England in 1791; was for forty years a publisher in London, and issued the three valuable series of textbooks—rudimentary, educational, and classical—now published by Messrs. Virtue, and edited some of the works in question. D. at Canterbury Villas, London, Dec. 18, 1862. Author of *A Catalogue of Works on Architecture and the Fine Arts* (1823), *A Rudimentary Dictionary of Terms used in Architecture, Building, Engineering, etc.* (2 parts, 1849–50), *London Exhibited in 1851* (1851), and other works, and editor of *Quarterly Papers on Architecture and Archæology* (4 vols., 1843–46), *Quarterly Papers on Engineering* (6 vols.), and *Divers Works of Early Masters in Christian Decoration* (2 vols., imperial folio, 1846).

Wealth [Ang. Sax. *weln;* Ger. *Wohl;* Dan. *vel,* supposed by some to have the same root with Lat. *valeo,* to "be strong"], a collective term for riches, material possessions in all their variety. The chief subject of political economy is wealth, and hence that science is sometimes called "the science of wealth." As a technical term of science, wealth embraces all and only such objects as both have utility—*i. e.* fitness to gratify human desire—and can be appropriated in exclusive possession, and therefore exchanged; in other words, all objects of *value.* (See Value.) It was formerly a popular notion that only money is real wealth. The idea still lingers in many minds in a way to confuse and complicate problems of both private and public finance. Money, though it measures all values, forms but a small part of the sum of wealth, and is desirable not for itself, but for the wealth in other forms which it can purchase. The term *wealth* does not properly include human beings, nor their capacities and qualities, such as strength, skill, genius, judgment, fidelity, etc. These are of highest consequence as means for the production and security of wealth, but it is only the products of their active employment which can be counted in the category of wealth. Nor does the term, in its generic sense, properly include evidences of debt, such as mortgages, bonds, stocks, etc. These things only indicate a title to possession and a mode in which real wealth is distributed. A mortgage on a farm given for borrowed money or as a part of the purchase price simply indicates that the mortgagor and the mortgagee are for the time, till the fulfilment of certain conditions, joint owners of the farm. The wealth is in the farm. It is not increased one whit by the mortgage itself. The issue of bonds by the U. S. government adds nothing directly to the wealth of the country. Each bond for $1000 gives its holder simply a lien on the wealth of the nation, at some time or other to be brought under control of the government by taxation. Many a mischievous illusion comes from mistaken views of these things. In the estimate of his personal property one may count in all he possesses of these evidences of debt, but the amount thus set down to his advantage is to be subtracted from some other man's wealth or from the common wealth of the country. In themselves they add nothing to the real wealth of a people or of the world, though they render an important service in bringing the wealth of a community into productive use. They are always symbols, not substance.

Wealth is produced only through the development of the resources of nature by human labor. The prime source of all utilities is the free bounty of God in nature, and the basis of the right of possession is the labor put forth to bring out the properties of nature in form and place to meet the desires of man. To accumulate wealth, labor must be continued beyond what is essential to meet immediate necessities, and the check of forethought and abstinence must be laid on the immediate consumption of the products of labor. Hence, *industry* and *frugality* are the indispensable conditions of the production and increase of wealth. These are characteristics which distinguish civilized from savage men, and thus wealth becomes a sign of civilization. At the same time, it is to be noted that wealth is maintained only by a continual process of reproduction. It must be perpetually renewed or it disappears. Values in one form are consumed that new values may appear, and the increase of wealth is as the value in the new form is greater than the value destroyed. Mill says, "The greater part of England's wealth to-day was produced within the last twelvemonth." (For other aspects of the subject see Political Economy.)

A. L. Chapin.

Weare, p.-v. and tp., Hillsborough co., N. H. P. 2092.

Weare (Meshech), b. at Hampton, N. H., June 16, 1713; graduated at Harvard 1735; studied and practised law; sat several years in the legislature; was Speaker 1752; commissioner to the colonial congress at Albany 1754; be-

came a justice of the supreme court and chief-justice 1777; was councillor from Rockingham county and chairman of the committee of safety 1775; was chosen president of the State 1776, and annually re-elected during the war, in which he rendered great services to the defence of the Northern colonies from Burgoyne's invasion, raising and equipping the forces sent to the frontier under Gen. Stark: and was again chosen president under the new constitution 1784. D. Jan. 14, 1786.

Wea'sel [Ang.-Sax. *wesle*], a name employed for representatives of the family Mustelidæ and the sub-family Mustelinæ, and more especially restricted to the species of the genus *Putorius*. These are especially distinguished by the small number of molars, there being only 34 teeth in all—viz. M. $\frac{1}{2}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{3}{3}$; the lower suctorial molar tooth has no inner tubercle; the body is very slender and elongated, especially in the small species, and so much so as to have obtained the name vermiform; the tail is moderate; the feet are essentially digitigrade. The species are among the boldest and most bloodthirsty of carnivorous animals, and especially destructive to poultry, which they generally seize by the neck, and, after sucking their blood, proceed to devour the carcasses leisurely, or perhaps leave, satisfied with quenching their thirst for blood alone. The species are mostly confined to cold and temperate regions, although a few extend into tropical countries. The generally-recognized species in North America are the *Putorius vulgaris*, or common little weasel; the *P. longicauda*, nearly related to the former, found in the upper Missouri and Platte countries; the *P. frenata*, or bridled weasel, of the south-western portions of the U. S.; the *P. visor*, or common mink; and the *P. nigripes*, or black-footed ferret of the Western plains. In Europe and Northern Asia are found a number of other species more or less closely related to those of North America. THEODORE GILL.

Wea'ther [Ang.-Sax. *weder*], the condition of the atmosphere prevailing at any moment over any region of the earth. This term is therefore to be carefully distinguished from *climate*, since the latter refers to the average condition of the weather for a considerable period; as, for instance, a month or year. The weather is in most portions of the earth exceedingly variable, but the climate is sensibly constant; the climates of the inhabited countries appear to have undergone only slight changes during the entire period over which history extends, notwithstanding occasional local exceptions, due, probably, to the drainage of lakes and marshes, the improved cultivation of the ground, or a slow change in the elevation of the land. On the other hand, decided changes in local climates seem to have taken place in those remote periods contemplated in the study of geology, so that it has been possible for strata to accumulate in which are found fossil animals and plants such as are supposed, but not known, to require very different climates from those now prevailing in the respective localities. One of the most recent of these geological periods is that known as the Glacial, during which greater quantities of snow, and possibly more intense cold or longer winters, prevailed than now. A large part, if not the whole, of these slow general changes in climate may be explained as due to changes in the distribution of land and water or of high land and low land; which changes are still going on throughout the entire earth. The sufficiency of the subsidence and elevation of land to account for these climatic changes has been maintained by many. Probably the most comprehensive and satisfactory view of the subject is given by Sartorius von Waltershausen in *Untersuchungen der Klimat der Gegenwart und der Vorwelt* (*Nat. Verh. Haarlem*, 2d series, vol. xxiii., 1865). In this mode of viewing the subject of permanency of climate all extreme assumptions seem to be avoided, and it is seen to be unnecessary to assume variations in solar radiation, or in the earth's orbit, or in its axis of rotation, or in the constitution of the atmosphere, or in the temperature of those portions of space through which the solar system has moved.

The terms applied to the different sorts of weather are also applicable to climate; thus, the combination of hot, moist air without wind forms sultry weather; cold, moist air with wind forms raw weather. The terms *damp* and *dry* have somewhat different significations in various parts of the world, but usually when the relative humidity is above 90 per cent. the air is called damp, while a humidity of 60 per cent. or less is dry weather; at 30 or 40 per cent. the air becomes very dry, and at less than 20 uncomfortable except to those who are accustomed to the very dry air of the interior of the continents, where relative humidities of 10 and 20 per cent. frequently occur. The expression *dull* weather applies when the sun is obscured by cloud or fog and haze, so that a twilight darkness seems to brood over the earth.

As the characteristic constant features of the climate of any region are shown by tables of appropriate monthly and seasonal averages, so the varying features of the weather are shown by tables of appropriate extreme values. An ingenious attempt has been made by J. W. Osborne of Washington to devise some single number or curve that should represent at a glance the combined influence of temperature, moisture, and wind upon the human body; this he seeks to do by determining the rate of cooling of a mass of water at a temperature of blood-heat contained in a porous vessel and exposed to the open air. (See *Proceedings Amer. Assoc. Adv. Sci.*, 1875.) In the absence of data furnished by such apparatus, which would afford a simple means of comparing the weather in different countries and on different days, we give the following approximate estimates based on the ordinary registers of meteorological observations:

	New York.	Toronto.	St. Paul.	New Orleans.
Greatest daily range of temperature	35	45	40	25
Greatest daily rainfall	6	$3\frac{1}{2}$	3	9
Greatest daily range of relative humidity	30	30	25	20

The variability of the weather is also seen by tabulating the frequency with which any phenomenon occurs. Thus, the number of days in each month on which rain or snow fell at Toronto was, according to the records for thirty years, as follows:

Month.	Average.		Maximum.		Minimum.	
	Rain.	Snow.	Rain.	Snow.	Rain.	Snow.
Jan.	4.6	14.0	10	23	0	5
Feb.	4.0	12.6	11	21	0	4
Mar.	6.2	10.0	15	18	0	3
Apr.	10.0	3.6	17	11	3	1
May.	11.8	0.4	18	2	5	0
June.	11.9	0.1	22	2	5	0
July	10.7	0.0	16	0	4	0
Aug.	10.8	0.0	17	0	4	0
Sept.	11.1	0.0	17	0	4	0
Oct.	12.5	1.8	22	7	6	0
Nov.	10.0	6.9	15	18	5	1
Dec.	5.7	13.6	11	23	1	5

Weather Predictions.—The rapid changes that are continually taking place in the weather of the countries beyond the tropics have from time immemorial made it desirable to know the probable character of the weather a few days in advance. The predictions made by the ancients and by the majority of persons at present depend generally on local rules founded upon personal experience or tradition. Many of these are of the value of myths, in that they have descended to us from most ancient times, and were brought to us from distant countries, where alone they could have any applicability. Others of these rules have a foundation in a more correct philosophy: thus, the colors of the sky at sunset and sunrise depend on the moisture then present, and give a hint as to the prospect of cloudy or clear weather; thus, also, the behavior of plants and hygroscopic substances depends on the quantity of moisture, and shows whether the air is dry or nearly saturated; the aspects of the clouds, the direction of the wind, the audibility of distant sounds, etc., etc., are all more or less reliable indications of the weather that is to be experienced within a few hours. Those predictions of the weather that are based upon astronomical phenomena, especially the phases of the moon, and which are even still published in popular almanacs, and are as current among the ignorant to-day as they were 3000 years ago, must be looked upon as the outgrowth of ancient systems of astrology; a careful comparison of these predictions with the weather will show that they are no better than they would be if all reference to the celestial bodies was omitted. Some meteorologists have, however, compiled for certain localities tables for weather prediction founded on the assumed natural constancy of climates, and which may be illustrated by an example. Thus, if 100 years of observation at New York show that during the first ten days of September only one is rainy and only three cloudy, then the prediction "clear weather" for any one of those days would have been verified seven times out of ten. This same principle has been skilfully applied to the climate of the Barbadoes by Gov. Rawson, who has tabulated the chances that a rainy season will follow a given dry one, or *vice versâ*, and whose tables, based on thirty years of experience, enable him to attain a very satisfactory degree of precision in his official predictions, which, however, must be regarded as belonging to climatology rather than to the weather. Another interesting question is as to the chance of a change in the weather from day to day. Thus, the permanency of the weather in a portion of the U. S. is such that if we should always predict for to-morrow the same weather that we are experiencing to-day, we should come out right in about six cases out of ten; on the Pacific coast we should come right in about nine cases out of ten.

In so far as weather predictions are based upon the principle of the general uniformity of climate, they can, however, scarcely be said to be the application of scientific meteorology. The predictions published by the meteorological offices of many civilized nations, which is the U. S., are based upon a very different course of reasoning. In these offices there is being developed a system of rational deductive meteorology in which certain fundamental physical laws are applied to the condition of the atmosphere at any moment as given by observations and weather-charts. It is essential to the successful application of this mode of prediction that the weather-charts should cover a very large extent of territory, since certain atmospheric changes are propagated with great rapidity to great distances; and again, the region for which predictions are to be made should be centrally located with reference to the surrounding stations, since the winds, moisture, and barometric pressure, etc., are liable to advance from the N., S., or E., although most frequently coming from the W. So extensive are these changes that we must view the atmosphere as a whole; and it will readily be granted that only by the study of weather-maps of the entire globe can deductive meteorology attain the completeness toward which it must ever approach. The progress already made, however, warrants the conclusion that in this as in every other department of nature a few inexorable laws are at work producing their results with unerring certainty, and without any of that mysterious chance which is so often spoken of as characteristic of the weather. (See METEOROLOGY and SIGNAL SERVICE.) C. ABBE.

Wea'therford, p.-v., cap. of Parker co., Tex.

Weatherford (WILLIAM), b. in Alabama about 1770, was the son of a Seminole woman by a white trader; became a skilful hunter and warrior and the leading chief of his tribe; was the commander in the war of 1813–14 against the U. S.; surrendered to Gen. Jackson Apr., 1814; lived thenceforth peaceably on his plantation at Little River, Monroe co., Ala., where he d. in 1824.

Weather-Glass. See BAROMETER, by PRES. F. A. P. BARNARD, and HYGROMETRY, by JOSEPH HENRY, LL.D.

Weather-Glass, Poor Man's. See PIMPERNEL.

Wea'therly, p.-b., Lausanne tp., Carbon co., Pa. P. 1076.

Wea'thersfield, tp., Trumbull co., O. P. 5184.

Weathersfield, p.-v. and tp., Windsor co., Vt. P. 1557.

Weat'land, p.-v., Clinton co., Ia., on Chicago and North-western and Davenport and St. Paul R. Rs., has 3 churches, 1 graded school, a library, 1 newspaper, Masonic lodge, and 1 hotel. P. 788.

FRANK L. DENNIS, EDR. "NEWS."

Wea'ver (A. W.), U. S. N., b. July 1, 1832, in the District of Columbia; entered the navy as midshipman May 10, 1848; became lieutenant in 1855, commander in 1866, captain in 1876; served in the Susquehanna at the capture of Forts Hatteras and Clark, and at the battle of Port Royal in 1861; commanded the gunboat Wivern in some sharp battles and skirmishes on the Mississippi River in 1862 and 1863, and in 1865 commanded the iron-clad Mahopac in the last Fort Fisher fight. Favorably mentioned by Rear-Admirals Farragut, Porter, and Lardner.

FOXHALL A. PARKER.

Wea'ver-Bird, a common name for the Ploceinæ, a sub-family of the finches, remarkable for their curious nests. They belong to the genera *Ploceus*, *Euplectes*, *Textor*, *Hyphantornis*, *Philetærus*, etc. Comparatively little is known of these birds, as they are mostly African, although a few are Asiatic, but their remarkable nests, constructed so as to protect the eggs and young from snakes and monkeys, have long been objects of curiosity.

Wea'ver's Mill, tp., Morgan co., Ala. P. 491.

Wea'verville, p.-v. and tp., cap. of Trinity co., Cal. P. of v. 816; of tp. 1399.

Weav'ing, the operation of producing cloth or other textile fabrics by means of a loom from the combination of threads or filaments. The art was rudely practised in the infancy of civilization, was brought to considerable perfection in Egypt, India, and Greece, and has assumed, by the great inventions of modern times, a foremost rank among mechanical industries. (See LOOM, by PROF. W. E. A. AXON.)

Webb, county of S. Texas, bounded W. by the Rio Grande, which separates it from Mexico. Stock-raising is the chief industry, and cattle and sheep are numerous. Cap. Laredo. Area, about 1200 sq. m. P. 2615.

Webb, tp., Reynolds co., Mo. P. 634.

Webb (ALEXANDER S.), son of James Watson, b. in New York Feb. 15, 1835; graduated at West Point July, 1855, when commissioned brevet second lieutenant of 2d Artillery; served with his regiment in Florida and on frontier duty 1855–57; as assistant professor of mathematics at West Point 1857–61. Returning to duty with his regiment, he served in the defence of Fort Pickens Apr.–July, 1861; appointed captain 11th Infantry May 14, 1861, and engaged in the battle of Bull Run, July 21. As major 1st Rhode Island Vol. Artillery, he served in the defences of Washington Sept., 1861–Apr., 1862, and with the Army of the Potomac in the Virginia Peninsular campaign Apr.–Aug., 1862; commissioned lieutenant-colonel and assistant inspector-general Aug. 20, 1862; was chief of staff 5th corps until November, when assigned to duty at Washington as inspector of artillery at Camp Barry. Returning to duty in the field Jan., 1863, he served as assistant inspector-general 5th corps until June 23, when appointed a brigadier-general of volunteers and assigned to the 2d corps. At Gettysburg his brigade met the assault of the third day, where Gen. Webb displayed conspicuous bravery, was wounded, and brevetted major for gallantry. In the subsequent operations of the campaign he commanded a division (2d corps), gaining the brevet of lieutenant-colonel for gallantry at Bristoe Station, Oct. 14, 1863. In the Richmond campaign of 1864 he led a brigade in the battles of the Wilderness and Spottsylvania, being severely wounded in the last day's fight (May 12), and disabled from active service until Jan., 1865, when, returning to duty, he served as chief of staff to Gen. Meade, commanding the Army of the Potomac, during the remainder of the campaign resulting in the surrender of Gen. Lee, and subsequently, until Feb., 1866, as acting inspector-general of the military division of the Atlantic, having been mustered out of the volunteer service the month previous. In July, 1866, he was appointed lieutenant-colonel 44th Infantry, and served at West Point until 1868. In 1871 he accepted the presidency of the College of the City of New York. For gallantry at Gettysburg and Bristoe Station he was brevetted major-general U. S. volunteers, and colonel, brigadier-general, and major-general U. S. A. for gallantry at Spottsylvania and for gallant and meritorious services during the rebellion.

Webb (CHARLES HENRY), b. at Rouse's Point, N. Y., about 1835; was founder and editor of the *Californian* newspaper; wrote for other San Francisco papers and for the Eastern magazines; became a well-known humorous correspondent of the New York *Tribune* and other papers under the signature of "John Paul," and travelled in Europe in that capacity 1876. He is the inventor of an adding-machine, and author of several burlesque dramas and travesties.

Webb (EDWARD BRAINERD), b. in England in 1820; became an eminent civil and railway engineer: constructed the Londonderry and Coleraine Railway, conducting successfully the great blasting operation at the Downhill Tunnels June 6, 1846; went to Brazil 1852; built there the first railway on the eastern coast of South America; was instrumental in effecting telegraphic communication with Europe and with the distant coast-provinces of Brazil by means of submarine cables, and directed other important works; afterward constructed the first railway in Colombia, and is now (1876) chief engineer to two railways in the Argentine Republic. Author of *Our Iron Breakwaters and Piers* (1862) and other professional works.

Webb (GEORGE JAMES), b. in Massachusetts about 1805; was many years professor in the Boston Academy of Music; prepared, with T. B. Hayward, *The Musical Cabinet* (1832), with William Mason *The Melodist*; contributed to William Russell's *Orthophony* (24th ed. 1864), and was author of *The American Glee-Book*, *The Common-School Songster*, *The Vocal Class-Book for Schools*, *The Massachusetts Collection of Psalmody*, and other musical works.

Webb (HENRY LIVINGSTON), son of Gen. Samuel B., brother of Gen. James Watson Webb, b. at Claverack, N. Y., Feb. 6, 1795; settled in Southern Illinois in 1817; was repeatedly a member of both branches of the legislature; was a major of volunteers in the Black Hawk war, colonel of the 18th regiment U. S. infantry in the Mexican war, and subsequently general of Illinois militia. D. at Macanda, Ill., Oct. 5, 1876.

Webb (JAMES WATSON), son of Gen. Samuel B., b. at Claverack, N. Y., Feb. 8, 1802; entered the U. S. army as 2d lieutenant of Artillery Aug., 1819; became adjutant 3d Infantry 1825; was stationed in 1820 at Chicago, twelve years before even the first house was erected where that flourishing city now exists; was promoted to a first lieutenancy in 1823, and the next year was made assistant commissary of subsistence; in 1827 resigned his commission, and took charge of the *Morning Courier*, which had been established in New York in May of that year;

in 1829 purchased the *Enquirer*, and united the two under the name of *The Morning Courier and New York Enquirer*, and became sole editor, and the next year sole proprietor—a position he held for thirty-four years. This journal was at an early period identified with the interests of the Whig party, and was an able advocate of its principles. In 1851, Gov. Hunt of New York appointed him an engineer-in-chief of the State of New York, with the rank of brigadier-general. In 1849 he was appointed minister to Austria, and to Constantinople in 1861. The same year he was appointed by Pres. Lincoln envoy extraordinary and minister to Brazil, where he served two terms of four years each. Being in Paris in 1865, he negotiated a secret treaty with the emperor Napoleon for the removal of the French troops from Mexico. Gen. Webb resigned the mission to Brazil in 1869, before the inauguration of Pres. Grant, and has since resided in New York City.

Webb (Philip Cartaret), b. in England in 1700; became an attorney-at-law, an eminent antiquary, and a member of Parliament, and was a joint solicitor of the treasury 1756–65. D. in 1770. Author of a reply to Warburton's *Divine Legation*, of several forensic publications, of *A Short Account of Domesday Book* (1756), and of *A Short Account of Danegeld* (1756).

Webb (Samuel Blatchley), b. at Wethersfield, Conn., Dec. 15, 1753, was the sixth in descent from Richard Webb of Gloucestershire, England, who was made a freeman of Boston 1632, and accompanied Rev. Thomas Hooker in the settlement of Hartford, Conn., 1635, driving away the Dutch, who were settled on the spot subsequently known as Webb's Point. Being a step-son and private secretary of Silas Deane, young Webb took part at an early age in the movements preliminary to American independence, and on hearing of the battle of Lexington promptly left Wethersfield for Boston in command of Capt. Chester's company of light infantry; took part in the battle of Bunker's Hill, where he was wounded; was commended in general orders for gallantry, and wrote to Mr. Deane an account of the battle, now on file in the library of the Connecticut Historical Society. He was soon appointed aide-de-camp to Gen. Putnam; became private secretary and aide-de-camp to Gen. Washington, with the rank of lieutenant-colonel, June 21, 1776; was the writer of the order for promulgating the Declaration of Independence in New York City July 9, 1776; was associated with Col. Joseph Reed a few days later in refusing to receive a letter from Lord Howe addressed to "George Washington, Esq.;" was engaged in the battle of Long Island; was wounded at White Plains and at Trenton; was engaged at Brandywine; raised, and organized almost entirely with his own funds, the 3d Connecticut regiment, of which he took command 1777; was captured with his regiment by the British fleet in Gen. Parsons's unfortunate expedition to Long Island, Dec. 16, 1777, and not exchanged until 1780, when he succeeded Baron Steuben in the command of the light infantry, with the brevet rank of brigadier-general; arranged, by request, the meeting between Washington and Count Rochambeau in the house in which he was born, at Wethersfield, Conn., May 19, 1781; was an intimate and trusted friend of Washington throughout the war, and subsequently was one of the sixteen officers who founded the Society of Cincinnati at Newburg-on-the Hudson June 19, 1783, and was selected to hold for Washington the Bible on which he took the oath of office as first President of the U. S. at New York City 1789. In that year he married Catharine Hogeboom of Claverack, Columbia co., N. Y., where he passed the remainder of his life, and d. Dec. 3, 1807. He kept a diary of his experiences throughout the war, portions of which were printed in 1876.

Webb (Thomas Smith), b. in Rhode Island about 1770; became grand master of the (Masonic) grand lodge of Rhode Island; composed Masonic poetry and music; was one of the compilers of the rituals now in use in the U. S., and published *The Free Mason's Monitor, or Illustrations of Masonry* (1797), which is still in high repute, and was edited by E. T. Carson (1865). D. in 1819.

Webb (William H.), b. in New York City June 19, 1816; educated in the grammar-schools of New York; learned the art of shipbuilding under his father, Isaac Webb, after whose death, in 1840, he carried on that business, and constructed many vessels of great speed and capacity upon original plans. Among them have been vessels of war for the Russian, Italian, and other foreign governments, and the iron-clad ram Dunderberg for the U. S. navy.

Webbe (Edward), b. in London, England, in 1554, son of Richard Webbe, master-gunner of England; resided at Moscow in the service of Capt. Anthony Jenkinson, ambassador to Russia, 1566–68; returned to Moscow in the Russian fleet of 1570; was taken prisoner by the Crim Tartars in their capture of Moscow, May 24, 1571; was taken as a slave to the Crimea, and ransomed the following year; served under Don John of Austria at the capture of Tunis, Oct., 1572; was master-gunner on board the ship Henry when it was captured by the Turks after a fight of two days, 1573; was made a galley-slave; served as a gunner for the Turks in their war against the Persians 1580–82; was afterward taken to Syria, Egypt, India, and Toorkistan, and again to Constantinople, where he was imprisoned in chains with 2000 other Christian slaves; was ransomed 1588; went to Italy; was tried for heresy at Padua; was imprisoned for the same cause at Rome, and also at Naples on suspicion of being a spy; became gunner to the king of Naples; escaped to England 1589; went to France, and was appointed chief master-gunner to Henry IV., but returned to England the following year, when he printed his curious and entertaining book, *The Rare and most Wonderful Things which Edward Webbe, an Englishman borne, hath seene and passed in his troublesome Travailes*, etc. (1590), of which a careful reprint was edited by Edward Arber in 1868. Webbe's subsequent career is unknown.

Webbe (George), D. D., b. at Bromham, Wiltshire, England, in 1581; graduated at Corpus Christi College, took orders in the Church of England; became minister of Steeple Aston, Wiltshire, rector at Bath 1621, and bishop of Limerick 1634. D. in 1641. Author of *God's Controversie with England* (1609), *A Posie of Spiritual Flowers* (1610), *The Practice of Quietness* (10th ed. 1705), and other works, and printed many sermons, being "accounted the best preacher in his time in the royal court, and the smoothest writer of sermons that were then published."

Webbe (Samuel), son of a government officer, b. in 1740 in Minorca, which then belonged to England; after his father's death came to London; was apprenticed to a cabinet-maker, his mother having become reduced in her circumstances; afterward became a copier of music; learned the principles of composition from a German organist, and published a large number of glees, catches, canons, masses, anthems, and songs, some of which were highly esteemed. He studied Latin, French, Italian, and German, and is said also to have had some knowledge of Hebrew. D. in London May 25, 1816.—He had a son of the same name, b. in London about 1770, who was also a distinguished composer.

Webbe (William), b. in England about the middle of the sixteenth century; graduated at one of the universities; translated Virgil's *Georgics* into English hexameters, and published *A Discourse of English Poetrie, together with the Author's Judgment touching the Reformation of our English Verse* (London, 1586), republished in vol. ii. of Haslewood's *Ancient Critical Essays upon English Poets and Poetry* (2 vols., 1811–15), and recently edited by Edward Arber in vol. xi. of his *English Reprints* (1870), and wrote *Tancred and Gismund, a Tragedy* (1592). His later career is unknown.

Web'ber (Charles Wilkins), b. at Russellville, Ky., May 29, 1819; was a grand-nephew of Hon. William Wilkins of Pittsburg and nephew of Wilkins Tannehill, a distinguished Western writer; went in 1838 to Texas, then struggling for independence; was for several years connected with the famous Texan Rangers, seeing much of wild and adventurous life on the frontier, which afterward furnished the material for several books; returned to Kentucky and studied medicine; afterward entered Princeton Theological Seminary with a view to the Presbyterian ministry, but soon abandoned that purpose, and settled in New York as a writer for literary periodicals, especially the *New World*, the *Democratic Review*, and the *Sunday Despatch*; was associate editor and joint proprietor of the *Whig Review*; projected with the two sons of his friend Audubon the naturalist a monthly magazine of mammoth size to be illustrated with copper-plate colored engravings by Audubon, but published only the first number; was engaged in an unsuccessful attempt to lead an exploring and mining expedition to the region of the Colorado and Gila rivers 1849, and in 1855 went to Central America, where he joined the filibuster Walker in Nicaragua, and was killed in a skirmish the following year (1856). Author of *Old Hicks the Guide, or Adventures in the Camanche Country in Search of a Gold-Mine* (1848), *The Gold-Mines of the Gila* (1849), *The Hunter Naturalist, etc.* (1851), with 40 engravings from original drawings by Mrs. Webber; *Wild Scenes and Song-Birds* (1854), with 20 colored illustrations from drawings by Mrs. Webber; *Tales of the Southern Border* (1852), *Spiritual Vampirism* (1853), *Shot in the Eye, and Adventures with the Texan Rifle Rangers* (1853), and other works.

Webber (Samuel), D. D., b. at Byfield, Mass., in 1759; graduated at Harvard College 1784; became a Con-

gregational minister; was professor of mathematics and natural philosophy in that institution 1789–1806, and president from May 6, 1806, until his death, at Cambridge July 17, 1810. He was one of the commissioners employed by the U. S. government to determine the N. E. boundary, and published a textbook of mathematics (1801).

Web'berville, p.-v., Travis co., Tex. P. 330.

Webb's Mill, tp., Clarke co., Ala. P. 799.

We'ber, county of N. Utah, lying on the Great Salt Lake, intersected by Weber River and traversed by Central and Union Pacific and Utah Central R. Rs. The surface in the centre is mountainous, and the streams flowing thence toward Salt Lake irrigate and fertilize a considerable tract. Cattle and sheep are the chief livestock. Staples, wheat, Indian corn, and potatoes. Cap. Ogden City. Area, 540 sq. m. P. 7858.

Weber, a river which rises in the Wahsatch Mountains, in Summit co., Ut., and after passing through cañons remarkable for their noble and strange scenery, its waters at last reach Great Salt Lake. It is a small stream, but is important as affording a route for the Union Pacific R. R. It abounds in fine trout.

Weber (Albrecht Friedrich), b. at Breslau Feb. 17, 1825; studied classical and Oriental philology in his native city, in Bonn, and in Berlin under Bopp; visited England and France in 1846, and was appointed professor of ancient Indian languages and literature at the University of Berlin in 1856. His principal works are his edition of *White Yajurveda* (3 vols., 1849–59) and *Indische Studien* (10 vols., 1849–67), containing many valuable essays on subjects relating to Indian language, literature, and antiquities. He also wrote—*Vorlesungen über indische Literaturgeschichte* (1852), *Die vedischen Nachrichten von den Naxatra* (2 vols., 1860–61), *Ueber das Râmâyana* (1870), *Ueber ein zum weissen Yajus gehöriges phonetisches Compendium des Pratijnâsûtra* (1872).

Weber (Ernst Heinrich), b. at Wittenberg June 24, 1795; studied medicine at Leipsic, and was appointed professor there of comparative anatomy in 1818; in 1840 also in physiology. His principal works are—*Anatomia Comparata Nervi Sympathici* (1817), *De Aure et Auditu Hominis et Animalium* (1820), *Lehre vom Bau und von der Verrichtung der Geschlechtsorgane* (1846), and a number of minor essays and monographs collected in 1851 under the title *Annotationes Anatomicæ et Physiologicæ*.—His brother, Wilhelm Eduard Weber, b. at Wittenberg Oct. 24, 1804, studied natural science at Halle; was appointed professor of physics at Göttingen in 1831, but dismissed in 1837 for political reasons; accepted a chair in 1843 at Leipsic, but returned in 1849 to Göttingen. In connection with his brother, Ernst Heinrich, he published in 1825 *Die Wellenlehre*, and in 1840, in connection with Gauss, *Resultate aus den Beobachtungen des magnetischen Vereins*, with an *Atlas des Erdmagnetismus*. From 1846 to 1867 he also published a series of essays on the connection between electricity and magnetism under the title *Elektrodynamische Maassbestimmungen*.—The third brother, Eduard Friedrich Weber, b. at Wittenberg Mar. 10, 1806; studied medicine at Leipsic and Halle; was appointed professor of medicine at Leipsic in 1835, and d. there May 18, 1871. In connection with his brother, Wilhelm Eduard, he wrote *Mechanik der menschlichen Gewerkzeuge* (1836).

Weber, von (Karl Maria Friedrich Ernst), Baron, b. at Eutin, near Lubeck, Dec. 18, 1786; showed very early great talent for art, especially for music, but received a somewhat forced and desultory education, as his father, an unstable character and a man of very various fortune—successively a soldier, a financial agent, a chapel-master, and now the leader of a band of strolling actors—wished to make him a musical prodigy, such as Mozart had been. Wandering about from place to place, young Weber published in 1798 his first composition, six fughettis for the piano, and wrote his first opera, *Die Macht der Liebe und des Weins*. The result, however, did not answer the expectations, and for a couple of years father and son devoted themselves to the improvement of the recent invention of lithography by Senefelder. In 1800 their enthusiasm and means of subsistence were spent. Young Weber returned to his art, and produced the opera *Das Waldmädchen*, which was performed at Chemnitz, and in the following year *Peter Schmoll und seine Nachbarn*, which was performed in 1802 at Augsburg; neither of these works, however, produced any great effect. In 1803 he went to Vienna, where he studied under the celebrated Abbé Vogler, a spirited and peculiarly-gifted teacher of music, and by his recommendation he received in 1804 a place as director of music at the theatre of Breslau. Here he began to compose a great opera, *Rübezahl*, which he never finished, and of which only the overture exists in a much altered form, *Zum Eichenkranz der Tonkunst*; but the situation did not agree with his tastes, and in 1806 he accepted a position as private secretary to Duke Louis of Würtemberg. At this the most dissolute court in Europe he spent four years in idleness and dissipation. Like his father, he had a taste for "high life," but no talent for it; in 1810 he left Ludwigsburg morally and bodily impaired, in debt, and in disgrace. Once more he met with Abbé Vogler in Darmstadt, and under the influence of the atmosphere which he breathed here he again took up music, composed the cantata, *Der erste Ton*, several sonatas, overtures, etc., transformed the *Waldmädchen* into the *Sylvana*, which was performed with some success at Frankfort, and wrote the operetta *Abu Hassan*. After travelling in Germany and Switzerland, he settled in 1813 in Prague as director of the opera, and remained here till 1816, doing good service and establishing for himself a wide reputation. He possessed great ability as an operatic manager, and his music (in 1814) to Körner's war-songs, among which were *Lützow's wilde Jagd*, *Schwertlied*, etc., and his great cantata *Kampf und Sieg* after the battle of Waterloo, were true revelations of his genius, and spread his fame all over Germany. In 1816 he went to Dresden as director of the royal opera, and here he remained till his death. The position was not without difficulties. The Italian opera was the pet of the court, and the great work of Weber's life was to drive the Italian opera out of Germany. Not one of his great operas was first brought on the stage in Dresden. *Preciosa* and *Freischütz* were first performed at Berlin Mar. 15 and June 18, 1821, *Euryanthe* at Vienna Oct. 25, 1823, and *Oberon* at London Apr. 12, 1826. The success of *Freischütz*, however, was instantaneous and very great. In Berlin it completely annihilated the influence of Spontini. It became a favorite on the operatic stage of Northern and Central Europe; it exercised a decided influence on Marschner and Mendelssohn, on Meyerbeer and Auber, on the whole modern music, even on Richard Wagner; and as it was the first, it is still one of the freshest, musical embodiments of the romantic spirit. Weber conducted in person the first performance of *Oberon*, and d. shortly after, June 5, 1826, at London. He was buried in Moorfields chapel, but in 1844 his remains were brought to Dresden, where in 1860 a fine statue of him by Rietschel was raised in front of the theatre. His *Autobiography* and other writings were edited in 1828 in 3 vols. by Theodor Hell, and his life was elaborately described by his son (in 3 vols., 1864). Clemens Petersen.

Web'ster, county of S. W. Georgia, drained by affluents of Chattahoochee and Flint rivers; surface undulating, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Preston. Area, 325 sq. m. P. 4677.

Webster, county of Central Iowa, drained by Des Moines and Lizard rivers, and traversed by Des Moines Valley and Illinois Central R. Rs.; surface undulating, with alternate prairie and woodland; soil moderately productive. Staples, Indian corn, wheat, hay, and wool. Cap. Fort Dodge. Area, 1080 sq. m. P. 10,184.

Webster, county of N. W. Kentucky, drained by Green River and its affluents, and traversed by St. Louis and South-eastern R. R.; surface rolling, soil productive. Swine and sheep are the chief live-stock. Staples, tobacco, Indian corn, and wool. Cap. Dixon. Area, 290 sq. m. P. 10,937.

Webster, parish of N. W. Louisiana, bordering on Arkansas, formed since the census of 1870; surface rolling, soil productive. Cap. Minden. Area, 550 sq. m. P. 9522.

Webster, county of S. W. Missouri, drained by branches of Gasconade and White rivers and traversed by Atlantic and Pacific R. R.; surface undulating, with much iron ore; soil fertile. Swine, sheep, and cattle are the principal livestock. Staples, Indian corn, wheat, oats, tobacco, and wool. Cap. Marshfield. Area, 575 sq. m. P. 10,434.

Webster, county of S. Nebraska, bordering on Kansas, and intersected by Republican River; surface undulating, soil fertile. Cap. Red Cloud. Area, 576 sq. m. P. 2590.

Webster, county of Central West Virginia, drained by Elk and Gauley rivers; surface hilly, with much bituminous coal and iron ore. Staples, Indian corn, wool, and tobacco. Cap. Webster Court-house. Area, about 400 sq. m. P. 1730.

Webster, tp., Fayette co., Ala. P. 647.

Webster, tp., Harrison co., Ind. P. 1025.

Webster, v., Tippecanoe tp., Kosciusko co., Ind. P. 87.

Webster, tp., Hamilton co., Ia. P. 811.

Webster, tp., Madison co., Ia. P. 486.

Webster, tp., Webster co., Ia. P. 560.

Webster, p.-v. and tp., Androscoggin co., Me. P. 939.

Webster, p.-v. and tp., Worcester co., Mass., at the junction of Norwich and Worcester and Southbridge branch of New York and New England R. Rs., 16 miles S. of Worcester, contains 7 churches, excellent public schools, 1 bank, a library association, 1 newspaper, several iron and brass foundries, a straw-factory, and 1 woollen, cotton, and linen mill. It was named in honor of Daniel Webster, and incorporated in 1832. P. 4763. JOHN CORT, ED. "TIMES."

Webster, tp., Houghton co., Mich. P. 876.

Webster, p.-v. and tp., Washtenaw co., Mich. P. 974.

Webster, tp., Rice co., Minn. P. 414.

Webster, p.-v. and tp., Merrimack co., N. H. P. 689.

Webster, p.-v. and tp., Monroe co., N. Y. P. of v. 291; of tp. 2749.

Webster, p.-v. and tp., cap. of Jackson co., N. C. P. 1407.

Webster, tp., Scioto co., O. P. 200.

Webster, tp., Wood co., O. P. 922.

Webster, tp., Marshall co., West Va. P. 1143.

Webster, p.-v. and tp., Taylor co., West Va. P. 955.

Webster, tp., Vernon co., Wis. P. 812.

Webster (BENJAMIN), b. at Bath, England, Sept. 3, 1800; educated for the navy, and afterward for the musical profession, but ultimately became an actor in 1825; maintained a high popularity during an artistic career of half a century; became manager of the Haymarket Theatre 1837; employed Bulwer-Lytton, J. S. Knowles, Douglas Jerrold, and Bayle Bernard, and many other dramatists, paying annually some £2000 for original plays, which were brought out by Macready, Wallack, Strickland, Matthews, and their compeers; built the New Adelphi 1858, and became lessee of the Olympic 1866, both of which theatres are still (1876) under his management, and is president of the new Dramatic College.

Webster (DANIEL), LL.D., b. at Salisbury (now Franklin), N. H., Jan. 18, 1782, being the second son of Ebenezer Webster by his second wife, Abigail Eastman; enjoyed but limited educational advantages in childhood, and was indebted for his earliest instruction to his mother; spent a few months in 1797 at Phillips Exeter Academy under Benjamin Abbot; completed his preparation for college in the family of Rev. Samuel Wood at Boscawen; entered Dartmouth College in the autumn of 1797; supported himself in great part by teaching school during the winters; was considered the foremost scholar of his class, being decidedly proficient in the classics and in English literature; was distinguished in the debates of the college societies, before which he delivered several addresses which found their way into print; graduated 1801; entered the law-office of Hon. Thomas W. Thompson (afterward U. S. Senator) at Salisbury; continued his legal studies in 1802 at Fryeburg, Me., where he was principal of the academy, and acted as copyist in the office of the registrar of deeds; completed his studies in the office of Christopher Gore, Boston, 1804–05, at which time he was assiduous in preparing reports of cases decided by the supreme and circuit courts; was admitted to the Suffolk bar in the spring of 1805; commenced practice at Boscawen, N. H.; removed to Portsmouth 1807; soon rose to eminence at a bar where Samuel Dexter, Joseph Story, and Jeremiah Mason were at the height of their fame; married Grace Fletcher of Hopkinton, N. H., June, 1808; became known as a decided Federalist, but did not at first court political honors; attracted notice by his eloquence in opposing the declaration of war against Great Britain; was consequently nominated and elected to Congress by the Federalists 1812; took his seat in the special session of May, 1813; was appointed to the committee on foreign affairs; made his maiden speech June 10, 1813, in support of a series of resolutions moved by himself in condemnation of the Berlin and Milan decrees; took a prominent part in the debates on the war and the finances, advocating the increase of the navy and the repeal of the embargo; effected the defeat of the proposal for a new U. S. bank by means of a speech exhibiting great mastery of economical subjects; was re-elected 1814; supported the charter of the Bank of the U. S. Apr., 1816, and secured the passage of a resolution for a return to specie payments at the Federal custom-houses; was admitted to practice at the bar of the Supreme Court at Washington; removed to Boston, Mass., 1816; devoted himself with great assiduity to the practice of his profession for seven years; gained by his argument in the celebrated Dartmouth College case, carried by appeal to Washington in 1817, a rank among the most distinguished jurists of the country (Mar. 10, 1818); was thenceforth retained in nearly all the leading cases before the Federal Supreme Court; was chosen in 1820 a member of the convention for revising the constitution of Massachusetts, in which task he bore a leading part; delivered at Plymouth, Dec. 22, 1820, his celebrated discourse on the 200th anniversary of the landing of the Pilgrims, which was the pioneer of those great efforts which placed him in the front rank of orators; declined about this time a nomination as U. S. Senator; was elected a Representative in Congress from the city of Boston 1822; took his seat Dec., 1823; made early in the session (Jan., 1824) his celebrated speech on the Greek revolution, which established his reputation as one of the first statesmen of the age; opposed the increase of protective duties, and as chairman of the judiciary committee reported and carried through a complete revision of the laws of the U. S.; was almost unanimously re-elected in the autumn of 1824, when he supported the candidacy of John Quincy Adams, of whose administration he became the leading Congressional champion, advocating in a notable speech the convocation of the congress of Panama for the consolidation of the independence of the Spanish American republics; added to his fame as a popular orator by his magnificent address at the laying of the corner-stone of the Bunker Hill Monument June 17, 1825, and by his eulogy of Adams and Jefferson delivered at Faneuil Hall, Boston, Aug., 1826; was re-elected to Congress in the latter year, but transferred to the Senate in 1827 to fill the unexpired term of Elijah H. Mills, who resigned from ill-health; retained his seat in that body by successive re-elections until 1841; made his début in the Senate by an elaborate argument in favor of moderation in the proposed augmentation of the duties on foreign woollens, but nevertheless gave his vote for the protective tariff of 1828; lost his wife in January of that year; married Caroline Bayard Le Roy of New York City Dec., 1829; made what is generally regarded as the ablest of his parliamentary efforts in his second speech (Jan. 26–27, 1830) in reply to Robert Y. Hayne of South Carolina, who in the famous debate which incidentally arose upon a resolution offered by Senator Samuel A. Foot of Connecticut, in relation to a survey of the public lands, had bitterly attacked the Eastern States, and had affirmed for the first time the doctrine of nullification; and, though opposed to the financial policy of Gen. Jackson, gave him a cordial support in his measures for the defence of the Union against the anarchical policy proclaimed by John C. Calhoun; made a notable speech in May, 1832, in favor of the renewal of the charter of the U. S. Bank; supported Henry Clay for the Presidency in that year, but opposed his Compromise tariff bill, and voted for the "Force bill" of the administration in the great nullification crisis of 1833, when he victoriously measured his forces in debate with Calhoun; united with him, nevertheless, in securing the passage of the famous resolutions condemning Jackson's course on the removal of the deposits Sept., 1833; purchased about this time an estate by the seaside at Marshfield, Mass., which he made his summer residence; was recognized as the chief Northern leader of the Whig party, organized about 1834, upon the general break-up of the earlier party issues; received the electoral vote of Massachusetts for the Presidency 1836; opposed the Sub-Treasury bill in Sept., 1837, in a speech reputed the most effective of all his arguments on the subject of finance; made a brief visit to Europe in 1839, being received in the court-circles of England and France with the attention due to his character and talents; took an active part in the Presidential campaign of 1840 in favor of Gen. Harrison, whose success he facilitated by his eloquence no less than by the prompt withdrawal of his own proposed candidacy for the second place on the ticket; was appointed secretary of state by Pres. Harrison Mar., 1841, and continued in office by Pres. Tyler; displayed consummate diplomatic ability in the negotiation of the "Ashburton treaty" of Aug. 9, 1842, which terminated in a favorable manner long-pending questions upon the impressment of seamen and the N. E. boundary of the U. S.; remained in office, at a great sacrifice of personal interest and inclination, after the disruption of the cabinet by the defection of Pres. Tyler from Whig interests, through a patriotic desire of completing these and other important diplomatic negotiations; resigned his post May, 1843; resumed with energy, for a short time, the practice of his profession at Boston, declining the offer of a seat in the Senate; delivered a splendid oration on the completion of the Bunker Hill Monument 1843; was pressed by his friends for the Presidential nomination in 1844, when with great earnestness he supported Mr. Clay and opposed the annexation of Texas; resumed his seat in the Senate as the successor of Rufus Choate Dec., 1845; combated the admission of Texas as a slave State and the prosecution of the Mexican war (in which, nevertheless, his second son, Edward, took part as major of Massachusetts volunteers, and died in the City of Mexico); contributed in an unofficial way to the solution of the Oregon question with Great Britain 1847; was dis-

appointed in his well-founded expectation of receiving the Whig nomination for the Presidency 1848; was profoundly affected by the magnitude of the legislative issues which arose in the session of 1849-50 from the recent annexation of Mexican territory and the discovery of gold in California, and, though retaining his anti-slavery convictions, was induced by a controlling desire for peace to support Clay's "Compromise measures," including the Fugitive Slave law, in a famous speech of Mar. 7, 1850, which lost him the confidence and support of the majority of the Whig party, and thereby contributed to its disorganization and extinction; became secretary of state under Pres. Fillmore on the death of Gen. Taylor, July, 1850; displayed all his wonted energy and ability in the famous correspondence with Chevalier Hulsemann, the Austrian minister (Dec., 1850), upon the reception accorded to Kossuth and the Hungarian exiles; in the measures taken to repress filibustering expeditions against Cuba, and afterward to obtain the pardon of the followers of Narciso Lopez, who had been deported to Spain; in the collision with British pretensions relative to Central America and to the fisheries; and in the negotiation of a treaty securing reciprocity with the Canadian provinces; delivered a magnificent address at the laying of the corner-stone of the Capitol extension at Washington July 4, 1851; made his last forensic argument in the celebrated Goodyear patent case at Trenton, N. J., Jan., 1852; was thrown from his carriage and seriously injured near Plymouth, Mass., May, 1852; was defeated by Gen. Scott in the contest for the Presidential nomination at the Baltimore Whig convention of that year, receiving only 32 votes; made a brief visit to Washington in August, and tendered his resignation on account of failing health, but was prevailed upon to remain in office in the vain hope of a recovery. He d. at Marshfield Oct. 24, 1852, and was buried in the family tomb erected by himself in the cemetery of that town.—He left but one surviving child, FLETCHER, b. at Portsmouth, N. H., July 23, 1813, who graduated at Harvard 1833; became a lawyer and private secretary to his father; was secretary of legation to China 1843; surveyor of the port at Boston 1850-61; entered the Union service as colonel of the 12th Massachusetts Vols., and was killed at the battle of Bull Run, Va., Aug. 30, 1862.—In person, Mr. Webster was of imposing stature, with a head and brain of unusual size, a dark complexion, and large, dark, lustrous eyes, and has been well represented in numerous portraits and in a magnificent bust by Hiram Powers. He possessed great strength; was from his youth passionately fond of athletic sports, hunting, and fishing; paid much attention to scientific agriculture and to the improvement of stock on his celebrated Marshfield estate; was of genial and convivial habits, and sometimes imprudent in the latter particular; was generous and improvident in money-matters, which had to be managed for him by a self-constituted committee of his lifelong supporters, the "solid men of Boston;" was devoted to his family and his friends; abounded in gayety and humor in his conversation; was the supreme representative of American eloquence in its argumentative and logical aspect, being master of a pure vigorous English style, cultivated by close and long-continued study of the English classics; and in grasp of intellect has been excelled by few of his age or country. Early in life he joined the Congregational Church, and, though he did not remain actively identified with any religious body, was a diligent student of the Bible, and caused a statement of his firm belief in Christianity to be inscribed upon his tomb. By his will he appointed as his literary executors Edward Everett, George Ticknor, Cornelius C. Felton, and George Ticknor Curtis. Many partial collections of his speeches have been made. An authoritative edition of his works appeared under the title *The Speeches, Forensic Arguments, and Diplomatic Papers of Daniel Webster* (6 vols., 1851; 12th ed. 1864), preceded by a *Notice of his Life and Writings* by Edward Everett. Two volumes of his *Private Correspondence* were published by his son Fletcher (1857; 5th ed. 1864). Several popular biographies have appeared, including one by the present writer (*The Private Life, etc.*, 1853), and an elaborate *Life* was written by George Ticknor Curtis (New York, 2 vols., 1869). A work on *Daniel Webster and his Contemporaries*, by Hon. C. W. Marsh, has appeared in New York in the present year (1876). CHARLES LANMAN.

Webster (EBENEZER), father of Daniel, b. at Kingston, N. H., in 1739; served under Gen. Jeffrey Amherst in the French war; was one of the original settlers of Salisbury (now Franklin), N. H., 1761, that town being then the most northern settlement in New England; kept a country inn; was captain of the Salisbury militia at the siege of Boston 1775; served at White Plains and at Bennington; was at West Point at the time of the treason of Arnold; attained the rank of colonel of militia; sat in both branches of the State legislature; was judge of common pleas of Hillsborough county from 1791 until his death, and was reputed a man of great natural endowments and force of character. D. at Salisbury in 1806.

Webster (EZEKIEL), brother of Daniel, b. at Salisbury, N. H., Mar. 11, 1780; graduated at Dartmouth College 1801; studied law; attained considerable eminence at the New Hampshire bar, and served in the State legislature. D. at Concord, N. H., Apr. 10, 1829.

Webster (HORACE), b. in Hartford, Vt., Sept. 21, 1791; graduated at the U. S. Military Academy July, 1818, when appointed 2d lieutenant of infantry, but retained at West Point as assistant professor of mathematics until Oct., 1825, at the close of which year he resigned his commission of first lieutenant, having accepted the appointment of professor of mathematics and philosophy in Geneva (now Hobart) College. In 1848 was appointed principal of the Free Academy then organizing in the city of New York, plans of organization of which he prepared. From 1852, in addition to his duties as president, he was also professor of moral, intellectual, and political philosophy until 1869, when he retired from the presidency and accepted the place of emeritus professor. Under his able administration the institution over which he so long presided became justly celebrated, and is now known as the College of the City of New York. D. at Geneva, N. Y., July 12, 1871.

Webster (JOHN), b. in England toward the close of the sixteenth century; was associated with Dekker, Chettle, Drayton, Marston, Rowley, Middleton, Munday, Heywood, and Wentworth Smith in writing some of their plays, and ultimately became an author on his own account. Of his personal history nothing is known. Among his dramas are *The White Devil* (1612), *The Duchess of Malfy* (1623), and *Appius and Virginia* (1624). The two former have greater resemblances to Shakspeare than the productions of any of his contemporaries. Webster's dramatic works have been edited by Dyce (4 vols., 1830) and by Hazlitt (4 vols., 1857-58).

Webster (JOHN), b. in England about 1590; was one of the principal settlers of Hartford, Conn., 1636; was a magistrate 1639-55, deputy governor 1655, and governor 1656, and in 1659 was associated with Rev. Mr. Russell and others in purchasing and settling the territory now forming the towns of Hadley, Hatfield, Granby, and Amherst, Mass. D. at Hadley Apr. 5, 1661.

Webster (JOSEPH DANA), b. at Hampton, N. H., Aug. 25, 1811; graduated at Dartmouth College in 1832; appointed second lieutenant in the corps of topographical engineers July, 1838, in which he attained a captaincy in 1853; resigned Apr., 1854, and removed to Chicago, where he was president of the commission on sewerage which perfected the remarkable system of sewerage for that city; also planned and executed the raising of the grade of Chicago. In the civil war he became colonel 1st Illinois Heavy Artillery; was Gen. Grant's chief of staff at the battle of SHILOH (which see), where at the close of the first day's fight by great energy he occupied the ridge covering Pittsburg Landing with all the remaining artillery, by which means the hitherto victorious enemy were checked. Commissioned brigadier-general Nov. 29, 1862, and for a time military governor of Memphis; chief of staff to Gen. Grant during the Vicksburg campaign, and to Gen. Sherman from 1864 to close of the war. Assessor of internal revenue at Chicago 1869-72; assistant U. S. treasurer at Chicago until July, 1872, when appointed collector U. S. revenue. D. at Chicago Mar. 12, 1876.

Webster (NOAH), LL.D., b. at West Hartford, Conn., Oct. 16, 1758, a descendant of Gov. John Webster, and on the mother's side of Gov. William Bradford of Plymouth; graduated at Yale College 1778; pursued the study of the law while teaching school at Hartford; was admitted to the bar 1781; taught a classical school at Goshen, Orange co., N. Y., 1782-83; prepared there his spelling-book, grammar, and reader, printed under the title *A Grammatical Institute of the English Language, etc., in Three Parts* (Hartford, 1783-85), a work so successful that the sale of the spelling-book had in 1876 exceeded 40,000,000; printed an edition of Gov. Winthrop's *Journal*; wrote political articles for the Hartford *Courant* 1784; published *Sketches of American Policy* (1785), advocating the formation of a Federal Constitution; travelled in the Southern States the same year, visiting Washington at Mount Vernon; delivered a course of lectures on the English language in the principal Atlantic cities 1786; taught an Episcopal academy at Philadelphia 1787, in which year he issued a pamphlet, *An Examination of the Leading Principles of the Federal Constitution*; edited in New York Dec., 1787, to Nov., 1788, the *American Magazine*, an unsuccessful enterprise; practised law at Hartford 1789-93; married a daughter of William Greenleaf of Boston 1789; returned to New York,

and founded Nov., 1793, a daily paper, the *Minerva*, to which was soon added a semi-weekly edition entitled the *Herald*, papers which still exist (1876) under the names *Commercial Advertiser* and *New York Spectator;* published in his paper, over the signature of "Curtius," an elaborate defence of Jay's treaty; settled in New Haven 1798; published *A Brief History of Epidemics* (2 vols., 1799), *Rights of Neutral Nations in Time of War* (1802), a *Compendious Dictionary of the English Language* (1806), and a *Philosophical and Practical Grammar of the English Language* (1807); devoted himself thenceforth to the great labor of his life, the preparation of the *American Dictionary of the English Language* (2 vols. 4to, 1828), having formed for his own use a *Synopsis of Words in Twenty Languages*, which remains unpublished; resided at Amherst, Mass., 1812–22; was influential in the establishment of Amherst College, and was president of its first board of trustees; returned to New Haven 1822; visited Europe 1824–25, pursuing his philological studies at the Bibliothèque du Roi, Paris, and completing his dictionary by the aid of the libraries of the University of Cambridge 1825, and devoted his leisure for the remainder of his life to the revision of that work and of his schoolbooks, and to the preparation of a series of intermediate dictionaries. He was for several years a member of the legislatures of Massachusetts and Connecticut, judge of one of the State courts of Connecticut, and took a prominent part in scientific and literary associations which were grouped around Amherst and Yale colleges, being assisted in the preparation of his dictionary by several members of the faculty of the latter institution. From 1808 he was a member of the Congregational Church, and was universally beloved for the simplicity, uprightness, and kindliness of his character. D. in New Haven May 28, 1843. He had superintended in 1840 the publication of the 2d ed. of his *Dictionary* (1840–41), carefully revised and with the addition of several thousands of words. A 3d ed. was edited by his son-in-law, Prof. Chauncey A. Goodrich, D. D. (1847), as also the 4th ed. (pictorial, 1859), the latter containing 99,798 words. A 5th ed., with 114,000 words, 3000 illustrations, and extensive revisions in every branch, but especially in etymology, was brought out in 1864 by Prof. Noah Porter, D. D., now president of Yale College. A 6th ed. is understood to be in preparation, to which the labors of several years will be devoted. Among the many minor publications of Dr. Webster were *Dissertations on the English Language* (1789), *A Collection of Essays* (1790), *The Revolution in France* (1794), *Political Progress of Britain* (1795), *Letters to Dr. Priestley* (1800), *Banking Institutions and Insurance Offices* (1802), *Origin, History, and Connection of the Languages of Western Asia and of Europe; Letters to a Young Gentleman on commencing his Education* (1823), *A History of the U. S.* (revised ed., 1838), and *A Collection of Papers on Political, Literary, and Moral Subjects* (1843), including reprints of some of the preceding. He also published editions of the Bible (1833) and of the New Testament (1839), "with amendments of the language."

PORTER C. BLISS.

Webster (PELATIAH), b. at Lebanon, Conn., in 1725; graduated at Yale College 1746; studied theology; preached at Greenwich, Mass., 1748–49; became a wealthy merchant at Philadelphia; was an active promoter of independence, both by his pen and his purse, for which he suffered imprisonment in the city jail by the British authorities 1778, and was an able writer upon finance and politics. D. at Philadelphia in Sept., 1795. Author of *An Essay on Free Trade and Finance* (1779–80), *A Dissertation on the Political Union and Constitution of the Thirteen United States of North America* (1783), *An Essay on Credit, in which the Doctrine of Banks is considered* (1786), *Political Essays on the Nature and Operation of Money, Public Finances, etc.* (1791), and other treatises of similar character, chiefly contributed to the periodicals of Philadelphia.

Webster (THOMAS), b. in the Orkney Islands about 1773; was educated as an architect; became an assistant to Count Rumford in his researches in domestic economy; subsequently devoted himself to scientific pursuits, especially geology; became keeper of the museum of the London Geological Society, and its draftsman 1814; house secretary and curator 1826, and professor of geology in University College, London, 1840. D. in London Dec. 26, 1844. Author of several geological monographs, and, with Mrs. Frances Byerley Parkes, of the well-known and valuable *Encyclopædia of Domestic Economy* (1844).

Webster (THOMAS), R. A., b. in London, England, Mar. 20, 1800, son of a musician of the royal establishment at Windsor; became in boyhood a member of the choir at the chapel royal, St. James; studied painting at the Royal Academy, where he exhibited a portrait-group 1823; has been since 1835 one of the best-known English painters of domestic scenes, which usually abound in "character, expression, and quiet humor," and was elected to the Academy 1846. Among his best efforts are the exquisite *Dame's School* (1845) in the Vernon Gallery, *A Village Choir* (1848), and *Dotheboys Hall* (1848).

Webster City, p.-v., Boone tp., cap. of Hamilton co., Ia., has 2 newspapers. P. 1339.

Webster Court-house, p.-v., cap. of Webster co., West Va.

Webster Groves, p.-v., St. Louis co., Mo.

Webster's Plantation, tp., Penobscot co., Me. P. 28.

Weddahs (*Veddas*), the name of a primitive hill-tribe in Ceylon. The pronunciation of the name of the community in regard to the *first* letter is one which is not clearly distinguishable. It is somewhat between the sound of *v* and *w*. The same difficulty exists in English. We see some poets of great rhythmic power rhyming *love* with *of*, *enough*, *prove*, and *rough*. Thus "Weddah" might be written "Veddah." As the word is pronounced in Ceylon it would perhaps be most accurately written as "*Vweddha*." The terminal *h* is customary, not needful. Take in English the case of the virtually silent *f* (as in the name *Ffoulkes*) or the hardly-pronounceable *D* in Dnieper or Dniester of the Russian, or the *kee*-sound in the Spanish Guadal*qui*vir. By these analogies, so near at home, one may see a glimpse of the difficulties of Oriental transliteration. Some Weddahs themselves pronounce the name of their tribe and caste *H'hed*, seemingly a short, sharp, aspirated ejection of tone, with "*ed*" for the base; the *d* being *hard*, produced by the excessive curling of the tongue during the act of pronunciation.

The Weddahs are confined to Ceylon. They occupy a small territory, 90 miles long, 40 broad. They were especially brought to the notice of the prince of Wales during his royal tour through India, and executed before him some curious antics—"dances" they could scarcely be called. Some are jungle Weddahs, and some are half civilized. The latter live in rude villages. The former, living in the highlands of Uva and Medamahanuwara, are wilder, and shift their habitations. They clear out a piece of jungle and plant such roots as tapioca upon it, feed on honey and fruits, and monkeys, etc., shot by their arrows, and after a year's sojourn in small reed huts constructed by their clearings, they remove to another locality, and open out more jungle to cultivate the virgin soil. The village Weddahs are more settled, but the instinct of the whole tribe is nomadic. There are not more than 1000 primitive, pure-blooded Weddahs living now, but the very rarity of the caste makes a study of it valuable. Diamonds would not be precious unless they were rare. It is said that the Weddahs of the primeval forests of Ceylon never build any kind of hut or dwelling by which they may be protected from climatic influences. This is, at least, scarcely probable. They often in their wanderings make shift for themselves, but their reed huts are known to many inland Ceylon coffee-cultivators. They are fond of chasing deer and trapping the porcupine. They always *cook* their food before they eat it. They are fond of iguanas. They have good packs of hunting-dogs. Water is, with honey and palm-wine, their exclusive drink. They are only lately beginning to learn to smoke. They sometimes chew betel and the bark of various trees. They are generally "left-handed," as the saying is; and though the tallest Weddah known is not more than 5 feet 4½ inches high, they are wiry and capable of great exertion. In Mr. Hartshorne's essay on the Weddahs in the *Fortnightly Review* for Mar., 1876, we have the clearest and most precise information on the subject. They draw bows 6 feet high with a pull up to 56 pounds. The arrows are generally about 3 feet 6 inches long. Mr. Hartshorne says: "One of them, Latty, was able to hold his bow drawn to its full length for upward of two minutes, without the slightest tremor of the left arm. They are, as a rule, good shots, and upon one occasion, in Feb., 1872, I saw a Weddah bring down a pariah dog at the distance of 35 yards when it was running away. He took very deliberate aim, and the arrow passed through nearly the whole length of the animal, entering at the hinder quarter, and coming out through the fore shoulder." Weddahs are tolerably good axe-men. They are experts in the art of making fire by rubbing two pieces of wood together, but recently they have acquired the knowledge of flint and steel. Beads for the neck and empty cartridge-cases as ear-rings placed in the distended lobes of the ears are highly prized as ornaments amongst Weddah women. Clothing is considered a superfluity as a rule, unless a gay-colored handkerchief wrapped round the head and a dozen silk strings round the waist may be considered clothing. They are very partial to a kind of curry or thick mulligatawny broth made out of flying-ants at the commencement of the rainy season, and seasoned with green ginger. They

very rarely wash, as they consider bathing deleterious to health. It is untrue that they never laugh, though it is true that not one out of a thousand has ever seen them laugh. But they are prone to tears. Laughter in others only provokes disgust in the Weddah. By nature he is certainly morose. But to say he *cannot* laugh is, *a priori*, an improbability. He were then not human. Repression of feeling on the part of a Spartan of old did not signify that he could not feel. The barbarous Weddah is a hard-worked animal, with his emotions blunted. What should he laugh at? He must gather the honey for his mid-day meal; he must tear the succulent root from its crevice in the rock; he must cut down the hard wooded palm for a taste of its edible pith; he has to feed many hungry mouths; his meat for weeks depends on the accuracy of his aim whilst a spotted deer glances by him through the *shóla* at lightning speed. He may weep: he knows sorrow. He may frown: he knows disappointment. He may bear a wrinkled brow: he knows care. And he *might* laugh if he only knew what pleasure and luxury were.

The Weddahs appear to have no religion. They do not even know of the name of the being so popular in the worship of Ceylon—*Buddha*. Attempts have recently been made to christianize the tribe, but this is difficult, as few of the primitive and pure Weddahs can even count above six. Each Weddah is his own doctor; his only medicines and surgical instruments are green ginger, castor-oil berries, and sharp arrow-heads of flint or of steel. When a wife is confined, the husband attends her. The dead of the Weddahs are buried; deer-skin, if obtainable, is used as the coffin. At burials no females are present. The general belief of Weddahs is, that departed spirits become devils and must be propitiated; so offerings are nearly always made after funerals to the ghost of the departed. The language of the people seems to be one of the roughest of Aryan dialects. Some have said that the Weddahs are the only savages who now speak a dialect of the Aryan. This is a mistake. Many savages of the Assam frontier speak dialects which must be affiliated with Aryan. But this is only *one* example. The subject cannot here be exhaustively entered into. The Weddah is one of the great types of the primeval man. He is a child of seclusion; his home is the secluded forest: what he can kill he eats; what he can dig is his own. The mountain is his home, the shady trees are his shelter; he drinks of the running brook: the hollow of his palm is his cup. His knowledge is small, but so are his needs. R. C. CALDWELL.

Wed'derburn (ALEXANDER), earl of Rosslyn and Baron Loughborough, b. at Chester Hall, East Lothian, Scotland, Feb. 13, 1733; studied law in Edinburgh and at the Inner Temple, London; was called to the bar 1757; was made king's counsel 1763; entered Parliament; became solicitor-general Jan. 26, 1771; conducted the defence of Lord Clive; was appointed attorney-general June, 1773; defended Govs. Hutchinson and Oliver of Massachusetts before the privy council and denounced Franklin Jan., 1774; was a strong advocate of the war-measures of Lord North; became privy councillor, chief-justice of the common pleas, and Baron Loughborough 1780, first commissioner of the great seal Apr., 1783, and lord chancellor Jan. 27, 1793, and retired with the title of earl of Rosslyn Apr., 1801. D. in Berkshire Jan. 3, 1805.

Wedderburn (DAVID), b. in Scotland about 1570; received a careful classical education, and became distinguished as a writer of Latin, both prose and verse; was master of Aberdeen grammar school 1602–40; became teacher of the "high class" in Aberdeen University 1614, and professor in Marischal College 1619. D. about 1652. Author of several poems in the *Deliciæ Poetarum Scotorum*, of *Institutiones Grammaticæ* (1633), *Persius Enucleatus* (1664), and other works.

Wedderburn (Sir DAVID), BART., a descendant of the preceding, b. at Musselburgh, Scotland, Dec. 20, 1835; graduated at the University of Cambridge; became an advocate at the Scottish bar and an active politician; sat in Parliament for South Ayrshire 1868–74; has travelled in the U. S., and is a contributor to the British magazines, especially the *Fortnightly Review*, in which he published in 1876 a notable account of *Mormon History from a Mormon Point of View*.

Wedderburn (JAMES), b. at Dundee, Scotland, about 1500; edited with his brother Robert *Ane Compendious Buike of Godly and Spirituall Sangs, collectit out of Sundrie Partes of the Scripture, wyth sundrie of uther Ballates changed out of Prophane Sangs, for avoyding of Sinne and Hurlotrie* (printed at Edinburgh about 1548), and which was the principal psalm-book used in Scotland. He was also the reputed author of *The Complaynt of Scotland* (1548), "the only classic work in old Scottish prose." D. in England about 1564.

Wedding and Wedlock. See MARRIAGE, by J. N. POMEROY, LL.D.

Wedge [Ang. Sax. *wecg*], in geometry, a volume bounded by a quadrilateral called the *back*, by two quadrilaterals called *faces*, and by two triangles called *ends*; the faces meet in a straight line called the *edge*.

Wedge, one of the so called mechanical powers, is a modification of the inclined plane. In the ordinary wedge, as well as in knives, nails, and all cutting and pointed instruments, this mechanical power is practically used.

Wedgwood (HENSLEIGH), grandson of Josiah, b. in Dorsetshire, England, about 1803; graduated at, and became fellow of, Christ College, Cambridge; is a barrister-at-law in London, and married his cousin Frances, daughter of Sir James Mackintosh the historian. Author of *Principles of Geometrical Demonstration, deduced from the Original Conception of Space and Form* (1841), *The Development of the Understanding* (1848), *The Geometry of the First Three Books of Euclid* (1856), *On the Origin of Language* (1866), and *A Dictionary of English Etymology* (3 parts, 1859–67; new ed. 1876), and has contributed valuable papers to the *Proceedings* and *Transactions* of the Philological Society.

Wedgwood (JOSIAH), F. R. S., b. at Burslem, Staffordshire, England, July 12, 1730, was the younger son of a potter in easy circumstances, and descended from a family identified for several generations with the ceramic art; lost his father at the age of nine years; was apprenticed to his brother Thomas in 1744; worked at the potter's wheel several years; was lame from his sixteenth year as the result of a severe attack of small-pox; was thus led to devote himself rather to the artistic development than to the manual operations of his profession; received a somewhat limited early education, but ultimately corrected its defects; entered into business for himself with a partner named Harrison at Stoke in 1752, manufacturing the ordinary cheap wares then in demand, to which, however, his careful superintendence gave an artistic finish previously unknown; was from 1754 to 1759 partner of Thomas Wheildon, the most eminent potter of his day; devoted himself for many months to a careful study of, and experiments upon, the fictile materials then in use, resulting in the invention of a new green "tortoise-shell" earthenware, having the smoothness and brilliant appearance of glass, from which he made toilet vessels, services of dessert, knife-handles, and articles of *virtu*, which were highly appreciated by the jewellers of London and Bath; established himself in business at his native place in 1759; perfected in 1761 a fine cream-colored ware, specimens of which, being presented to the new queen, Charlotte of Mecklenburg, obtained him the title of queen's potter and permission to entitle his new art-product "queensware;" rapidly acquired a considerable fortune, of which he made a liberal use; married his cousin, Sarah Wedgwood, Jan. 25, 1764; was the most efficient promoter of Brindley's Grand Trunk Canal, to which he subscribed £1000, and for which he cut the first sod at Burslem July 26, 1766; adapted the engine-lathe to the uses of his art; produced in 1766 his fine black "basaltes" or "Egyptian" ware, and shortly afterward his celebrated jasper ware; began building the celebrated establishment which he named Etruria in 1767; formed a partnership in 1768 with Thomas Bentley of Liverpool, a man of fortune and artistic tastes, who contributed largely to the success of his plans; made experiments in the qualities of many kinds of clays, importing from Ayoree in the Cherokee district of South Carolina a fine porcelain clay; opened his works at Etruria June 13, 1769; began about this time to produce beautiful copies of classical vases and other ancient masterpieces, chiefly from the engravings in Sir William Hamilton's *Antiquities*; opened in 1770, at Chelsea, a branch establishment for the painting and finishing of his wares; opened in London soon afterward a salesroom of his own, which became a fashionable resort of the nobility; received orders of immense amount from the Continent, especially from Queen Catharine II. of Russia, for whom he executed a service of many hundreds of pieces, each representing a different English landscape; was elected to the Royal Society and to the Society of Antiquaries; invented the pyrometer; contributed several papers to the *Transactions* of scientific societies; erected a magnificent mansion at Etruria; employed Flaxman and other great artists as his modellers; executed magnificent copies of the famous Barberini or Portland Vase 1790; admitted his three sons and his nephew, Thomas Byerly, to partnership the same year; was a liberal patron of education, literature, and the arts; was highly esteemed by the royal family; enjoyed the intimate friendship of the duke of Bridgwater, Earl Gower, and other prominent noblemen, and was regarded as the father of his art in modern times. D.

at Etruria Jan. 3, 1795.—His sons JOHN and JOSIAH, and their descendants, have continued his business to the present day. By his daughter Susanna he was grandfather of the celebrated naturalist Charles Darwin, and other descendants have been prominent in literature or science. His statue by Davis has been erected at Stoke-upon-Trent, and a memorial institute was opened at Burslem Oct. 26, 1863. His biography has been written by Llewellyn Jewett (1865) and by Miss Eliza Meteyard (2 vols., 1865–66), who is also authoress of *Memorials of Wedgwood* (1875) and *Wedgwood Handbook* (1875). PORTER C. BLISS.

Wedgwood (RALPH), son of Thomas, a cousin and partner of Josiah, b. in Staffordshire, England, about 1766; was educated as a chemist; became proprietor of a pottery at Burslem, and afterward at Ferrybridge, Yorkshire, but did not succeed; taught chemistry in schools in the central counties; invented a "penna-polygraph" for writing with several pens attached to one handle; patented in 1806 a "pocket secretary" or "manifold writer," which came into general use, and spent several years (1806–14) in fruitless endeavors to induce the admiralty to adopt a scheme for his "fulguri-polygraph," an electric telegraph, which he had devised. D. at Chelsea in 1837. Author of *The Book of Remembrance*, etc. (1814), and of a pamphlet on his telegraphic project (1815).

Wedgwood (THOMAS), youngest son of Josiah, b. at Etruria, Staffordshire, England, in May, 1771; educated at the High School and University of Edinburgh, and at home under the tutorship of John Leslie, afterward the celebrated professor; studied chemistry under the direction of his father; became expert in physical and mathematical science; made ingenious experiments in optics, the results of which were published in two papers on the *Production of Light from Different Bodies* in the *Philosophical Transactions* for 1792; invented an imperfect process of photography, by means of which he took the first heliotype about 1793; was an intimate friend of the most prominent literary men of the time, and a liberal benefactor to Coleridge, Wordsworth, Mackintosh, and Leslie, and would undoubtedly have achieved distinction as a psychologist had it not been for a painful disease which he suffered for years previous to his death, which occurred June 10, 1805. Mackintosh and Coleridge undertook to write his biography, but never fulfilled their trust, and a volume of *Metaphysical Essays*, committed to the former as editor, never saw the light. An ingenious paper on *The Origin of our Notion of Distance* in the *Quarterly Journal of Science and Arts*, vol. iii., is the best remaining specimen of his philosophical studies. (See *The Younger Wedgwoods and their Friends* (1871), by Eliza Meteyard.)

Wedgwood Ware. See POTTERY AND PORCELAIN MANUFACTURE, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Wednes'bury (wenz'bere), town of England, county of Stafford, near the sources of the Tame, in the centre of a very rich mining district, has extensive manufactures of ironware of almost every description. P. 15,298.

Wednes'day (wenz'dy), ["Odin's day;" Ger. *Mittwoch*, "mid-week;" Fr. *Mercredi*; Late Lat. *dies Mercurii*, "Mercury's day"], the fourth day of the week, so named in consequence of an identification of the Northern god Odin with the Roman Mercurius.

Wedow'ee, p.-v. and tp., cap. of Randolph co., Ala., on Wedowee Creek, about 4 miles from Tallapoosa River, contains 1 church, 2 schools, a Masonic lodge, 1 hotel, 2 newspapers, and 1 grist and 2 saw mills. P. of v. 130; of tp. 1791.

JAMES M. K. GUINN, ED. "RANDOLPH ENTERPRISE."

Weed, or **Shot of Grease,** an inflammation of the lymphatics in the hind legs, or more rarely the fore legs, of horses. Overwork, overfeeding, and exposure to cold are among the causes. Foment the parts thoroughly, give 5 drops of tincture of aconite every two hours, let the horse have a smart dose of aloes, and if he is in good condition bleed him. Afterward give him a few weeks' rest and pasturage, with shelter in rainy weather.

Weed (STEPHEN H.), b. in New York in 1834; graduated at the New York Free Academy 1850, and from the U. S. Military Academy July, 1854, when appointed brevet second lieutenant of artillery; served on the Texan frontier and in the Florida war 1855–57, and the Utah expedition 1858–61, being engaged in the actions at Egan Canion and Deep Creek, Aug.–Sept., 1860. Appointed captain 5th Artillery May 14, 1861, he was engaged at regimental head-quarters and on recruiting duty August to November, and at Camp Grehle, Pa., Nov., 1861, to Mar., 1862, when, joining the Army of the Potomac, he commanded his battery throughout the Peninsular campaign of 1862, as at Manassas, Antietam, and Chancellorsville, in all of which battles he displayed great bravery and ability. After Chancellorsville he was placed in command of the artillery brigade 5th corps, and June 6 was appointed a brigadier-general of volunteers. At Gettysburg he commanded a brigade of regulars 5th corps, and in the terrible struggle of July 2, 1863, for the possession of Little Round Top he was instantly killed at the head of his command.

Weed (THURLOW), LL.D., b. at Cairo, Greene co., N. Y., Nov. 15, 1797; was cabin-boy on a Hudson River vessel when ten years of age; entered a printing-office at Catskill two years later; worked in several villages in the interior of New York; was a volunteer on the northern frontier of New York in the war of 1812–15, serving as quartermaster-sergeant; established in 1818 the *Agriculturist* newspaper at Norwich, Chenango co., N. Y.; edited several other papers during the ensuing ten years, among which was the *Anti-Masonic Inquirer* at Rochester 1826–27; took an active part in the controversy arising from the disappearance of William Morgan, with the details of which he was familiar, as he also was with the origin of the Mormon imposture in the same region; was twice elected to the New York assembly 1826–30; contributed largely to the election of De Witt Clinton as governor 1826; settled at Albany in 1830; founded there the *Evening Journal*, a newspaper established in the interests of the party then being formed in opposition equally to the administration of Pres. Jackson, as represented by the "Albany Regency," and to the nullification policy of Calhoun; was an original leader of the Whig party; contributed largely to the election of Gov. Seward in 1838 and 1840, to the nomination of Harrison in 1836 and 1840, and to his election on the latter occasion; became known as the most adroit of party managers; wielded an immense influence in legislation and in the distribution of executive appointments, but declined to accept any public office; was active in promoting the nomination of Gen. Taylor in 1848 and of Gen. Scott in 1852; exerted his influence in 1856 and 1860 in favor of the nomination of William H. Seward, but rendered cordial support to Fremont and Lincoln; was an advocate of the energetic prosecution of the war 1861–65; visited Europe at the request of Pres. Lincoln Nov., 1861, remaining abroad until June, 1862, and exerted an important influence upon English opinion through his personal relations with leading statesmen; withdrew from the *Evening Journal* in 1862; settled in New York City 1865, and was for some time editor of the *Commercial Advertiser*; retired from active journalism in 1868, but continued throughout the administration of Pres. Grant, and especially during the grave constitutional crisis ensuing upon the election of 1876, to exert a powerful influence upon the counsels of his party, and was a frequent contributor over his own signature to the columns of the political journals. He has published *Letters from Europe and the West Indies* (Albany, 1866), collected from the *Evening Journal*; has published some interesting chapters of *Reminiscences* in the *Atlantic Monthly* (1870) and in other periodicals, and is understood to be engaged in the preparation for the press of an autobiography and of portions of an extensive correspondence which will doubtless prove valuable materials for the political history of the U. S., and especially of New York, during the half century in which (with his friends Seward and Greeley) he was the arbiter of Whig and Republican policy. PORTER C. BLISS.

Wee'don (GEORGE), an innkeeper and postmaster of Fredericksburg, Va., when the Revolutionary war broke out, was made a lieutenant-colonel of the 3d Virginia regiment Feb. 13, 1776, colonel of the 1st Virginia regiment Aug. 12, and a brigadier-general Feb. 24, 1777. In the battle of Brandywine he commanded the brigade of Greene's division which stopped the British pursuit and saved the routed army. Having resigned on account of some misunderstanding, he resumed command in 1780, and fought at the siege of Yorktown, Oct., 1781.

Weeds'port, p.-v., Cayuga co., N. Y., at the junction of New York Central and Southern Central R. Rs., and upon Erie Canal, has 5 churches, a union school, 2 banks, 1 newspaper, 1 foundry, and 3 hotels. Large quantities of coal are transhipped here. P. 1348.

GEO. R. NASH & CO., PUBS. "SENTINEL."

Wee'hawken, p.-v., Hudson co., N. J.

Week [Ang.-Sax. *wecoc*], a period of seven days, forming a subdivision of the lunar month, corresponding to the four quarters of the moon, or about 7⅜ days. It was in common use among the ancient Hebrews, who in Ex. xx. 11 referred its origin to the creation of the world, and in Deut. v. 15 to the exodus from Egypt. It was not a Hebrew invention, however, as may be seen from Josephus, Philo Judæus, Clemens of Alexandria, and others. It was found as a civil institution in the very earliest times among the Hindoos, Persians, Assyrians, and Egyptians.

But the Jews were the only nation with which the week had a religious signification. With the Egyptians, Assyrians, etc., the seventh day was simply a day of recreation; with the Jews it was the day of worship, the sabbath. The Greeks divided the month into three periods of ten days (*decades*), and the Romans gathered the days into periods of eight days (*nundinæ*); with both, the first day of the period was the market-day, on which country people came to town and stirred up both business and public life. The period of seven days, the week proper, was introduced to the Romans and Greeks partly by Christianity (which may be inferred from the fact that the term *sabbath* was adopted), partly by the Egyptian astronomy and astrology. It recommended itself to the practical Romans as peculiarly convenient by its relation both to the lunar month and to the solar year. Among the Jews the days of the week had no names; they were simply counted. But the Egyptians named them after the seven planets then known, and in the following way: they arranged the planets according to their distance from the earth, beginning with the most distant; ascribed a planet to each hour, and named the day after the planet which reigned over its first hour. This method of appellation was adopted by the Romans, so that when Saturn presided over the first hour of the first day, which consequently became *Saturday*, the first hour of the second day would fall to the sun, etc. (For further details see the special articles on the days.)

Weekes (Henry), R. A., b. at Canterbury, England, in 1807; studied sculpture under Behnes and at the Royal Academy, where he entered 1823; was many years the principal assistant of Chantrey, whom he succeeded in his studio at Pimlico 1841; was elected to the Academy 1863, and became professor of sculpture there May 16, 1873. He executed the first bust of Queen Victoria (1837), statues of Cranmer, Latimer, Ridley, Wellesley, Bacon, Hunter, Harvey, Charles II., and many others, and gained a gold medal for the best treatise on the fine-art section of the Great Exhibition of 1851. D. May 29, 1877.

Weeks (John M.), b. at Litchfield, Conn., May 22, 1788; was educated at Salisbury, Vt., whither his parents removed in 1789; invented the "Vermont beehive," and was a contributor to agricultural journals. D. at Salisbury Sept. 1, 1858. He wrote *A Manual on Bees* (1854), also a posthumous *History of Salisbury, Vt.* (1860), edited, with a *Memoir of the Author*, by G. A. Weeks, and left in MS. a *History of the Five Nations*, still unpublished (1876).

Weeks, Feast of. See Pentecost and Easter.

Weems (Mason L.), b. at Dumfries, Va., about 1760; studied divinity in London; took orders in the Episcopal Church; was for several years rector of Pohick church, near Mount Vernon, Gen. Washington being one of his parishioners, and was subsequently famous for his success and his eccentricities as a book-agent for Matthew Carey, travelling through the Southern States, canvassing chiefly for his own books of which the most celebrated were the *Lives* of Washington (1810) and of Marion (about 1805), to which were subsequently added those of Franklin (1817) and Penn (1819). The *Life* of Marion was written from data furnished by Gen. Horry, but the latter disavowed all responsibility for the manner in which his materials had been used. Several of the most widely-circulated anecdotes of the youthful days of Washington, such as the famous story of the "little hatchet," rest upon the questionable authority of Weems, who seems not to have shared his hero's conspicuous devotion to truth. D. at Beaufort, S. C., May 23, 1825.

Wee'nix (Jan Baptist), the Elder, b. at Amsterdam in 1621; received his first instruction in the art of painting from Abraham Bloomaert and Nicholas Moojaert; resided for several years in Italy; settled after his return in Utrecht, and d. there in 1660. He painted mostly landscapes and seaport scenes.—His son, Jan Weenix, the Younger (b. at Amsterdam in 1644, d. there in 1719), studied under his father, and acquired a great reputation as a painter of animals and hunting-scenes. There are numerous pictures by him in the galleries of Amsterdam, Munich, and Dresden.

Weep'ing [Ang.-Sax. *wépan*]. Weeping is a physical expression of certain mental emotions by shedding tears, accompanied, especially in children, by facial distortion and involuntary muscular contractions in other parts of the body. For the purpose of secreting the tears there is a special apparatus placed within the orbit at its upper part, consisting of a body called the lachrymal gland; of a reservoir, the lachrymal sac, and of certain canals, the ducta lachrymalia, which collect the tears from the inner angle and convey them to the lachrymal sac; and of a tube, the lachrymal duct, by which the secretion is carried from the sac into the nose. Aside from the office of the tears in, as we have said, expressing certain emotions, they serve to lubricate and keep moist the lining membrane of the eyelids and external coat of the eyeball, the conjunctiva. The secretion of tears, whether for emotional or ordinary physiological purposes, is effected through the intermediation of the fifth pair and the sympathetic nerves. In emotional weeping the action is probably mainly induced through the sympathetic. In the lachrymation which is for the purpose of lubricating the ocular surfaces, or which is the result of irritating applications to them or to the neighboring mucous surfaces, the fifth is the channel of communication with the brain.

Weeping is probably originally the expression of physical pain only. And yet, as is well known, very young infants, whose crying is in every instance due to physical uneasiness, do not shed tears. But, as Darwin noticed in the case of one of his own children, this is not the result of any inability of the lachrymal gland to secrete tears; for having accidentally brushed the open eye of the infant when seventy-one days old with the cuff of his coat, that eye watered freely, but the other did not weep, though the child screamed violently. As the individual advances toward adult life, tears are less apt to be shed as an expression of physical pain, until when fully grown it is exceedingly rare to find a man or woman, however much the countenance may be distorted and the body writhe, weep from bodily suffering.

Weeping is excited by anger, sorrow, fear, joy, and in some cases by sympathy with others in their sorrows or joys, and again by intense interest in the highly-wrought and exalted actions of those in whom we are interested; and still, again, by musical compositions—more by singing than by instrumental performances—which, in a manner not easily explained, awaken in us the emotional excitement that leads to tears. The minor key has most influence in this direction. Funeral marches are almost invariably composed in it. I have known highly-intellectual men and women who could listen to female voices without being moved till a certain note was sounded, generally one in the lower register, when tears would trickle down their cheeks. Contralto voices are, in my experience, more emotional than soprano. Diseases of the brain tending to diminish the functional activity of the organ increase the disposition to shed tears, and in some cases this is carried to an extent that would be ridiculous were it not a morbid phenomenon. The writer had a patient, a gentleman who had an organic disease of the brain, who could not see a funeral without weeping, and another who could not read the obituary column in a newspaper without shedding tears profusely. The insane are much more easily affected to tears than sane persons, and they weep disproportionately to the exciting cause.

Sobbing, which is a species of weeping, appears to result in part from the attempt to restrain the emotions, and from a cause analogous to that which induces sighing—namely, the demand of the system for additional aëration of the blood—a process which intense emotion serves to disturb.

Bibliography.—Sir Charles Bell, *The Anatomy of Expression* (London, 1844); Lavater, *L'Art de connaître les Hommes par la Physionomie* (Paris, 1820); Lemoine, *De la Physionomie et de la Parole* (Paris, 1865); Piderit, *Wissenschaftliches System der Mimik und Physiognomik* (1867); Duchenne, *Mécanisme de la Physionomie humaine* (Paris, 1862); Bain, *The Emotions and the Will* (3d ed., London, 1875); Darwin, *The Expression of the Emotions in Man and Animals* (London, 1872); Pflüger, *Die Endigungen der Absonderungsnerven in der Speicheldrüse* (Bonn, 1866); Demetschenko, *Zur Innervation der Thränendrüse* (*Pflüger's Archiv*, Bonn, 1872).

William A. Hammond.

Weeping Water, p.-v. and tp., Cass co., Neb. P. 481.

Weerselo', town of the Netherlands, province of Overyssel, has some manufactures of woollen and cotton fabrics. P. 5445.

Weert, town of the Netherlands, province of Luisburg, has some breweries, tanneries, distilleries, and manufactures of tobacco. P. 6788.

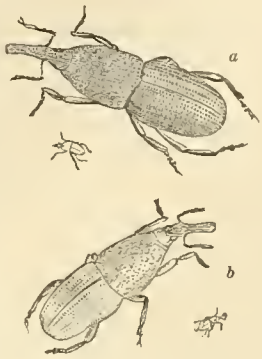
Wee'saw, tp., Berrien co., Mich. P. 1213.

Weever. See Trachinidæ, and also Great Weever.

Weever, or **Weaver** (John), b. in Lancashire, England, in 1576; educated at Queen's College, Cambridge; travelled on the Continent and throughout the British isles in quest of antiquities, and published a valuable work, *The Ancient Funeral Monuments within the United Monarchy of Great Britain*, etc. (London, folio, 1631), of which a 3d ed., with addenda and an index by Rev. William Tooke, appeared in 1767. D. in London in 1632.—He is not to be confounded with another John Weever, his contemporary (b. 1576), who was author of *Epigrammes in the Oldest Cut and Newest Fashion* (1599), and of a quaint

poem, *The Mirror of Martyrs, or the Life and Death of that Thrice-valiant Capitaine and most Godly Martyre, Sir John Oldcastle, Knight, Lord Cobham* (1601).

Wee'vil [Ang.-Sax. *wifel*], a term which, when compounded with some other word, is properly applied to many snout-beetles (Curculionidæ), but more particularly to the insects belonging to the genus *Bruchus* of Linnæus, formerly included among the Rhynchophora, but now placed in a family (Bruchidæ) which connects the snout-beetles with the leaf-beetles (Chrysomelidæ), and has greatest affinities with these last. The snout-beetles are characterized by the extension of the head into a snout or proboscis, at the tip of which the jaws are placed. By means of this snout the eggs are inserted where the larva is destined to live. Their larvæ are, with few exceptions, footless, clumsy grubs, with a horny head, and live within the blossoms, fruits, seeds, stems, or roots of plants. Some few even live within leaves. There are over 400 described North American species of the Curculionidæ proper, distributed among nearly 100 genera. The following are among the more notable in their larval habits: *Conotrachelus nenuphar*, Herbst, the plum-weevil (see CURCULIO), works, as larva, in the flesh of stone fruit, and transforms in the ground; *C. crataegi*, Walsh, infests the pear and quince; *Anthonomus pruinicida*, Walsh, works in the stones of plums, and transforms therein; *A. suturalis*, Lec., is inquilinous in *Phylloxera*, hickory galls; *A. quadrigibbus*, Say, works in apples and other pip fruit; *Cœliodes inæqualis*, Say, works in grapes; *Anoleis fragariæ*, Riley, injures the crown and root of the strawberry; *Baridius trinotatus*, Say, the potato-stalk weevil, bores the stems of the potato; *Ithycerus novaeboracensis*, Forster, the New York weevil, breeds in the twigs of oaks; *Pissodes strobi*, Peck, burrows in the tips of pines; *Hylobius pales*, Herbst, in the stems and roots of *Pinus sylvestris*; *Magdalis armicollis*, Say, works under the bark of elms; *Dorytomus mucidus*, Say, breeds in the blossoms of cottonwoods and willows; *Phytonomus comptus*, Say, feeds on the leaves of *Polygonum*, and constructs a silken mesh-like cocoon in which to transform; *Prionomerus calceatus*, Say (= *carbonarius*, Gyll.), lives between the leaf-cuticles, and also makes a cocoon on the magnolia or tulip tree; *Otidocephalus lævicollis*, Horn, which resembles a wingless gall-fly, is inquilinous in the gall of *Cynips q. globulus*. The species of the genus *Attelabus* breed in thimble-shaped rolls of the leaves of oak, hickory, rose, sumach, etc. *Balaninus* comprises species with very long snouts, and known as "nut-weevils," different species infesting different nuts, as *caryæ*, Horn, hickory nuts; *Sayi*, Gyll., chestnuts; *uniformis*, Lec., and *quercus*, Horn, acorns. *Rhynchophorus Zimmermanni*, Fabrs., our largest species, breeds in the palmetto palm; *Spenosphorus zeæ*, Walsh, breeds in moist, rotting wood; *S. pulchellus*, Schh., in stems of cockle-bur and other herbaceous plants. The grain-weevils are more particularly referred to at the end.



a, *Calandra granaria*; *b*, *C. oryzæ*. (The small outlines show the natural size.)

The Bruchidæ, or weevils proper, mostly breed in the seeds of leguminous plants; their larvæ are fat, clumsy, wrinkled grubs, and in some instances are provided with short legs. Their eggs are not inserted in the pods, as has been heretofore asserted by authorities, but are invariably glued to the outside of the pod: they are elongate, generally smooth, but sometimes beautifully reticulate. The new-born larva eats directly through the pod and into the seed, the hole of entrance effectually closing up if the pod is yet green. The pea-weevil (*Bruchus pisi*, L.) affects peas, one individual appropriating the contents of one pea; the eggs are laid while the pod is forming. The bean-weevil (*Bruchus fabæ*, Riley) infests beans, several individuals developing in the same bean; *Bruchus bivulneratus*, Horn, breeds in the seeds of *Cassia marilandica*, and its eggs, which are reticulate and fastened by two filaments anteriorly and one posteriorly, are laid on the mature pod; the honey-locust seed-weevil (*Spermophagus robiniæ*, Schh.) has distinct thoracic legs, and spins from the mouth a cocoon of silk, mixed with excrement, in which to undergo its transformations.

Though the term "weevil," when used alone, is often very loosely and incorrectly applied by farmers to several insects that affect wheat, and particularly to the wheat-midge (*Cecidomyia tritici*)—a little orange, dipterous maggot that affects the growing ear—it strictly belongs to the grain-weevil (*Sitophilus granarius*, L.), which is the greatest pest to stored grain, and frequently reduces a lot of wheat to mere husks before its presence is noticed. The beetle is about one-eighth of an inch long, of a deep chestnut-brown color, with nine deeply-punctured striæ along each elytron, and without wings. The female with her snout makes an oblique puncture just under the skin of the stored grain, and lays an egg therein, from which egg there hatches a whitish grub that devours the substance of the kernel and undergoes its transformations within the hull. In from forty to fifty days from hatching the perfect weevil eats its way out. Several generations are produced each year, and when once the species is established it increases at an alarming rate, more particularly in warm climates. There is a closely-allied form, known as the rice-weevil, and generally considered a distinct species (*Sitophilus oryzæ*, L.), which differs principally in being somewhat smaller, and in having wings, and four pale or reddish spots on the elytra. The habits of the two are similar. Both infest most kinds of dry grain, including maize, and both are widespread over the world, having been introduced from one part to another. The remedies employed against these weevils are principally kiln-drying, sulphur fumes, and the sprinkling of air-slaked lime among the grain. The best antidote, however, is cleanliness. All rubbish that the weevils can harbor under should be burned, cracks filled up, the walls whitewashed, and a general supervision had over the grain, which should be kept as cool as possible, and well aired.

C. V. RILEY.

Wegatch'ie, p.-v., Rossie tp., St. Lawrence co., N. Y. P. 201.

Wegefarth, an unorganized county of N. W. Texas, in the "Panhandle" W. of the Indian Territory, is watered by the forks of Red River, is hilly in the W. and undulating in the E., and is uninhabited except by nomadic Indians.

Weige'la, a shrub found in China by the celebrated naturalist Dr. Robert Fortune, by whom it was introduced into England and named *W. rosea*, but afterward found to be identical with *Diervilla*, a genus introduced into Europe from Canada in the eighteenth century. In the U. S., where there are two species, it is familiarly known as "bush honeysuckle."

Weigh'ing, Chemical. (See also WEIGHTS, CHEMICAL.) The accurate determination of the weight of a substance is of special importance in quantitative analysis (see CHEMICAL ANALYSIS) and in other chemical processes. In order to arrive at true results in this operation the balance and weights employed must be correct, and certain precautions observed in their use. The chemical balance, in its most approved form, consists of a light but strong brass beam, which is suspended at its centre on an agate or steel knife-edge, resting on a smooth agate plane fixed on a brass column. At each extremity of the beam is a steel or agate prism supporting an agate plane, from which the pans are suspended by means of bent wires. Except when in use, the weight of the beam and pans does not rest upon the agate surfaces, but is supported by a brass frame which is operated by means of an eccentric extending outside of the balance-case. A second attachment is often added, which supports the weight of the pans and prevents their oscillation. The movements of the beam are indicated by a long index-needle extending below and passing over a small ivory scale. The beam is often graduated into tenths, the smaller weights (milligrammes and fractional parts thereof) being estimated by means of a bent wire centigramme weight, termed the *rider*, which is placed upon the divisions of the beam by means of a rod operated from the exterior of the case. The balance is maintained in a horizontal position by the aid of levelling-screws and a circular spirit-level. The stability of the beam is regulated by having a movable weight placed above its point of suspension; its equilibrium can be adjusted by means of movable vanes or by screws attached to its extremities. The entire instrument must always be protected from the influence of currents of air, dust, etc., by a glass case provided with suitable windows. The balance used in ASSAYING (which see) is particularly adapted for accurately weighing small amounts of material with *rapidity*; it is smaller than the ordinary chemical balance, and is provided with loose scale-pans. In order that a chemical balance may be accurate, the point on which the beam rests must be above the centre of gravity of the balance; the point of suspension of the scales must be in a line absolutely horizontal with the fulcrum; the beam must be of sufficient strength to support the weights used without bending; and the arms of the beam must possess equal length. The greatest sensibility is attained when the friction of the edges upon the supporting planes is as small as possible, when the beams

are of the slightest possible weight, and when the centre of gravity lies as near as possible to the fulcrum or point on which the beam rests. A good chemical balance should stand the following tests: When the pans are empty, the index-needle should point to the zero of the scale, or make equal and slow excursions on either side; if the pans are removed, the beam should be in equilibrium, and remain so when it is turned round from right to left if its construction permits of this change; on equally loading the pans, the beam should also be in equilibrium, and resume its orginal position when its oscillations are suddenly arrested; it should bear a load of 75 grammes on each pan, and indicate a weight of 1 milligramme; in its ordinary condition the addition of $\frac{1}{10}$th milligramme should cause the beam to turn distinctly. A chemical balance should be moved as little as possible, and be carefully protected from moisture and acid fumes. Presence of moisture is best prevented by placing in the balance-case a dish containing chloride of calcium or quicklime. The parts of the balance should never be removed or cleaned without adequate cause.

Weighings may be executed either *directly* or *by substitution*. By the former mode the substance is placed upon one scale and the weights upon the other. It is advisable always to place the substance to be weighed upon the same pan—most conveniently the left—although in assaying the reverse is practised. Much time is saved in determining the weight of a substance if a systematic plan in using the weights is adopted, and they are added in their proper order, as 20, 10, 5, 2, 1, etc., the rider being employed for the milligrammes. As soon as equilibrium is nearly attained, the increase or decrease of weight required will be indicated by the rapidity and extent of the oscillations of the index-needle. Errors in reading off the result of a weighing are often avoided by counting first from the vacant spaces left in the weight-box, and then removing the weights from the pan while again counting them. The body to be weighed is seldom or never placed directly upon the pan, but is introduced into a vessel of platinum, porcelain, or glass which has been weighed when empty. It is then weighed with the substance, and its weight when empty subtracted, or the weight of the vessel and substance is first determined, a portion of the latter taken out, and the weighing repeated, the quantity of substance removed being then the decrease in weight. Bodies that rapidly absorb moisture must invariably be weighed in closed vessels, and those that possess a higher temperature than the surrounding air should be allowed to cool in a vessel containing chloride of calcium or concentrated sulphuric acid, in order to avoid the condensation of moisture upon their surfaces; besides, if a substance is weighed when hot, the current of heated air produced in the balance-case always affects the movements of the beam, causing it also to expand slightly, thus vitiating the accuracy of the weighing. As the specific gravities of the substances weighed are not the same as that of the weights used, *absolutely correct* results are obtained only when the process is performed *in vacuo*, or when corrections are made by adding the weights of the volumes of air corresponding to the volume of the substance and weights. This refinement, however, is seldom necessary, as the density of the air is very small compared with that of the solids involved.

The method of weighing by substitution, which affords exceedingly accurate results even if the beams are unequal in length and are not in exact equipoise, is often employed in the determination of the atomic weight of an element. It is executed by placing the substance to be weighed in one pan, restoring the equilibrium of the balance by adding weights to the other pan, removing then the substance, and again counterpoising by substituting the necessary weights in its place; or it can be accomplished also by first placing a *tare*, consisting of shot or wire, and having a greater weight than the substance, in one pan, and balancing it with the proper weights; the weights are then removed and the substances to be weighed put in their place, together with the smaller weights required to counterpoise the tare, and the weights added deducted from the known weight of the tare, the difference being the weight of the substance.

Weighing by reversal—*i. e.* repeatedly changing the substances weighed from one pan to the other, and restoring equilibrium to the beam by means of a small and constant weight—is advantageously employed in comparing nearly equal weights. The same result is obtained by causing the beam to oscillate slowly and observing the extent of each excursion. For this purpose, a small scale, divided into spaces of $\frac{1}{100}$th of an inch, is fixed to one end of the beam, and the length of each oscillation determined by viewing the scale through a fixed compound microscope provided with a horizontal wire in the focus of the eyepiece, or by having a small mirror attached to the beam, in which the image of the scale is observed by means of a fixed telescope.

Good chemical balances are manufactured by Becker (New York and Brussels), Oertling (London and Berlin), Fortin (Paris), Staudinger (Giessen), Steinheil (Munich), and Sacré (Brussels). J. P. BATTERSHALL.

Weigh'ing-Machines. Weighing is the direct and accurate comparison of a body, the potential gravity of which is not known, with another body, the gravity of which has been previously ascertained, and which is taken as a standard, as a pound in this country, a gram in France, a tale in China, or a cattie in Japan. If, for example, we take one of these weights, or any other, and arrange in relation therewith and under identical conditions another body which counteracts or balances the gravity of the weight, we know that the second is exactly equal to the first. These conditions are fulfilled in the simplest and oldest form of weighing-machines, the common balance. This is simply a lever having its fulcrum in the centre and its arms of equal weight and length. The standard weight being placed at one end of the lever, and the article to be weighed at the opposite end, and equidistant from the fulcrum or point of suspension, the lever will be horizontal or balanced when the article to be weighed is brought exactly to the same weight as the standard of weight. The term "balance" is therefore applied to this variety of weighing apparatus. Furthermore, this balancing of the unknown potential gravity of a body against force the degree of which is known is the essential principle of all weighing. If, instead of having the arms of the lever of equal length, we make one of the arms two, three, four, or more times the length of the other, it follows that one unit of the standard weight on the long arm will balance two, three, four, or more units, as the case may be, on the short arm, and the calculation as to the weight on the latter is therefore readily made. This last-indicated apparatus is the common steelyard, the standard weight being adjustable at any required point along the length of the long arm of the lever, which arm is marked with a scale or index to indicate the distance from the fulcrum at which the movable weight will counterbalance the body attached to the short arm. Although this scale in reality indicates the relative distance from the fulcrum of the standard weight and the body weighed (which is nothing more than indicating the ratio between the standard weight and that of the body weighed), these distances are commonly marked in the units of weight; for instance, the pound and the conventional fractions thereof. If we vary the construction, and instead of causing the body to be weighed to bear against the known potential gravity of another or standard weight, we substitute in place of the latter a spring, the power to compress which to any requisite degree is known, we have the same result; for the resistance of the spring to compression up to a certain point being equal, say, to one, five, or ten pounds, a body applied to the spring weighing one, five, or ten pounds will of course compress it; and this degree of compression in proportion to the weight being marked upon a scale, the force or potential gravity exerted upon the article weighed is ascertained in the same manner as if the scale was applied to a lever indicating the position at which the movable or standard weight would balance a body having a certain ratio to such standard weight. If in place of the spring we substitute any other means of exerting a force that is measured and known, we can in like manner ascertain the weight or potential gravity of the body placed to bear in opposition to it. No matter what the construction of the apparatus, or what the character of the measured or standard force, this is the *modus operandi* of all weighing apparatus, from the largest railroad scale down to the delicate torsion apparatus used in weighing, so to speak, the tension of any part of an electrically-excited body.

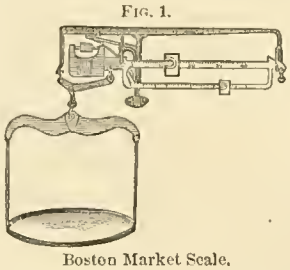
The production of accurate weighing apparatus, however, is beset with many difficulties in practice. To avoid friction, to reduce the construction to the simplest form consistent with perfect utility, and to adapt the apparatus to the myriad uses to which it is applied in arts, industry, and scientific research, are problems that have only been approximately solved. The most delicate and perfectly-constructed weighing apparatus are those employed by chemists, a full description of which, together with the extraordinary care and skill required in their use, may be found in any standard treatise on chemical manipulation. Foreign manufacturers greatly excel Americans in the production of these balances, while the Americans are unequalled in the large and heavy scales required in traffic. A Howe railroad scale capable of weighing up to twenty tons has been made so perfect in working and adjustment that its beam was turned by the weight of a quarter dollar laid upon its platform. In all weighing-machines involving the principle of the lever balance the fulcra or points of suspension are made with knife edges in order to reduce friction to the lowest point. The bringing of the beam or lever to a free suspension horizontally between two limits

of movement is the common indication that the standard weight or poise is balanced by the weight of the body weighed; the scale or index of the beam indicating the ascertained weight of the latter. This bringing of the beam to a place of rest, as just mentioned, is sufficiently accurate for all commercial or industrial purposes, but in balances of chemists, jewellers, and the like, another means is resorted to. The balance-beam or lever has projecting down from its centre a long arm which swings in front of a horizontal scale, the zero-point of which is in a vertical line with the central pivot or fulcrum of the lever. When the point, therefore, of the arm is opposite the zero-mark, the lever is balanced, and the standard weights are counterpoised by the article to be weighed. Inasmuch, however, as the perfect cessation of motion of the beam would require a long time, the balance of the lever is taken for granted when the arm swings regularly to and fro with a sweep of equal length on each side of the zero-mark.

One curious and very old form of balance depends for its utility upon the increasing resistance of a body swung from a vertical to a horizontal position. In this the article to be weighed is suspended from the upper short arm of a lever, while the long arm, loaded to the requisite degree, swings along an index or scale formed on an arc attached to the standard to which the lever is pivoted; only a small weight is required to move the long arm in the lower part of the arc or scale, but the resistance of the long arm increases in proportion as it is moved upward, its place in relation to the scale of course indicating the potential gravity of the article suspended from the short arm. It would not be impossible to construct a weighing-machine in which the article weighed should force upward a column of mercury or other liquid, the rise of the liquid in its tube of course indicating the degree of potential gravity or weight exerted upon it. If the liquid should be forced upward into a tube closed at its upper end to provide a vacuum above the liquid, we should have simply the principle of the barometer, for in this the atmosphere is just as much weighed as a sack of potatoes or a bushel of corn is weighed upon a pair of standard scales.

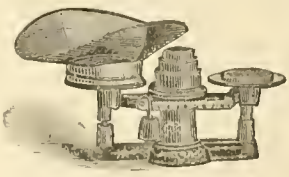
The spring balance comprises an oblong metallic shell having a hook at the upper end, by which it can be suspended from the hand or attached to a fixed support, and having a scale upon its face. A rod extends through the spiral spring, and is attached to the latter at its upper end, and carries a hook at its lower extremity, to which the article to be weighed is attached, the degree of compression, and consequently the force expressed in pounds or other units of weight, being indicated by a small pointer attached to the rod and passing through a slot in the face of the shell in proper relation with the scale. This is a common and convenient appliance, but cannot be relied upon for any degree of accuracy. A far better device is the improved Boston market scale, which operates on much the principle of the steelyard, but with greater accuracy, the heavier weights being indicated on a major scale, and the smaller ones on a minor scale, both forming parts of the same beam. The pan which holds the article to be weighed, instead of being attached directly to the short arm of the lever, is connected by a secondary lever, an adjustable counterpoise being arranged to balance the weight of the beam or long arm of the lever. The common balance for weighing small quantities—as, for example, household supplies, coffee, sugar, tea, etc.—is provided at one end with a pan for holding the article, and the other with a plate for holding the various weights. These are technically termed "even balances," and sometimes have, besides the weight, a scale or side beam attached to the lever or beam, and are sometimes constructed to be used indifferently with weights on one end of the beam, or with a supplemental beam having an adjustable poise.

Fig. 1.



Boston Market Scale.

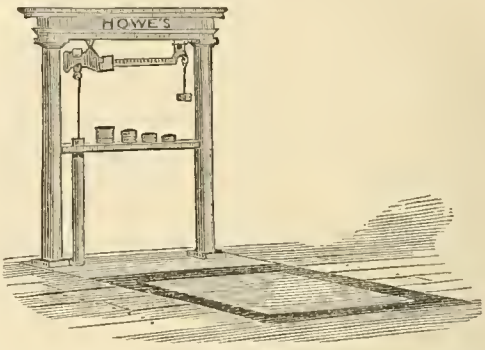
Fig. 2.



Even Balance, with side scale or beam.

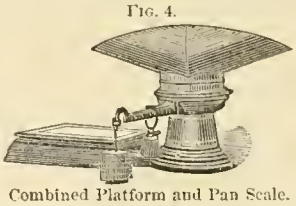
If, instead of suspending the body to be weighed directly to one arm of the lever, we extend a rod from the one arm—as, for example, the short arm when the principle of the steelyard is employed—downward to a frame capable of a downward movement by weight or pressure applied thereto, taking care to properly balance the platform against the beam, we have the same relation of the article weighed to the beam carrying the standard weight. By this means the apparatus is rendered capable of use under many circumstances where the simpler balances or steelyards could not be employed. This arrangement is in fact that of a common platform scale. Sometimes these platform scales are made so small as to be used on counters in retail grocery stores and markets; sometimes of a size sufficient to weigh a loaded railroad car. A good example of this class is the railroad dépôt scale. The credit of the invention of the platform scale appears to be due to James Edgell, an English inventor, whose patent is dated 1774. He calls it a compound "ballance" or engine. He describes it as comprising a platform placed nearly level with the surface of the ground or floor, and supported by four pillars resting on four different points of suspension of the short brachia or arms of an equal balance, whose longer arms at the points of application thereof meet and are combined or coupled together under the large scale or platform. Several levers or unequal balance-beams are inserted between the balance-beam just mentioned and the scale or basin that receives the weights; the shorter arm of the one being applied to and acting on the longer arm of the other. If a scale be hung to the longer arm of the last balance-beam, a small weight will equiponderate with a large weight on the large platform.

Fig. 3.



Dépôt Scales.

Fig. 4.

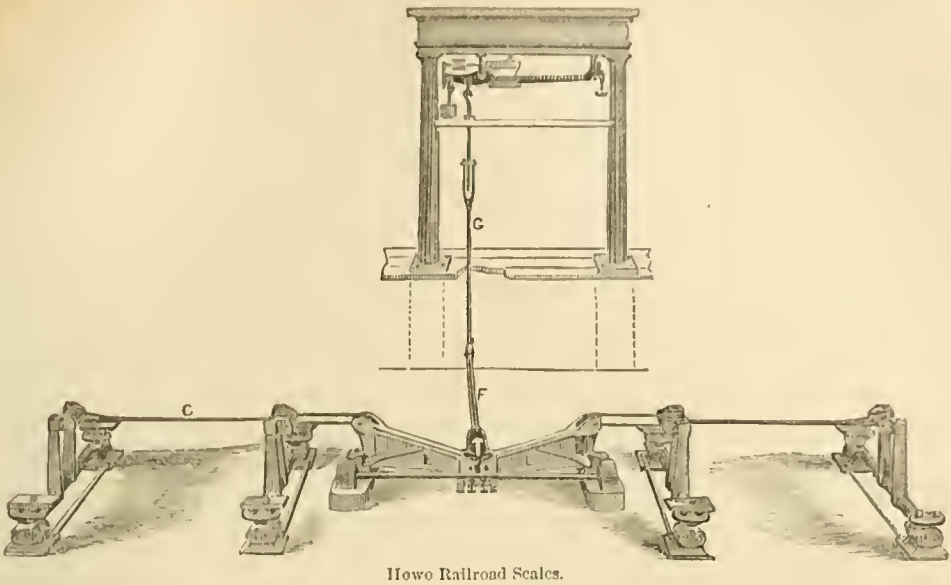


Combined Platform and Pan Scale.

There is of course a vast difference between this initial machine of 100 years ago and the apparatus of the present day. But although forty-three British patents on platform scales were granted between the date above given and the year 1866, the most approved mechanism for weighing heavy bodies is of American invention and manufacture. The pioneer in this movement was Thaddeus Fairbanks, who forty-five years ago (June 13, 1831), in conjunction with E. Fairbanks, secured a patent on apparatus for weighing heavy bodies; the next year the same parties obtained another patent in the same class, and three years later two more; and afterward (Feb. 10, 1837) five others. Fairbanks's scales were a great advance upon others previously in use, although since excelled by more recent inventions and improvements. These latter relate, among other things, to a reduction of friction, the avoidance of injury to the pivot-bearings, and the general simplification of the mechanism by which the movement of the platform is communicated to the beam. In the larger sizes of old-fashioned platform scales—as, for example, a hay-scale—the platform is supported upon levers which have their points of suspension at the four corners of the platform, as shown in the illustration of Fairbanks's four-ton scale, the platform itself resting upon the knife-edges provided near the pivoted outer extremities of the levers. In still larger or railway scales the points of suspension are necessarily more numerous, being at intervals of about ten feet around the periphery of the platform. It is of course essential to the perfect operation of the scale that the levers which sustain the platform should be subjected to as little friction upon their bearings or points of suspension as the beam upon its knife-edge or fulcrum. The arrangement of the levers underneath the platform, and the manner in which they are suspended and arranged

in the old-fashioned type of large scales—for example, the four-ton scale—is illustrated in the figure of Fairbanks's platform bearings. Each lever F is provided at its extremity with knife-edged bearings placed in a stirrup depending from the fixed frame timber A surrounding the pit in which the platform and its adjuncts are arranged.

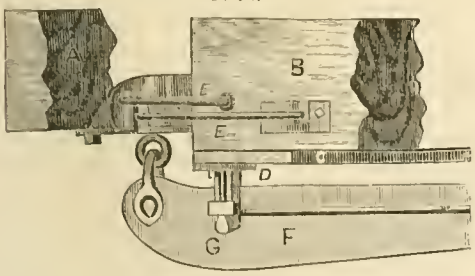
Fig. 5.



Howe Railroad Scales.

At a suitable distance from the just-mentioned extremity of the lever are knife-edged bearings G; an iron casting D extends downward from the platform B, and, passing astride of the lever F, rests on the knife-edges G at each side of said lever. If, now, the load to be weighed could be dropped vertically upon the platform B, this arrangement would be sufficient; but in practice the load is drawn in wagons or cars, as the case may be, upon the platform, and on striking the edge of the latter gives it a positive lateral movement which tends to make the casting D scrape upon the knife-edges G; and this dulls the knife-edges and impairs the accuracy of the apparatus. In order to prevent this lateral movement of the platform B, check-rods E are extended from the fixed frame timber A to the platform, and are designed to resist the lateral strain exerted thereon by the passage of the load thereto. If these check-rods by the swelling of the timber or the rusting of the rods themselves should be deranged in any way, they are liable to bind and impair the reliability of the scale. In the Howe scale the check-rods are dispensed with, and perfect freedom secured to the platform without involving the frictional movement or scraping of the casting D upon the knife-edge. This is done, as shown in the figure of Howe's platform bearing and railroad scale by

Fig. 6.

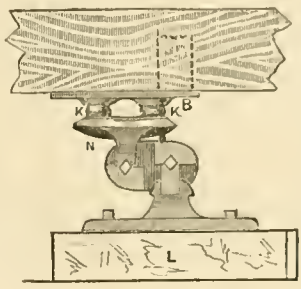


Fairbanks Platform Bearing.

making the main levers A of elbow shape, their upper ends connecting by rods with the centre levers E, from which, through a supplemental lever F and rods G, motion is communicated to the beam. The lower ends of the elbow-levers A (the form of which is shown in the larger view) have knife-edges resting on chilled iron blocks, these knife-edges forming the fulcra of the said levers. The short arms of these levers have knife-edges, which receive the bearings of the casting N. In the upper side of the casting N are two shallow cup-shaped recesses which receive the balls or spheres K, and on these rest the cupped bearings B, fastened to the timber of the platform. The centre levers, E, of course work on knife-edges. When the load strikes the edge of the platform, the movement of the latter simply causes it to sway slightly on the spheres, and this is immediately corrected by the gravity of the platform itself, there being absolutely no grating of the knife-edges on their bearings, inasmuch as the lateral motion of the platform cannot be transmitted to them, all need of check-rods, as herein just mentioned, being dispensed with. By the peculiar arrangement, moreover, of the levers, the number of knife-edges is reduced from eighty to thirty-nine.

The modifications of weighing apparatus to suit the exigencies of various branches of traffic are very many—some in practical and every-day use, others as yet only theoretical. Among the former is the common weighmaster's frame, in which an ordinary scale or steelyard is suspended on a portable frame from the short arm of a lever, by which the scale can be lowered bodily for adjustment to a cask or other article to be weighed, and then lifted clear of the floor to permit the weighing operation. A recent invention for use in charging blast furnaces, and designed to permit the employment of the most illiterate operatives, is made with a beam having three separate scales or indexes, one for coal, one for ore, and one for the flux; the adjustable poises of each scale are capable of being fixed at any desired point along the same; and to each scale, or to the poise thereof, is attached a sample of the material which that particular scale or index of the beam is designed for weighing; thus a piece of ore is suspended from the scale for weighing ore, from the fuel scale a piece of coal, and from the flux scale a lump of lime, these being held in suitable holders depending from the scales, which latter form parts of one beam. Cranes for lifting and subsequently weighing ponderous bodies have been made, and appear to have been first proposed by two English projectors about forty years ago. Various contrivances for the automatic weigh-

Fig. 7.



Howe Platform Bearing.

Fig. 8.

Weighmaster's Frame for Steelyard Scale.

ing of materials passing through the apparatus have been projected, but none, so far as the writer knows, have come into any extended use. Among these was an English invention for automatically weighing cotton as it comes from the openers or scutchers preparatory to spinning, the cotton being carried by an endless belt, and thence between rollers which conduct it to a receptacle mounted on levers arranged as part of a weighing-machine; when the accumulated cotton reached a certain limit of weight, its action upon the levers was calculated to bring into operation mechanism for stopping the supply until the receptacle was emptied. Another automatic weighing-machine, which embraces the principle of the well-known gravity water-meter, is intended for automatically weighing grain, the grain passing to a box or hopper, which as soon as a certain weight is reached tilts and empties the box into a conduit which conducts it to the bin.

Previous to the year 1875, 119 different weighing-machines were patented in the U. S., the earliest of which was granted May 10, 1811, to F. Armat of Philadelphia for an apparatus for weighing hay, live cattle, etc. On Jan. 6, 1830, E. Cady secured a patent on a machine for weighing a boat and cargo; this was called a tonnage-meter, and the following year D. Loring patented a machine for weighing canal-boats, loaded wagons, etc. Among other curiosities may be mentioned one patented in 1858 which comprises a weighing mechanism for coal-carts.

JAMES A. WHITNEY.

Weightman (ROGER C.), b. at Alexandria, Va., in 1786; became a printer at Washington, D. C., and was at one time Congressional printer; served as an officer of cavalry in the war of 1812–15; became a general of District of Columbia militia; was mayor of Washington 1824–27; became cashier of the Bank of Washington 1827; was for many years librarian of the patent office, and during the civil war had command of the troops quartered in that edifice. D. at Washington Feb. 2, 1876.

Weight of a Body, the resultant action of the force of gravity on all of its particles.

Weight of Observations. If several observations are made for the purpose of determining the value of a required quantity, it may happen that some of these are more reliable than others, in which case they are said to have greater *weight*. The weight of an observation is a number which expresses the degree of its reliability. Let us suppose that n observations are made, giving results that may be denoted by a, a', a'', etc., and let the corresponding weights be represented by the numbers c, c', c'', etc. If we now take the symbol Σ to denote *the algebraic sum of homologous quantities*, it may be shown that the expression $\frac{\Sigma(ca)}{\Sigma(c)}$ is more likely to be the true value of the quantity sought than the result obtained by the ordinary method of average. The numbers c, c', etc. are often assigned by the observer at the moment of observation, and are intended to express the relative degree of confidence which he has in the several observations. This method of weighting observations is purely arbitrary, and should be employed with great caution.

The term *weight* is also applied to a function which is often used in computing the *probable error* of a result obtained by combining several observations. This function depends on the theory of probabilities. In accordance with this theory, the weight is equal to *the square of the number of observations divided by twice the sum of the squares of the residual errors*. The residual errors are found by subtracting each result of the group from the arithmetical mean of all the results. The probable error is equal to the number .476936 divided by the square root of the weight. By the term *probable error* we mean a quantity such that there is the same probability of *the difference between the result obtained and the true result* exceeding or falling short of it. Thus, if 31 observations have been made for the determination of the longitude of a place, giving a mean result equal to $2m.\ 43.49s.$, and if it is an even chance that the error of this result (either in excess or in defect) is less than $0.029s.$, then the probable error is $0.029s.$, and the result is written $2m.\ 43.49s. \pm 0.029s.$

The method of computing the weight and the probable error of the arithmetical mean may be illustrated by an example taken from Brunnow's *Spherical Astronomy*, p. 53: On the 21st of May the difference of longitude between the observatory at Ann Arbor and the Lake Survey station was determined by telegraph, 31 stars being observed at both stations. The mean value of the longitude thus obtained was $2m.\ 43.49s.$; the sum of the squares of the differences between this result and each of the individual results was found to be 1.77. From these data we find the weight of the mean result equal to $\frac{31}{2 \times 1.77}$, or to 271.47, and the probable error equal to $\frac{0.476936}{\sqrt{271.47}}$, or to $0.029s$. The weight of the result of a single observation of a group is equal to the weight of the mean results *divided* by the square root of the number of observations, and the probable error of the result of a single observation is equal to the probable error of the mean result *multiplied* by the square root of the number of observations. Thus, the weight of the result of a single observation in the case just considered is $271.47 \div \sqrt{31}$, or 48.48, and the probable error of a single result is $0.029s. \times \sqrt{31}$, or $0.16s$.

W. G. PECK.

Weights and Measures. See APPENDIX.

Weights, Atomic. Those proportions of different chemical species of matter which enter definitely into chemical reactions and combinations—which, chemically speaking, saturate each other or are *equivalent* to each other—are found to have definite *centripetal* tendencies or weights. Dalton originated the hypothesis—upon his noble discovery, made in the first years of the nineteenth century, of the law of multiple combining proportions—that these definite centripetal tendencies of chemical equivalents were simply those of the *atoms of matter*, and that, therefore, each chemical element must have a certain numerical ratio representing the proportional force with which its atom tends to the centre of the universe, which he called its *atomic weight*. The Daltonian hypothesis is among the grandest generalizations of the human intellect, and its author's name is written among the highest upon the rolls of science. (See CHEMISTRY for some account of Dalton's discoveries.)

HENRY WURTZ.

Weights, Chemical. In chemical operations the use of the French or metric system of weights (see GRAMME and METRIC SYSTEM) is almost exclusively adopted. For ordinary analytical purposes a set of weights extending from 1 milligramme to 50 grammes is sufficient. The series commonly met with comprises the following weights: three *riders* (see WEIGHING, CHEMICAL), three of .001, one of .002, one .005, two of .01, one of .02, one of .05, three of .1, one of .2, one of .5, three of 1., one of 2., one of 5., two of 10., one of 20., and one of 50. The weights above 1. gramme are made of brass, preferably, plated with gold; those below are usually formed of flat squares of platinum, bent up at one corner. With the exception of the milligrammes, each weight has its value indicated upon it. The entire set is preserved from the action of acids and the air by being enclosed in a small wooden case, the platinum weights being also protected by a glass cover. Notwithstanding this precaution, weights invariably become somewhat tarnished in time, but the error caused by this fact is too slight to seriously affect their accuracy, and is, moreover, more than equalized by the loss proceeding from wear. The weights should never be touched with the fingers, but always taken from the case with a small ivory-tipped forceps, and all cleaning should be confined to dusting them with a camel's-hair brush. A new set of weights should always be carefully tested by weighing against each other; thus, a 2. grm. weight should exactly counterbalance two 1. grm.; a 5. grm., one 2. grm. and three 1. grm., etc.; or one 1. grm. is exactly balanced by a *tare* of tin-foil, and then successively replaced by the other simple grammo weights and their equivalents of the smaller denominations. In ASSAYING (which see) a system of weights especially adapted to the results required—expressing the value of the alloy tested in thousandths of the arbitrary weight taken—is usually employed.

J. P. BATTERSHALL.

Weights, Measures, and Moneys, Metric System of. See METRIC SYSTEM, by PRES. F. A. P. BARNARD.

Weil (GUSTAV), b. at Sulzburg, Baden, Apr. 21, 1808, of Jewish parentage; studied first Jewish theology at Metz, then classical and Oriental philology at Heidelberg and Paris; resided 1830–36 in Algeria, Constantinople, and Cairo; was appointed assistant librarian at the University of Heidelberg in 1836, and professor of Oriental languages in 1845. He translated into German the *Arabian Nights* (4 vols., 1837–41) and the *Life of Mohammed* by Abd-el Malik ibn Hischam (2 vols., 1864), and wrote—*Mohammed der Prophet* (1843), *Historisch-kritische Einleitung in den Koran* (1844), *Geschichte der Khalifen* (5 vols., 1846–62), and *Geschichte der islamitischen Völker von Mohammed bis zur Zeit des Sultans Selim* (1866).

Wei'len (JOSEPH), b. at Tetin, Bohemia, Dec. 28, 1828; studied at Prague and Vienna; served in the Austrian army in Hungary in 1848, and was appointed professor of history and geography at the engineering academy of Znaim in 1852, professor of the German language and lit-

orature at the military academy in Vienna, and custodian at the imperial library in 1861. His poems, *Phantasien und Lieder* (1853) and *Männer vom Schwerte* (1851), attracted some attention, and several of his dramas had still more success—*Tristan* (1860), *Edda* (1865), *Drahomira* (1867), *Graf Horn* (1870), and *Der neue Achilles* (1872).

Wei'mar, town of Germany, capital of the grand duchy of Saxe-Weimar, on the Ilm, is a quiet, neat, and friendly place, though rather indifferently built, and not containing any eminent edifices. It has no manufactures and no trade, but several good educational and scientific institutions, and the whole atmosphere is, so to speak, impregnated with the remembrance of Goethe, Schiller, Herder, and Wieland, and the life the town witnessed when these men resided here; and this, its old fame, and the monuments and relics which it contains, attract annually a great number of visitors. P. 15,998.

Weimar, DUKE OF. See BERNHARD.

Wein'heim, town of Germany, grand duchy of Baden, is celebrated for its leather manufactures and its excellent wine. P. 6130.

Weins'berg, small town of Würtemberg, formerly a fine imperial city, on the Neckar, in the centre of a beautiful valley, and surrounded with vineyards and orchards, is famous for the siege which Count Welf (or Guelph) sustained here in 1140. Irritated by the desperate resistance which he had met from the besieged, the emperor Conrad III. ordered that all the men in the town should be put to death, and only the women were allowed to leave the place with what property they could carry along with them. On the day of surrender the women then marched out carrying their husbands on their backs. In the parish church is a picture of 1659 representing the event. P. about 3000.

Weir (HARRISON WILLIAM), b. at Lewes, England, May 5, 1824; was apprenticed to a wood-engraver at London; gave great attention to natural history and studied water-color painting; was one of the original members of the Society of Painters in Water-Colors; became noted for his wood engravings of animals in the *Illustrated London News*, the *Children's Friend*, and the *Band-of-Hope Review*, and by his illustrations to several books on natural history, and is author of *The Poetry of Nature* (1865), *Funny Dogs with Funny Tales*, *The Adventures of a Bear*, and other highly-successful juvenile works illustrated by himself.

Weir (ROBERT WALTER), b. at New Rochelle, N. Y., June 18, 1803; became a successful painter at the age of nineteen; studied three years in Italy, returning 1827; was professor of perspective in the National Academy of Design 1830–31; succeeded Charles R. Leslie as instructor in drawing at West Point 1834, and has been full professor there since 1846. Among his best-known works are the *Embarkation of the Pilgrims*, in the rotunda of the Capitol at Washington; *Indian Captives*, in the Athenæum at Boston; *View of the Hudson from West Point*, *Pæstum by Moonlight*, *The Landing of Hendrick Hudson*, and *Columbus before the Council of Salamanca*.—His son, JOHN FERGUSON WEIR, has been since 1869 professor of painting and design in the Yale College School of Fine Arts.

Weis'bach (JULIUS), b. near Annaberg, Saxony, Aug. 10, 1806; studied at Freiberg, Göttingen, and Vienna; travelled much in the Austrian countries to investigate their mines, and was appointed professor of mathematics in 1833 at the academy of Freiberg, where he d. Feb. 24, 1871. His *Versuche über den Ausfluss des Wassers durch Schieber, Hähne, Klappen und Ventile* (1842), and *Versuche über die unvollkommenen Contraction des Wassers beim Ausfluss desselben aus Röhren und Gefässen* (1843) were of great importance for the science of hydraulics. His *Lehrbuch der Ingenieur- und Maschinen-mechanik* (3 vols., 1845–51) has been translated into English by L. Gordon (London, 1847–48) and by W. R. Johnson (Philadelphia, 1849). He also wrote *Handbuch der Bergmaschinen-mechanik* (2 vols., 1835–36), *Die neue Markscheidekunst* (2 vols., 1850–59), *Der Ingenieur* (1848; often republished), and *Experimentalhydraulik* (1855).

Weis'haupt (ADAM), b. at Ingolstadt, Bavaria, Feb. 6, 1748; studied law in his native city, and was appointed professor there in 1772. He acquired great reputation as a teacher, but came into controversy with the Jesuits, and was dismissed from his office in 1785; went to Gotha, and d. there Nov. 18, 1830. He was the founder of the society of the ILLUMINATI (which see), and most of his writings relate to this subject: *Apologie der Illuminaten* (1786), *Das verbesserte System der Illuminaten* (1787), *Pythagoras oder Betrachtung über die geheime Welt- und Regierungskunst* (1790), *Materialien zur Beförderung der Welt- und Menschenkunde* (3 vols., 1810), *Ueber Staatsausgaben* (1820), *Ueber das Besteuerungssystem* (1820).

Weiss (JOHN), b. in Boston, Mass., June 28, 1818; was taught at Chauncy Hall School and Framingham Academy; graduated from Harvard College in 1837; taught at Chauncy Hall and Jamaica Plain; entered the Cambridge Divinity School in 1840; passed the winter of 1842–43 in Heidelberg, Germany; was graduated from the Divinity School, and settled in Watertown in 1843; withdrew on account of strong anti-slavery opinions, and went in 1847 to New Bedford; left soon by reason of ill health; spent some years in repose, quiet study, and travel; was minister again in Watertown 1859–70; retired in order to devote himself to literature; published in 1845 a translation of Schiller's philosophical and æsthetic essays, *Æsthetic Prose*, preface to an American edition of Smith's *Memoir of Fichte* (1846), *Life and Correspondence of Theodore Parker* (1864), *American Religion* (1871); has written and delivered courses of lectures on Greek religious ideas, humor in Shakspeare, Shakspeare's women; and was author of numerous magazine articles, reviews, lectures, sermons, discourses, literary, biographical, social, political—all stamped with singular originality of thought, intense feeling, and humanity of purpose. Mr. Weiss was one of the leading disciples of the Transcendental philosophy, an ardent abolitionist in the days of slavery, a zealous champion in the cause of woman's political emancipation, and an apostle of rationalism in religion. D. in Boston, Mass., March 9, 1879. O. B. FROTHINGHAM.

Weis'senburg, town of Alsace-Lorraine, at the foot of the Vosges, 32 miles N. E. of Strasbourg. While under French dominion it was strongly fortified, but it was taken by the Germans Aug. 4, 1870, and its fortifications were razed. P. 5886.

Weissenburg, p.-v. and tp., Lehigh co., Pa. P. 1644.

Weis'senfels, town of Prussia, province of Saxony, on the Saale, in a beautiful district rich in vineyards, has several cotton-spinning and weaving factories, and manufactures tobacco, porcelain, and articles of silver and gold. In one of its churches are the remains of Gustavus Adolphus. P. 15,443.

Weiss'kirchen, town of Austria, Military Frontier, is beautifully situated on the Nera, surrounded with orchards and vineyards, and has several silk-throwing and spinning factories. P. 6587.

Weisskirchen, town of Austria, in Moravia, has large dyeworks, cloth manufactures, and trade in wool. P. 5970.

Weiss'port, p.-b., Carbon co., Pa. P. 359.

Weit'zel (GODFREY), b. at Cincinnati, O., Nov. 1, 1835; graduated at the U. S. Military Academy July, 1855, when appointed brevet second lieutenant of engineers; as assistant to Capt. Beauregard he was employed in the construction and repairs of fortifications about New Orleans until 1859, when transferred to West Point as assistant professor of engineering; in Jan., 1861, was ordered to duty with Co. A, Engineers; served in the defence of Fort Pickens Apr.–Sept., 1861; was chief engineer department of the Ohio Oct.–Dec., 1861. In the organization of Gen. Butler's expedition to New Orleans, Weitzel, being familiar with the forts and surrounding country, was selected as chief engineer. He planned the capture of New Orleans, and on its fall was appointed acting military commander and mayor of the city. Commissioned brigadier-general of volunteers Sept. 16, 1862, he cleared the enemy from the La Fourche district, the battle of Labadieville occurring Oct. 27. Remained in possession of the district until Apr., 1863, when, dispersing the enemy, he joined his force to that besieging Port Hudson, and during the siege was in command of a division, and upon its surrender was placed in command of the 1st division of the 19th corps and ordered to Donaldsonville; engaged in the expedition to Sabine Pass. In Apr., 1864, he was ordered to Virginia, and made chief engineer of the Army of the James, as such constructing the defences of Bermuda Hundred and Deep Bottom, and in command of 2d division of 18th corps was engaged in the various operations of that army, including the actions near Drury's Bluff; in command 18th corps in the repulse of the enemy at Fort Harrison. In Nov., 1864, he was promoted to major-general, and in December was placed in command of the 25th corps. In that month he accompanied Butler's unsuccessful expedition to Fort Fisher as second in command. The troops N. of the Appomattox were assigned to his command in Mar., 1865, and on the morning of Apr. 3 he took possession of the city of Richmond. Commanded a military district in Texas Apr., 1865, to Mar., 1866, when mustered out of the volunteer service. Brevet major for gallantry at Thibodeaux; lieutenant-colonel for Port Hudson; colonel for Fort Harrison; brigadier and major general for gallant and meritorious services during the rebellion. Returning to duty with his corps, in which he attained a majority Aug., 1866, he has

since been engaged on important engineering work in connection with the Louisville and Portland Canal, St. Mary's Falls Canal, improvement of the falls of the Ohio, etc., and on lighthouse construction.

Wel'born, tp., Conway co., Ark. P. 1275.

Wel'by (Amelia B. **Coppuck**), b. at St. Michael's, Md., Feb. 3, 1819; removed with her parents to Kentucky in childhood; resided at Lexington and at Louisville; was married to a merchant of the latter city, Mr. George B. Welby, in 1838; began in 1837 to contribute poems to the Louisville *Journal* over the signature of "Amelia," which were highly praised by Prentice and Griswold, and obtained for her a considerable reputation. They were collected into a volume which was published at Boston 1844, passed through several editions, and was issued at New York (1850), with illustrations by R. W. Weir. D. in Louisville, Ky., May 3, 1852.

Welch, tp., Cape Girardeau co., Mo. P. 589.

Welch (Moses Cook), D. D., b. at Mansfield, Conn., 1754; graduated at Yale College 1772; was at first a teacher; studied law, and afterward theology; served in the army of the Revolution, and was minister of Mansfield from June 2, 1784, until his death, Apr. 21, 1824. He was associated with (Rev. Dr.) Samuel Nott in the early part of the Revolution in making saltpetre for the supply of the army with powder, and a pioneer explorer of Western New York; was the teacher of Eleazar Williams (called the dauphin of France), and a very effective preacher. He published many single sermons.

Welches, tp., Macon co., N. C. P. 546.

Welches Creek, tp., Columbus co., N. C. P. 818.

Weld, Wold, or **Dyer's Weed** [Lat. *Reseda luteola;* Fr. *gaude;* Ger. *Gelbkraut* or *Wau*], an annual herbaceous plant, often growing wild, which is a native of the southern parts of Europe, but has been naturalized in the U. S. It contains a yellow coloring-matter termed luteoline ($C_{20}H_{14}O_8$) which is highly esteemed for its durability, and ranks among the vegetable dyes next to the Persian berry. Luteoline is extracted from the plant by treatment with boiling water; it is more soluble in alcohol and in ether; when heated it sublimes and condenses in yellow needles; it furnishes yellow lakes with plumbic acetate, alum, and stannous chloride, and is extensively used for imparting a gold color to silks and for paper-staining. The entire plant is also employed for dyeing purposes in Europe, including England (especially in Kent), but its consumption has greatly diminished since the introduction of quercitron. In preparing baths from weld the exhausted plant should be removed from the liquid, and the latter used as soon as possible, as its decoction speedily undergoes decomposition on exposure to the air. J. P. Battershall.

Weld, county of N. E. Colorado, bordering on Nebraska and Wyoming, watered by the South Platte and its affluents, and crossed in the W. part by Denver Pacific R. R. The surface is an elevated plain, scantily wooded, but with much coal and iron ore; soil very productive when irrigated. Sheep and cattle are the principal live-stock. Staples, oats, Indian corn, wheat, hay, and wool. Cap. Greeley. Area, about 11,000 sq. m. P. 1636.

Weld, p.-v. and tp., Franklin co., Me. P. 1130.

Weld (Angelina Emily **Grimké**), wife of Theodore Dwight Weld, and sister of Thomas Smith and Sarah Moore Grimké, b. at Charleston, S. C., Feb. 20, 1805; became a resident of Philadelphia, where, with her sister Sarah, she joined the Society of Friends 1828, and emancipated a number of slaves whom they inherited from their parents 1836; was also associated with her sister in delivering public addresses against slavery in New England and New York, and achieved great success by her eloquence, which was then a novelty in the U. S., and had an important bearing upon the rise of the "woman's rights" movement, and was joint authoress, with Sarah, of *An Appeal to the Christian Women of the South* on the subject of slavery. She was married to Theodore D. Weld May 14, 1838.—Her sister, Sarah Moore Grimké, b. at Charleston, S. C., Nov. 26, 1792; d. at Hyde Park, Mass., Dec. 23, 1873.

Weld (Charles Richard), b. at Windsor, England, in 1818; educated at Dublin; studied law at the Middle Temple; was called to the bar 1841; was assistant secretary to the Royal Society 1845–61, district superintendent of the International Exhibition of 1862, assistant British commissioner to the Paris Exposition 1867, partner with Lovell Reeve in the publishing business since 1861; was a friend and literary assistant of Sir John Franklin, and brother-in-law of the poet Tennyson. D. at Bath Jan. 15, 1869. Author of a *History of the Royal Society, with Memoirs of the Presidents* (2 vols., 1848), *A Vacation Tour in the U. S. and Canada* (1855), and other similar *Tours* in Ireland, Scotland, Brittany, Burgundy, and Italy; also of various other works.

Weld (Horatio Hastings), b. at Boston, Mass., in 1811; became a practical printer; edited newspapers in Lowell, Boston, New York, and Philadelphia, and took orders in the Protestant Episcopal Church 1845. Author of *Corrected Proofs, a Volume of Sketches* (1837), *Life of Christ* (1850), *Scripture Quotations* (1851), and *Sacred Poetical Quotations* (1851), and edited Franklin's *Autobiography* (1849), *The Sacred Annual* (1851), *The Women of the Scriptures, Scenes in the Lives of the Apostles,* and *Scenes in the Lives of the Patriarchs and Prophets.*

Weld (Isaac), brother of Charles Richard, b. at Dublin in 1774; travelled extensively in Europe and America, and was for many years secretary and vice-president of the Royal Dublin Society. D. in 1856. Author of *Travels through the States of North America,* etc. (1799), a work which was translated into several languages, and was long regarded as of standard authority; *Illustrations of the Scenery of Killarney* (1807), and *A Statistical Survey of the County of Roscommon* (1832).

Weld (Lewis), b. in Hampton, Conn., Oct. 17, 1796; graduated at Yale College in 1818, when he became teacher in the American asylum for the education of the deaf and dumb; in 1830, upon the resignation of Mr. Gallaudet, was appointed his successor; as chief executive officer sustained himself in the performance of its varied responsibilities with honor to himself and to the satisfaction of the board of directors for nearly twenty-three years. During a few of the last years of his life he was oppressed with chronic infirmities. D. Dec. 30, 1853.

Weld (Theodore Dwight), b. at Hampton, Conn., Nov. 3, 1803; educated at Hamilton College; studied theology at Lane Seminary, Cincinnati, O.; headed the secession of most of the students of that institution to Oberlin on account of the suppression of an anti-slavery society by the board of trustees; became an anti-slavery lecturer, but losing his voice in 1836, took the post of editor of the publications of the American Anti-Slavery Society; wrote many pamphlets against slavery, and several volumes, among which were *The Bible against Slavery, Slavery as it Is,* and *The Power of Congress over the District of Columbia;* spent several sessions at Washington 1841–43, working in connection with the anti-slavery members of Congress; established in 1854 a school of a high class at Eagleswood, N. J., in which colored pupils received especial attention, and in 1864 removed to Hyde Park, near Boston, where he has since resided, devoting himself chiefly to lecturing.

Weld (Thomas), b. in London, England, Jan. 22, 1773; was the eldest son of Thomas Weld, a wealthy Roman Catholic who was the founder of Stonyhurst College, Lancashire; succeeded in 1810 to the ancestral estates at Lullworth, Dorsetshire; lost his wife 1815; became a Roman Catholic priest 1821, giving up the family estates to his next brother; was employed at Chelsea and Hammersmith; was created coadjutor bishop of Kingston, Upper Canada, and bishop of Amyclæ *in partibus infidelium* Aug. 6, 1826, but never proceeded to Canada; went to Rome with his daughter, Lady de Clifford, 1829; was created a cardinal by Pope Pius VIII., and d. at Rome Apr. 19, 1837. (See Cardinal Wiseman's *Recollections of the Last Four Popes.*)

Welde (Thomas), b. in England about 1590; graduated at Trinity College, Cambridge, 1613; took orders in the Church of England; was for some years minister of a church at Farling, Essex; being molested as a Puritan by the ecclesiastical authorities, emigrated to New England; arrived at Boston June 5, 1632; was ordained the following month as first minister of the church of Roxbury; received in November as a colleague the celebrated John Eliot; took a prominent part at the trial of Mrs. Anne Hutchinson as an opponent of her peculiar doctrines 1637; was associated with Eliot and Richard Mather in 1639 in making the translation of the Psalms known as the "Bay Psalm-Book" (*The Whole Book of Psalms faithfully translated into English Metre,* Cambridge, 1640), which was the first volume printed in New England; was sent with Hugh Peters to England in 1641 as agent for the colony—a post he filled until 1646, when he was dismissed and requested to return, but remained in England; was afterward pastor of a church at Gateshead, near Newcastle-upon-Tyne; accompanied Lord Forbes to Ireland, and resided there some time; subsequently returned to England, and was ejected from his living for nonconformity 1662. D. Mar. 23, 1662. He published *A Short Story of the Rise, Reign, and Ruin of the Antinomians, Familists, and Libertines that infected the Churches of New England* (London, 1644; 2d ed. 1692), a celebrated tract of which another shorter version, *Antinomians and Familists condemned,* etc. (1644), appeared about the

same time, leaving it doubtful which is the original edition, and whether Gov. John Winthrop may not have been the chief author, as maintained by several antiquaries. It was answered by Rev. John Wheelwright in his *Mercurius Americanus*, etc. (1645). Welde also wrote a controversial tract, *An Answer to W. R. his Narrative of the Opinions and Practices of Churches lately erected in New England* (1644). —One of his sons, THOMAS, remained in New England (d. Jan. 17, 1683).—His grandson, THOMAS, b. in 1652, graduated at Harvard 1671, and was minister of Dunstable, Mass., from 1685 to his death, June 19, 1702. The latter was father of HANNAH, b. at Dunstable Sept. 2, 1702, graduated at Harvard 1723, was settled as pastor at Attleborough Oct. 1, 1727, was a notable preacher, and who survived until May 14, 1782.

Weld'ing, a term applied to a phenomenon exhibited by *iron, platinum*, and probably some other metals, consisting in the assumption at a certain temperature of a glutinous cohesion between surfaces, accompanied, in the case of iron, with a considerable degree of plasticity and viscosity. It is doubtful whether this character as manifested in iron differs in nature from the same character as assumed by semi fused shellac or sealing-wax. It is one of the most important properties, in a practical sense, of both iron and platinum, for without it neither of these valuable metals could be readily or cheaply obtained in large homogeneous masses. The process of puddling iron is founded on the welding cohesiveness produced at the heat of the puddling-hearth as the iron gradually loses its carbon and other contaminating impurities. The tool of the operative causes the particles of iron, as they gradually "come to nature," to cohere together gradually into a ball. The same remark applies to the processes of obtaining soft iron direct from the ore in bloomeries or Catalan forges. (See IRON.) Platinum is obtained in masses by forming it into sponge by chemical means, then compressing this into a cylinder, which, when heated highly and hammered, *welds* into a compact homogeneity. HENRY WURTZ.

Wel'don, tp., Benzie co., Mich. P. 74.

Weldon, p.-v., Halifax co., N. C., at the head of navigation on Roanoke River and on Petersburg Raleigh and Gaston, Seaboard and Roanoke, and Wilmington and Weldon R. Rs., 97 miles E. of Raleigh, contains good schools, 1 semi-weekly newspaper, and fine water-power. P. 208. MANNING BROS., EDS. "ROANOKE NEWS."

Weldon (Sir ANTHONY), BART., b. in England about 1590, became clerk of the kitchen to James I., whom he accompanied in his "progress" through Scotland in 1617, when he wrote a description of Scotland and its people which gave so much offence that he was dismissed from office with a pension. He survived until after 1655. He published *The Court and Character of King James* (1650) and *The Court of King Charles* (1651), both of which have been several times republished, and exhibit those monarchs in no favorable light. He left in MS. a *Brief History of the Kings of England, particularly those of the Royal House of Stuart* (1755).

Weldon (JOHN), b. at Chichester, England, about 1670; was a pupil of Henry Purcell in sacred music; was for some time organist of New College, Oxford; was appointed gentleman extraordinary of the chapel royal 1701, organist of the same 1708, and second composer to the court 1715; was at the same time organist of St. Bride's and of St. Martin-in-the-Fields; wrote several fine anthems, some pleasing songs, and part of the music to Congreve's *Judgment of Paris*. D. in 1736. His anthems *Hear my Crying* and *In Thee, O Lord!* are still favorites.

Wel'haven (JOHAN SEBASTIAN CAMMERMEIER), b. at Bergen, Norway, Dec. 22, 1807; studied at the University of Christiania; began to lecture on philosophy in 1840; was appointed professor in 1846, and d. Nov. 8, 1872. In 1832 he published *Henrik Wergelands Digtekunst og Character*, and thereby opened that memorable controversy which forms the introduction to the Norwegian literature. (See NORWEGIAN LANGUAGE AND LITERATURE.) In 1833 he founded the *Vidar*, a weekly paper, which in 1836 was transformed into a daily paper, the *Constitutionelle*, and in 1834 he published that book which became the centre of the whole contest, *Norges Dæmring*, a collection of poems, in which he attacked the prejudices and narrow tendencies of the awakening national spirit with merciless sarcasm, and unfolded his own wider views and loftier ideas. Another collection of poems, without any polemic tendency, appeared in 1851, and a third in 1863. He also wrote several valuable essays on the elder Danish-Norwegian literature. His collected works were published in 8 vols. in Copenhagen (1868).

Welker (MARTIN), b. in Knox co., O., Apr. 25, 1819; was admitted to the bar 1840; was clerk of Holmes co. court 1846–51 and judge of common pleas for the 6th district 1851–56; settled at Wooster, and was elected lieutenant governor as a Republican 1857; served in the early part of the civil war as judge-advocate; was assistant adjutant general of Ohio 1862, and superintended the draft in that State; was a delegate to the Philadelphia Loyalists' convention 1866; sat in Congress 1865–71, and was appointed in 1872 U. S. judge for the northern district of Ohio.

Well [Ang.-Sax. *weallan*, to "gush out"]. *Well*, like the German *Brunnen*, originally signified a natural flowing spring, and some mineral springs are still called wells. Living springs were the only sources of drinkable water known to primitive man, and though excavated wells are among the most ancient of human permanent constructions, they are too laborious, too costly, and require too great an amount of mechanical skill to have been executed until the arts had made a considerable progress, and social institutions were so far organized as to secure to individuals, or at least families or tribes, long enjoyment of the fields and the pastures of which they had taken possession. In pastoral life, and especially in the climates in which pastoral industry appears to have been first largely practised, water is the first requisite for the establishment of a camp or the temporary occupancy of feeding-grounds for cattle. The nomad Bedouins now rarely if ever dig wells. For their small herds the slender threads of living water found here and there in the desert, cisterns and pools accumulated from the winter rains, suffice, and in many of their habitual routes of travel they still find a supply of water in wells excavated, like those of Jacob and of Beersheba, in the patriarchal ages. Ancient writers speak of wells in the North African desert several hundred feet deep, and their accounts have been confirmed by modern travellers; but in a large part of that waste a continuous sheet of water exists at depths so moderate as to be easily reached by cutting through the bed of indurated sand which overlies it. The wells of the Sahara are square excavations, not walled up with stone, but lined with a framework of palm-trunks, and they yield an abundant supply of water for cattle and for irrigating the small gardens which Arab industry finds it convenient to till. The water often rises to the surface, and pours over like that in an artesian boring, and the wells are choked in a few years by fine sand brought up by the flow. The removal of the sand is a difficult and dangerous operation, as the work must be performed under water, and it is the special vocation of a sort of guild or corporation.

In the East, wells are generally round, but sometimes square, and when not cut through solid rock are generally stoned, as in Europe. In their present condition they are usually without a curb, the orifice being closed by a flat stone, and they are unprovided with any apparatus for raising the water, the traveller being expected to furnish his own rope and bucket. The Greek and Roman wells were provided with curbs, and it appears that these were used long before the general employment of sweeps or of pulleys for hoisting the bucket, for the edges of the most ancient curbs are everywhere cut into channels by the friction of the rope drawn over them, which would not be the case if the water-vessels had been attached to a sweep or to a rope passing over a pulley suspended from above.

In Europe, several apartments, sometimes fifteen or more, in different stories in the same house, often draw water from a common well in the court by the aid of an ingenious mechanical contrivance. Over the centre of the well, and two or three feet above it, a stout iron ring, of a diameter considerably smaller than the orifice of the well, is suspended by strong wires running from the ring to a window in each apartment to be supplied. A bucket is attached to a double pulley or block running on the wire, which carries it down to the ring, whence it is lowered into the water by slackening, and drawn up by hauling in the rope over the lower sheave, with very little labor.

The economical and sanitary value of water, and the frequent difficulty and expense of procuring it, gave wells great importance in the eyes of the ancient world, and those distinguished for purity or abundance of water were regarded with almost idolatrous reverence. Hence great care was bestowed upon their construction and preservation, and they were often sumptuously decorated and provided with many useful as well as ornamental accessories. Many ancient well-curbs of fine material and workmanship are found in museums of ancient art, and some of those in the Vatican—particularly one of marble, thought to be Etruscan—are among the most admirable works of sculpture in that great museum. In India, too, valuable wells are considered and treated almost as temples. Grant Duff, in his recent *Notes of an Indian Journey*, p. 33, speaks of "a famous well" at Ahmedabad, "an exquisite combination of galleries, pillars, and deep cool pools sunk beneath the soil." Of remarkable wells we may mention that in

the citadel at Cairo, traditionally ascribed to the patriarch Joseph. This is several hundred feet in depth, and is surrounded by a double winding ramp by which beasts of burden can descend and bring up water. There is a very similar well, though not of very ancient construction, at Orvieto. Among the most extraordinary, as well as deepest, excavated wells known is that at Scarpa, not far from Tivoli. According to Nibby and other writers, this well, which is in solid rock, circular and about nine feet in diameter, is above 1700 feet deep, but has seldom more than 18 feet of water in it. At what period it was excavated is quite unknown, and as it does not appear to be connected with any mining gallery or with any aqueduct, it is not easy to conjecture the purpose for which it was executed.

Persons of acute observation acquire by long practice a wonderful skill in detecting the *indicia* which point to the existence of water at accessible depths beneath the surface of the earth. Paramelle, a French priest of the last generation, though often at fault in his geology, is declared by high scientific authorities to have been infallible in practice; and he claims to have discovered and revealed more than 10,000 subterranean fountains in the course of a few years. (See Paramelle, *Quellenkunde* (12mo), and on ancient wells, Smith, *Dictionary of Greek and Roman Antiquities*, article "Puteal.") The ingenious and simple method of obtaining water by what is called the American well, consisting in driving a small iron tube, provided with a perforated hollow conical point of steel, a few feet into the ground and applying a hand-pump to the orifice, deserves special notice as an economical and speedy process which in many cases obviates the necessity of common wells altogether. (See WELLS.) GEORGE P. MARSH.

Wel'land, river of Ontario, Canada, an affluent of the Niagara, which it joins above the Falls after a course of about 60 miles, forms part of the Welland Canal, which connects Lake Erie with Lake Ontario.

Welland, county of Ontario, Canada, bounded S. by Lake Erie and E. by the river Niagara. It is level, and very productive of wheat and all kinds of farm products. It is traversed by various railroads and the Welland Canal. Cap. Welland. P. 20,572.

Welland, p.-v., cap. of Welland co., Ont., Canada, on Welland River, Railway, and Canal, and on Canada Southern Railway, 12 miles S. of St. Catharine's, has a fine water-power and 2 weekly newspapers. (Formerly called MERRITTSVILLE.) P. 1110.

Wellbeloved (CHARLES), D. D., b. at York, England, about 1770; became a Unitarian minister at his native place, and was noted for his philological and archæological attainments. D. at York in 1858. Author, among other works, of *Eboracum, or York under the Romans* (1842), and a translation of the Old Testament, of which the first portion (Genesis to Solomon's Song) appeared in 1838 (2 vols.), and again, along with other translations by Rev. George Vance Smith and Rev. John Scott Porter, under the title *The Holy Scriptures of the Old Covenant, in a Revised Translation* (3 vols., 1859–62). A *Memoir* (1860) was written by Rev. John Kenrick.

Wel'ler, tp., Henry co., Ill. P. 1560.

Weller, tp., Richland co., O. P. 1140.

Weller (JOHN B.), b. in Ohio about 1812; was a Democratic member of Congress 1839–45; was lieutenant-colonel of Morgan's Ohio regiment in the Mexican war, and became its commander on the death of Col. Morgan at the battle of Monterey; was the first commissioner to Mexico under the Treaty of Guadalupe Hidalgo 1848; settled in California 1849; was U. S. Senator 1851–57, governor of California 1858–60, minister to Mexico 1860–61, and delegate to the national Democratic convention at Chicago 1864. D. at New Orleans, La., Aug. 17, 1875.

Wellersburg, p.-b., Somerset co., Pa. P. 290.

Welles (EDWARD R.), D. D., b. at Waterloo, N. Y., about 1834; graduated at Hobart College; studied theology under Rev. Dr. Wilson; took orders in the Protestant Episcopal Church about 1857; was many years minister of the Episcopal church at Red Wing, Minn., the most important parish of the State; was long an active member of General Conventions, and was consecrated bishop of Wisconsin Oct. 25, 1874.

Welles (GIDEON), b. at Glastonbury, Conn., July 1, 1802; educated at the Episcopal academy at Cheshire and at Norwich University; studied law under Judges Williams and Ellsworth; editor and proprietor of the Hartford *Times*, a Democratic paper, 1826–37; supported the candidacy of Gen. Jackson for the Presidency; was a member of the legislature 1827–35; postmaster of Hartford 1836–41; State comptroller 1842–46, and chief of a bureau in the navy department 1846–49; was an original member of the Republican party, and chairman of the Connecticut delegation at the Chicago convention, where he was influential in securing the nomination of Lincoln for the Presidency; was secretary of the navy through the administrations of Lincoln and Johnson; wrote largely for the press, and contributed a valuable series of war-memoirs to the *Galaxy* magazine (1875–76). D. in Hartford, Conn., Feb. 11, 1878.

Welles (NOAH), D. D., b. at Colchester, Conn., Jan. 23, 1718; graduated at Yale College 1741; taught a school at Hartford several years; was tutor at Yale 1745–46; studied theology; was ordained pastor of the Congregational church at Stamford, Conn., Dec. 31, 1746; took an active part in the polemic concerning the validity of non-episcopal ordination 1763, publishing three pamphlets on the subject, and printed other single sermons and addresses. D. at Stamford Dec. 31, 1776.

Welles'ley, p.-v., Norfolk co., Mass.

Wellesley (ARTHUR). See WELLINGTON.

Wellesley (HENRY), D. D., F. S. A., b. in 1792, son of the Marquis Wellesley by his first wife, Mlle. Hyacinthe Gabrielle Roland (d. 1825), but deemed illegitimate in English law because born before the marriage of his parents; graduated at Christ Church, Oxford, 1816; took orders in the Church of England; became rector of Woodmancote, Hurstmonceaux, Sussex, 1838, and principal of New Inn Hall, Oxford, 1837, and was subsequently select preacher to the University of Oxford, curator of the Bodleian Library, of the university galleries, and of the Taylor Institution; was an accomplished scholar in the classical and modern languages, also in the fine arts and archæology, having been a member of the Sussex Archæological Society from its formation, and a leading contributor to its volumes. D. at Oxford Jan. 11, 1866. Author of *Anthologia Polyglotta, or a Selection of Versions in Various Languages, chiefly from the Greek Anthology* (1849), *Stray Notes on Shakspeare* (1865), and of the part relating to Italian and majolica ware in Marryat's *History of Pottery and Porcelain* (1851).

Wellesley (RICHARD COLLEY), MARQUIS WELLESLEY, K. G., D. C. L., and earl of Mornington, brother of the first duke of Wellington, b. at Dublin, Ireland, June 20, 1760; educated at Eton and at Christ Church, Oxford; distinguished himself in oratory and in Latin versification; succeeded, on the death of his father in 1781, to the titles of Viscount Wellesley and earl of Mornington, and took his seat in the Irish House of Peers; was obliged to sell the family estates to discharge the pecuniary obligations of his father; was one of the original knights of St. Patrick 1783; was elected to the British House of Commons for Beeralston 1785, and for Saltash 1786, but was unseated on petition in the latter year; advocated in the Irish Parliament, during the regency debate of 1789, the restriction of the powers of the prince during the malady of the king; became, in consequence, a favorite of George III.; obtained an election from Windsor; was made one of the lords of the treasury, a member of the Irish, and subsequently (1793) of the British, privy council; gave especial attention to the affairs of India; was appointed an unpaid member of the board of control 1795; was raised to the House of Lords as Baron Wellesley, and appointed governor-general of India, Oct. 4, 1797; arrived at Calcutta May, 1798; found the native powers of India ripe for a struggle against British ascendency, to which they were incited by Bonaparte, who was then in possession of Egypt, was meditating an expedition to India, and had formed an alliance with the celebrated Tippoo, sultan of Mysore; sent a small British force into the territories of the nizam, ordering him to disband his levies and to surrender 124 French officers; despatched Gen. Harris with an army of only 20,000 men against the capital of Mysore Feb. 3, 1799, coming himself to Madras to superintend the operations, which resulted in the storming of Seringapatam and the death of Tippoo May 4; divided the territories of Mysore with the nizam, and made his brother, Col. Arthur Wellesley, governor of Seringapatam, July, 1799; was created Marquis Wellesley in the peerage of Ireland Dec. 2, 1799; received the thanks of Parliament, and refused £100,000 of prize-money offered by the East India Company; directed his attention with great success to the commercial interests and the internal organization of the British empire in India; made treaties with the nizam and the sultan of Muscat; took quiet possession of the territories of the nabob of the Carnatic in consequence of the treachery of that prince; effected the occupation by the British of the frontier provinces of Oude; concluded a treaty with the shah of Persia, which resulted in the fall of the celebrated Afghan conqueror Zemaum Shah, who had for years disturbed the W. of India by his formidable hordes; sent in 1801 a force of 7000 men, under Gen. Baird, up the Red Sea to co-operate with Gen. Sir Ralph Abercromby against the French in

Egypt; had a quarrel with the board of directors and tendered his resignation 1802, but was induced to withdraw it; engaged in a desperate but brilliant and victorious struggle with the Mahrattas 1803–05, signalized by the triumph of his brother at Assaye and of Lord Lake at Laswaree, the conquest of the whole country between the Jumna and the Ganges, the humiliation of Scindia and Holkar, and the submission of the rajah of Berar; built the viceregal palace at Calcutta; founded a college for the cultivation of Indian literature; inaugurated surveys of the country upon a vast scale and effected great financial reforms, making his administration the most memorable in Anglo-Indian history; returned to England Aug., 1805; was received with honor by the government and the East India Company, which conferred upon him an annuity of £5000, but was annoyed by the presentation in the House of Commons of articles of impeachment, which, however, were almost unanimously rejected; was ambassador in Spain 1808–09; secretary of state from Dec., 1809, to Jan., 1812; was designated as prime minister on the assassination of Mr. Perceval, May, 1812, but was unable to form a satisfactory cabinet; remained in opposition for the ensuing ten years, but rendered invaluable parliamentary support to his brother during the campaigns of the Peninsula and of Waterloo; accepted the office of lord lieutenant of Ireland under Canning Dec., 1821; was an advocate of the Roman Catholic claims, and attempted a policy of conciliation, but was obliged to have recourse to energetic measures to repress violent outbreaks; was recalled on the accession of his brother to the premiership 1828, owing to a difference of opinion between them on the "Catholic question;" was lord steward of the household under the Liberal government of Earl Grey 1830–31; a second time lord lieutenant of Ireland 1833–34, and lord chamberlain 1835, but resigned from public life the same year on account of advanced age and straitened circumstances, and was the recipient of a testimonial of £20,000 from the East India Company. D. at Kingston House, Knightsbridge, London, Sept. 26, 1842, and was buried, in compliance with his will, in the vault at Eton College chapel. Statues have been erected in London and at Calcutta. He was twice married, the second time Oct. 29, 1825, to Mrs. Patterson, an American lady (daughter of Richard Caton of Maryland, and granddaughter of Charles Carroll of Carrollton), but left no legitimate issue, and the marquisate became extinct at his death. The earldom went to his next brother, but afterward reverted to the duke of Wellington. He published several political pamphlets shortly before his death, and privately printed a small volume of poems in English, Latin, and Greek, entitled *Primitiæ et Reliquiæ* (1840; 2d issue 1841). His *Despatches, Minutes, and Correspondence, etc., during his Administration in India* (5 vols., 1836–37), and his *Despatches and Correspondence during his Mission to Spain* (1838), were edited by R. Montgomery Martin, and his *Memoirs and Correspondence* (3 vols., 1846) by Robert R. Pearce. PORTER C. BLISS.

Well'fleet, p.-v. and tp., Barnstable co., Mass. P. 2135.

Welling (JAMES C.), LL.D., b. at Trenton, N. J., July 14, 1825; graduated at Princeton 1844; settled in New York 1848; was for some years correspondent and literary editor of the *National Intelligencer*, its associate editor 1855–65, and its principal conductor during the war; visited Europe for his health 1866; was president of St. John's College, Annapolis, Md., 1867–70, professor of belles-lettres at Princeton 1870–71, and became president of Columbian College, Washington, D. C., Nov. 6, 1871. He has been a contributor to the *North American Review* and to other literary periodicals.

Wel'lington, city of New Zealand, capital of the province of the same name, and, since 1865, of the whole colony, is on an inlet of Cook's Strait, has an excellent harbor, and is connected by railway with Upper Hutt. It is well built, carries on a considerable trade, exporting wool, tallow, and gum, and had 10,507 inhabitants in 1875.

Wellington, town of England, Shropshire, has large smelting-furnaces, nailworks, and malt-houses. P. 5576.

Wellington, county of the W. central part of Ontario, Canada, has a soil generally fertile and well cultivated, and the manufacturing interests are thriving. It is traversed by divisions of the Grand Trunk and Great Western railways. Cap. Guelph. P. 68,289.

Wellington, port of entry of Prince Edward co., Ont., on a bay of Lake Ontario called West Lake, the seat of important fisheries. P. 517.

Wellington, p.-v., cap. of Sumner co., Kan., on the N. bank of Slate Creek, 12 miles W. of Arkansas River, has excellent schools, 1 bank, and 1 newspaper. The soil is adapted to the growth of wheat. The village was laid out in 1871. P. about 600.

JOHN H. FOLKS, Ed. "SUMNER COUNTY PRESS."

Wellington, p.-v. and tp., Piscataquis co., Me. P. 681.

Wellington, p.-v., Lafayette co., Mo.

Wellington, p.-v. and tp., Lorain co., O., on Cleveland Columbus Cincinnati and Indianapolis R. R., 35 miles S. of Cleveland, has 3 churches, a fine union school building, 1 bank, 1 newspaper, several large mills, and 2 hotels; it is the principal market for dairy products in Ohio, the shipment of cheese alone amounting to 10,000,000 pounds annually. P. of v. 1281; of tp. 1891.

J. C. ARTZ, Ed. "ENTERPRISE."

Wellington, tp., Monroe co., Wis. P. 502.

Wellington (ARTHUR WELLESLEY), K. G., DUKE OF, b. at Dangan Castle, county Meath, Ireland, in Apr., 1769 (or, as some biographers allege, at Merrion Square, Dublin, May 1), was the third son of Garrett Wellesley or Wesley (as the name was then spelled), first Viscount Wellesley and earl of Mornington (d. 1781), who attained some distinction as a musical composer, his mother being Anne Hill Trevor, oldest daughter of Arthur, first Viscount Dungannon; received his earlier education at Eton College; spent six years (1781–87) in the military seminary at Angers, France, then under the direction of the celebrated engineer Pignerol; was rapidly pushed by family influence through the lower grades of the service, entering the army as ensign of the 73d Foot Mar. 7, 1787; was appointed lieutenant in the 76th Dec. 25, captain of the 58th Foot June 30, 1791, exchanged into the 18th Light Dragoons Oct., 1792, was promoted to major Apr. 30, and lieutenant-colonel of the 33d Foot Sept. 30, 1793; was elected to the Irish Parliament for the borough of Trim, where his family possessed preponderating influence, in the summer of 1790; was appointed aide-de-camp to the earl of Westmoreland, lord lieutenant of Ireland, 1791; saw his first field-service under the duke of York in the Netherlands in 1794, when, having obtained through his brother's influence the command of the 33d regiment, he embarked at Cork for Ostend (May); joined the main body of the army at Antwerp; commanded three battalions during the disastrous retreat of the British army through Holland Jan., 1795, conducting himself with credit in several sharp skirmishes with the French; was commissioned colonel May, 1796; embarked for India with his regiment the same year, arriving at Calcutta Feb., 1797; was placed in command of the subsidiary forces furnished by the nizam for the campaign against Tippoo Sultan 1799; bore a prominent part in the victory of Malluvelly; commanded the reserves in the trenches at the assault and capture of Seringapatam, May 4; was appointed governor of Mysore by his brother, the governor-general (see WELLESLEY, MARQUIS OF); waged a campaign against a celebrated Mahratta freebooter, Dhoondia Waugh, self-styled "the king of the two worlds," whom he defeated and killed Sept. 10, 1800; was named second in command to the expedition sent to Egypt 1801, but was prevented from embarking by illness; became major-general Apr., 1802; commanded the expedition against the Mahrattas, and restored the peishwa Apr.–May, 1803; besieged and took Ahmednuggur Aug. 8–12; entered Aurungabad Aug. 29; defeated Scindia at the decisive battle of Assaye, Sept. 23, and again at Argaum, Nov. 29; took the great fort of Gawilghur in December; concluded a treaty with Scindia Dec. 30, imposing upon him stringent conditions; was knighted and received the thanks of the king and Parliament 1804; arrived in England Sept., 1805; took part in Lord Cathcart's expedition to Hanover in November; married Lady Catharine Pakenham, second daughter of the third earl of Longford, Apr. 10, 1806; was elected to the British Parliament for Newport, Isle of Wight; became chief secretary for Ireland under the duke of Richmond Apr., 1807; had a command under Lord Cathcart in the expedition against Copenhagen, and negotiated the capitulation of that city Sept. 7, 1807; became lieutenant-general Apr. 25, 1808, and commander-in-chief of the forces sent to the Peninsula in June; sailed from Cork, and landed at Coruña in July, offering his aid to the Galicians for the expulsion of the French, but the offer being declined, he re-embarked; landed at Mondego Bay, Portugal, Aug. 1, and defeated Gen. Laborde at Roliça Aug. 17; was superseded in the chief command by Sir Harry Burrard Aug. 20; gained over Junot the brilliant victory of Vimeira Aug. 21; signed the armistice which led to the convention of Cintra Aug. 31; returned to England at the close of the year, and received the thanks of Parliament for Vimeira; resumed his seat in Parliament Jan., 1809; was again appointed to the chief command of the army in the Peninsula on the death of Sir John Moore, and arrived at Lisbon Apr. 22, 1809; succeeded in passing the Douro

in the face of the French army, and entered Oporto May 12; was appointed by the prince regent marshal-general of the Portuguese army the same month; defeated the French under Marshals Victor and Sebastiani in the great battle of Talavera, July 27–28, but was compelled by the non-co-operation of the Spanish army to fall back on Badajoz, crossing the Tagus at Arzobispo Aug. 4; received the thanks of Parliament; was created Baron Douro of Wellesley and Viscount Wellington of Talavera, with a pension of £2000, Sept. 4, 1809; fortified his famous triple lines of intrenchments, 30 miles in length, between the Tagus and the Atlantic, at Torres Vedras; repulsed Marshal Massena at Busaco Sept. 27, 1810; again occupied the lines of Torres Vedras Oct. 10; pursued the French along the line of the Mondego in their retreat upon Santarem; received the thanks of Parliament for the liberation of Portugal Apr. 11, 1811; gained the victory of Fuentes de Onoro May 3–5; took Almeida and invested Badajoz May 19, but retreated June 10 within the frontiers of Portugal; carried Ciudad Rodrigo by assault Jan. 19, 1812, for which he was made by the Spanish regency duke of Ciudad Rodrigo and a grandee of Spain (January), and by his own government created earl of Wellington with a further pension of £2000; reinvested Badajoz Mar. 16; took it by storm Apr. 6; routed Marshal Marmont with great slaughter at Salamanca July 22, and occupied Madrid Aug. 12; was made generalissimo of the Spanish armies, created marquis of Wellington Oct. 3, and granted £100,000 by Parliament; laid fruitless siege to Burgos Sept. 19 to Oct. 21; retreated to Portugal; visited Cadiz and Lisbon, and was received as a deliverer; received heavy reinforcements during the winter; entered Spain in two columns with 200,000 men in the spring of 1813; obtained a signal victory over King Joseph and Marshal Jourdan at Vitoria June 21, capturing 150 cannon and driving the French into the Pyrenees; was made field-marshal of England July 3, and duke of Vitoria in Spain; laid siege to San Sebastian and Pamplona, but was repulsed in an attempt to storm the former July 25; gained a series of battles in the Pyrenees July 27–31; carried San Sebastian by assault Aug. 31; crossed the river Bidassoa into France Oct. 7; received the capitulation of Pamplona Oct. 31; took up his head-quarters at St. Jean de Luz Nov. 10; crossed the Nivelle and the Nive, and repulsed Marshal Soult Dec. 10–18; left two divisions to blockade Bayonne, and pursued Soult, whom he defeated at Orthez Feb. 27, 1814, and at Toulouse Apr. 10, and occupied that city Apr. 12, having meanwhile sent Gen. Beresford to take possession of Bordeaux; learned of the occupation of Paris by the allies, and proceeded thither; was made marquis of Douro and duke of Wellington May 11; arrived at London June 23, and took his seat for the first time in the House of Lords June 28; received (as a matter of course) the thanks of Parliament and a further pension; went to Paris as ambassador to the restored monarch, Louis XVIII., in August; attended the Congress of Vienna Jan., 1815; took command of the British army in Flanders in April on the return of Napoleon from Elba; repulsed Marshal Ney at Quatre Bras June 16; gained, with the Prussian marshal Blücher, the decisive battle of WATERLOO (which see), June 18; crossed the French frontier and marched upon Paris June 21; was commander-in-chief of the allied army of occupation in France 1815 to Nov., 1818; received £60,000 as Waterloo prize-money; was made prince of Waterloo by the king of the Netherlands; was presented by the British nation with the estate of Strathfieldsaye, Hampshire, costing £263,000; attended the Congress of Aix-la-Chapelle for the evacuation of France, and was created field-marshal of Austria, Russia, and Prussia Oct., 1818; was appointed master-general of the ordnance, giving him a seat in the cabinet, Jan. 1, 1819; became governor of Plymouth Oct., 1819; attended the Congress of Verona 1822; was ambassador to Russia, and appointed constable of the Tower 1826; became commander-in-chief Jan., 1827, governor of Dover Castle and lord warden of the Cinque Ports Jan., 1829; was prime minister in the Tory interest from Jan. 8, 1828, to Nov. 15, 1830, steadily opposing Roman Catholic emancipation and all projects of parliamentary reform, on which account he was hooted in the streets of London, the windows of Apsley House, his town residence, broken by the mob, and an attempt made to burn his country residence June, 1832; was appointed chancellor of Oxford University Jan. 29, 1834; was secretary of state for foreign affairs Dec., 1834, to Apr. 8, 1835; became a member of the cabinet without a portfolio 1841; was visited by Queen Victoria at Walmer Castle 1842; was a second time appointed commander-in-chief Dec., 1842; gave a reluctant support to the free-trade measures of Sir Robert Peel, and was president of the privy council 1845–46, after which he declined further political honors on account of advanced age, though he continued to attend the House of Lords and was assiduous in the discharge of his duties at the court of the youthful queen. He died of apoplexy at his official residence as lord warden of the Cinque Ports, Walmer Castle, Kent, Sept. 22, 1852; received a magnificent funeral, and was buried in St. Paul's cathedral, London, Nov. 9. In person he was of middle size, but strongly built, and his capacity for enduring fatigue gave him the familiar title of "the Iron Duke." His leading characteristics as a soldier were invincible resolution and singleness of purpose, combined with a full measure of caution. His political, social, religious, and literary instincts were pre-eminently conservative—a fact which brought him into unpopularity during the unquiet agitations for reform, but did not detract from the affectionate pride and veneration with which he was regarded by his countrymen during the protracted evening of his life. Numerous statues and memorials have been erected to his memory, and works illustrative of his military exploits are naturally abundant. The most notable personal biographies are those of Maxwell (3 vols., 1839–41), Stocqueler (2 vols., 1852–53), Brialmont (3 vols., 1856–57), and C. D. Yonge (2 vols., 1860). His *Despatches* (2 series, 25 vols., 1834–65), edited by Col. John Gurwood, and his *Supplementary Despatches and Memoranda* (17 vols., 1858–73), edited by his son Arthur Richard, the present duke, exhibit him in a most favorable light, and constitute invaluable materials for history. Other volumes of selections from the vast mass of his correspondence are promised (1876). PORTER C. BLISS.

Wellingtonia Gigantea. See SEQUOIA.

Wells. See ARTESIAN WELLS, by PROF. E. W. HILGARD, PH. D.; GAS-WELLS, in GAS-LIGHTING, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.; OIL-WELLS, in PETROLEUM, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D., and in PETROLEUM, GEOLOGY OF, by PROF. J. S. NEWBERRY, M. D., LL.D.; TUBE-WELL and WELL, in WELL, by HON. G. P. MARSH.

Wells, county of N. E. Indiana, intersected by Wabash River, and traversed by Fort Wayne Muncie and Cincinnati R. R.; surface rolling, with much good timber-land; soil fertile. Live-stock abundant. Staples, wheat, Indian corn, wool, lumber, and dairy products. Cap. Bluffton. Area, 372 sq. m. P. 13,585.

Wells, tp., Appanoose co., Ia. P. 953.

Wells, p.-v. and tp., York co., Me. P. 2773.

Wells, tp., Tuscola co., Mich. P. 194.

Wells, p.-v., Faribault co., Minn.

Wells, tp., Rice co., Minn. P. 1153.

Wells, p.-v. and tp., Hamilton co., N. Y. P. 817.

Wells, tp., Jefferson co., O. P. 1414.

Wells, p.-v. and tp., Bradford co., Pa. P. 1207.

Wells, tp., Fulton co., Pa. P. 589.

Wells, p.-v. and tp., Rutland co., Vt. P. 483.

Wells (C. H.), U. S. N., b. Apr. 3, 1822, in Pennsylvania; entered the navy as a midshipman Sept. 25, 1840; became lieutenant in 1855, commander in 1866, captain in 1871; served on the E. coast of Mexico during our war with that country, and participated in the capture of Tuspan and Tampico; was executive officer of the Susquehanna at the capture of Port Royal, and commanded the Galena in the battle of Mobile Bay. Favorably mentioned by Rear-Admiral Farragut and Capt. Lardner.
FOXHALL A. PARKER.

Wells (CHARLES), b. in England about 1798, was an early and intimate friend of the poet Keats, who introduced his name in one of his best-known sonnets; published anonymously a prose volume of *Stories after Nature* (1822) and *Joseph and his Brethren, a Scriptural Drama* (1824), under the pseudonym of "H. L. Howard," both of which were received by the critics with such utter indifference that, accepting their verdict as decisive, he published nothing more, and his very existence as a literary man was forgotten until his poem fell into the hands of the "new school" of Swinburne and the Rossettis, by whom it has been pronounced second in dramatic merit to Shakspeare alone. This opinion was first made public by William M. Rossetti in a supplementary chapter to Gilchrist's *Life of Blake* (1863), and was occasionally re-echoed in various review articles until 1876, when Mr. Swinburne published an edition of the poem, preceded by a critical *Introduction*, in which an eminent place among English poets was claimed for Wells, and this verdict has been in great measure confirmed by recent critics. Mr. Wells is still living (1876), but the facts of his career have not been made known.

Wells (CHARLOTTE **Fowler**), sister of Orson Squire and Lorenzo Niles Fowler, b. at Cohocton, Steuben co., N. Y., Aug. 11, 1814; educated at the Franklin Academy, Plattsburg, but was largely self-taught; became, like her

brothers, interested in phrenology about 1833; studied the writings of Spurzheim, in which she became proficient; taught a class in phrenology as early as 1835; joined her brothers in 1837 in establishing in New York City the famous phrenological partnership subsequently known as "Fowlers & Wells;" married, in 1844, Mr. Samuel R. Wells, who in 1845 became a partner in the house, of which he ultimately became the head; rendered very efficient support to her brothers and her husband in all departments of their business, being endowed with rare executive abilities, and since the death of her husband in 1875 has been the sole proprietor and director of the establishment, including the widely known *Phrenological Journal*, which retains its prosperity under her management, and is engaged in an earnest effort to found a permanent institution for the instruction of students in phrenology.

SUSAN B. ANTHONY.

Wells (DAVID AMES), D. C. L., b. at Springfield, Mass., June 17, 1828; graduated at Williams College 1847, and at the Lawrence Scientific School, Cambridge, 1851; was assistant professor there 1851–52; was associated with Dr. A. A. Hayes as a practical chemist at Boston 1853–55; patented in 1856 several improvements in bleaching; was a member of the publishing-house of G. P. Putnam & Co., New York, 1857–58; was associate editor of the Springfield *Republican* 1858; settled at Norwich, Conn.; visited Europe on commissions of the U. S. government 1862 and 1867; was U. S. special commissioner on revenue 1866–70; produced on that subject fifteen important reports; became university lecturer on political economy at Yale College 1872; visited Europe 1873; delivered in that year an address before the Cobden Club in London; was chosen a foreign associate of the French Academy of Political Sciences, in the place of John Stuart Mill, deceased, 1874; received in the same year the degree of D. C. L. from Oxford University; has been since 1867 a strong advocate of free trade; has taken considerable part in recent efforts for civil-service reform, and was an unsuccessful Democratic candidate for Congress at the special election of Apr., 1876. He edited the *Annual of Scientific Discovery* (Boston, 16 vols., 1850–65), Charles Knight's *Knowledge is Power* (1856), Timbs's *Things not Generally Known* (1857), Brodie's *Psychological Inquiries* (1857), and an abridgment of Burton's *Pilgrimage to El-Medinah and Mecca* (1857), and is author of *The Year-Book of Agriculture* (1856), *Familiar Science* (1856), *The Science of Common Things* (1857), *Elements of Natural Philosophy* (1857), *Principles and Applications of Chemistry* (1858), *First Principles of Geology* (1861), *Our Burden and our Strength* (1864), of which 7 editions, amounting to above 50,000 copies, were printed in that year; was joint author with S. H. Davis of a *History and Sketches of Williams College* (1847; new ed. 1859); has published numerous pamphlets on agriculture, science, and revenue, and contributed to the *Transactions* of several societies.

Wells (EDWARD), D. D., b. in England about 1665; graduated at Christ Church, Oxford; took orders in the Church of England; became rector of Blechley, Buckinghamshire, and in 1719 of Cotlesbach, Leicestershire, where he d. in 1727. Author of *A Treatise of Ancient and Present Geography* (1701), *Historical Geography of the New Testament* (1708), *Historical Geography of the Old Testament* (1711–12), and other works; edited the works of Xenophon (5 vols., 1703) and Dionysius (1704), and published a revised translation of the Bible, with notes, prefaces, a paraphrase, and the Greek text of the New Testament (21 parts, 1709–28).

Wells (HENRY H.), b. at Rochester, N. Y., Sept. 17, 1823; educated at the Romeo Academy, Mich.; studied and practised law at Detroit; sat in the legislature 1854–56; served in the war, attaining the rank of brigadier-general of volunteers; settled in Virginia 1865; was military governor of Virginia 1868–69; was the Republican candidate for governor of Virginia at its reorganization in 1869, but defeated by Gilbert C. Walker; was U. S. district attorney for Virginia 1869–72, and appointed district attorney for the District of Columbia Sept., 1875.

Wells (HENRY TANWORTH), R. A., b. in London, England, in Dec., 1828; became distinguished first as a miniature and subsequently as a *genre* painter in oil; began to exhibit at the Royal Academy in 1845; was chosen an academician 1870, and is noted for the strict fidelity of his portraits.

Wells (HORACE), b. in Hartford, Windsor co., Vt., Jan. 21, 1815; received a good English education, and at the age of nineteen (1834) began the study of dentistry in Boston, and in 1836 he opened an office in Hartford, Conn., to practise his profession. His mind was early turned to the subject of the possibility of preventing pain in the extraction of teeth. In Aug., 1840, Dr. Brockett of Brooklyn, then a medical student, went to Wells to have a molar tooth extracted; the operation was difficult, and so painful that Wells said that there ought to be some method of mitigating such suffering, and that he thought a man might be made so drunk by the inhalation of nitrous oxide gas as to prevent the pain of dental and other operations. This was four years before the discovery of anæsthesia, and it shows how deeply impressed this subject was upon the mind of Wells at that early day. On Dec. 10, 1844, Mr. G. Q. Colton delivered a lecture in Hartford, Conn., on "laughing gas," and after the lecture he administered the gas to Wells and several other gentlemen. One of them (Mr. Cooley), while under its influence, fell over some benches, and was evidently badly injured; when he returned to consciousness, Wells rushed up to him and inquired if he was hurt. He replied, "No." Wells then said, "You must have been hurt, for you struck your legs against the benches." The young man then, at Wells's suggestion, pulled up his pantaloons; the blood was running down his legs and his knees were badly injured. When again questioned by Wells he said, "I did not feel any pain at the time." Wells then turned to a friend (Mr. David Clarke), who was near by, and an eyewitness of all this, and remarked, "I believe a man by taking that gas could have a tooth extracted or a limb amputated and not feel the pain." So thoroughly was Wells convinced of this fact that he told his wife on their way home that he intended to take the gas the next day and have a tooth extracted. On arriving home, he left his wife and went to see his friend, Dr. Riggs, to announce his great discovery, and his intention to take the gas for the extraction of a tooth. Riggs tried to dissuade him from it, but his mind was made up, and he said, "As the young man did not feel pain at the time he was hurt, why cannot the gas be used in the extraction of teeth?" Early next morning (Dec. 11) Wells called on Colton and engaged him to go to his office at ten o'clock and give him the gas. He did so, and Dr. Riggs extracted a large molar tooth. Wells did not seem to feel any pain. He remained unconscious for a few moments, and on coming to he exclaimed, "A new era in tooth-pulling! It did not hurt me more than the prick of a pin. It is the greatest discovery ever made."

From that moment Wells's enthusiasm was unbounded. He immediately began the administration of the gas, and daily extracted teeth under its influence; and other dentists in Hartford adopted the same practice with like success. Dr. Marcy, then of Hartford, on witnessing Wells's operations, told him that when a student at Amherst College he with other students had for amusement often inhaled nitrous oxide gas and also the vapor of sulphuric ether, and that the effects of the two were identical; and he suggested to Wells to try ether as a substitute for the gas. On this hint Wells did try it. He inhaled it himself, and he says, "I found it very difficult to inhale the vapor of ether, in consequence of the choking sensation. For this reason, and for the reason that Dr. Marcy and myself came to the conclusion that nitrous oxide gas was not so liable to do injury, I resolved to adhere to this alone."

About a month after the discovery of anæsthesia by Wells, Dr. Marcy (Jan., 1845) gave the vapor of sulphuric ether to a sailor for the extirpation of a small wen on the side of his head. The patient was insensible and the operation successful, but Marcy after this experiment still advised Wells to stick to the gas, as being more agreeable and perhaps safer than ether. Wells continued the use of the gas, and the dentists (Riggs, Terry, Braddock, and Crowfoot) and the doctors in Hartford were all convinced of its value as an anæsthetic. But Wells felt that his great discovery should be laid more broadly before the profession and the world, and early in 1845 went to Boston for this purpose. Through his former pupil and partner, Dr. Morton, dentist, he was introduced to Dr. John C. Warren, Dr. Charles T. Jackson, Dr. Hayward, and others. Dr. Warren received him kindly, and Wells remained in Boston several days with the expectation of giving the gas to a man who was to submit to an amputation at the hands of Dr. Warren. For some cause the operation was postponed. Wells was then invited to address the class at the medical college on the subject. He did so at some length, and then administered the gas for the extraction of a tooth. Unfortunately, the gas-bag was removed too soon; the patient was not sufficiently anæsthetized; the operation was therefore a failure; the patient screamed out, and said he felt the pain of extraction. Wells was hooted at, and unfeelingly hissed out of the amphitheatre by the thoughtless young men present, and he was pronounced a charlatan and his anæsthetic a humbug. He returned home greatly mortified at his failure, was taken suddenly ill, and did not recover his health for many weeks.

In 1841–42, Morton was a pupil of Wells. In 1842, Wells established Morton in Boston, and for a while was his partner. In 1845–46, after Wells's discovery of anæsthesia, they

had frequent interviews, sometimes in Boston and sometimes in Hartford. After Wells's unfortunate visit to Boston, Morton became greatly interested in the subject of anæsthesia. Notwithstanding Wells's failure in Boston, Morton witnessed his continued success with the gas in Hartford, and was anxious to try it again in Boston. During one of his visits to Wells in Hartford in 1846, Morton asked Wells to show him how to make the gas. Wells told him to ask Dr. Charles T. Jackson to make it for him, as he was a chemist. On returning home, Morton called on Jackson. Jackson told Morton that the manufacture of nitrous oxide gas required some nicety of manipulation, that there was some danger of his getting nitric instead of nitrous oxide, and that he was too busy at that time to make it for him. Morton explained that he wished to use it to render patients insensible for the extraction of teeth. Jackson then told him to use the vapor of sulphuric ether, saying that it was perfectly safe, and that the students at Cambridge often inhaled it for amusement.

On the evening of the day (Sept. 30, 1846) that Morton had this interview with Jackson he gave the ether to a patient and extracted a tooth without pain; and on Oct. 16 he gave it in the Massachusetts General Hospital to a patient who had a tumor excsected from the neck by Dr. John C. Warren. On the next day (Oct. 17) he gave it to another patient for Dr. Hayward, who exsected a tumor from the arm; and from that time it came rapidly into use by the whole profession throughout the civilized world. On Oct. 27, 1846, Jackson and Morton published to the world, by letters patent, the discovery of *letheon* as an anæsthetic, but it was seen at once that their letheon was nothing more or less than pure sulphuric ether. Jackson resigned his interest in the patent to Morton, and soon sent a communication to the French Institute claiming the honor of the discovery of anæsthesia by ether. Morton then set up his claim as the real discoverer, giving Jackson credit only for some unimportant suggestions. While Jackson and Morton were sending bulletins to the Institute of France, Wells sailed for Europe in Dec., 1846, to lay his claims before the French Institute as the real discoverer of anæsthesia. His mission was a failure, and he returned home in Mar., 1847, to prepare the documents upon which his claim was to be presented to the Institute. And thus this tripartite war was waged with great fury, Morton and Jackson denying everything to Wells, and denying everything to each other. They denied that nitrous oxide gas had any anæsthetic properties. Wells brought forward his Hartford experience, and he gave the gas for surgeons in general practice, proving that prolonged operations could be performed under its influence. Dr. Marcy exsected a large gland, the patient being under the gas for fifteen minutes; Dr. Ellsworth amputated a thigh; and Dr. Berresford exsected a large tumor under its influence—all in Hartford. But notwithstanding all this, Wells saw nitrous oxide gas supplanted by sulphuric ether as an anæsthetic—ether which he had tried and rejected. He saw his claims as the great discoverer of anæsthesia unrecognized abroad, disputed and set aside at home, and he was disappointed and dispirited. He then went to New York to lay his claims as the discoverer of anæsthesia before the profession of the great metropolis. Soon after his arrival in New York, he showed signs of mental aberration, and on Jan. 14, 1848, in a fit of madness he ended his life with his own hands.

A few years after the death of Wells, Morton applied to Congress for a grant of money for the discovery of anæsthesia. The friends of Wells opposed the grant on the ground that Wells was the real discoverer. If Morton had claimed remuneration for the introduction of sulphuric ether as an anæsthetic, he might have carried his point; this would have been honor enough. But he and his friends were not satisfied with this, and they claimed all the glory of the great discovery of anæsthesia. They admitted that Wells tried to make the discovery, but asserted that he failed, because nitrous oxide gas could not produce insensibility to pain. They even attempted to prove this before a Congressional committee appointed for this purpose. Morton declared that nitrous oxide gas never had, and never could, produce the effect claimed by Wells. Wells was dead, and there was no one to controvert him. The world had accepted ether and chloroform, and no one cared to inquire into the steps by which this was brought about.

If nitrous oxide gas can produce insensibility to pain, as Wells claimed, then Wells was the first to demonstrate the fact that anæsthesia can be produced by the inhalation of gases and vapors. But if it does not possess this property, as asserted by Morton, then Morton was the real discoverer by giving us ether. Let us see how curiously, how providentially, this question has been settled, and settled to the satisfaction of all unprejudiced minds. Colton seems to have been incidentally an important agent in establishing the truth. We have seen how Wells's discovery grew out of Colton's lecture in Hartford in Dec., 1844. Colton continued his popular lectures on this subject for many years after this. In 1862 he lectured in the town of New Britain, Conn., and, as usual, related how the great discovery of anæsthesia was made, giving Wells all the honor. An old lady present wished to have some teeth extracted: she was afraid to take ether or chloroform, and she requested her dentist, Dr. Dunham, to get Colton to give her the gas for their extraction. He did so, and taught Dr. Dunham how to make the gas. One year after this (1863) Colton returned to New Britain on his usual annual lecture-tour, and he found Dunham extensively engaged in extracting teeth under the influence of the gas. Colton and Dunham then went to New Haven, with the understanding that Colton was to give the gas and Dunham to extract teeth. After the first day, Donham returned home, and Dr. Smith of New Haven took his place, and in a few weeks people came by thousands to take the gas and get teeth extracted. Colton, then seeing that it could be made a good business, went to New York and opened the Colton Dental Institute, where since 1863 he er his agents have given the gas to 97,000 persons without an accident.

All this disproves the assertion made by Morton and his adherents. If nitrous oxide gas produces anæthesia today in the hands of Colton and others, it did it in the hands of Wells in 1844, and Wells was therefore the discoverer of anæsthesia. The fact that other anæsthetics are cheaper and easier of administration does not in the least invalidate his claims. It has been used in general surgery by many eminent surgeons in New York, Philadelphia, Baltimore, and elsewhere. The writer has used it in difficult and prolonged operations (ovariotomy), requiring 30, 40, 57, and 60 minutes, and in one case an hour and 50 minutes, and always with the most satisfactory results. All this goes to prove that to Wells is due all the honor of the great discovery of anæsthesia by nitrous oxide gas—in 1844.

To Morton and Jackson is due the credit of introducing ether as an anæsthetic—in 1846; to Sir James Y. Simpson is due the imperishable honor of introducing chloroform as an anæsthetic—in 1847; and to Dr. B. W. Richardson of London is due the credit of introducing the bi-chloride of mytheline for the same purpose at a later period. Morton's labors do not invalidate Wells's claims; Simpson's do not invalidate Morton's; Richardson's do not invalidate Simpson's. They are all good in their way: but Wells was the original discoverer of the principle upon which they all act.

In Boston, Mass., a monument has been erected to the discoverer of anæsthesia, but no man is designated thereon by name. The citizens of Hartford, Conn., have erected a bronze statue of Wells (by Bartlett) in their Capitol Park, claiming for him the discovery of anæsthesia, the greatest boon that medical science has given to humanity since the immortal discovery of Jenner.

But long before the day of Horace Wells we were on the eve of the discovery of anæsthesia. In 1790, Priestley discovered nitrous oxide gas. In 1799, Sir Humphry Davy experimented with it, and in 1800 he published his *Researches, Chemical and Philosophical, chiefly concerning Nitrous Oxide Gas and its Respiration*, in which he distinctly announced his belief that it might be used as an anæsthetic in surgical operations. But no one acted upon his suggestion, and this grand idea was lost to the world till its resuscitation by Wells. But prior to Wells ether was used as an anæsthetic by Dr. Crawford W. Long of Athens, Ga. It is well known that sulphuric ether was used sportively ever since the beginning of this century by the young men in all our New England colleges; and in certain sections of the South its use as an excitant was at one time very common. Dr. Wilhite of South Carolina informed the writer that "ether frolics" were the fashion forty years ago in some portions of Georgia; that boys and girls, meeting at quiltings and other parties, often wound up the evening's entertainment with an ether frolic; and that the effects of the ether, carried only to the stage of intoxication, were identical with those of nitrous oxide gas, such as laughing, dancing, speaking, fighting, etc. In 1842, Dr. Crawford W. Long practised medicine in Jefferson, Jackson co., Ga. He had four students at the time—viz. P. A. Wilhite, D. I. Long, H. R. P. Long, and John S. Groves. They all occasionally indulged in "ether frolics." On several occasions Dr. Long became furiously excited under the influence of the ether, and could not be controlled. After recovering from the intoxication he often noticed that his arms were badly bruised, and he was not conscious of having felt any pain at the time. From this fact he inferred that it might be used as an anæsthetic in surgery. Accordingly, for this purpose he administered the ether to a Mr. Venables, putting him profoundly under its influence,

and then exscted a tumor from Mr. V.'s neck. The operation, entirely painless, was witnessed by the four medical students above named and by others. Dr. Long performed other operations under ether. The first one was on Mar. 30, 1842. His operations were known to medical men in the neighborhood. But Dr. Long did not communicate his discovery to any scientific body, nor did he write it out for any medical journal till the year 1849, when he sent it to the *Southern Medical and Surgical Journal*, which was long after the labors of Wells, Morton, Jackson, and Simpson in this direction were fully recognized. In a communication by Dr. Charles T. Jackson to the *Boston Medical Journal*, Apr. 11, 1861, he says he visited Dr. Long at Athens, Ga., on Mar. 8, 1854, to examine into Dr. Long's claims to being the first to use sulphuric ether as an anæsthetic in surgery, and he further says: "From the documents shown me by Dr. Long it appears that he employed sulphuric ether as an anæsthetic agent—First, on Mar. 30, 1842, when he extirpated a small glandular tumor from the neck of James W. Venable, a boy [Mr. Venable was twenty years old when the operation was performed—J. M. S.], in Jefferson, Ga., now dead. Second, on July 3, 1842, in the amputation of the toe of a negro boy belonging to Mrs. Hemphill of Jackson, Ga. Third, on Sept. 9, 1843, in the extirpation of a tumor from the head of Mary Vincent of Jackson, Ga. Fourth, on Jan. 8, 1845, in the amputation of a finger of a negro boy belonging to Ralph Bailey of Jackson, Ga. Copies of the letters and depositions proving these operations with ether were all shown me by Dr. Long. He also referred me to physicians in Jefferson who knew of the operations at the time."

From these facts it is clear that Dr. Crawford W. Long was really the first man who ever performed an operation under an anæsthetic. His operations were witnessed by medical students, known and talked of by medical men in the community, but, unfortunately, he procrastinated their publication till the great discovery of anæsthesia was made by others. J. MARION SIMS.

Wells (SAMUEL ROBERTS), b. at W. Hartford, Conn., Apr. 4, 1820; became a partner in the publishing-house of Fowler & Wells, New York, 1844; travelled extensively in the U. S., Canada, and Europe, lecturing on phrenology; edited the *Water-Cure Journal* (1850–62), the *Phrenological Journal* (1863–75), and the *Illustrated Annual of Phrenology and Physiognomy* (1865–75), and was author of *The New Physiognomy, or Signs of Character* (1866), *How to Read Character* (1869), and *Wedlock, or the Right Relations of the Sexes* (1869). D. in New York Apr. 13, 1875.

Wells (WILLIAM), PH. D., b. in New York City in 1820; graduated at Williams College, Mass.; studied in Europe, and was professor of modern languages in Genesee College, N. Y., from 1852 to 1865, then of the same at Union College, Schenectady, N. Y. He has been a contributor to periodicals and reviews.

Wells (WILLIAM CHARLES). See APPENDIX.

Wells (WILLIAM HARVEY). See APPENDIX.

Wells (WILLIAM VINCENT), great-grandson of Samuel Adams, b. at Boston, Mass., Jan. 2, 1826; educated in the Boston schools; became a captain in the merchant service, and was four times wrecked; visited South America and Europe; went to California 1849; built and commanded the first steamboat seen on the interior waters of California; edited several papers at San Francisco; travelled in Central America, exploring the gold-regions of Honduras; was influential in promoting the expedition of Walker to Nicaragua, and became consul-general in Honduras. Author of *Walker's Expedition to Nicaragua* (1856), *Explorations and Adventures in Honduras* (1857), and *The Life and Public Services of Samuel Adams*, etc. (Boston, 3 vols., 1865).

Wells'boro', p.-b., cap. of Tioga co., Pa., on Corning Cowanesque and Antrim R. R., contains 4 churches, good schools, 1 bank, 2 newspapers, several saw and planing mills, 2 tanneries, carriage and marble shops, and 5 hotels. It is surrounded by a rich dairy and farming section. P. 1465. A. F. BARNES, ED. "AGITATOR."

Wells'burg, p.-v., Ashland tp., Chemung co., N. Y. P. 542.

Wellsburg, p.-v. and tp., cap. of Brooke co., West Va. P. 1366.

Wells Dépôt, p.-v., York co., Me.

Wells River, p.-v., Orange co., Vt.

Wells'ville, p.-v., Montgomery co., Mo.

Wellsville, p.-v. and tp., Allegany co., N. Y. P. of v. 2034; of tp. 3781.

Wellsville, p.-v., Yellow Creek tp., Columbiana co., O. P. 2313.

Wellsville, p.-v., Cache co., Ut.

Wellwood (Sir HENRY **Moncreiff**), BART., D. D., b. at Blackford, Perthshire, Scotland, Feb. 6, 1750, being eldest son of Rev. Sir William Moncreiff; educated at Glasgow and Edinburgh universities; was ordained a minister of the Church of Scotland 1771; was for some time his father's successor as minister at Blackford; became pastor of St. Cuthbert's, Edinburgh, 1775, and moderator of the General Assembly 1785; was a popular preacher; "succeeded Dr. John Erskine in the chieftainship of the Whig party in the Kirk of Scotland;" took an active part in the ecclesiastical controversies of his time, and late in life assumed the name of WELLWOOD. D. at Edinburgh June 14, 1827. Author of *Discourses on the Evidence of the Jewish and Christian Revelations* (1815), *An Account of the Life and Writings of John Erskine, D. D.* (1818), of many pamphlets on ecclesiastical topics, and of several volumes of *Sermons*. His *Posthumous Sermons* (3 vols., 1829–31) were selected by Dr. Andrew Thomson, and edited, with an *Account of the Author's Life*, by his son, Sir JAMES WELLWOOD MONCREIFF, BART. (1776–1851), who became a judge of session and a lord justiciary, known by the courtesy title of Lord Moncreiff.—JAMES MONCREIFF, son of the latter, b. at Edinburgh Nov. 29, 1811, was an eminent advocate and member of Parliament, and was created Baron Moncreiff of Tullicbole Jan. 1, 1874.

Wels'by (WILLIAM NEWLAND), b. in Cheshire, England, about 1803; graduated at St. John's College, Cambridge, 1823; was called to the bar at the Middle Temple; became an eminent barrister-at-law, and was many years recorder of Chester, where he d. July 1, 1864. He published, with several associates, *Reports of the Decisions of the Court of Exchequer from 1836 to 1856* (27 vols.); edited, with Edward J. Beavan, Chitty's *Collection of Statutes of Practical Utility* (4 vols., 1851–54) and Sir Christopher Rawlinson's *Municipal Corporation Acts* (2d ed. 1849), and was author of *Lives of Eminent English Judges of the Seventeenth and Eighteenth Centuries* (1846).

Wels'ford (HENRY), b. in England about 1810; is author of *The Origin and Ramifications of the English Language*, etc. (1845), *Mithridates Minor, or an Essay on Language* (1848), *Lights and Shadows of Spiritual Life* (1855), and other works.

Welsh (DAVID). See APPENDIX.

Welsh (JOHN), of Scotland. See APPENDIX.

Welsh (JOHN), F. R. S., b. at Borcland, Kirkcudbrightshire, Scotland, Sept. 27, 1824; educated at the University of Edinburgh with a view to the profession of an engineer; became a proficient in physics and astronomy; was engaged by Sir Thomas Brisbane as observer in his magnetical and meteorological observatory at Makerstown; became assistant in 1850, and subsequently superintendent, at the Kew Observatory; made four balloon ascents for scientific purposes in 1852; made several inventions for the purpose of giving greater precision to the observations of magnetic dip and force, and made several valuable reports on meteorology to the British Association, for which body he undertook the Scottish division of the magnetic survey of Great Britain. D. at Falmouth May 11, 1859.

Welsh (WILLIAM). See APPENDIX.

Welsh Language and Literature. Hitherto it has been usual to divide the Welsh language, historically considered, into three periods—namely, those of Old, Middle, and Modern Welsh. This answered very fairly at a time when the student of the Celtic languages knew but little about the early inscribed stones of Wales and Cornwall, which mark out one or two previous periods in the history of the language. To these, in default of a better, the term Early Welsh may be applied, which, however, renders that of Middle Welsh inadmissible; but in order to disturb the old terminology as little as possible, the adjective *Mediæval* may be used instead of *Middle*. The whole range of the past existence of the language admits of being parcelled out as follows:

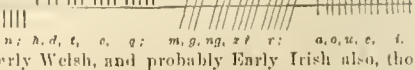
(1) *Pre-historic Welsh*, ranging from the time when the ancestors of the Welsh and the Irish ceased to form one nation, or to speak one and the same language, to the subjugation of the Britons by Julius Agricola; or, let us say, to the end of the first century. (2) *Early Welsh*, of the time of the Roman occupation down to the departure of the Romans in the beginning of the fifth century. (3) *Early Welsh*, of what is called the Brit-Welsh period, from that time to the eighth century. (4) *Old Welsh*, from then to the coming of the Normans into Wales, in the latter part of the eleventh century. (5) *Mediæval Welsh*, thence to the Reformation. (6) *Modern Welsh*, from that epoch to the present day.

This would be the order to follow if one were not stinted in materials to serve as specimens of the earlier stages; but that being the case, it will be preferable here to proceed backward, from the known to the less known. Modern Welsh, accordingly, takes the lead, and of this two kinds may be distinguished—namely, biblical and journalistic Welsh, whereof the latter is the vernacular of the Welsh of the present day, and is to be met with, more or less touched up, in Welsh periodicals and newspapers, of which there are no less than thirty published in Wales and America. Journalistic Welsh is characterized, as might be expected, by a growing tendency to copy English idioms, which is the result, no doubt, of continual contact with that language and of frequently translating from it. Biblical Welsh, as the term indicates, is the language of the Welsh translations of the Bible and a number of other books, mostly theological, of the time of the Reformation and later. This is still the language of the best authors, and the supposed model of all. We are unable to give any statistics as to the yearly yield of the Welsh press, but it is certain that it is fast increasing; it comprises works on theology, history, poetry, and biography, as well as grammars, dictionaries, and encyclopædias, not to mention a considerable number of English books which are translated for the use of the reading public in Wales and the U. S. of America. Among these last may be mentioned, for instance, plays of Shakspeare and a work on shorthand.

Passing beyond the time of the Reformation, we come to the Mediæval Welsh of the *Brut*s or chronicles, so called from their commonly beginning with an account of Brutus or Brytus, a fictitious personage postulated as the first colonizer of Albion for the sake of accounting for its being called Britain. He was held to be a son of Æneas, and so were the Welsh made out to be of Trojan descent. It is right, however, to state that inventions of this kind were not by any means peculiar to the Welsh, and it is even probable that the Brutus tale is of English rather than Welsh origin. The same kind of Welsh also prevails in the romances called the *Mabinogion*, which consists mostly of tales about Arthur and the Knights of the Round Table. A number of these *Mabinogions* were published in 1849 by Lady Charlotte Guest, but they have been some time out of print, and a new edition of them is a decided desideratum. In point of quaintness of style, vividness of description, and comic exaggeration they are not surpassed by any other literature of the same kind and date: nor is there any other which can boast of having directly or indirectly exercised so much influence on European thought in the Middle Ages. To the earlier part of this period belong also the *Laws of Wales*, the Venedotian version of which is found in a manuscript which has been assigned to the twelfth century: three versions were edited by Mr. Aneurin Owen for the English record office in 2 large 8vo vols. in 1841. The form in which they are known to us dates from the reign of Howell the Good, in the tenth century, but in point of substance they are the growth of laws and customs which were the common inheritance of all the Aryan nations, modified, of course, by the coloring which the special history and surroundings of the Welsh could not help giving them. The mediæval period was highly productive of Welsh poetry; among the leading Welsh poets of the time may be mentioned Dafydd ab Gwilym, who lived in the fourteenth century. He boasts having sung seven score and seven odes to Morfudd, the lady he loved; and some of his compositions are admitted to possess great merit and beauty. But more interesting, however, to the philologist are the contents of a manuscript called the *Black Book of Carmarthen*, which dates from the twelfth century, and has been published in Skene's *Four Ancient Books of Wales* (Edinburgh, 1868). It contains the oldest version extant of a considerable portion of the poems, which it has been the habit of some writers to attribute to the sixth century. As to the language of these poems, it is hardly older, on the whole, than the manuscript containing them; and even supposing that they are substantially compositions of the sixth century, or rather that some of them are such, linguistically they are of the twelfth or the eleventh century. This difficulty is bridged over by assuming that successive minstrels and reciters unconsciously changed the form of the words they used into harmony with the pronunciation of their own time. This must be to a certain extent admitted, but even then the leap from the twelfth to the sixth century is a very long one; and Mr. Skene, making the best of the archaisms they contain, the historical allusions in them, and the metrical peculiarities of some of them, has only succeeded in making it appear probable that some of them date, though not exactly in their extant form, as early as the ninth, or perhaps the preceding century. Besides Mr. Skene's book, Stephens's *Literature of the Kymry* (London, 1849) and Nash's *Taliesin* may be consulted on this question and others nearly allied with it.

Thus far, the student of Welsh has abundance of literature at his command; but when he passes the threshold of the twelfth century it ceases to be so, his only materials for the study of Old Welsh being inscriptions and glosses, together with a few other scraps in the blank spaces of Latin manuscripts. The inscriptions of this period are written in letters which archæologists are wont to term Hiberno-Saxon, and are far less numerous than those of an earlier period, owing, probably, to their having become, in consequence of the prayers in them, objects of the iconoclastic rage of later times. An instance or two will show this more clearly, and also that the Welsh they contain is confined to proper names. In Gwnnws churchyard in Cardiganshire, preceded by a sort of cross meant to do duty also as the monogram of Christ, we read *Quicunque explicauerit hoc nomen det benedixionem pro anima Hiroidil filius Carotinn;* and in the wall of a chapel on Caldy Isle, off the coast of Tenby, there is a stone with an illegible Ogam on its edges and an inscribed cross on its face, followed in Hiberno-Saxon letters by the legend, *Et signo crucis in illam fingsi; rogo omnibus ibi ammuluntibus exorent pro anima Catnoconi.* As to the manuscript portion of the materials just mentioned, a Welshman reading a Latin work sometimes wrote the Welsh equivalents of Latin words which gave him trouble between the lines or in the margin, and thus arose the Welsh glosses, as they are called. Their date is ascertained by experts, and none of them are now admitted to be older than the ninth century. As they contain but few complete sentences, they teach us very little as to the syntax of Old Welsh. On the other hand, they enable one to ascertain what phonological changes have taken place in the language since the ninth century; and, among other things, they afford us the means of watching the rise and growth of that system of consonantal mutation which has been carried out with such persistence in Welsh that it has often been supposed to be peculiar to it and as old as the Kymric race. As a matter of fact, it is a species of phonetic decay which is not wholly unknown in most languages, and has very exact parallels in some of the Italian dialects, especially that of Sassari in the island of Sardinia. This was first pointed out by Prince L. L. Bonaparte in his introduction to the Gospel of St. Matthew, translated into the Sardo-Sassarese dialect by the Canon G. Spano (London, 1866). Since then Prof. Hugo Schuchardt of Halle has written on the same subject in the journal called the *Romania*.

The next step backward lands us in the Brit-Welsh period of the language, for the study of which our materials are very slender. They may be said to be of two kinds—namely, inscriptional and manuscript. Those of the former kind consist mostly of very simple epitaphs written in Latin, but containing Kymric names. Somewhat over 100 such inscriptions, by far the greater number of which still exist, are known, scattered over Wales, Devonshire, and Cornwall, not to mention a few in Scotland from Luce Bay to Edinburgh. They are written in Roman capitals more or less debased: toward the end of the period the capitals are found interspersed with minuscules of the Hiberno-Saxon type, so called, owing to the fact that it is customary to write and print Irish in this character, and that it was also the character used formerly by the English. More correctly speaking, letters of this kind are neither Irish nor English, but Kymric or Welsh, and the inscriptions in question supply all the successive gradations whereby Roman capitals assumed this form, of which the modern Irish alphabet will serve as a specimen (for the characters of which see IRISH LANGUAGE AND LITERATURE). However, both the Irish and the Welsh had an alphabet of their own of a very peculiar nature, known as the Ogam or Ogham, from its Irish inventor, a mythical personage called *Ogbma*, nearly related, probably, to Ogmios, the Hercules of the Gauls. Most of the early monuments of Ireland are written in Ogam, and over twenty of those of Wales, Devonshire, and Cornwall are partly, and one or two wholly, in Ogam: they cover the country from Ruthin in Denbighshire to South Devonshire. In Wales the Ogam grew out of use as early as the eighth or ninth century, whereas in Ireland it has come down in manuscript—a fact which has not left room for genius to distinguish itself by discovering the key to it. The following is the Irish Ogam, with the traditional values of the letters:



b, l, f, s, n; h, d, t, c, q; m, g, ng, z r; r; a, o, u, e, i.

But for Early Welsh, and probably Early Irish also, the values of the Ogams must have been rather the following, in the same order: *b, l, w, s, n; ch, d, t, c, qu; m, g, ng, z, r; a, o, u, e, i.* It is to be noticed that the Ogam is not

written on the face of a stone, but along the edges, which are here represented by the continued line from which the digits hang: the vowels consist of notches. Lastly, the clumsiness of such an alphabet precludes the probability of its having been either invented or introduced into Britain after the Romans had introduced their letters: as to its origin, it could be shown to be based on the Phenician alphabet, but the proof could not here be entered upon. But to return to the inscriptions themselves. We can best give the reader an idea of them by quoting an instance or two: At St. Dogmel's, near Cardigan, there is a stone which reads in Roman capitals, *Sagrani Fili Canatami*, and in Ogam, *Sagramni Maqui Cunatami: Cunatami* is now *Cynlaf*. At Cilgernam in the same neighborhood there is a stone which reads, *Trencugussi Fili Maceitreni*, and in Ogam, *Trenagusu Maqvi Maqeitreni*. A tombstone at Penmachno, in Carnarvonshire, reads in Roman capitals, *Cantiori Hic Jacit Venedotis Cive Fuit Consobrino Magli Magistrati*. The other kind of materials mentioned consists of a few proper names used by Gildas and others who wrote during this period. They are exceedingly few, but very important as helping us to some precision as to the inscriptions and to the assigning their approximate date.

As to the early Welsh of the time of the Roman occupation, we have still less to go upon: there are a few inscriptions of the period containing Celtic names, which are presumably of Kymric origin. Besides these, a few names of men and places are handed down in the writings of Tacitus, Ptolemy, and others. Beyond this lies the prehistoric period of the language. What it was then like is entirely a matter of inference, by no means wanting in ethnological interest, but far too difficult a question to be disposed of in a few words. Suffice it to say that in all probability much of that which distinguishes the Celtic languages—and among them Welsh—from the other Aryan tongues, and from one another, is to be ascribed to the Aryan settlers in the British Isles having in the course of time and conquest absorbed other races speaking languages very different from their own. Such an absorption could not happen to a very great extent without the dying language of the vanquished producing a lasting effect on that of the dominant race.

Race and Language.—The Celtic languages still spoken are Welsh, Breton, Gaelic in Ireland and the Scotch Highlands, and Manx in the interior of the Isle of Man. Among the dead ones are Old Cornish, which lingered on into the last century, Pictish, and Gaulish. Of these, Cornish has left behind it a considerable quantity of literature, while the Pictish words extant may perhaps be counted on one's fingers; the Gauls have left us a number of monuments, from which, together with other sources, a fair number of their proper names and a few other specimens of their vocabulary have been collected—enough, in fact, to enable one to assign the Gauls their proper place in the Celtic family. Now, as to the modern Celts of the British Isles and Brittany, all are agreed that they divide themselves naturally into two branches, the one Kymric and the other Goidelic. To the latter belong the Irish and the Gaels of Scotland, together with the Manx: to the former, the Welsh, the Cornish, and the Bretons. Then as to the ancient Gaels, it is usual to range them with the Kymric nations, so that the entire Celtic family is commonly spoken of as consisting of Goidelic nations on the one hand, and Gallo-British ones on the other. A word as to the terms *Goidelic* and *Kymric*. The former is derived from the Old Irish *Goidel* or *Gaedel*, "an Irishman or Gael;" in modern Irish it is spelled *Gaoidheal*, with a silent *dh*, which has led to the simplified spelling *Gael*. The latter is from the Welsh word *Cymro*, "a Welshman," plural *Cymry*, to which may be added *Cymraes*, "a Welshwoman," which are supposed to represent earlier and longer forms, Combroe-s, from Combrag-i, Combrag-issa: compare the Gaulish tribe-name, *Allobrox*, *Allobroges*. In any case, the Welsh national name has nothing whatever to do with either Cimbri or Cimmerii.

The foregoing classification of the Celts, however, is to be rejected as resting on a bad foundation—namely, the following: The Welsh and the Gauls belong, it is argued, to the same Celtic branch, because Welsh agrees with Gaulish in changing *qu* into *p*, whereas Irish has *c*. Thus, the Old Irish word for *four* was *cethir*, while in Welsh it is *pedwar*; and the Gauls called a kind of carriage in use among them *petorritum*, a form which is supposed to involve the Gaulish word for *four*: the Latin, it is needless to add, was *quatuor* or *quattuor*, and the Aryan original was probably *qutvar*. Now, a glance at the equivalents of *qu* will serve to convince one that this is not the kind of argument to base an ethnological theory upon. For there were Greeks who called *four* πίσυρες, and Italians who said *petus* for *quatuor*: not to mention the Romanians, who have made the Latin words *aqua* and *equa* into *ape* and *cape* respectively; but will anybody assert that this proves the Welsh and the nations alluded to to be nearly related? The change of *qu* into *p* is a phenomenon which it is the business of the phonologist to explain, but the physiological law underlying it knows no racial boundary. Moreover, to be of any use as an argument, the *p* coincidence between Welsh and Gaulish ought to involve coincidence of time—that is to say, Gauls and Welsh should have made *qu* into *p* at the same time, so as to admit of the supposition that they were as yet one nation, speaking one and the same language; but it is not so. The Gauls had replaced *qu* by *p* some time before we have any history of them, whereas the early Welsh do not seem to have done so before the sixth century. It happens that Aryan *p* simple was lost in the Celtic languages at a very early date. So, previous to the passage of *qu* into *p*, the latter sound was in all probability unknown to the Kymric race, as well as to the Irish; accordingly, we find that the Ogam alphabet made no provision for it, and that, when the Welsh at length borrowed names with *p* from the Romans, they were unable to write them in Ogam without inventing a non-Ogamic symbol. In the two instances which occur the symbols used are different, so that the scribes may be said to have extemporized them without agreeing on a common one. The names with *p* are very scarce in Kymric inscriptions; the first native one is *Porcius*, which occurs on a stone near Trawsfynydd, in Merionethshire: it is probably of the same origin and date as the *Vortipori* (vocative) of Gildas, who wrote about the middle of the sixth century. On the other hand, *qu* occurs more frequently on the monuments of Wales and Cornwall; and especially noticeable is the genitive *maqui* of the word for *son*. *Maqui* is common also on early Irish monuments: in Old Welsh it is always *map*, now *mab*, and in Old Irish it is reduced to *mace* or *mac*. And, among the other instances, may be mentioned the name *Quenvendani* on a stone in Pembrokeshire: the first part *Quenvend*, is now *penwyn*: Irish, *Ceanfinn*, "whitehead or white-headed," and the Gaulish equivalent occurs on a coin in De Saulcy's collection in the form ΠΕΝΝΟΟΥΙΝΔΟΟ—*i. e. Pennovindos*.

As it appears that there is no reason for dividing the Celts into Goidelic and Gallo-British nations, we are at liberty to classify them more in harmony with geography into continental and insular Celts, and to subdivide the latter group into Goidelic and Kymric. In other words, the insular Celts may be regarded as forming one nation long after they migrated from the continent of Europe to the British Isles: and it was only after some of them crossed over to Ireland and settled there that the well-known differences of language between the Welsh and the Irish grew up in the course of many centuries of separation by the Irish Sea. As a matter of fact, the linguistic divergences usually relied upon by the advocates of the Gallo-British theory as proving the existence of a profound primeval difference between them, may, like the *p-qu* instance, be shown to date after the beginning of the fifth century. This, however, cannot be entered upon here, as it would be requisite to survey more or less minutely the entire field of Celtic phonology. JOHN RHYS.

Welsh Onion, another name for the CIBOL (which see).

Wel'ton, p.-v. and tp., Clinton co., Ia. P. 956.

Welton, tp., Mineral co., West Va. P. 627.

Wel'witsch (FREDERICK), M. D., b. in Holland about 1810; became an eminent botanist; spent eighteen years in the Portuguese possessions of Western Africa, where he collected above 40,000 specimens of plants, which he brought to England, and published several works on African botany and on natural history. D. in London Oct. 20, 1872. In 1863 he discovered at Mossamedes, West Africa, a remarkable plant which was named by Dr. J. D. Hooker *Welwitschia mirabilis*. It is placed among the Gnetaceæ, a family nearly allied to the conifers; is never above a foot high, though its trunk is sometimes six feet in diameter; is found only in an elevated rainless, stony plateau; attains an estimated age of above a century; produces flower-stalks twelve inches high, cones two inches long, and cotyledons six feet long, which extend in all directions.

Wel'wood (JAMES), M. D., b. near Edinburgh, Scotland, in 1652; educated at the universities of Glasgow and Leyden; accompanied William III. to England 1689; became one of the royal physicians for Scotland, and practised with great reputation at Edinburgh, where he d. in 1716. Author of a *Vindication of the Revolution in England* (1689) and of *Memoirs of the Most Material Transactions in England for the Hundred Years preceding the Revolution* (1700), often reprinted, commended by the earl of Chatham, and edited in 1820 by Baron Maseres.

Wen [Ang.-Sax. *weam*], a cystic tumor occurring upon the surface of the body, especially frequent on the scalp. It originates by the occlusion of a follicle of the skin or

scalp, and the subsequent slow accumulation of sebaceous matter secreted by the lining of the steadily-increasing cyst. The tumor, therefore, is round and symmetrical, and, causing a distension of the overlying skin or scalp, is smooth and shiny. It may be soft, semi-solid, or indurated, according as its contained sebaceous matter is fluid, rich in pultaceous fatty granules, or has had its fluid elements absorbed, leaving only inspissated and calcific substance. The wen is a harmless, non-malignant tumor. Whether single or present in large numbers, its removal is easy and harmless. The overlying tissues are to be incised, without cutting into the wen, when with the handle of a scalpel or a small ivory paper-cutter the round, ball-like cyst may be pried or peeled out. If the cyst has been cut into and the cheesy contents evacuated, the membranous sac must be seized with forceps and gently drawn out, for if left it will refill. Once properly removed, it cannot return. E. Darwin Hudson, Jr. Revised by Willard Parker.

Wen'ceslas, or **Wenzel,** emperor of Germany (1378–1400), b. at Nuremberg Feb. 26, 1361, a son of the emperor Charles IV., of the house of Luxemburg. He was a weak, violent, and cruel character, and spent most of his time in dissipation. In order to get money he annulled all debts due to Jews on condition that the creditors should pay from 15 to 30 per cent. into the imperial treasury; and when the mob of Prague fell upon the Jews and killed 3000 of them, he simply confiscated the property of the victims. In Bohemia, which was his hereditary dominion, and of which he had been crowned king when only three years old, he ruled with the highest degree of arbitrariness and cruelty. John Nepomuk he tortured with his own hand, and threw him, hands and feet tied together, into the Moldau. But in 1393 the Bohemian nobles, who hated him for the partiality he showed toward the Germans, formed a conspiracy against him, headed by his own brother, Sigismund, king of Hungary, seized him, and held him a prisoner at Prague for a long time. He was finally restored to liberty, but his power was henceforward much circumscribed in Bohemia. In Germany, where his influence never had been great, he finally lost all authority, and when he allied himself with France for the purpose of ending the papal schism by deposing both Boniface IX. and Benedict XIII., the electors of Mentz, Cologne, Treves, and the Palatinate assembled at Oberlahnstein and formally deposed him (Aug. 20, 1400). Ruprecht of the Palatinate, who was elected emperor in his stead, was never generally acknowledged, but when, after the death of Ruprecht in 1410, Sigismund of Hungary was elected emperor, Wenceslas renounced his claims on the German crown, though he continued to bear the title till his death, Aug. 16, 1419.

Wen'dell, p.-v. and tp., Franklin co., Mass. P. 539.

Wendell (John L.), b. in New York City in 1784; became a member of the Albany bar, and was for many years reporter of the supreme court of New York. D. at Hartford, Conn., in 1861. His *Reports of Cases* (26 vols., 1829–42) and *Digest of Cases* (1836) are well known to the profession; he also edited Starkie's *Law of Slander* (Albany, 2 vols., 1843) and Blackstone's *Commentaries* (New York, 4 vols., 1847).

Wends, or **Vends** (*i. e.* "wanderers"), a Slavic race of Germany, considered by some as identical in race with the Vandals (who are generally thought to have been of Teutonic stock), and, with more probability, considered by others as the same as the Venedi, or old Venetians. They anciently inhabited a large part of Northern and Northeastern Germany, and figure much in the accounts of the early and mediæval wars of the Scandinavians and Germans, by whom they were finally overcome. Some of their tribes were exterminated, and the remainder were cruelly oppressed. At present the number of Wends (*i. e.* people speaking the Wendish language, exclusive of the large numbers who are Germanized) is put at 140,000, of whom 83,000 are in Prussia (Liegnitz and Frankfort), and Saxony (the kingdom) has (1871) 52,097 Wends, mostly in the district of Bautzen. It is to be noted that the Sloventzi of Austria (1,260,000 in number) are called Vinds also, and their language is called the Vindish. They are also of the Slavic race. The Wendish language resembles the Czechic. There are several dialects—the Upper Lusatian, the Evangelical or Protestant, and the Catholic. There are some collections of Sorabian-Wendish songs and ballads, and several good grammars of the language.

We'ner, Lake, the largest lake of the Scandinavian peninsula, in the southern part of Sweden, 30 miles from the Cattegat, at an elevation of 105 feet, covers an area of 2005 feet. It receives the Clara-elv, and sends its waters to the Cattegat through the Götha-elv. It is connected with Lake Wetter by canals, and thus an inland communication is established between the Baltic and the Cattegat.

Wen'ham, p.-v. and tp., Essex co., Mass. P. 985.

Weno'na, p.-v., Marshall co., Ill., on Chicago and Alton and Illinois Central R. Rs., 100 miles S. W. of Chicago, has 5 churches, 1 bank, a good school system, 1 newspaper, foundry and stoveworks, and planing and flouring mills. The Wenona Union fair is held here, and is second in importance only to the State fair. P. about 2000.
Cadet Taylor, Ed. "Index."

Wenona, p.-v., Bay co., Mich.

Wens'leydale (James **Parke**), Baron, b. at Highfield, near Liverpool, England, Mar. 22, 1782; graduated at Trinity College, Cambridge, 1803; became a fellow there 1804; was called to the bar at the Inner Temple 1813; became a puisne judge in the court of king's bench 1828, baron of the exchequer and privy councillor 1834; retired, and was created a peer for life under the title of Baron Wensleydale, Jan. 16, 1856, thereby giving occasion to animated discussions on the part of the House of Lords upon the validity of this innovation, resulting in a report by the committee of privileges (Feb. 25) against the patent, and the grant of a new patent in the ordinary form as Baron Wensleydale of Walton, Yorkshire, with remainder to himself and his issue male. D. at Ampthill Park, Bedfordshire, Feb. 25, 1868, leaving no issue, and the title thereby became extinct.

Wen'tletrap [Ger. *Wendeltreppe*, "winding stair"], a popular name for the shells of the gasteropods of the genus *Scalaria*, family Turritellidæ. There are about 100 living and as many more extinct species. The finest are from the warm seas. *S. pretiosa*, from China, is very fine and lustrous, and a single shell has been sold for $1000 (200 guineas), but its price is now moderate. *S. grœnlandica* is abundant in the North Atlantic, and is devoured by the codfish. These creatures emit a purple juice, like many other shell-fish.

Went'worth, county of Ontario, Canada, W. of the head of Lake Ontario. Area, 454 sq. m. It is a fertile and well-cultivated region, and is traversed by various railways, centring at Hamilton, the capital. P. 57,599.

Wentworth, p.-v. and tp., Grafton co., N. H. P. 971.

Wentworth, p.-v. and tp., cap. of Rockingham co., N. C. P. 1767.

Wentworth (Anne Isabella **Milbanke**), Baroness and Lady Byron, b. in England May 17, 1792, was the only child of Sir Ralph Milbanke and his wife Judith, sister of Thomas Noel, Viscount Wentworth, of whose large estates she became the heiress; married Lord Byron, the celebrated poet, Jan. 2, 1815, but separated from him in Feb., 1816, after the birth of their only child; devoted her large income to charitable objects, especially industrial schools and reformatory institutions, and inherited the title of Baroness Wentworth 1856. D. May 16, 1860.—Her daughter, Ada Augusta, b. in London Dec. 10, 1815; married, in 1835, William, Lord King, now earl of Lovelace, and d. Nov. 27, 1852. The title of Baron Wentworth was inherited by her eldest son, Byron Noel (b. May 12, 1836), from 1856 until his death, Sept. 1, 1862, since which time it has been borne by her only surviving son, Ralph Gordon Noel (b. July 2, 1839), who is known by the courtesy title of Viscount Ockham, and has several children.

Wentworth (Benning), b. at Portsmouth, N. H., July 24, 1696; graduated at Harvard 1715; became a merchant; was frequently elected to the assembly; was appointed a member of the council 1734; was royal governor from 1734 to 1767; made grants of land in Southern Vermont, occasioning a famous conflict with New York concerning jurisdiction, and gave to Dartmouth College 500 acres of land, on which its buildings were erected. D. at Portsmouth Oct. 14, 1770. The town of Bennington, Vt., was named in his honor.

Wentworth (Charles Watson). See Rockingham, Marquis of.

Wentworth (John), grandson of William, b. at Portsmouth, N. H., Jan. 16, 1671; became a captain in the merchant marine; was appointed by Queen Anne a councillor for New Hampshire 1711; became justice of common pleas 1713, and lieutenant-governor of New Hampshire 1717, the province being then dependent on Massachusetts. D. at Portsmouth Dec. 12, 1730.

Wentworth (John), b. at Dover, N. H., Mar. 30, 1719; became a lawyer and a colonel of New Hampshire militia; was a member of the legislature 1768–75, and Speaker 1771; was chairman of the Revolutionary committee of correspondence and president of the first convention 1774, state councillor 1776–81, judge of common pleas for Strafford co. 1773–76, and judge of the supreme court 1776–81. D. May 17, 1781.

Wentworth (Sir John), Bart., LL.D., nephew of Gov. Benning, b. at Portsmouth, N. H., Aug. 9, 1737; gradu-

ated at Harvard 1755; went to England as agent of the province 1765; obtained through the marquis of Rockingham the appointments of surveyor of the king's woods in America and that of governor of New Hampshire, which he held from 1767 to 1775; gave its charter to Dartmouth College; encouraged agriculture and promoted the settlement of the colony; went to England at the outbreak of the Revolution (1775); was lieutenant-governor of Nova Scotia 1792–1808, and was created a baronet 1795. D. at Halifax, N. S., Apr. 8, 1820.

Wentworth (John), son of Col. John (1719–81), b. at Dover July 17, 1745; graduated at Harvard 1768; was a member of the committee of safety during the Revolution; sat in the legislature 1776–80; was a delegate to the Continental Congress 1778–79, and a signer of the Articles of Confederation; councillor 1780–84, and State senator 1784–87. D. at Dover Jan. 10, 1787.

Wentworth (John), nephew of Sir John, b. at Portsmouth, N. H., in 1768; was taken to England about 1775; educated as a lawyer; became a barrister at the Inner Temple; published a *Complete System of Pleading* (London, 10 vols., 1797–99); was appointed attorney-general of Prince Edward's Island; resided some years at Portsmouth, where he married his cousin, a daughter of Col. Michael Wentworth, and returned in 1816 to London, where he d. soon afterward.

Wentworth (John), LL.D., grandson of John, Jr. (1745–87), b. at Sandwich, N. H., Mar. 5, 1815; graduated at Dartmouth College 1836; settled in Illinois 1836; studied law at Cambridge Law School, and was admitted to the bar 1841; sat in Congress as a Democrat 1843–51 and 1853–55, and as a Republican 1865–67; was mayor of Chicago 1857; took a leading part in the Illinois constitutional convention of 1861, and edited the Chicago *Democrat* for many years previous to 1861. Author of a *History of the Family of Wentworth* (2 vols., 1870), which is perhaps the most elaborate of all American genealogical works.

Wentworth (Tappan), b. at Dover, N. H., Feb. 24, 1802; became a lawyer at Lowell, Mass.; was president of the common council of that city 1842; served four years in the Massachusetts senate and eight years in the assembly; was a member of Congress 1853–55, and a delegate to the Loyalists' convention at Philadelphia 1866. D. at Lowell June 12, 1875.

Wentworth (Thomas). See Strafford, Earl of.

Wentworth (William), b. at Alford, Lincolnshire, England, in 1615; came to Massachusetts in 1636 with Rev. John Wheelwright; was associated with that clergyman in his difficulties with the Massachusetts government respecting the "Antinomian" opinions attributed to him and to Mrs. Hutchinson; took part in the settlement of Exeter, N. H., 1639; removed thence to Wells, Me., and ultimately settled at Dover, N. H., where he was a ruling elder in the church and often preached. In 1689 he was instrumental in saving Heard's garrison from destruction by the Indians. D. at Dover Mar. 16, 1697. From him are descended all persons of the name in the U. S.

Wentworth Location, p.-v., Stratford tp., Coos co., N. H. P. 38.

Wentz'ville, p.-v., St. Charles co., Mo.

Weogufka, p.-v. and tp., Coosa co., Ala. P. 404.

Wer'dau, town of Germany, kingdom of Saxony, on the Pleisse, has several dyeing establishments and manufactures of cloth and yarn. P. 10,326.

Wer'den, town of Rhenish Prussia, on the Ruhr, manufactures woollen, linen, cotton, and silk fabrics, alum, and copperware. P. 6264.

Werden (Reed), U. S. N., b. Feb. 28, 1818, in Pennsylvania; entered the navy as midshipman Jan. 9, 1834; became lieutenant in 1847, commander in 1862, captain in 1866, commodore in 1871, rear-admiral in 1875; commanded the steamer Stars and Stripes in the fight at Roanoke Island and at the capture of Newberne, and for "gallant service" commended by Rear-Admiral Goldsborough.

Foxhall A. Parker.

Wer'der, von (August), b. Sept. 12, 1808; entered the Prussian army in 1825; took part in the Russian campaigns in the Caucasus in 1842–43, and was severely wounded; became a member of the staff in 1846; received the command of the 4th battalion of chasseurs in 1856; that of the 4th guard infantry brigade in 1863, with the title of major-general; that of the 3d infantry division in 1866, with the title of lieutenant-general, and led this division with distinction in the campaign against Austria in 1866. In the war against France in 1870 he was a member of the staff of the crown prince, but soon received the command of the Baden-Würtemberg army corps, which he led at Wörth, Aug. 6, 1870. He conducted the siege of Strasbourg; was made a general of infantry after the capitulation of the fortress, and repulsed victoriously (Jan. 15–17, 1871) the attack of Bourbaki at Belfort, which success made him very popular in Southern Germany, where an invasion by the army of Bourbaki was generally anticipated. His statue was raised at Freiburg.

August Niemann.

Wer'geland (Henrik Arnold), b. at Christiansand, Norway, June 17, 1808; studied theology at the University of Christiania; received in 1836 an appointment at the library; became keeper of the archives of the state in 1840, and d. Aug. 12, 1845. His collected works (Christiania, 9 vols., 1852–57) contain a large philosophical or religious poem, *The Creation, Man, and the Messiah*, several tragedies, dramas, vaudevilles, and farces or dramatic satires, which in their time attracted much attention; but the best of his productions are his lyrical poems and fairy tales. His influence, however, on Norwegian literature and civilization can by no means be measured by the æsthetic worth of his works. (See Norwegian Language and Literature.) A good selection of his works appeared in 1859 in 1 vol. (See Lassen, *Henrik Wergeland og hans Samtid*, Christiania, 1867.)

Wer'ner (Abraham Gottlob), b. Sept. 25, 1750, at Wehrau, Upper Lusatia, where his father was director of smelting-works; studied at the mining academy of Freiberg and at the University of Leipsic, and was appointed professor of mineralogy in 1815 at Freiberg, where he d. June 30, 1817. His writings are not numerous, comprising only a few minor books, or rather pamphlets—*Ueber die äussern Kennzeichen der Fossilien* (1774; translated into English by Weaver, Edinburgh, 1849), *Kurze Klassification und Beschreibung der Gebirgsarten* (1787), and *Neue Theorie über Entstehung der Gänge* (1791; translated into English by Charles Anderson, Edinburgh, 1809). But by his lectures, to which students from all European countries gathered, he gained many disciples, and his theory, the so-called Neptunian, forms a most important chapter in the history of geology. In 1845 the Wernerian Society was founded in Edinburgh by one of his disciples, Robert Jameson.

Werner (Friedrich Ludwig Zacharias), b. at Königsberg Nov. 18, 1768; studied law at the university of his native city, and entered the Prussian civil service in 1793, holding office first in Warsaw till 1805, then in Berlin. While in Warsaw he wrote in 1800 his first drama, *Söhnen des Thals*, inspired by his enthusiasm for the Freemasons, and in 1804, the *Kreuz an der Ostsee*, to which Hoffmann composed the music. In Berlin he wrote *Martin Luther, oder die Weihe der Kraft*, and *Der 24ste Februar*. This last drama is a representation of Fate as the absolute ruler of human destiny—not the Mohammedan fate, which may fill the heart with fanatical enthusiasm, but a peculiar, mystic, and fantastic power, merely fit to strike the imagination with terror. The whole play is, like his other dramas, the outburst of an ill-regulated imagination, rather than the product of any genuine dramatic or poetic talent, but it is by no means without power. It made a great sensation, and called forth scores of imitations. In 1807 he resigned his office in the Prussian service; travelled in Germany, Switzerland, and France; visited Goethe at Weimar and Madame de Staël at Coppet; went in 1809 to Rome; joined the Roman Catholic Church Apr. 19, 1811; was ordained a priest in 1814; preached in Vienna during the Congress, and made an enormous sensation by the peculiar blending, in his sermons, of coarseness and real power. He spent 1816–17 in Podolia in the house of Count Choloniewski, but in the latter year he returned to Vienna, where he continued to preach with great effect till his death, Jan. 18, 1823. His *Sämmtliche Werke*, with a biography by Schütz, were published in 14 vols. (1839–41), and contain, besides the above dramas, the tragedies *Attila, Wanda, Kunegunde*, and *Die Mutter der Makkabäer* (1820), lyrical poems, hymns, sermons, etc.

Clemens Petersen.

Werner (Karl), b. at Weimar Oct. 4, 1808; studied painting at the academies of Leipsic and Münich; resided in Italy from 1833 to 1853; visited Spain in 1857, and the Orient twice, in 1862 and 1867. He devoted himself to water-colors, and paints mostly landscapes and architecture, subjects from Munich, Prague, Venice, Palermo, Granada, and the Orient. His most celebrated works are—*The Triumphal Procession of Doge Contarini*, five feet high; *The Zisa Hall in Palermo, The Lions' Court of the Alhambra*, and *Jerusalem and the Holy Land*, comprising 30 designs, published with colored plates and text at London (1866–67).

Werner, von (Anton), b. at Frankfort-on-the-Oder May 9, 1843; studied painting at the Academy of Berlin and in Carlsruhe under Adolph Schröder; won a prize for his *Luther before Cajetan* (1865) and *Conradin of Hohenstaufen and Frederick of Baden hearing the Sentence of Death* (1866); painted for the University of Kiel, in 1870,

Luther before the Diet of Worms and *The National Uprising of 1813*; accompanied the German head-quarters during the Franco-German war, and received orders from the emperor for the execution of several large frescoes in the triumphal monument in the Königsplatz in Berlin.

Wernigero'de, town of Prussia, province of Saxony, on the Holzemme, has manufactures of woollen and linen fabrics, bricks, and tiles. P. 6925.

We'sel, town of Rhenish Prussia, on the Rhine, is strongly fortified, and has a good harbor, from which steamboats ply to Amsterdam, manufactures of nails, paper, tobacco, chemicals, and woollen fabrics, and an active trade. P. 18,519.

We'ser, river of Europe, is formed by the junction of the Fulda and Werra at Minden, Hanover, whence it flows northward, and enters the North Sea after a course of 250 miles. It is navigable for vessels drawing 7 feet of water up to Bremen, but large ships ascend no farther than Bremerhafen, at its mouth, and the river is not of much consequence as a road of traffic.

Wes'ley, tp., Will co., Ill. P. 924.

Wesley, p.-v. and tp., Washington co., Me. P. 336.

Wesley, p.-v. and tp., Washington co., O. P. 1450.

Wesley (Bartholomew), the great-grandfather of John and Charles Wesley. As his name was written *Westley*, it is not improbable that he was a descendant of the family represented by John Westley, bachelor in degrees, rector of Langton Matravers, Dorset, England, 1481. *Lea* means a "field," and Hutchins, the historian of Dorset, speaks of a place in that county called *West Leas*; this may have originated the family name. Bartholomew Wesley was the son of Sir Herbert Wesley, or Wellesley (which see). He was born about 1595. He married the daughter of Sir Henry Colley of Kildare, Ireland. Dr. Calamy states that when at the university (perhaps Oxford) he studied physic as well as divinity. He was rector of Catherston and Charmouth, two villages in Dorset, in 1650, and was ejected from both by the Act of Uniformity in 1662. After his ejectment he practised physic for a living, and preached among the nonconformists "as the times would permit." Dr. A. Clarke says: "He was so affected by the premature death of his son John, who was also a minister, that his health rapidly declined, and he did not long survive him. This must have been some time after 1678." Calamy says: "He was, when an old man and the vigor of life was gone, as tender-hearted and affectionate as he had been pious and prudent." T. O. Summers.

Wesley (Charles), M. A., youngest son of the Rev. Samuel Wesley, rector of Epworth, and Susannah Wesley, b. at Epworth Dec. 18, 1708, O. S. (Dec. 29, N. S.). In 1716 he was sent to Westminster School, under his elder brother, Samuel Wesley (which see). Whitehead says: "When he had been some years at school, Mr. R. Wesley, a gentleman of large fortune in Ireland, wrote to his father and asked if he had any son named Charles: if so, he would make him his heir. Accordingly, a gentleman in London brought money for his education several years. But one year another gentleman called—probably Mr. Wesley himself—talked largely with him, and asked him if he was willing to go with him to Ireland. Mr. Charles desired to write to his father, who answered immediately, and referred it to his own choice. He chose to stay in England." Southey says: "Mr. John Wesley, in his account of his brother, calls this a fair escape. The fact is more remarkable than he was aware of, for the person who inherited the property intended for Charles Wesley, and who took the name of Wesley or Wellesley in consequence, was the first earl of Mornington, grandfather of Marquis Wellesley and the duke of Wellington." In 1721, Charles was admitted king's scholar at St. Peter's College, Westminster; in 1726 was elected to Christ Church College, Oxford. While there he became so serious, devout, and zealous that the wits at Oxford called him and his godly companions "Methodists"—a title which had been given derisively to rigidly religious persons a century before. When, with his brother John, he was about to embark for America with Oglethorpe in 1735, he was ordained deacon by Dr. Potter, bishop of Oxford, and the next Sunday presbyter by Dr. Gibson, bishop of London. After preaching with little success in Frederica, Ga., he returned to England, reaching his native land Dec. 3, 1736. On Whitsunday, May 21, 1737, he experienced the "witness of adoption," by which he was raised to a higher plane in the divine life—an event which he commemorated in an immortal hymn, beginning, "Oh! for a thousand tongues to sing!" so popular among Methodists and others. Being excluded from the churches of the Establishment because of his "Methodism," despite his High Church proclivities, he began at once to co-operate with his brother in his great work of evangelization. As far as his health and family circumstances would admit, he travelled extensively in England and Wales, and was very successful as a preacher. But he is chiefly renowned as "the poet of Methodism." He wrote thousands of hymns on every religious theme, versifying large portions of the Scriptures, including most of the Psalms, which beautiful paraphrases have been published in *The Wesleyan Psalter*, edited by the present writer. His hymns constitute the staple of the Methodist hymnals, and are too well known and too highly esteemed to require further notice in this place. D. in London Mar. 29, 1788. At the conference which followed his death John Wesley answered the question "Who died this year?" thus tersely: "Charles Wesley, who after spending fourscore years with much sorrow and pain, quietly retired into Abraham's bosom. He had no disease, but after a gradual decay of some months 'the weary wheels of life at last stood still.' His least praise was his talent for poetry, although Dr. Watts did not scruple to say that that single poem, 'Wrestling Jacob,' was worth all the verses he himself had written." The last lines which he composed were dictated to his wife when he could scarcely articulate:

"In age and feebleness extreme,
Who shall a sinful worm redeem?
Jesus, my only hope thou art,
Strength of my failing flesh and heart;
Oh! could I catch a smile from thee,
And drop into eternity!"

He composed on horseback, in bed, anywhere, on every occasion, and wrote his compositions as soon as he could get pen and paper. Some of his manuscripts have fallen into our possession: they are written in a neat, unique hand, in the style of chirography prevalent in the Wesley family. Charles Wesley was married in 1749 to an excellent woman, Miss Sarah Gwynne of Wales, who after his death was supported principally by his brother John. By her he had eight children, three of whom, two sons and a daughter, lived to a good old age. The daughter, Miss Sarah Wesley, was a woman of fine parts. Her correspondence with Dr. A. Clarke in regard to a ludicrous anecdote of her grandfather and his clerk at Epworth may be found in Tyerman's *History of S. Wesley*, pp. 453, 454. Charles, her eldest brother, was b. Sept., 1757. He inherited the musical genius of his mother and an infant brother, who died before he was born, and who sang a tune and beat time before he was a year old. In his third year Charles learned from his mother to play on the harpsichord. In his fourth year his father introduced him to Dr. Boyce, a leading musician in London, where his astonishing precocity in music led to the proposal that he should be one of the king's singing boys in the chapel royal—an offer his father declined. For half a century, till his death in 1834, he had no rival at the organ, unless it was his brother Samuel. He was b. Feb., 1776. At the age of three he played "God save great George, our king!" Fischer's minuet, which he had caught from street organs. When his brother was playing he would scrape on his little fiddle and beat time to the music. The best organists in London took pleasure in teaching them gratuitously, as they could learn anything and play the hardest music at sight. Samuel became the foremost composer and performer of his age. He composed a high mass for the chapel of Pope Pius VI., who thanked him in a Latin letter written to the apostolic vicar in London. He d. in that city in 1837. The service of music performed at his funeral was grand and impressive beyond precedent. Charles was never married; Samuel was married twice. By his first wife he had three children—Charles Wesley, D. D., late chaplain to Queen Victoria and sub-dean of the chapel royal of St. James's Palace; Emma, who married an artist, and is dead; and the late John William, who for some years was a clerk at the Wesleyan Mission-house, London. By his second wife Samuel had seven children. The first of these was Dr. Samuel Sebastian Wesley, late organist of Gloucester cathedral, and the greatest musical genius in England. He d. Apr. 19, 1876. The other five of Charles Wesley's children, named, respectively, John, Martha Maria, Susannah, Selina, John James, died in infancy. We have a list of 51 of his living descendants, bearing the names of Wesley, Dennis, Newenham, Glenn, Simmonds, Martin, and Bayley. (See *Life of Charles Wesley*, by Thos. Jackson, and Stevenson's *Memorials of the Wesley Family*.) The poetical works of Charles Wesley have been recently edited, in a series of 13 vols., by Dr. Osborn, London.

T. O. Summers.

Wesley (Sir Herbert). Two branches of the Wesley family preserve genealogical tables of their respective ancestry dating back to 1350. From one of those branches sprang Sir Herbert Wesley (or Wellesley) of Westleigh, Devon, who married a relative, Elizabeth Wellesley of Dangan, Ireland. From her branch of the family came Arthur,

the famous duke of Wellington. Sir Herbert and his wife Elizabeth had three children—WILLIAM, HARCHAN, and BARTHOLOMEW. William married the daughter of John Eden of West Ducklund. They had three children—ARTHUR, BRIDGET, and WILLIAM. Arthur died without issue; Bridget married Sir Francis Pulpre; William married Ann, daughter of Sir Thomas Pigott. They had four children—THOMAS, GEORGE, FREDERICK, and MARY. Nothing is known of three of them. George was born in the early part of the eighteenth century. He married first Miss Pelham, who died without issue. His descendants assert that he then married a daughter of Samuel Wesley, rector of Epworth, but without proof. Two sons were the issue of this second marriage—FRANCIS and HENRY, who died unmarried. Francis was born in 1764, and married Miss Bamfylde. They had two sons—WILLIAM, who died without issue, and FRANCIS, who died in 1851. His son ALFRED married Anne Lillie. They had five sons, who are all living, or were recently—to wit, ERNEST GEORGE, LEWIS HERBERT, CHARLES, HENRY, and EDWARD. Ernest George has been for some years in the U. S. He was for a while a preacher of the M. E. Church in New Jersey. He has contributed some poetical pieces to the Nashville *Christian Advocate*, and corresponded with the editor, the present writer, affirming his descent from the rector of Epworth, but through which of his daughters he could not say; nor could his brother Lewis Herbert, when interrogated by Mr. George J. Stevenson of London, from whom we have received much of our information concerning the Wesley family; so that they are probably in error in regard to that intermarriage. Ernest George has recently left the M. E. Church for the Baptist. Lewis Herbert Wesley is an advanced ritualist, a "missioner," in England. Another of the brothers was some time since seeking an alliance with the Wesley family in the person of a daughter of the late Rev. Dr. Charles Wesley, chaplain in ordinary to the queen, and grandson of the poet of Methodism, who d. in 1859. T. O. SUMMERS.

Wesley (JOHN), son of Bartholomew Wesley (or Westley), and grandfather of the founder of Methodism, b. about 1636; educated at New Inn Hall, Oxford, where he was distinguished for piety and diligence and the successful study of the Oriental tongues. After taking his degree, he became a member of a "particular church at Melcombe in Dorsetshire," by which he was sent to preach among the seamen and at Radipole, near Weymouth, though not as a pastor, but a kind of lay-preacher. In 1658 he became the minister of Winterborne Whitchurch, Dorset, by the appointment of the trustees and the approval of the "triers"—persons appointed by Cromwell to authorize men to preach. After the Restoration, he was brought before Gilbert Ironside, bishop of Bristol, who interrogated him concerning his ministry, but dismissed him, saying, "I will not meddle with you. Farewell, good Mr. Westley." But he was subsequently twice imprisoned, and after the passage of the Bartholomew act in 1661 ejected from his living, and persecuted from place to place, till finally he found shelter in Preston; and being called to preach to a society in Poole, he officiated there as pastor, but still resided in Preston to avoid coming under the Five-mile act, Poole being a corporate town. He was several times apprehended, and four times imprisoned. He d. about 1670. Application was made to bury him in the church at Preston, but the vicar would not suffer it. He had a numerous family, but nothing is known of any of them except his two sons, MATTHEW and SAMUEL (which see). His widow survived him about half a century. T. O. SUMMERS.

Wesley (JOHN), A. M., son of the Rev. SAMUEL WESLEY and SUSANNAH WESLEY (which see), b. at Epworth, Lincolnshire, Eng., June 17, 1703, O. S. (June 28, N. S.). When nearly six years of age he narrowly escaped burning to death in the fire which consumed the Epworth parsonage. He received his early training principally from his incomparable mother. At the age of eleven he was sent to the Charter-house School, London, where he made great attainments; at the age of sixteen was elected to Christ Church, Oxford. Here he acquired extraordinary proficiency in all kinds of learning, especially in the classics, logic, and theology. He was ordained deacon by Bishop Potter Sept. 19, 1725, and presbyter Sept. 22, 1728; obtained a fellowship in Lincoln College, Oxford, Mar. 17, 1726; during that year assisted his father at Epworth; was made Greek lecturer and moderator of the classics Nov. 7, 1726; took his M. A. degree in Feb., 1727, and in that year he became his father's curate at Epworth and Wroote, but as it was necessary for him to reside at Oxford, he resigned the curacy and returned to Oxford Nov., 1729. He then became the head of the society at Oxford composed of Charles Wesley, Mr. Morgan, and Mr. Kirkman, who were derisively called "Methodists" because they were so methodical in their lives and strict in the performance of religious duties. Messrs. Ingham, Broughton, Clayton, Hervey, Whitefield, and others subsequently joined their society. In 1735 the two brothers accompanied Oglethorpe to Georgia—John to be a missionary to the Indians, and Charles to be secretary to the governor and a clergyman in the colony. The way was not opened for the mission to the Indians; and as the colonists would not endure the rigid, ascetic discipline which the Wesleys wished to enforce (being then of the extreme High Church party), they returned to England, Charles in 1736, and John in 1738. While he was at Savannah, he paid his addresses to a Miss Hopkey, but was fortunately unsuccessful: if he had married her, he would have been very "unequally yoked." On his voyage, in Georgia, and on his return to England he became acquainted with some Moravians, whose experience in regard to justification by faith and the assurance of pardon led him to exclaim, "I, who went to America to convert others, was never myself converted to God." He used the word "converted" in a peculiar sense. He was all the time a sincere and devout Christian, full of good works, but he had not a clear sense of pardon by the witness of the Spirit, as he subsequently had. He says: "In the evening (of May 24, 1738) I went very unwillingly to a society in Aldersgate street (London), where one was reading Luther's preface to the Epistle to the Romans. About a quarter before nine, while he was describing the change which He works in the heart through faith in Christ, I felt my heart strangely warmed. I felt that I did trust in Christ, Christ alone, for salvation; and an assurance was given me that he had taken away my sins, even mine, and saved me from the law of sin and death." While he was seeking this experience—viz. May 1, 1738—he formed the first Methodist "society," in Fetter Lane, London. The following summer he visited Count Zinzendorf and the Moravians in Germany to study their discipline and to intensify his spiritual life. On his return from Germany, being excluded from the churches of the Establishment because of his "Methodism," he imitated Whitefield, preaching in the fields and in private houses, wherever occasion served. The foundation-stone of his first chapel was laid in Bristol May 12, 1739. An old foundry in Moorfields, London, was purchased, and opened for preaching Nov. 11, 1739. Wesley says: "In the latter end of the year 1739 eight or ten persons came to me in London and desired that I would spend some time with them in prayer, and advise them how to flee from the wrath to come: this was the rise of the *united society*." From that period to the close of his life he was incessantly engaged in preaching, forming societies, governing them, providing them spiritual help. As their members increased rapidly in various parts of the kingdom, and as few clergymen would co-operate with him, while some repelled his followers from their churches, he was led to employ laymen to preach, though not to administer the sacraments. The first whom he employed was Thomas Maxfield, in 1741. Wesley would have silenced him at first, but his mother remonstrated, telling him, "He is as surely called of God to preach as you are." John Nelson, a stone-mason of Birstall, and others, soon followed. In 1742, Wesley instituted *class-meetings*—first at Bristol, where they were originated for the purpose of paying a debt on the chapel, but as they were found admirably adapted to maintain godly discipline and Christian fellowship, they became an important and permanent feature of Methodism. He held his first *conference* at the Foundry in London June 25, 1744, when there were present four clergymen, besides himself and his brother Charles, and four lay-preachers—ten in all. In Aug., 1744, he preached his last sermon before the University of Oxford. At the next conference (Aug. 1, 1745) only one clergyman besides himself and brother were present, the other seven being lay-preachers. The third conference was held at Bristol May 12, 1746. It was attended by John and Charles Wesley, John Hodges, and six lay-preachers. The work was then systematically arranged and divided into "circuits"—seven in England and Wales, none as yet in Scotland and Ireland—and the call and qualifications of preachers were defined substantially as in the present Methodist Discipline. Twelve "assistants" were then recognized. Thus originated the great Wesleyan system of *itinerancy*. In June, 1748, he opened Kingswood School, near Bristol, an institution designed for the education of preachers' sons and others. This was the nucleus of the vast system of literary and theological institutions which now obtains among the Methodists. In 1753, supposing that he was going to die, he wrote his own epitaph: "Here lieth the body of John Wesley, a brand plucked out of the burning: who died of a consumption in the fifty-first year of his age: not leaving, after his debts are paid, ten pounds behind him; praying, God be merciful to me an unprofitable servant!" His friend Whitefield, supposing him to be near the grave, wrote him a touching letter, concluding

thus: "*Ego sequar, etsi non passibus æquis.* My heart is too big, tears trickle down too fast, and you are, I fear, too weak for me to enlarge. Underneath you may there be Christ's overlasting arms! I commend you to his never-failing mercy, and am, revered and very dear sir, your most affectionate, sympathizing, and afflicted younger brother in the gospel of our common Lord." But Wesley lived to preach the funeral sermon of Whitefield, Nov. 18, 1770. At the twenty-seventh conference, held Aug. 7, 1770, "minutes" were adopted which led to a more formal and permanent separation from the Calvinistic Methodists, who were in connection with Whitefield and Lady Huntingdon. A sharp and prolonged controversy took place, in which the saintly Fletcher of Madeley came to the help of Wesley and defended his evangelical Arminianism against the fierce attacks of Toplady, Richard and Rowland Hill, and others. The result is too well known to be here recorded. The Wesleyan Methodists have never since "leaned toward Calvinism." When he was fourscore years of age, naturally looking forward to his death, and being desirous to perpetuate the work of God wrought through his instrumentality, he had "the Deed of Declaration" executed, Feb. 24, 1784, by which the government of the connection was assigned legally to the conference, consisting of 100 preachers and their successors for ever. This fixed the *status* of British Wesleyan Methodism with regard to both doctrine and discipline. In 1766 two Irish local preachers, Embury and Strawbridge, began to preach in New York and Maryland; and at the conference in 1769, Wesley sent to America two travelling preachers, Boardman and Pilmoor, to take charge of the societies they had formed. In 1770 he set down in the appointments, "No. 50, America." In 1771 he sent over Francis Asbury and Richard Wright, and in 1773, Messrs. Rankin and Shadford. As the work increased so rapidly in America, as the colonial Church of England, to which the Methodists generally had looked for the sacraments (their own preachers not being empowered to administer them), was virtually extinct, as the English bishops would not ordain ministers for America, and as Wesley had long before repudiated the theory of prelatical succession, recognizing the parity of bishops and presbyters as to order—being importuned by the American societies, he provided them with an ordained ministry. He was a staunch Episcopalian; so he ordained Richard Whatcoat and Thomas Vasey as elders, or presbyters, and the Rev. Thomas Coke, LL.D., a clergyman of the Church of England, as superintendent, or bishop. At a conference in Baltimore Dec., 1784, Bishop Coke, assisted by the Rev. Mr. Otterbein of the German Reformed Church and others, consecrated Francis Asbury bishop, and ordained others as elders, or presbyters, and deacons. Thus originated Methodist *episcopacy*. At first, Wesley, being intensely loyal, wrote against the American "rebellion;" but when he saw the hand of God in it, he wrote a powerful letter to Lord North, imploring the government to stop the war. When, therefore, the colonies had acquired their independence, Wesley was fully prepared to take this important step. Speaking of the American brethren, he said: "We judge it best that they should stand fast in that liberty wherewith God has so strangely made them free." He abridged and modified the liturgy, offices, ordinal, and Articles of the Church of England for the M. E. Church in America, as, with some changes, they are used by that Church to this day. This was the crowning act of his life. He ordained a few ministers for special service in England and Scotland, and he would have ordained more of them, but he wished to keep his connection, as far as possible, within the pale of the national establishment. But for this he would have organized his societies in Great Britain and Ireland into an Episcopal Church, like the M. E. Church in America. Wesley's constant prayer was to lay down his body with his charge "and cease at once to work and live." His prayer was answered, for he labored on to the last. It has been well said of him: No man perhaps ever accomplished so much. He rode, chiefly on horseback, 5000 miles, and preached 500 sermons every year for nearly fifty years; arranged and governed his societies, which numbered before his death some 80,000 members; carried on an immense correspondence; read every work of note as it came from the press; wrote commentaries on the Bible, grammars of the Hebrew, Greek, Latin, and French languages, works on logic and philosophy, controversial treatises, journals, sermons, etc., and abridged over 100 volumes for "A Christian Library." He was never in a hurry—always cheerful, deferential to women, and fond of children. His generosity was limited only by his means. He acted upon the principle he laid down for others: Make all you can by industry; save all you can by economy; give all you can by liberality. When a young man he walked from London to Epworth (160 miles) that he might have more to give away. In after life, though he realized £20,000 by his writings, his personal expenses did not average £100 a year, and he left nothing at his death. His life was often in danger from the fury of mobs, and his delicate mind felt keenly the contempt of the higher classes, his equals, yet he could say, None of these things move me. He lived in constant activity, cheerfulness, and trust in God. A lady once asked him, "Mr. Wesley, supposing that you knew that you were to die at twelve o'clock to-morrow night, how would you spend the intervening time?" "How, madam?" he replied; "why, just as I intend to spend it now. I should preach this evening at Gloucester, and again at five to-morrow morning. After that, I should ride to Tewkesbury, preach in the afternoon, and meet the societies in the evening. I should then repair to friend Martin's house, who expects to entertain me, converse and pray with the family as usual, retire to my room at ten o'clock, commend myself to my heavenly Father, lie down to rest, and wake up in glory." Like the rest of the Wesley family, he was fond of music and poetry. He published several volumes of tunes for the organ and voice, and quite a library of hymns and poems. He wrote elegant hymns himself, and is accredited with the admirable translations from the German, French, and Spanish found in his hymn-books. He was a keen and judicious critic, and many of the hymns of his brother Charles, Dr. Watts, Herbert, and others were greatly improved by his pruning and correction. He lived long enough to see the tongue of slander hushed and the hand of persecution stayed, except in rare instances, and to win golden tributes from Dr. Samuel Johnson, Alexander Knox, and other distinguished men of the age. Knox closes an exquisite eulogy of him with this sentence: "I never was so happy as while with him, and scarcely ever felt more poignant regret than at parting from him; for well I knew 'I ne'er should look upon his like again.'" His person is thus described: "The figure of Mr. Wesley is remarkable. His stature was low; his habit of body, in every period of life, the reverse of corpulent, and expressive of strict temperance and continual exercise; and, notwithstanding his small size, his step was firm and his appearance, till within a few years of his death, vigorous and muscular. His face, for an old man, was one of the finest we have seen. A clear, smooth forehead, an aquiline nose, an eye the brightest and most piercing that can be conceived, and a freshness of complexion scarcely ever to be found at his years, and expressive of the most perfect health, conspired to render him a venerable and interesting figure. Few have seen him without being struck with his appearance, and many who had been greatly prejudiced against him have been known to change their opinion the moment they were introduced into his presence. In his countenance and demeanor there was a cheerfulness mingled with gravity—a sprightliness which was the natural result of an unusual flow of spirits, and yet was accompanied with every mark of the most serene tranquillity. His aspect, particularly in profile, had a strong character of acuteness and penetration. In dress he was a pattern of neatness and simplicity. A narrow plaited stock, a coat with a small upright collar, no buckles at his knees, no silk or velvet in any part of his apparel, and a head as white as snow, gave an idea of something primitive and apostolic, while an air of neatness and cleanliness was diffused over his whole person." He was two or three times "crossed in love," but, considering it his duty to enter the conjugal state, he married, in 1757, Mrs. Mary Vizelle, a woman of cultivation and apparent piety, but she proved a very vixen, who did all in her power to ruin him. He bore her treatment with marvellous forbearance till she finally robbed him of important papers and left him for ever, whereupon he calmly said, *Non eam reliqui, non dimisi, non revocabo.* She died in 1781, leaving him a ring. He died in London Mar. 2, 1791, surrounded by some of his preachers and other friends, exclaiming, "The best of all is, God is with us." He was buried Mar. 9 at City Road chapel, where a marble tablet commemorates his life and labors. On Mar. 30, 1876, a marble tablet to the memory of John and Charles Wesley, showing their profiles, and also representing John Wesley preaching on his father's tomb at Epworth, where he was excluded from the church, was unveiled in Westminster Abbey by Dean Stanley in the presence of the president of the conference, Dr. Jobson, who designed the tablet, and others, who took part in the impressive ceremony. Time works great changes. (See *Life of John Wesley*, by John Hampson, by Dr. Coke and Henry Moore, Dr. John Whitehead, Robert Southey (with notes by Dr. Curry), Richard Watson (with "Observations on Southey's Life of Wesley," and notes by the present writer); *Vie du Révérend Jean Wesley* (a French translation of Watson's *Life of Wesley*, with notes, etc.); Isaac Taylor's *Wesley and Methodism*; Tyerman's *Life of Wesley*; Dr. Rigg's *Living Wesley*; *Journal of John Wesley*, in his *Works*, 7 vols.)

T. O. SUMMERS.

Wesley (Matthew), eldest son of John Wesley, who was ejected from the vicarage of Whitchurch, and uncle of the founder of Methodism, b. about 1662. He settled as a physician in London, and was eminent in his profession, making a large fortune. He contributed to the support of the dependent family of his brother Samuel, whose wife gives an interesting account of a visit he made to Epworth in 1731. An elegy on his death may be found in the *Gentleman's Magazine*, June, 1737. He had a son who was educated at Oxford, but who shortened his life by intemperance. Charles Wesley used to say, "This young man was a profligate, and the only drunkard in the family." D. in June, 1737. (*See* A. Clarke's *Wesley Family*, and Tyerman's *Life of the Rev. Sam. Wesley, Sr.*) T. O. Summers.

Wesley (Samuel, Sr.), son of John and grandson of Bartholomew Wesley, or Westley (which see), and father of the founder of Methodism. B. at Winterborn-Whitchurch, Dorset, 1662. His education began at the free school in Dorchester conducted by Henry Dolling. At fifteen he went to an academy in London, where he remained till Aug., 1683; was thence transferred to the Stepney academy, conducted by the learned nonconformist divine Edward Veal, one of the Bartholomew sufferers. At the end of about two years that academy was broken up in consequence of the persecution of the magistrates, and Wesley was sent to the famous academy of Charles Morton, Newington Green, where he had De Foe for a schoolmate. Here he remained till the summer of 1683. During all this period he was expected to enter the ministry among the nonconformists, and he wrote satires, lampoons, etc. against the Episcopal clergy, encouraged thereto by the nonconformist ministers. But after more carefully examining the subject, he renounced nonconformity and entered as a *servitor* and *pauper scholaris* in Exeter College, Oxford, in 1683, and remained there till 1688. He eked out his subsistence at the university by his pen. He took his degree of B. A. June 19, 1688, and seven weeks after was ordained deacon at Bromley by Dr. Sprat, bishop of Rochester. He was first appointed to a curacy, with an income of £28 a year. At the end of one year he was appointed chaplain on board a man-of-war, with £70 a year. He held this office one year, during which he began his *Life of Christ*. He then held for two years a curacy in London, with £30 a year, which he raised to £60 by his pen. At this time he married Susannah, daughter of the eminent ejected nonconformist divine, Dr. Samuel Annesley. In 1691 he was appointed to the parish of South Ormsby in Lincolnshire, where he also acted as domestic chaplain to the marquis of Normandy, who desired him to be raised to an Irish episcopate, but William and Mary and Archbishop Tillotson favored it not. As Wesley could not tolerate the immoralities of the earl of Castleton, who kept a mistress in his parish, he had to leave South Ormsby. Having dedicated his *Life of Christ* to Queen Mary, she presented him with the living of Epworth in Lincolnshire, of which he was rector thirty-nine years, and where he d. Apr. 22, 1735. For four or five years he had also the rectory of Wrooto, a little village near Epworth, which, however, hardly paid his curate. In 1734 he resigned it to his son-in-law, John Whitelamb. As he was the father of nineteen children (some of them twins), had to assist poor relations (including his widowed mother), met with many reverses, and never had more than £200 a year for his salary, it is no wonder that he sometimes complained of the *res angusta domi*. When censured by his brother for not getting along better in the world, he referred to "eight children born and buried, ten living brought up and educated," three sons having the best education he could get for them in England. "He can struggle with the world, but not with Providence: nor can he resist sickness, fires, and inundations." He was a man of great learning, of large benevolence, loyal, devout, and conscientious in the exercise of his sacred functions. He is frequently described as a Tory and a High Churchman, but he was no Jacobite or bigot. He was the eulogist of William and Mary and Tillotson, who headed the Low-Church party. He rejoiced when he learned what his sons John and Charles were doing at Oxford, which gained for them the name of "Methodists" and "The Holy Club." He wrote (Dec. 1, 1730): "I hear my son John has the honor of being styled the 'father of the Holy Club.' If it be so, I must be the grandfather of it; and I need not say that I had rather any of my sons should be so dignified and distinguished than to have the title of His Holiness." He was a prolific author. His first volume of poems, called *Maggots*, was published in 1685; it consists of humorous and satirical pieces on various subjects. He was the principal contributor to the *Athenian Gazette* and the author of numerous pamphlets. But his great works were *The Life of Christ, an Heroic Poem, Dissertations on the Book of Job*, in Latin, and *Eupolis's Hymn to the Creator*. As an author he is best known to the present age by his two elegant hymns, found in Methodist hymnals, "Behold the Saviour of mankind," and "O Thou who when I did complain." (*See Life and Times of the Rev. Samuel Wesley*, by Tyerman, in which will be found a full account of the mysterious noises which disturbed the Epworth parsonage in 1716–17, considered by some preternatural; A. Clarke's *Wesley Family*; and the various *Lives* of John and Charles Wesley.) T. O. Summers.

Wesley (Samuel, Jr.), A. M., eldest son of the Rev. Samuel and Susannah Wesley, and brother of John and Charles Wesley (which see), b. in London Feb. 10, 1690. His brother John states that he had the mark of a mulberry on his neck: "Every spring it was small and white; it then grew larger, exactly as real mulberries do, being greenish, then red, then a deep purple, as large and of as deep a purple as any real mulberry on the tree." He made no attempt to speak till he was nearly five years old, when, being missed by his mother, who called for him loudly by name, he cried out from under a table, "Here am I, mother." She then taught him to read, and laid the foundation of his exalted intellectual and moral character. In 1701 he was sent to Westminster School, where he was admitted king's scholar in 1707. He there attracted the attention of Dr. Sprat, bishop of Rochester, who took him to his seat at Bromley to read to him at night, which the youth did not much relish, as he was hoarse and purblind. In 1711 he was elected to Christ Church, Oxford. After taking his A. M. degree, he went to officiate as usher in his old school at Westminster, and soon, by the advice of his friend Bishop Atterbury, entered into holy orders. He became familiar with Lord Oxford, Pope, Swift, Prior, and other Tory poets and statesmen, though he associated also with Addison and others of his class. He was the uncompromising friend of Atterbury, and this probably kept him from preferment in the Church. In 1732 he became headmaster of Blundell's free grammar school at Tiverton, where he remained till his death, Nov. 6, 1739. He was buried in Tiverton churchyard, where his tombstone bears an inscription which describes him as a man of uncommon wit and learning, eminent for piety and benevolence, and an excellent preacher. He was one of the founders of the first infirmary set up at Westminster, now St. George's Hospital. He belonged to the old High Church school, and did not co-operate with his Methodist brothers. Like them, he was greatly gifted in poetry. He began writing charity hymns when he was about twenty years of age. The first edition of his poems was published in quarto in 1736; a second, with additions, was published in 12mo in 1743. A new edition was published, with a *Life* of the author, by William Nichols in 1862. They consist of odes, epigrams, epitaphs, epithalamiums, translations, hymns, etc., and are characterized by great classical elegance, genial humor, sparkling wit, and sometimes withering satire. He will be best known to posterity by his hymns in the Methodist hymnbook on the Passion, Easter, to God, the Father, Son, and Holy Ghost, and an exquisite piece on the death of a young lady: "The morning flowers display their sweets." T. O. Summers.

Wesley (Susannah), wife of the Rev. Samuel Wesley, Sr. (which see), was the youngest daughter of the famous ejected nonconformist divine, Dr. Annesley, b. Jan. 20, 1669. Before she was thirteen years old she conformed to the Church of England, and in 1689 became the wife of Samuel Wesley, to whom she bore nineteen children. Her method of teaching her children was peculiar and successful. It is detailed in a letter to her son John dated July 24, 1732. They were not taught to read till they were five years old, when they learned the alphabet in a day or two, and began to spell and read, first a line, and then a verse, mastering it perfectly. She was a model *materfamilias*, and her famous sons owed much to her wise and godly counsels. After her husband's death and a short sojourn with her daughter Emilia, she resided with her son John in London, and became his judicious adviser in carrying on his great work. She was the true matriarch of Methodism. She encouraged her son to employ lay-preachers, and she was profited by their ministry. Her writings show that she had a superior intellect and a devout spirit. In her last days her experience was rich and ripe, and she spoke clearly of the assurance of pardon, on which she had previously been reserved, though she appears to have been a true Christian all her days. D. in London July 23, 1742. "We stood around her bed," said her son John, "and fulfilled her last request, uttered a little before she lost her speech, 'Children, as soon as I am released sing a psalm of praise to God.'" An immense multitude attended her burial in Bunhill Fields, Aug. 1, when her son John de-

livered a solemn discourse. Her tomb has been reconstructed, and an appropriate epitaph perpetuates her memory. Dr. A. Clarke says the names of only thirteen of her nineteen children have been recovered: SAMUEL, JOHN, CHARLES (see the foregoing articles); SUSANNAH, b. Mar. 31, 1691; d. Apr. 17, 1693; EMILIA, b. 1692, married an apothecary at Epworth, named Harper, who left her a widow. She taught school at Leicester and Gainsborough, as she was a good scholar. For many years before her death (about 1770) she resided at the preachers' house in West street, London. She was a poet, and her brother John said, "My sister Harper was the best reader of Milton I ever heard." She was a constant attendant at her brother's chapel, the old Foundry. ANNESLEY and JEDEMIAH (twins), b. 1694; d. in infancy. SUSANNAH (the second so named), b. 1695. She was highly cultivated, but unequally yoked to Richard Ellison, who proved "little inferior to the apostate angels in wickedness," so that she was forced to separate from him. She had four children—JOHN, who lived and died at Bristol: he left two daughters and a son—ELIZABETH, who was unfortunate in life, and was often relieved by John Wesley; PATIENCE, who married at Bristol, and became a devout dissenter: JOHN was a respectable man, who resided in Bristol. ANN, Susannah's second child, married Pierre le Lièvre, a French Protestant refugee. He left a son, Peter le Lièvre, who was educated at Kingswood School, took orders in the Church of England, and died at his living in Lutterworth. He left a son who became a clergyman of good character. Ann married a second time—a gentleman named Gaunt, who soon left her again a widow. It was at the house of this Mrs. Gaunt, in London, that her mother, formerly Susannah Wesley, died. DEBORAH ELLISON, married Pierre Collet, another French refugee, and, like the former, a silk-weaver. RICHARD ANNESLEY ELLISON died at twenty-seven, leaving two daughters—one, Mrs. VOYSEY, wife of a dissenting minister, who had four children, all respectable: MARY WESLEY, b. 1696: married her father's curate at Wroote, John Whitelamb, and died in childbed. She was somewhat deformed in body, but exquisitely beautiful in countenance and angelic in disposition; MEHETABEL WESLEY, b. at Epworth 1697; d. Mar. 21, 1751. She could read the Greek Testament when eight years old. She had a fine poetic genius, and was full of sprightliness and wit, but she was unequally yoked to a plumber and glazier named William Wright, who treated her badly and broke her heart. For several years before her death she enjoyed the ministrations of her brothers, and in association with the Methodists closed her life in triumph. ANNA WESLEY, b. at Epworth 1702; she married John Lambert, a surveyor of Epworth; MARTHA WESLEY, b. at Epworth 1707, in 1735 married the Rev. Wesley Hall, who became an apostate, an adulterer, a monster of wickedness, whose demon-like conduct she bore with superhuman patience. She had ten children; nine died at Salisbury, and the survivor, WESLEY, while being educated at the expense of his uncles, died at the age of fourteen. Martha (Mrs. Hall) was a great favorite with Dr. Samuel Johnson and other learned men. She died in triumph July 12, 1791, shortly after the death of her brother John, whom she resembled in body and mind. KEZIAH WESLEY, b. at Epworth 1710; d. at the house of her sister, Mrs. Hall, Mar. 9, 1741. She was a teacher for some time in a boarding school at Lincoln. Like every other member of the Wesley family, she possessed a fine mind (though afflicted in body), and died the death of the righteous. T. O. SUMMERS.

Wesleyan Female College, located at Macon, Ga., was founded in 1836, and, it is believed, was the first female college in the world that was chartered with full powers to confer upon females the usual degrees conferred by other colleges upon males. It is well endowed, and has been in a prosperous condition for forty years, under the control of the Methodist Episcopal Church, South.

A. H. STEPHENS.

Wesleyan Methodists. See METHODISM, by ABEL STEVENS, A. M., LL.D.

Wesleyans, Primitive. See METHODISM, by ABEL STEVENS, A. M., LL.D.

Wesleyan University, located at Middletown, Conn., is the oldest of the colleges under the control of the Methodist Episcopal Church. About the close of the first quarter of the present century the leading minds of that Church became convinced of the need of some institution of collegiate rank in New England or New York which should be under the auspices of their own denomination. Accordingly, in the spring of 1829 a joint committee appointed by the New York and New England conferences issued proposals inviting the several towns within a specified region to compete for the location of the proposed college by the offer of subscriptions. In response to these proposals, two large stone buildings in the city of Middletown, erected five years before for the American Literary, Scientific, and Military Academy, but recently vacated by the removal of that institution to Norwich, Vt., were now offered to this committee as a gift, on the condition that an endowment fund of $40,000 should be raised for the new college. This offer, accompanied by a subscription of $18,000 from the citizens of Middletown, was at once accepted; the remainder of the $40,000 was soon raised, and the college organized and chartered under the name of the Wesleyan University. Its first class, numbering 6, was graduated in 1833. At present (1876), the faculty comprises 16 professors and instructors; the students number 176. Some three years since the curriculum was judiciously modified in accordance with modern educational theories, and expanded by the introduction of a considerable number of elective studies. The college now offers three courses of study of four years each. The classical course is substantially the same as that of other New England colleges; the Latin-scientific course omits Greek, and the scientific course both Latin and Greek, in order to give time for more thorough attention to the modern languages and to physical science. Nine-tenths of the students now take the classical course. In 1872 the doors of the college were opened to ladies. Within the last decade the material interests of the college have greatly advanced. Three elegant buildings have been erected—a library, the gift of Isaac Rich, Esq.; the memorial chapel, which commemorates the 18 alumni and students who fell in the late war; and the Orange Judd hall of natural science, the gift of the gentleman whose name it bears. The total value of the buildings and grounds of the college, as given in the last report of the treasurer (1875), is $400,000. During the current year a vigorous and hopeful effort is making to secure a generous enlargement of the endowment of the college. The library numbers about 27,000 volumes; the observatory contains a 12-inch refracting telescope by Alvan Clarke & Sons; finely-appointed laboratories, with ample chemical and physical apparatus and extensive cabinets illustrating the departments of geology and natural history, furnish the undergraduate with unusual facilities for the study of physical science. The presidents of the college have been—Wilbur Fisk, D. D., 1831–39; Stephen Olin, D. D., LL.D., 1839–41; Nathan Bangs, D. D., 1841–42; Stephen Olin, D. D., LL.D., second term, 1842–51; Augustus William Smith, LL.D., 1851–57; Joseph Cummings, D. D., LL.D., 1857–75; and Cyrus D. Foss, D. D. The whole number of graduates of the college is 1138, of whom about 950 are now living. C. T. WINCHESTER.

Revised and approved by Cyrus D. Foss, D. D., President of Wesleyan University.

Wesleyan University, an institution of learning at Delaware, O., chartered in 1843, and organized in 1844 under the auspices of the Ohio and North Ohio conferences of the M. E. Church; has fine grounds and above 800 varieties of trees and shrubs, the site having formerly been a noted watering-place called the Sulphur Springs; has an endowment fund of $250,000, and has sold large numbers of cheap scholarships, and is well provided with cabinets of natural history. The presidents have been Rev. Edward Thomson, D. D. (subsequently bishop), 1846–60; Rev. Frederick Merrick, D. D., 1860–73; Rev. Lorenzo D. McCabe, 1873–76; and Rev. Charles H. Payne, D. D., inaugurated June, 1876.

Wesobul'ga, tp., Clay co., Ala. P. 907.

Wes'sel (JOHANN), also called **Gansfort** (the name of a village from which his family probably came), b. at Gröningen, Holland, about 1420; was educated in the school of Zwolle, then under the leadership of the celebrated Gerhard Groot, and enjoyed the friendship of Thomas à Kempis, who was sub-prior of the neighboring monastery of Mount St. Agnes; went to Cologne, where he learned Greek and Hebrew and studied Plato; resided for many years at Paris, where he took part with great energy in the controversy between nominalism and realism, and began to teach, having Reuchlin and Agricola among his pupils; visited Rome, and stayed for some time at Heidelberg, teaching philosophy, but turned more and more decidedly away from the whole scholastic method based on Aristotle, and began to be suspected of holding heretical views; retired finally to his native city, and d. there Oct. 4, 1489. According to Ullmann, he was pre-eminently the *theological* forerunner of the Reformation. Martin Luther said of him, "If I had read Wessel before I began, my opponents would have imagined that Luther derived everything from Wessel, so do we agree in spirit." Personally, he escaped persecutions, but his writings, by which he belongs to the Reformers before the Reformation, were partly burnt by the monks. The remaining works were first published by Luther in 1522 under the title *Farrago Rerum*

Theologicarum; afterward by Johann Lydius (1617). His *Life* has been written by Ullmann (1831) and Bähring (1846). (See also Ullmann's *Reformatoren vor der Reformation*, 2d vol. (1842; English translation 1855).)

Wes'sells (Henry Walton), b. at Litchfield, Conn., Feb. 20, 1809; graduated at the U. S. Military Academy July, 1833, when appointed brevet second lieutenant of 2d Infantry. Mainly on duty in garrison until 1837, he then served for five years in Florida against the hostile Seminoles; again in garrison until 1846, he was ordered in that year to Mexico; promoted captain Feb., 1847, he led his company in the operations of Gen. Scott's army from Vera Cruz to the City of Mexico; was wounded at Contreras, and brevetted major for gallantry on that occasion and at Churubusco; served on the Pacific coast 1849-51, and on the N. W. frontier 1855-61, being engaged in the Sioux expedition of 1855. In Aug., 1861, he was appointed colonel of the 8th Kansas Vols., and engaged on the Missouri border until Feb., 1862. Commissioned brigadier-general of volunteers Apr. 25, 1862, he was engaged before Yorktown and at the battle of Fair Oaks, where wounded; in the defence of Suffolk, Va., Sept.-Dec., 1862, when transferred to North Carolina, and engaged in the actions at Kinston and Goldsboro' during that month, and in subsequent defence of Newberne until May, 1863, when assigned to the defence of Plymouth, which place he was compelled to surrender Apr. 20, 1864, after a fight of four days, and was himself held a prisoner until August, when exchanged, and in November appointed commissary of prisoners. In charge of the draft rendezvous at Hart's Island Feb., 1865, until mustered out of the volunteer service, Jan., 1866. In Feb., 1865, he had attained a lieutenant-colonelcy in the 18th regular infantry, with which he served on the N. W. frontier until 1869. Brevet colonel and brigadier-general for gallant and meritorious services during the war. Retired Jan. 1, 1871.

Wessex. See Heptarchy.

West, tp., Effingham co., Ill. P. 859.

West, tp., McLean co., Ill. P. 911.

West, tp., Marshall co., Ind. P. 1489.

West, tp., Montgomery co., Ia. P. 432.

West, tp., Columbiana co., O. P. 1985.

West, tp., Huntington co., Pa. P. 1367.

West (Benjamin), LL.D., b. at Rehoboth, Mass., in Mar., 1730; was a bookseller at Providence, R. I., during the Revolution, and a manufacturer of clothing for the Continental soldiers; pursued mathematical and scientific studies; published an almanac 1763-93; furnished the Royal Society with his observations on the transit of Venus 1769; taught mathematics in the Episcopal seminary at Philadelphia 1781-86; was professor in Brown University 1786-99, and postmaster at Providence 1812-13. D. at Providence Aug. 13, 1813.

West (Benjamin), R. A., b. at Springfield, Pa., Oct. 10, 1738, of Quaker parents; displayed great artistic precocity in childhood; studied painting at Philadelphia 1757; practised his art in that city and the surrounding towns, and also in New York; resided and studied in Italy 1760-63; settled at London 1763; married there Miss Elizabeth Shewell, an American lady, 1765; soon acquired a high reputation by his portraits; enjoyed the friendship of Reynolds and of many distinguished men, and the patronage of the nobility and of George III., for whom he executed a large number of religious pieces and pictures from early English history; was elected to the Royal Academy 1768; was its president 1792-1802, and again from 1803 until his death; enjoyed a career of great prosperity, and produced above 400 pictures. D. in London Mar. 11, 1820, and was buried in St. Paul's cathedral. His best-known pictures were *The Battle of La Hogue*, *The Death of Wolfe* (1771), *Christ Healing the Sick* (1802), and *Death on the Pale Horse*. A *Life* (1816) was published by John Galt.

West (Gilbert), LL.D., b. in England in 1706; educated at Eton and Oxford; was for some time an officer of cavalry; became clerk of the privy council (1729) and under-treasurer of Chelsea Hospital, and was an intimate friend of William Pitt and of Lord Lyttelton, who was his cousin. D. at Wickham, Kent, Mar. 26, 1756. Author of *Observations on the History and Evidences of the Resurrection of Jesus Christ* (1747) and of a translation of the *Odes of Pindar* (1749).

West (J. Rodman), b. at New Orleans Sept. 19, 1822; studied at the University of Pennsylvania, but without graduating; captain of volunteers in the Mexican war; emigrated to California in 1849, where engaged in commercial pursuits until the outbreak of civil war, at which date he was publisher of the San Francisco *Price Current*; as lieutenant-colonel of the 1st California Vols. he served in New Mexico and the South-west. Returning to New Orleans soon after the close of war, he served as chief deputy U. S. marshal, auditor of customs, and auditor of improvements. In 1871 he was chosen U. S. Senator from Louisiana.

West (Nathaniel), D. D., b. in Ireland in 1794; studied theology in Scotland under Dr. Chalmers; came to the U. S. 1834; was pastor of churches at Meadville, Pittsburg, and Philadelphia, and chaplain of the Satterlee U. S. General Hospital at West Philadelphia from 1862 until his death, Sept. 2, 1864. Author of *A Complete Analysis of the Holy Bible*, etc. (1853).

West (Samuel), D. D., b. at Yarmouth, Mass., Mar. 4, 1730; graduated at Harvard 1754; was ordained 1761; was many years pastor at New Bedford, teaching the doctrines subsequently known as Unitarian; was an active Whig writer during the Revolution; decipherer the treasonable letter of Dr. Benjamin Church, and was a member of the Massachusetts constitutional convention. D. at Tiverton, R. I., Sept. 24, 1807. Author of an ingenious treatise, *Essays on Liberty and Necessity* (2 parts, 1793-95), in reply to Edwards *On the Will*.

West (Samuel), D. D., b. on the island of Martha's Vineyard, Mass., Nov. 19, 1738; graduated at Harvard 1771; was appointed chaplain at Fort Pownall in Penobscot; was ordained minister of Needham 1761, and pastor of the Hollis street church, Boston, 1789, and in the later portion of his career embraced the doctrines now known as Unitarian. D. at Boston Apr. 10, 1808. Author of *Essays* signed "An Old Man" in the *Columbian Centinel* (1806-07), and of several published sermons.

West (Stephen), D. D., b. at Tolland, Conn., Nov. 13, 1735; graduated at Yale College 1755; studied theology while teaching school at Hatfield, Mass.; became chaplain of Hoosick Fort 1757; succeeded Jonathan Edwards as missionary to the Stockbridge Indians 1758; was pastor of the Congregational church at Stockbridge 1759-1818, having resigned the charge of the Indian mission 1770, at which date he adopted the Hopkinsian theological opinions, having previously been an Arminian. D. at Stockbridge May 15, 1819. Author of *An Essay on Moral Agency*, *Remarks on Edwards's Enquiry on Freedom of the Will* (New Haven, 1772; enlarged 1794), *The Duty and Obligation of Christians to Marry only in the Lord* (1779), *An Essay on the Scripture Doctrine of the Atonement* (1785), *An Inquiry into the Ground and Import of Infant Baptism* (1791), *The Life of Rev. Samuel Hopkins, D. D.* (1805), and *The Evidences of the Divinity of Christ* (1816).

West Ac'ton, p.-v., Middlesex co., Mass.

West Al'bany, p.-v. and tp., Wabashaw co., Minn. P. 793.

West Alexan'der, p.-v., Washington co., Pa.

West Alexan'dria, p.-v., Preble co., O. P. 155.

West'all (Richard), R. A., b. at Hertford, England, in 1765; was apprenticed to an heraldic engraver in London; took evening lessons in drawing at the Royal Academy; became noted as a water-color painter; was an intimate friend of Lawrence, with whom he occupied a house in Soho Square, and produced several highly-finished pictures of historical and poetical subjects, but is best known by his numerous illustrations of books, especially of Boydell's superb editions of Milton and Shakspeare. He was teacher of drawing and painting to the princess Victoria, now queen. D. in London Dec. 4, 1836. Author of *A Day in Spring, and other Poems* (1808).

Westall (William), brother of Richard, b. at Hertford, England, Oct. 12, 1781; studied at the Royal Academy; accompanied as artist Capt. M. Flinders in his voyage around the world 1801; exhibited in Brook street, London, his collection of views in China and the East Indies, and was subsequently employed in making drawings for engravings. D. in London Jan. 22, 1850. Among his publications were—*Views in Madeira* (folio, 1811-14), *Views of the Caves in Yorkshire* (1818), *Views on the Thames*, *Britannia Depicta*, and *Views in London* (1825).

West Al'mond, p.-v. and tp., Allegany co., N. Y. P. 799.

West Amesbury. (See Merrimac, Essex co., Mass.)

West Am'well, tp., Hunterdon co., N. J. P. 4872.

West Bal'timore, p.-v., Clay tp., Montgomery co., O. P. 69.

West Bau'gor, p.-v., York co., Pa.

West Bath, tp., Sagadahoc co., Me. P. 373.

West Bat'on Rouge, parish of S. E. Louisiana, lying between Mississippi River and Bayou Fordoche, and traversed by Baton Rouge Grosse Tête and Opelousas R. R.; surface low, and exposed to inundation; soil fertile.

Staples, cotton, sugar, and Indian corn. Cap. Port Allain. Area, 225 sq. m. P. 5114.

West Baton Rouge, v., West Baton Rouge parish, La., on the W. bank of Mississippi River, contains 2 churches, several public schools, and 1 newspaper. Large quantities of cotton and sugar-cane are grown in the vicinity. P. 7140. H. J. HYAMS, ED. "SUGAR-PLANTER."

West Bear River, tp., Yuba co., Cal. P. 407.

West Bea'ver, tp., Snyder co., Pa. P. 1131.

West Bed'ford, p.-v., Bedford tp., Coshocton co., O. P. 152.

West Belle'ville, p.-v., St. Clair co., Ill. P. 1679.

West Bend, p.-v. and tp., Palo Alto co., Ia. P. 232.

West Bend, p.-v. and tp., cap. of Washington co., Wis., on Fond du Lac Air-Line R. R., a branch of Northwestern R. R., 34 miles N. of Milwaukee, contains 6 churches, 2 public schools and several private schools, 2 newspapers, 1 saw and 2 grist mills, a court-house, 4 hotels, 1 marble-factory, 1 bank, 3 furniture establishments, and 2 grain-elevators. P. of v. 1058; of tp. 2014.
WILLIAM GEORGE, ED. "REPUBLICAN."

West Berne, p.-v., Berne tp., Albany co., N. Y. P. 100.

West Beth'lehem, tp., Washington co., Pa. P. 1964.

West Black'stock, tp., Chester co., S. C. P. 1278.

West Bloom'field, tp., Oakland co., Mich. P. 1143.

West Bloomfield, p.-v. and tp., Ontario co., N. Y. P. 1651.

West Blue River, tp., Hamilton co., Neb. P. 89.

West'boro', p.-v., Jefferson tp., Clinton co., O. P. 237.

Westborough, p.-v. and tp., Worcester co., Mass., on Boston and Albany R. R., 32 miles W. of Boston, has excellent schools, 2 banks, 1 newspaper, 3 extensive boot and shoe manufactories, and 2 straw-goods establishments. The milk business is carried on extensively. P. 3601.
HOLTON & THURSTON, EDS. "CHRONOTYPE."

West Boyls'ton, p.-v. and tp., Worcester co., Mass. P. 2862.

West Brad'ford, tp., Chester co., Pa. P. 1536.

West Branch, p.-v., Cedar co., Ia.

West Branch, p.-v. and tp., Potter co., Pa. P. 302.

West Bran'dywine, tp., Chester co., Pa. P. 933.

West Brat'tleboro', p.-v., Windham co., Vt.

West Bridge'water, p.-v. and tp., Plymouth co., Mass. P. 1803.

West Brom'wich, town of England, county of Stafford, in the centre of a rich mining district, has large manufactures of glass, gas, and iron goods, firearms, swords, cutlery, and agricultural implements. P. 17,024.

West'brook, p.-v. and tp., Middlesex co., Conn. P. 987.

Westbrook, tp., Cumberland co., Me. P. 6583.

West Brook'field, p.-v. and tp., Worcester co., Mass. P. 1842.

West Brookfield, p.-v., Stark co., O.

West'brooks, tp., Sampson co., N. C. P. 1449.

Browns'ville, p.-b., Washington co., Pa. P. 547.

West Bruns'wick, tp., Schuylkill co., Pa. P. 1163.

West Buf'falo, tp., Union co., Pa. P. 1046.

West'burg, tp., Buchanan co., Ia. P. 519.

West Burke, p.-v., Caledonia co., Vt.

West Bur'lington, p.-v. and tp., Bradford co., Pa. P. 896.

West'bury, town of England, county of Wilts, has 6395 inhabitants, who are mostly engaged in cloth manufactures and iron-mining.

Westbury, p.-v., Victory tp., Cayuga co., N. Y. P. 152.

Westbury (RICHARD **Bethell**), BARON, b. at Bradford-on-the-Avon, Wiltshire, England, June 30, 1800; graduated with high honors at Wadham College, Oxford, 1818; became a fellow there and resident private tutor; was called to the bar at the Middle Temple 1823; entered Parliament 1832; became a distinguished practitioner in the equity courts; was made queen's counsel 1840; was knighted and appointed solicitor-general Dec., 1852; carried through the House of Lords the Succession-Duty bill, the Oxford University Reform bill, the bill for the abolition of ecclesiastical courts, and other important measures; was attorney-general under Lord Palmerston Nov., 1856, to Feb., 1858; carried, after a formidable struggle, measures for the abolition of the ecclesiastical testamentary courts and the establishment of the divorce and probate court, the judgeship of which was offered him, but declined; was a second time attorney-general, from June, 1859, until June 27, 1861, when he was raised to the chancellorship under the title of Baron Westbury; carried important measures of law reform relating to bankruptcy, landed estates, and professional education, and resigned the great seal July 4, 1865. D. July 20, 1873.

West Bux'ton, p.-v., York co., Me.

West Caln, tp., Chester co., Pa. P. 1398.

West Carlisle', p.-v., Pike tp., Coshocton co., O. P. 175.

West Charles'ton, p.-v., Orleans co., Vt.

West Cha'zy, p.-v., Clinton co., N. Y.

West Chesh'ire, p.-v., New Haven co., Conn.

West'chester, county of S. E. New York, bordering on Connecticut and on Long Island Sound, bounded W. by Hudson River, drained by Bronx and Croton rivers, and traversed by Hudson River, Harlem, and New York and New Haven R. Rs. The surface is generally level or rolling, but it is crossed by several ridges of hills, and contains valuable marble-quarries. In 1870 the county contained about 525 sq. m., with a pop. of 131,348, but in 1873 a portion of the county lying immediately contiguous to New York City was annexed to the city, of which it now forms a part. A considerable part of the present county is practically a suburb of New York. Stock-raising, gardening, fruit-culture, and manufacturing form the chief occupations of the people. There are nearly 600 manufacturing establishments, among the most important of which are those for iron, brick, carriages, furniture, clothing, saddlery, sash, doors, and blinds, sewing-machines, machinery, cutlery, carpets, and breweries. Horses and milch cows form the chief part of the live-stock. Staples, garden and dairy products, fruit, and hay. Caps. Bedford and White Plains. Area, about 500 sq. m. P. 131,348.

West Ches'ter, tp., Porter co., Ind. P. 1361.

West'chester, p.-v. and tp., Westchester co., N. Y. P. 6015.

West Ches'ter, p.-v., Union tp., Butler co., O. P. 257.

West'chester, v., Perry tp., Tuscarawas co., O. P. 198.

West Chester, p.-b., cap. of Chester co., Pa. P. 5630.

West Ches'ter, tp., Chester co., S. C. P. 2795.

West Cocalico, tp., Lancaster co., Pa. P. 2140.

West Colum'bia, p.-v., Waggoner tp., Mason co., West Va. P. 778.

West Con'cord, p.-v., Essex co., Vt.

West Corn'wall, p.-v., Litchfield co., Conn.

West'cott (BROOKE FOSS), D. D., b. near Birmingham, England, in Jan., 1825; was successively scholar and fellow of Trinity College, Cambridge, where he graduated 1848, having carried off high honors and several medals and prizes both in classics and mathematics; took orders in the Church of England 1851; was assistant master at Harrow School 1852–69; became preacher to the University of Cambridge 1859; examining chaplain to the bishop of Peterborough 1868, canon of Peterborough cathedral 1869, regius professor of divinity at Cambridge Nov. 1, 1870, and honorary chaplain to the queen Apr., 1875. Author of *Elements of the Gospel Harmony* (1851), being the Norrisian prize essay for the previous year, *A History of the Canon of the New Testament during the first Four Centuries* (1855; 4th ed. 1875), *Characteristics of the Gospel Miracles*, being sermons preached before the University of Cambridge, *An Introduction to the Study of the Gospels, with Historical and Explanatory Notes* (1860; 4th ed. 1872), *The Bible in the Church, a Popular Account of the Collection and Reception of the Holy Scriptures in the Christian Churches* (1864; 3d ed. 1872), *The Gospel of the Resurrection, Thoughts on its Relation to Reason and History* (1866; 3d ed. 1874), *A General View of the History of the English Bible* (1868), and *The Christian Life Manifold and One, Six Sermons* (1870). Prof. Westcott contributed several articles (including the important one on the canon) to Smith's *Dictionary of the Bible*, and is one of the New Testament revision company.

Westcott (THOMPSON), b. at Philadelphia, Pa., June 5, 1820; studied law; was admitted to the Philadelphia bar 1841; has been since its commencement in 1848 editor of the Philadelphia *Sunday Dispatch*; conducted the Philadelphia *Inquirer* 1863–75, and was a contributing editor of the Philadelphia *Commercial List* 1863–70. He has published a *Life of John Fitch, Inventor of the Steamboat* (1857), *The Tax-Payer's Guide* (1864), *Names of Persons who took the Oath of Allegiance to the State of Pennsylvania*

1777–89, with a History of the Test Laws of Pennsylvania (1865), *Chronicles of the Great Rebellion* (1867), extracted from the *Old Franklin Almanac*, which he edited 1860–72, as also the *Public Ledger Almanac* since 1873, *A Guide to Philadelphia and Vicinity* (1876), *The Centennial Portfolio* (1876), and has been publishing since Jan. 6, 1867, in weekly instalments in the *Sunday Dispatch*, an elaborate *History of Philadelphia*, embodying a vast amount of local information, the result of thirty years of patient labor and research. He has never held a public office of any kind.

West Creek, p.-v. and tp., Lake co., Ind. P. 1158.

West Deer, tp., Allegheny co., Pa. P. 1299.

West Del'phi, v., Deer Creek tp., Carroll co., Ind. P. 253.

West Den'nis, p.-v., Barnstable co., Mass.

West Depere', p.-v. and tp., Brown co., Wis. P. 875.

West Don'egal, tp., Lancaster co., Pa. P. 1136.

West Earl, p. v. and tp., Lancaster co., Pa. P. 1893.

West Ea'ton, p.-v., Madison co., N. Y.

West Eau Claire, tp., Eau Claire co., Wis. P. 2152.

West Eliz'abeth, p.-b., Allegheny co., Pa. P. 590.

West Elk'ton, p.-v., Gratis tp., Preble co., O. P. 156.

Wes'terlo, p.-v. and tp., Albany co., N. Y. P. 2381.

West'erly, p.-v. and tp., Washington co., R. I., on Pawcatuck River, 5 miles from Long Island Sound, and on Stonington and Providence R. R., 14 miles from Providence, has 4 national banks, 3 savings banks, 6 woollen mills, 2 cotton-mills, 2 machine-shops (1 with foundry, building printing presses), several granite-quarries, 8 churches, a graded and high school with 12 teachers and 500 scholars, a public library, 1 weekly newspaper, gasworks, lighted streets, police department, town-hall and lock-up, steam and hand fire-engines, 2 military companies with armory, lodges of Freemasons and Odd Fellows, 2 hotels in village, 7 at Watch Hill seaside, 5 miles by steamboat. P. (1876) 5708. The village lies on both sides of the river, having 500 houses on the Rhode Island side and 350 on the Connecticut side. P. (1870) 1709.

GEO. B. UTTER, ED. "NARRAGANSETT WEEKLY."

West'ern, p.-v., Linn co., Ia., 8 miles S. of Cedar Rapids and 16 miles N. of Iowa City, contains 2 churches, WESTERN COLLEGE (which see), and 1 school, 2 newspapers, and 1 flouring-mill. P. about 500.

W. H. SHREY, ED. "GAZETTE."

Western, tp., Henry co., Ill. P. 1372.

Western, tp., Oneida co., N. Y. P. 2123.

West'ern Austra'lia, a British colony, comprising the whole western portion of the Australian continent from the 129th meridian, and containing an area of 978,000 sq. m., with 24,785 inhabitants. (For a description of this immense territory and its climate see the article on AUSTRALIA.) The colony was first established in 1829 under the name of the "Swan River Settlement." It had 1540 inhabitants in 1832, 4622 in 1848, 8711 in 1852. Its growth has been very slow, and if a gold-field or some such thing is not discovered, there is little prospect of a more rapid progress. The only source of wealth peculiar to the colony which hitherto has been discovered are some forests which are said to contain large quantities of timber suited for ship- and house-building, but of this timber nothing has as yet appeared in the market, and the sandal-wood which at one time was exported from the colony was entirely exhausted in five years.

Western Branch, tp., Norfolk co., Va. P. 5100.

Western College was founded in 1856, and is under the control of the Church of the United Brethren in Christ. It is located at Western, Linn co., Ia., 8 miles S. of Cedar Rapids. It is supported by five annual conferences, and is the educational centre of the United Brethren Church in the North-west. These co-operating conferences are—in Iowa, the Iowa, East Des Moines, and West Des Moines; in Minnesota, the Minnesota; in Illinois, the Rock River. The buildings are three in number, all brick. The chapel building is 36 by 62 feet, and three stories in height. In it are five recitation-rooms, two society-halls, a library, laboratory, and cabinet-rooms; also the chapel. Neidig Hall is 30 by 40 feet, and two stories in height. This building is designed for the accommodation of ladies desiring to board themselves. Lain Hall is a three-story building, besides basement, and is 35 by 62 feet in size. It is the boarding-hall of the college, and contains 22 dormitories for students, steward's rooms, reception-room, music-room, and the ladies' society-hall. The faculty, headed by Rev. Ezekiel B. Kephart, A. M., as president, consists of a president, professors, and principal of the ladies' department. Tutors and teachers are employed in the subordinate departments. The courses of study are the classical and scientific, and as the institution was founded on the basis of co-education, these courses are open to any student, either lady or gentleman, who is prepared to enter. There is also a complete commercial department under the patronage of the college, which is an important auxiliary. Its graduates number 43, 38 of whom have graduated within the past eight years. It has an endowment of $16,000.

E. B. KEPHART.

West'ern Empire, The. When Theodosius the Great died (in 395) the Roman empire was divided, according to his will, into the Eastern or Byzantine empire, consisting of Greece, Macedonia, Mœsia, Thrace, Asia Minor, Pontus, Syria, and Egypt, with Constantinople for its capital; and the Western empire, consisting of Italy, Africa, Spain, Gaul, Pannonia, Dalmatia, and Illyricum, with Rome for its capital. There had been earlier divisions. (See DIOCLETIAN and VALENTINIAN.) But this of 395 became the decisive one by which a Western and an Eastern empire were finally established. Theodosius's oldest son, Arcadius, became the ruler of the Eastern empire—the younger, Honorius, of the Western; but, although it seems to have been Theodosius's idea that the two brothers should rule the two empires in community, a sharp and even hostile separation very soon took place between East and West, and the intrigues and treacheries of the Byzantine court played no inconsiderable part in the fearful devastation and final overthrow of the Western empire by the barbarians. Its existence was very short. In 476 its last emperor, Romulus Augustus (whom the Romans called Augustulus), was deposed by the barbarian chief Odoacer, and as he would not accept either the title or the power of emperor, the Roman senate addressed the Byzantine emperor, Zeno, expressing the wish that there should be only one sole monarch, consenting to the transference of the seat of government from Rome to Constantinople, and asking as a favor that Odoacer might be made general or military governor of Rome. From 395 to 476 the Western empire was ruled over by twelve emperors—namely, Honorius (423), Joannes (425), Valentinian III. (455), Maximus (455), Avitus (457), Majorian (461), Severus (465), Anthemius (472), Olybrius (472), Glycerius (473), Julius Nepos (474), and Romulus Augustus. But the general characteristic of the imperial government was, that the emperor had no power. His position was a name, his existence that of a shadow. The real power was in the hands of the generals, foreign and native, who commanded the armies, and it rested with them only as long as they were victorious; when defeated, they became shadows themselves. Thus, Stilicho ruled the empire under Honorius, Aëtius under Valentinian III., and Ricimer under Majorian, Severus, and Anthemius. The history of the empire during this period is the history of the intrigues between the generals, who were put into power by the fears of the emperor or the whims of the empress, and of the battles between their armies, which flew over the country whither the wind blew, alighting like a swarm of grasshoppers wherever they found a green spot. The provinces fell off, and established themselves in a sort of independence. In 418 the Goths founded an empire consisting of the southern part of Gaul and the northern part of Spain, with Toulouse for its capital. In 451, Britain was completely abandoned. In 427 the Vandals, called in from Spain by the Roman governor, Bonifacius, against his rival, Aëtius, conquered Africa, and twenty years later they conquered, under Genseric, both Sardinia and Sicily. In 465, Marcellinus separated Dalmatia from the empire, and made himself master of the Adriatic, and about the same time Ægidius ruled Gaul entirely independent of Rome. Indeed, when, in 476, the Roman senate pretended to reunite the Western with the Eastern empire, the Western empire consisted only of a corrupted, seven times sacked, and half-destroyed city, and so much territory as Odoacer's army could sweep over, and nothing more; the grand original building had literally fallen to pieces. (For detailed information concerning these matters see the special articles under the different names mentioned.)

CLEMENS PETERSEN.

Westernport, p.-v. and tp., Alleghany co., Md. P. 1687.

Westernville, p.-v., Western tp., Oneida co., N. Y. P. 235.

West'erville, p.-v., Franklin co., O., on Cleveland Mount Vernon and Columbus R. R. and on Alum Creek, 12 miles N. of Columbus, has 3 churches, Otterbein University, 1 newspaper, 1 foundry, flouring and saw mills, several lumber and coal yards, and 1 planing mill. P. about 1400.

S. R. GRAYBILL, ED. "BANNER."

West Fair'lee, p.-v. and tp., Orange co., Vt. P. 833.

West Fair'view, p.-v., Cumberland co., Pa.

West'fall, tp., Pike co., Pa. P. 960.

West Fal'lowfield, tp., Chester co., Pa. P. 1159.

West Fallowfield, tp., Crawford co., Pa. P. 503.

West Far'mington, p.-v., Trumbull co., O.

West Farms, p.-v. and tp., Westchester co., N. Y. P. of v. 1761; of tp. 9372.

West Farn'ham, p.-v., Missisquoi co., Quebec, Canada, at the junction of Stanstead Shefford and Chambly and South-eastern Counties railways, 41 miles S. E. of Montreal. Lumber, tubs, woollens, etc., are manufactured. The village has an academy. P. 1317.

West Felicia'na, parish of Central Louisiana, bordering on Mississippi, lying on the E. bank of Mississippi River, and traversed by West Feliciana R. R. Surface level, soil fertile. Staples, cotton, sugar, and Indian corn. Cap. St. Francisville. Area, 350 sq. m. P. 10,499.

West'field, tp., Bureau co., Ill. P. 1396.

Westfield, p.-v. and tp., Clark co., Ill. P. 1166.

Westfield, p.-v., Washington tp., Hamilton co., Ind. P. 608.

Westfield, tp., Fayette co., Ia. P. 1708.

Westfield, p.-v. and tp., Hampden co., Mass., on Boston and Albany R. R., at its junction with New Haven and Northampton R. R., 9 miles W. of Springfield. The village is beautifully situated in a valley excavated by geological agencies, 30 or 40 feet below the surrounding plain, 3 or 4 miles from the foot of the eastern slope of the range of hills which form the southern continuation of the Green Mountains. The bluffs which reach the limits of the village on the N. W. and S. W., and the rich alluvial soil of the valley, utilized for farms where not required for building purposes, make Westfield one of the most beautiful rural villages in Western New England. P. in 1875, 8492. Westfield contains 9 churches, 2 national banks, 2 institutions for savings, 1 public library, 1 State normal school, 1 public high school, 2 public grammar schools, and 1 weekly newspaper. The village is supplied with water from hills to the N. W. by a system of waterworks completed in Oct., 1874, at a cost of $243,810, having a storage capacity in the reservoirs of 1885 million gallons. The distributing reservoir is 292 feet above the village, delivering the water at an average pressure of 126 pounds to the inch. The public library and free reading-room was incorporated in 1866, and founded by the gift of the Athenæum building to the library association by one of the citizens. Other citizens provided for the care of the library, and furnished its shelves with books and its tables with current literature. It was opened to the public Jan. 1, 1868, and contained in Apr., 1876, 8400 vols. Prominent among the industries of Westfield is the manufacture of whips, of which $800,000 worth are produced annually. More whips are made here than in all the country besides. The American Whip Co. have the largest whip-shop in the world, own $70,000 worth of patents on styles of whips, process of making, or machinery used, and produce $450,000 worth of whips per annum. The manufacture of cigars is another of its most prominent industries, the total production in 1875 aggregating 18,046,000, requiring for their production about 340 tons of tobacco, a considerable portion of which is grown in the Connecticut Valley. Three paper-mills, 2 producing fine writing papers and 1 manila paper, form a part of the town's industries. At the Japanese mill, besides fine ledger paper, there is manufactured from all new-linen stock a kind of thick, tough material impervious to water, resembling raw hide, used for making racing-boats, machine-belting, pails, baskets, trunks, and a variety of domestic utensils. The church-organ works, established in 1841, have built 475 organs. Another church-organ manufactory has its works here; also steam-heating apparatus, flavoring extracts, and piano-leg establishments. Ratio of increase in valuation during the last ten years, 117 per cent.; in population, 49.3 per cent. P. in 1870, 6519. A. E. Gibbs.

Westfield, tp., Dodge co., Minn. P. 342.

Westfield, p.-v. and tp., Union co., N. J. P. 2753.

Westfield, city and tp., Chautauqua co., N. Y., on Lake Shore R. R., 59 miles W. of Buffalo, contains 5 churches, an academy, 2 banks, 1 newspaper, the Westfield lockworks, 1 steam heater, 1 handle and 3 carriage factories, 4 hotels, 1 paper-mill, mower and reaper factory, 3 grist-mills, water and gas works, and an efficient fire department. The surrounding country is devoted to mixed farming and grazing. P. of city, 3000; of tp. 3615.

F. A. Hall, Ed. "Republican."

Westfield, tp., Richmond co., N. Y. P. 4905.

Westfield, tp., Surry co., N. C. P. 800.

Westfield, tp., Medina co., O. P. 1023.

Westfield, p.-v. and tp., Morrow co., O. P. 1322.

Westfield, p.-b. and tp., Tioga co., Pa. P. of v. 370; of tp. 912.

Westfield, p.-v. and tp., Orleans co., Vt. P. 721.

Westfield, p.-v. and tp., Marquette co., Wis. P. 534.

Westfield, tp., Sauk co., Wis. P. 1230.

Westfield Plantation, tp., Aroostook co., Me. P. 76.

Westfield River, in Massachusetts, rises by three branches (the N., Middle, and W. branch) in the Green Mountains and their foot-hills in Berkshire and Hampshire cos., Mass. The main stream commences at Huntington, Mass. Throughout most of its course it is a wild, turbulent stream, affording good water-power. It joins the Connecticut opposite Springfield, Mass. In its lower course it is often called the *Agawam*.

West Fin'ley, p.-v. and tp., Washington co., Pa. P. 1471.

West Fitch'burg, p.-v., Worcester co., Mass.

West'ford, p.-v. and tp., Middlesex co., Mass. P. 1803.

Westford, p.-v. and tp., Otsego co., N. Y. P. 1300.

Westford, p.-v. and tp., Chittenden co., Vt. P. 1237.

Westford, tp., Dodge co., Wis. P. 1341.

Westford, p.-v. and tp., Richland co., Wis. P. 801.

West Fork, p.-v. and tp., Washington co., Ark. P. 1243.

West Fork, tp., Franklin co., Ia. P. 285.

West Fork, tp., Monona co., Ia. P. 54.

West Fork of Ivy, tp., Madison co., N. C. P. 746.

West Forks Plantation, tp., Somerset co., Me. P. 73.

West Frank'lin, tp., Armstrong co., Pa. P. 1098.

West Gale'na, tp., Jo Daviess co., Ill. P. 591.

West Gar'diner, p.-v. and tp., Kennebec co., Me. P. 1044.

West Go'shen, tp., Chester co., Pa. P. 944.

West Green'wich, p.-v. and tp., Kent co., R. I. P. 1133.

West Grove Station, p.-v., Chester co., Pa.

Westhamp'ton, p.-v. and tp., Hampshire co., Mass. P. 587.

Westhampton, tp., Burlington co., N. J. P. 1369.

West Hamp'ton, p.-v., Southampton tp., Suffolk co., N. Y. P. 439.

West Han'over, p.-v. and tp., Dauphin co., Pa. P. 1044.

West Hart'ford, p.-v. and tp., Hartford co., Conn. P. 1533.

West Ha'ven, p.-b., New Haven co., Conn., on New Haven Bay and on New York and New Haven R. R., 2½ miles S. W. of New Haven, has 3 churches, an academy, seminary, and graded school, a street railway, 1 newspaper, 4 hotels, Masonic lodge, carriage-pole factory, 1 planing-mill, coal- and ship-yards. P. 1852.

H. I. Thompson, Ed. "Journal."

West Haven, p.-v., Shiawassee co., Mich.

West Haven, p.-v. and tp., Rutland co., Vt. P. 713.

West Hem'lock, tp., Montour co., Pa. P. 396.

West Hemp'field, tp., Lancaster co., Pa. P. 3688.

West Ho'boken, p.-v. and tp., Hudson co., N. J., on the heights 160 feet above tide-water, 1½ miles W. of Hoboken ferry at Hudson River, directly opposite New York City, has 7 churches, a monastery of the Passionist Fathers, 1 newspaper, a large silk-hat factory, a street railway, and about 20 florists, who furnish an immense quantity of flowers for the New York market. St. Michael's church, connected with the monastery, is a handsome stone building, one of the largest churches in the U. S. P. 4132.

Alfred E. Gregory, Ed. "Palisade News."

West In'dian Planta'tion, tp., Penobscot co., Me. P. 13.

West In'dies, the common name of that archipelago which extends from the southern extremity of the peninsula of Florida to the northern coast of Venezuela. It consists of four groups of islands—the Bahama Islands, the Greater Antilles, the Virgin Islands, and the Lesser Antilles—and is described under these separate heads.

West Jef'ferson, p.-v., Madison co., O.

West Jer'sey, p.-v. and tp., Stark co., Ill. P. 1315.

West Kil'lingly, p.-v., Windham co., Conn.

West Lam'peter, tp., Lancaster co., Pa. P. 1760.

West'land, tp., Guernsey co., O. P. 889.

West Las Animas, p.-v., cap. of Bent co., Col., the S. W. terminus of Kansas Pacific R. R., and at the junction of Purgatoire and Arkansas rivers, has good schools, 1

newspaper, and 3 hotels. Principal business, cattle, sheep, wool, and hides. It is the forwarding point for New Mexico and Arizona. Slaughtering and shipping fresh beef are extensively carried on.

CHAS. W. BOWMAN, ED. "LAS ANIMAS LEADER."

West Leb'anon, p.-v., Warren co., Ind., on Toledo Wabash and Western R. R., 29 miles S. W. of Lafayette and 90 miles S. of Chicago, has 3 churches, 1 newspaper, 2 hotels, 2 mills, and good schools. P. 1053.

H. R. GREGORY, ED. "WARREN TIMES."

West Lebanon, p.-v., Grafton co., N. H.

West Lebanon, p.-v., Paint tp., Wayne co., O. P. 161.

West Lib'erty, p.-v., Muscatine co., Ia., at the crossing of Chicago Rock Island and Pacific and Burlington Cedar Rapids and Minnesota R. Rs., contains 5 churches, good schools, 1 newspaper, 1 flouring-mill, and 4 hotels. It is the centre for fine cattle in the West. P. 1500.

J. W. MCELRAVY, ED. "ENTERPRISE."

West Liberty, p. v., cap. of Morgan co., Ky. P. 142.

West Liberty, p. v., Liberty tp., Logan co., O. P. 741.

West Liberty, v., Liberty co., Tex. P. 230.

West Liberty, p.-v., Liberty tp., Ohio co., West Va. P. 251.

West Lin'coln, tp., Logan co., Ill. P. 3053.

West Lo'gan, v., Jefferson tp., Cass co., Ind. P. 978.

West Mac'edon, p.-v., Wayne co., N. Y.

West'macott (SIR RICHARD), R. A., b. in London, England, in 1775, son of a sculptor of some eminence, from whom he learned the rudiments of his art; studied under Canova at Rome 1793–97; obtained the first premium from the Academy of Florence 1794; made himself familiar with the best remains of ancient art in Italy; became an associate of the Royal Academy 1805, and an academician 1816; succeeded Flaxman as professor of sculpture at the Royal Academy 1827, and was knighted 1837. D. in London Sept. 1, 1856. Among his most noted statues are those of Addison, Pitt, Fox, Erskine, Nelson, the dukes of Bedford and York, that of Achilles in Hyde Park and of George III. at Windsor, and those of Cupid and Psyche in the possession of the duke of Bedford. Other admired works are an alto-relievo, *The Dream of Horace*, numerous monuments in St. Paul's cathedral and Westminster Abbey, and the groups of sculpture on the marble arch at Cumberland Gate and the pediment of the British Museum. Several of his academic lectures on sculpture were published in the *Athenæum* (1843).

Westmacott (RICHARD), R. A., F. R. S., son of Sir Richard, b. in London, England, in 1799; studied sculpture under his father; was in Italy 1820–26; was in general an imitator of his father's style, but with a preference for mythological and religious compositions; was elected associate 1838, and academician 1849, and succeeded his father as professor of sculpture 1857. D. in London Apr. 19, 1872. Among his best ideal works are—*Venus and Ascanius*, *The Cymbal-Player*, *A Girl and Faun*, *Venus instructing Cupid*, *Paolo and Francesca*, the bas-reliefs *The Blue Bell*, *Go and Sin no More*, *The Angel Watching*, on a monument of the Ashburton family, recumbent monumental figures of Archbishop Howley and the earl of Hardwick, and the group of figures on the pediment of the Royal Exchange. He contributed articles on sculpture to several journals and to the *Encyclopædia Britannica* (8th ed. 1859), published several of his academic lectures either separately or in the *Athenæum* (1856), and was author of a *Handbook of Sculpture, Ancient and Modern* (Edinburgh, 1864), and an essay *On Coloring Statues*.

West Maho'ning, tp., Indiana co., Pa. P. 1131.

West Man'chester, p.-v. and tp., York co., Pa. P. 1821.

West Man'heim, tp., York co., Pa. P. 1117.

West Mart'borough, tp., Chester co., Pa. P. 1189.

West'meath, an inland county of Ireland, province of Leinster, bordering on the Shannon, comprises an area of 708 sq. m., with 78,416 inhabitants, of whom 30,158 are unable to read and write. The surface is hilly, especially in the northern part, and much diversified by lakes, rivers, and forests. The soil is fertile, but only a small part of it is under tillage. Oats and potatoes are the common crops, and breeding and fattening of cattle the principal occupation. Since 1851, 31,683 persons have emigrated from this county. Principal town, Mullingar, one of the largest military dépôts in Ireland.

West Med'ford, p.-v., Middlesex co., Mass.

West Med'way, p.-v., Norfolk co., Mass.

West Mer'iden, railway station and principal post-office in the city of Meriden, New Haven co., Conn., on New York New Haven and Springfield R. R., 17 miles N. of New Haven and 17 miles S. of Hartford, on Middletown and Waterbury turnpike, and geographically near the centre of the State. Area of the city, 2400 acres; of the town, 24 sq. m. P. of city in 1876, about 9000; of town, about 16,000. Meriden is exceedingly picturesque, being skirted with mountains on the N. and E., known as the Hanging Hills, embracing the famous Cat Hole Pass, with Washington's Face, and Mount Lamentation, the whole being the southern terminus of a range of trap rock extending through Massachusetts into New Hampshire. The city is built principally on high hills, in every direction overlooking a broad valley through which lies the railway and a prominent stream having its source in the East Mountains and called Harbor Brook, from its swamps and marginal bushes having given refuge to the pursued regicides in the early days of the colony. The town embraces three post offices—namely, Meriden, West Meriden, and South Meriden—and four distinct villages—namely, Meriden, West Meriden, Prattsville, and Hanover; all but the last are embraced within the city limits; also 12 churches, 13 school districts and 11 public schools, 3 national and 2 savings banks, 2 fire insurance companies, 3 daily and 2 weekly newspapers, a public library and reading room; is the seat of the State reform school, numbering 150 pupils; has a gentlemen's club, 2 hotels, a turner's society and hall, 3 lodges of Masons (1 each of chapter, council, and commandery), 3 lodges of Odd Fellows, an encampment, a post of the Grand Army, a lodge of Knights of Pythias. The grand list of the town in 1876 was $8,715,701. There was invested in manufacturing $1,405,325; in merchandise and trade, $351,380; in banks and insurance, $1,800,000; there were 1887 dwellings and 171 mills, stores, and manufactories. Meriden derives its importance chiefly from the manufacture of silver-plated ware, malleable iron and bronze goods, lamp-burners, carriage and other hardware, pocket and table cutlery, woollen goods, machinery, piano stools, carriages, firearms. It has a paid fire department, one of the finest waterworks in the country, a gas-light company, 2 trotting parks, a beautiful cemetery, a fine public hall, 2 private halls, and an imposing police building. The manufacturing industries of Meriden represent almost every commodity, and in point of variety and number are second to none in New England.

LUTHER G. RIGGS, ED. "MERIDEN DAILY RECORDER."

West Mid'dlesex, p.-b., Mercer co., Pa. P. 888.

West Mid'dletown, p.-b., Washington co., Pa. P. 346.

West Mil'bury, p.-v., Worcester co., Mass.

West Mil'ford, p.-v. and tp., Passaic co., N. J. P. 2660.

West Mil'ton, p.-v., Miami co., O.

West'minster, city and tp., cap. of Carroll co., Md., on Western Maryland R. R., 28 miles N. W. of Baltimore, contains 8 churches, the Western Maryland College, 4 public schools and several private academies, 4 banks, 2 machine-shops, 6 hotels, gasworks, a shoe-factory, and 2 newspapers. It is a resort for city people during the heated term. P. of city, 2310; of tp. 5227. W. H. RIPPARD, ED. "SENTINEL."

Westminster, p.-v. and tp., Worcester co., Mass. P. 1770.

Westminster, p.-v. and tp., Windham co., Vt. P. 1238.

Westminster (HUGH LUPUS **GROSVENOR**), K. G., FIRST DUKE and THIRD MARQUIS OF, EARL GROSVENOR and BARON BELGRAVE, son of Richard, the second marquis, by his wife, Elizabeth Mary, daughter of the first duke of Sutherland, b. in London, England, Oct. 13, 1825; was member of Parliament for Chester 1847–69; succeeded to the marquisate on the death of his father, Oct. 31, 1869, and was created a duke 1874. He is married to his cousin, Constance Gertrude, daughter of the second duke of Sutherland, and is reputed the wealthiest nobleman in Europe.

Westminster (RICHARD **GROSVENOR**), SECOND MARQUIS OF, b. in England in 1795; was known in early life as Viscount Belgrave; educated at Christ Church College, Oxford; sat in Parliament for the county of Chester as a Whig 1818–35; succeeded to the peerage on the death of his father, Richard, the first marquis (1767–1845); was lord steward of the queen's household under the Russell ministry 1850–52, a member of the privy council, and possessed of real estate, mostly in London and Westminster, valued at £21,000,000. D. in London Oct. 31, 1869.

Westminster Abbey, dedicated to St. Peter. The architecture, the historical associations, and the monuments of this remarkable edifice, which may be regarded pre-eminently as the national church of England, require

separate notice and a larger space than can be allotted to it in a work of this description.

(1) Its architecture runs back to an ancient period, but long before any portion of the present building was in existence there stood upon the same spot a Saxon church. That church, built within what was called Thorney Isle, from its being covered with brushwood, was connected long before the Conquest with a monastic body of the Benedictine order, who named the place of their abode the "Western Monastery," or Westminster, to distinguish it, some say, from St. Paul's in London, which was called East Minster. The first church here of which, architecturally considered, we possess any accurate knowledge, was that built by Edward the Confessor, and consecrated Dec. 28, Holy Innocents' Day, 1065. Though built by a Saxon king, it was in the Norman style, cruciform in shape, and exceeding in magnificence any sacred building at that time in England; and there still remains, under what is called the pyx-house, a noble crypt pertaining to the Norman structure. Henry III. rebuilt the greater part of the abbey church in the style denominated Early English; and it is his work we continue to behold in the transepts and the choir, which worthily call forth the admiration of all visitors whether of the Old or the New World. He had previously raised a Lady chapel at the E. end; and then, when he erected the new choir and transepts, he transferred the high altar to the place it now occupies, and reared behind—between it and the Lady chapel—a lofty shrine, to which he removed the body of Edward the Confessor. That shrine, somewhat mutilated, still remains. The Norman nave was not removed until the middle of the fourteenth century, when the present nave and aisles were commenced in a style corresponding with the architecture of Henry III.'s abbey. The W. front and its grand window, as well as the completion of the nave and aisles, belong to the latter part of the fifteenth century. Henry VII. pulled down the Lady chapel, and built that which now bears his name, a charming specimen of the florid architecture of the period—*i. e.* Late Perpendicular—with richly-mullioned windows and elaborately groined and fretted roof. The gates are a beautiful specimen of metal-work. Sir Christopher Wren was the architect of the upper part of the western towers, which are by no means in keeping with the rest of the glorious pile. The extreme length of the whole is 511 feet, and the width across the transepts 203. The width of the nave and aisles is 79 feet; of the choir, 38; and of Henry VII.'s chapel, 70. The height of the roof is 102 feet, an unusual elevation in England. There were cloisters to the Norman abbey, but those which now afford such a pleasant shade on a hot summer's day were built in the thirteenth and fourteenth centuries. The chapter-house is an architectural gem, lately restored after long neglect, and, when the stained glass is inserted in the windows, will defy comparison with all other edifices of the same description. The exquisitely-carved screen at the back of the altar was erected recently. The architecture of the abbey has of late engaged the attention of well-skilled archæologists, and the results of their study are well preserved in a volume of *Gleanings* edited by Gilbert Scott and published in 1863.

(2) The historical associations of the Abbey can be but imperfectly specified in this work; they can be best studied in Dr. Stanley's *Memorials*. Westminster is the place where the sovereigns of England have been crowned ever since the Conquest; therefore, the grandest pageants of the kingdom have been exhibited before multitudes of spectators within the time-honored walls. The coronation-stone brought from Scotland by Edward I. may still be seen under the coronation-chair used by Richard II., which ever since, there is reason to believe, has been occupied by the English sovereigns during the solemnity of their inauguration. The funerals of kings and queens have also taken place in the minster. The remains of Oliver Cromwell, who never wore the crown, were for a time deposited in a vault under Henry VII.'s chapel with a pomp which royalty could not exceed. In the chapter-house the Commons met when that body became an assembly distinct from the Lords, and repeated their sittings there as late as the end of the reign of Henry VIII. The history of the abbey is interwoven with that of the English Reformation. One of the Protestant martyrs, Thomas Bilney, was arraigned before Cardinal Wolsey in the Westminster chapter-house. The abbey fell at the time of the dissolution of the monasteries, and the abbot was succeeded by a dean. For a short time Westminster had a bishop, but the experiment proved unsuccessful. In Queen Mary's time the abbey was restored, but after Elizabeth's accession the present institution of dean and chapter was established. Convocations were transferred to Westminster in the time of Henry VIII. That which acknowledged the royal supremacy was held here. In the time of Elizabeth the bishops met in Henry VII.'s chapel. In Charles I.'s reign both houses were gathered together under its beautiful roof to hear a speech from Archbishop Laud. In the Jerusalem chamber we find the bishops debating the final alterations made in the Book of Common Prayer in 1662; and afterward some of the most exciting scenes connected with the history of Convocation in the reigns of William III. and Anne occurred in the chamber itself, or in that part of the abbey where the lower house had been convened. The fortunes of the abbey have followed those of the nation, and therefore the Westminster Assembly was held in the Jerusalem chamber, and during the civil wars and Commonwealth, Episcopalian worship was interrupted, Presbyterians and Independents occupied the pulpit; and with the restoration of Charles II. worship began to flow back into the former channels. Since the Act of Uniformity the Book of Common Prayer has of course been the formulary of devotion used by the clergy in this ancient edifice. But since the present respected dean, Dr. Stanley, has occupied his post, proceedings have occurred in the abbey of national interest, and in harmony with that catholic spirit which ought to preside over the religious offices conducted in a national temple. Sermons on Sunday evenings have been preached to vast audiences; and for the last three years (written in 1875) on the evening of St. Andrew's Day, Nov. 30, set apart for intercession on behalf of missions, a layman professor, Max Müller, a Presbyterian clergyman, Dr. Caird, and a Congregational missionary, Dr. Moffat, have delivered lectures from the lectern in the centre of the nave.

(3) The tombs and monuments in the abbey are exceedingly numerous, and the life-stories of those who are buried under the pavement or commemorated on the walls would form a national biography. Some of the principal are grouped together according to the grounds on which history builds their fame. Sovereigns and members of royal families have graves and tombs in the chapels of Edward the Confessor and Henry VII. Edward himself slumbers under the shrine which bears his name, and which is curious as a work of art belonging to the age of Henry III. On the N. side that king sleeps, and next to him Edward I. On the S. side lie Edward III. and Richard II., and to the E. Henry V. in the beautiful chantry named after him. In the midst of Henry VII.'s chapel the founder and his wife repose side by side; at the W. end is the sepulchre of Edward VI. In the N. aisle are Queen Elizabeth and her sister Mary; in the opposite aisle is Mary Queen of Scots. Close to the tomb of Henry VII. we meet with the grave of King James; Charles II. is buried at the E. end of the N. aisle. His grave is unmarked; so is that of William III. Queen Anne was laid next her sister Mary in the southern aisle. George II. was the last of the kings interred in the abbey. The interment was in Henry's chapel. Some of the buried sovereigns have monuments. Several members of the royal families lie near their relatives. The N. transept is distinguished as the resting-place of eminent statesmen—Pitt, Fox, Wilberforce, Canning, Peel, Palmerston. The S. transept is marked by the world-known "Poets' Corner," perhaps the most attractive part of the whole building. Here lie Chaucer, Spenser, Beaumont, Ben Jonson, Cowley, Dryden, Addison; also hard by are monuments to Shakspeare, Milton, Isaac Watts, Goldsmith, and Johnson. Numbers of generals, admirals, courtiers, divines, men of letters, and other distinguished personages are covered by the marble pavement or have memorials of them by the pillars or on the walls. Two slabs on the central floor of the nave, lately inserted, mark the last home of George Stephenson and David Livingstone. It may be added that some of the monuments are much more remarkable on account of their sculpture than from interest attaching to the names they bear. JOHN STOUGHTON.

Westminster Assembly. This famous Assembly, if it does not form a landmark in the history of Protestantism, has exercised a great and lasting influence on the history and development of American as well as of British Presbyterianism, and its symbolical books are still regarded with veneration by almost all English-speaking Presbyterian churches throughout the world. After some unsuccessful attempts to obtain the sanction of the king, it was summoned by ordinance of the two houses of the English Parliament. It was intended that it should include among its members adherents of all the chief parties among English-speaking Protestants with the exception of that of Archbishop Laud, whose innovations and despotic tendencies had been one main cause of the troubles in Church and State. Almost all the clerical members were in episcopal orders, three or four were bishops, five afterward rose to be so, and several were known to be favorable to the continuance of episcopacy and to side with the king rather than with the Parliament. A place was found for some of the ministers of the French churches in England, for one or two

representatives of the Church of Ireland, and for some who had been pastors of the English churches in Holland; while invitations to send commissioners were addressed to the Church of Scotland, and, it is said, also to the churches of New England. The Assembly, as originally constituted by the ordinance, consisted of 121 divines and of 30 lay assessors, of whom 10 were peers and 20 commoners. Additions were made from time to time, chiefly to supply the places of those who had failed to attend or had been removed by death. The purposes for which, according to the ordinance, the Assembly was convoked were to vindicate the doctrine of the Church of England from all calumnies and false aspersions, and to recommend such further reformation of her discipline, liturgy, and government as might "be agreeable to God's holy word, and most apt to procure and preserve the peace of the Church at home, and nearer agreement with the Church of Scotland and other Reformed churches abroad." But when the Parliament, feeling their need of Scottish aid, acceded to the Solemn League and Covenant and urged the Scotch to send deputies to the Assembly, its objects were extended; and to promote the covenanted uniformity it was empowered to prepare a new confession of faith and catechism, as well as directories for public worship and church government which might be adopted by the churches of the three kingdoms. It retained to the last, however, that advisory character which has made some question whether it was properly an ecclesiastical synod at all, though in this respect it only resembled an ordinary English convocation, and in those respects in which it differed from that body it may claim the benefit of what is said in chap. xxxi. sec. ii. of its Confession.

It was on Saturday, July 1, 1643, that the divines, with the two Houses and a great congregation, met in Westminster Abbey, and after sermon by Dr. William Twisse, who had been named as prolocutor, the Assembly was constituted in the chapel of Henry VII., in which, only three years before, Laud's unfortunate convocation had been held. On the names being read over, it was found that "threescore and nine" had obeyed the summons of the Parliament. Bishop Brownrigg sent an excuse for his absence; Bishop Westfield and a few other royalists and conformists were actually present, and by the retention of their canonical habits seemed, as Fuller says, "the only nonconformists." The most of the divines came not in canonicals, "but in black coat or cloak and bands, in imitation of the foreign Protestants," and probably a more correct idea of the appearance of the Assembly may be formed from the plate of the French synod prefixed to the first volume of Quick's *Synodicon* than from the plate of the Assembly so common in England. The meetings continued to be held in the chapel of Henry VII. till after the arrival of the Scottish commissioners, and were chiefly occupied with the revision of the first fifteen of the English Articles. Soon after, the Covenant was subscribed by the Assembly and the House of Commons, and the last remaining royalist, Dr. Fentley of Lambeth, was expelled for opposing it, and for revealing the proceedings to Ussher, then in the king's quarters at Oxford. The Assembly was now authorized by the houses to treat of the questions of church government and worship; and about the same time, that it might have the benefit of a fire, it removed from Henry VII.'s chapel to the Jerusalem chamber, which since that time has generally been the meeting-place of the upper house of Convocation. Baillie, one of the Scotch commissioners, has left us the following graphic account of the Assembly at this early date: "The like of that Assembly I did never see, and, as we hear say, the like was never in England, nor anywhere is shortly like to be. They did sit in Henry the 7th's chapel, in the place of the convocation; but since the weather grew cold, they did go to Jerusalem chamber, a fair room in the abbey of Westminster, about the bounds of the college fore-hall, but wider. At the one end, nearest the door, and both sides, are stages of seats as in the new assembly-house at Edinburgh, but not so high; for there will be room but for five or six score. At the upmost end there is a chair set on a frame, a foot from the earth, for the Mr. Prolocutor, Dr. Twisse. Before it on the ground stand two chairs for the two Mr. Assessors, Dr. Burgess and Mr. White. Before these two chairs, through the length of the room, stands a table at which sit the two scribes, Mr. Byfield and Mr. Roborough. The house is all well hung, and has a good fire, which is some *daintise* at London. Foranent the table, upon the prolocutor's right hand, there are three or four ranks of forms. On the lowest we five do sit. Upon the other, at our backs, the members of Parliament deputed to the Assembly. On the forms foranent us, on the prolocutor's left hand, going from the upper end of the house to the chimney, and at the other end of the house, and backside of the table, till it come about to our seats, are four or five stages of forms, whereupon their divines sit as they please; albeit commonly they keep the same place. From the chimney to the door there are no seats, but a void for passage. The lords of Parliament use to sit on chairs, in that void, about the fire. We meet every day of the week but Saturday. We sit commonly from nine to one or two afternoon. . . . Ordinarily, there will be present above three score of their divines. These are divided into three committees; in one whereof every man is a member. No man is excluded who pleases to come to any of the three. Every committee, as the Parliament gives order in writing to take any purpose into consideration, takes a portion, and in their afternoon meeting prepares matters for the Assembly, sets down their mind in distinct propositions, backs their propositions with texts of Scripture. After the prayer, Mr. Byfield, the scribe, reads the proposition and Scriptures, whereupon the Assembly debates in a most grave and orderly way. No man is called up to speak: but who stands up of his own accord, he speaks, so long as he will, without interruption. . . . They harangue long and very learnedly. They study the questions well beforehand, and prepare their speeches, but withal the men are exceedingly prompt and well spoken. I do marvel at the very accurate and extemporal replies that many of them usually make."

The debates on the subject of church government were keen and protracted, and unexpected obstacles arose which for a time retarded a settlement. Twisse, Gataker, Palmer, Temple, and several other learned divines who were cordially on the side of the Parliament were inclined toward what they termed primitive episcopacy, under which the presbyters and their president governed the churches in common. They were not able all at once to reconcile themselves to various details of the Presbyterian system, though ultimately they agreed to acquiesce in it as affording the only chance of constituting a comprehensive national Church, with such reasonable powers of self-government as would prevent the recurrence of the oppressive despotism under which they had so long groaned. The Scotch commissioners and their more thorough going associates, the Puritans of the school of Cartwright, had for the sake of union occasionally to forego the claim of a *jus divinum* for the details of their polity, and to rest contented with the phrase "lawful and agreeable to the word of God," instead of "expressly instituted or commanded." The Independents, though fewer in number than either of the other parties, yet, backed up by their political friends outside, proved more unyielding, and in the end resolved rather to seek for toleration outside the national Church than for comprehension within it if it were not to be constituted more in accordance with their system than the majority of the Assembly were willing to allow. It was therefore agreed to lay aside the discussion of these topics for a time, and proceed to take up subjects on which there was likely to be a greater amount of harmony. Baillie seems to represent this as a mere matter of policy, but one cannot doubt that such men as Twisse, Henderson, Gillespie, Gataker, Tuckney, and Arrowsmith were actuated by more praiseworthy motives, nor refuse to admit that at a considerably later period the majority of the Assembly labored honestly and earnestly to retain the Independents within the national Church.

The subjects on which least disagreement was expected were those relating to the form of public worship and the statement of doctrines. Early in 1644 the Assembly remitted each of these to a small committee to prepare materials for the decision of them, and to bring these first before the large committees, and then before the Assembly. In this way the *Directory for Public Worship* was prepared in 1644, considerable progress was made with a practical *Directory for Church Government* in 1644–45, though the printing of it was delayed till 1647, and in 1645–46 the *Confession of Faith* was elaborated, and finally put into the shape in which it is still printed in Scotland. In the two following years the Assembly elaborated the *Catechisms*, and prepared the Scripture proofs for them as well as for the *Confession of Faith*. It spent part of the time also in attempting to complete its answers to the famous Erastian *Queries* of the House of Commons, and gave its sanction to certain papers in answer to the Independents, formerly drawn up by its grand committee. These last appeared ultimately in the volume entitled *The Grand Debate concerning Presbytery and Independency*. The former were never completed and published, but it is said that the substance of them is given in the preface to the *Jus Regiminis Ecclesiastici Divinum*, prepared by the London ministers. After 1648 the Assembly occupied itself almost exclusively with the examination of those appointed to ecclesiastical charges or desiring license as expectants or probationers, and it was only occasionally that the full quorum of forty could be brought together. The 1163d session was held Feb. 22, 1648–49. The subsequent sessions are not numbered, but the last of which an entry is made in the minutes took place on Mar. 25, 1652. These minutes, which are pro-

nounced by competent judges to be almost entirely in the handwriting of Adoniram Byfield, are still preserved in Dr. Williams's library, Grafton street, London. The whole of them were recently transcribed at the expense of the Church of Scotland, and the more important portion of them has been published by the Messrs. Blackwood, Edinburgh. The Assembly was not formally dissolved, but, as Fuller says, "it dwindled by degrees," and "vanished with the Parliament" which gave it birth.

The most various estimates have been formed of the merits of this Assembly from the time it met down to our own day. Clarendon has spoken of its members and their work with great contempt, and others have "damned them with faint praise;" but Baxter, perhaps as competent as any among their contemporaries to give an impartial verdict, did not hesitate to affirm that "the divines there congregated were men of eminent learning and godliness, and ministerial abilities and fidelity; and being not worthy to be one of them myself, I may the more freely speak that truth which I know even in the face of malice and envy, that, as far as I am able to judge by the information of all history, . . . the Christian world since the days of the apostles had never a synod of more excellent divines." "This," as Dr. Stoughton, one of the most competent judges in our own day, observes, "is high praise, but it comes nearer the truth than the condemnatory verdicts pronounced by some others. The Westminster divines had learning, scriptural, patristic, scholastical, and modern, enough and to spare, all solid, substantial, and ready for use." Hence, their work has stood the test of time, and is still valued and honored. Almost all of them were graduates of the universities of Oxford and Cambridge. Several of them had been honored to suffer in defence of the truths they taught, and many of them had the courage afterward to brave suffering, insult, and poverty rather than renounce their creed or abandon their views of church polity and discipline. Twisse, the prolocutor of the Assembly, was a man not only of subtle and speculative genius, but also of profound learning. He was esteemed one of the most influential theologians of the day, and held in honor by all the Reformed churches. Herle, who succeeded him as prolocutor, was, according to Fuller, "so much Christian, scholar, and gentleman that he could unite in affection with those who were disjoined in judgment from him." White and Burgess, the two assessors, were both men of acknowledged eminence. The former, surnamed, from his high standing in his parish, the "patriarch of Dorchester," was the maternal great-grandfather of the Wesleys. The latter was a most accomplished debater and public speaker, and proved a warm friend of the Scotch and one of the most valiant defenders of Presbytery. Reynolds was a divine "eloquent, learned, cautious," and at the Restoration was made bishop of Norwich. Calamy was a more cautious and liberal Calvinist still, and he too was offered but declined a bishopric. Arrowsmith, "the man with the glass eye," and Tuckney, the friend of Whichcot, successively professors of divinity at Cambridge, were men of high scholarship, extensive theological attainments, and considerable mental breadth. Staunton was a "walking concordance;" Seaman, "an invincible disputant;" Lightfoot, Coleman, and Gataker were all distinguished Oriental scholars; and the last named, after Ussher and Selden (who also had been invited to the Assembly), was accounted the most learned man in England. The age is acknowledged to have been an age of great preachers, and in the first rank among these fall to be numbered the following members: Gouge, on whose preaching Ussher and other scholars then congregated in the metropolis did not disdain at times to attend; Manton, in whom "clear judgment, rich fancy, and happy eloquence met;" Marshall, whose yet more impressive oratory is said to have secured for him greater influence with the Parliament than ever Laud enjoyed with the court; Calamy, who "delighted in that experimental strain of discourse which ever touches the hearts of men;" Burroughs and Greenhill, "the morning and evening stars" of Stepney; Hoyle, the friend of Ussher and professor of divinity in Dublin and Oxford, who was profound in patristic lore, and "reigned both in the schools and in the pulpit;" Palmer—"gracious, learned, little Palmer," as Baillie somewhat familiarly but kindly terms him—who could preach ably and attractively in French as well as in English; Caryl, long popular with the learned audience of Lincoln's Inn; and Goodwin, one of the most successful expository preachers of the age. With these were associated the very *élite* of the Scottish ministers and elders—Henderson, whose learning and culture even royalists acknowledged; Rutherford, twice invited to a professorship in Holland; Gillespie, the prince of disputants, who "with the fire of youth had the wisdom of age;" and Baillie, who has embalmed in graphic narrative their debates and gossip: together with Johnstone of Warriston and the "great marquis" of Argyll, who both suffered afterward on account of their principles; Loudon, the chancellor at once of the kingdom and of its most ancient university; and the engaging but versatile and unscrupulous Lord Maitland.

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ALEX. F. MITCHELL.

Westminster City and Liberties, so constituted by royal charter, extend as far as Kensington and Chelsea westward, Temple Bar eastward, Marylebone northward, and the Thames southward. The district is governed by a high steward elected by the dean and chapter, and by a high bailiff elected by the dean alone. It returns two members to Parliament, and the election in the days of Fox and Burdett produced immense excitement. Westminster includes several parishes, and the church of one of them, dedicated to St. Margaret, is close to the abbey. St. Margaret's church is the church of the House of Commons, and during the Commonwealth many fast-day sermons were preached from its pulpit. Sir Walter Raleigh is buried there, and at the Restoration, Oliver Cromwell's mother and other notabilities were dug out of their graves in the abbey and thrown into a pit opened in St. Margaret's churchyard. The last population-return for Westminster which we have seen gives 246,616; it is probably now 250,000.

JOHN STOUGHTON.

Westminster Confession of Faith and Catechisms. See WESTMINSTER STANDARDS.

Westminster Hall was originally built by William Rufus, but a new one arose in the reign of Richard II., when the old walls were raised higher, the windows enlarged, and a stately porch and noble roof of timber constructed. Parliaments were held in ancient times within this vast apartment: and it is a curious fact that the first meeting of a Parliament under its beautifully-carved beams of oak ended in the deposition of the king who built the edifice. Happily, the hall escaped the conflagration in 1834, and has been carefully restored and skilfully adapted as an immense vestibule to the Houses of Parliament, which can be approached by spacious flights of steps at the S. end. It has been the scene of many stirring events. Here Sir William Wallace of Scotland, Sir Thomas More, and the Protector Somerset were tried and condemned. Not to mention other trials, King Charles I. here appeared before the High Court of Justice, while the banners of Naseby hung over his head. Here the seven bishops just before the Revolution were acquitted, Dr. Sacheverell and the rebel lords of '45 were convicted, and Warren Hastings passed through that ordeal which has been rendered so famous by the eloquence of Burke and Sheridan and by the most brilliant assemblage, perhaps, ever seen in a court of justice. It must be also mentioned that here Oliver Cromwell was inaugurated as Lord Protector of England. Nor can some now living forget how in their youth, at the coronation of George IV., Westminster Hall witnessed a coronation banquet, and at the same time the challenge of the king's champion on horseback in complete armor.

Westminster Hall was long the centre of the English law courts; abutting on it were the court of chancery, the court of king's or queen's bench, the court of common pleas, and the court of exchequer. Originally they were held within the hall, in parts partitioned off for the purpose. These law courts were constructed outside, with entrances into them leading out of the hall. Great changes have been going on in the history of the legal profession. "When I entered the profession," says Mr. Foss in *Old London* (p. 223), "about the beginning of this century, there were only twelve judges in the three courts of

common law. This number was deemed one of peculiar sanctity, and it was considered a sort of sacrilege to suggest any increase, as if that had been the number ever since the institution. And yet that number had only been the regular staff of the courts from the reign of Edward VI. (1547), and it had been entirely forgotten that in all the previous reigns the number of judges had constantly varied, sometimes extending to nine in one court, eight in another, and six or five in a third, and sometimes being reduced to three, and even to two. James I., indeed, added one judge to the four judges then acting in each of the courts, but the increase was discontinued before the end of the reign, and from that time till the reign of William IV. (except during the Commonwealth) the number of judges continued to be twelve. But in 1830 the accumulation of business was at last met by an additional judge in each court, and ever since that date the common-law bench has consisted of fifteen judges."

The hall of old was blocked up with shops and stalls of divers descriptions. Booksellers, law-stationers, and sempstresses here plied their respective trades, while on both sides the building there was a display of banners taken at Blenheim and other battle-fields where Marlborough won his victories. It is curious to notice that in Queen Mary's time the floor was flooded, so that when the lord mayor of London came to present the sheriffs to the barons of the exchequer the place was full of water; and in the reign of Henry III. boats might have been rowed up and down, and no one could get in but upon horseback. But the old legal associations of the buildings, except in history, have now (1875) disappeared, as well as the shops and stalls, and, like the floods, are things of the past. By the legal reforms just effected the old courts are abolished, and instead of them we have a blending of law and equity in the high court of justice in its different divisions. When the new law courts are completed, they will absorb the supreme administration of justice, and gather round them in the future historical associations of English jurisprudence as Westminster Hall has done in the past.

JOHN STOUGHTON.

Westminster Palace, a name originating with the ancient royal residence close to Westminster Abbey, and still applied to the group of buildings used for the meetings of Parliament and other state purposes.

(1) A palace was built on what had been called Thorney Isle by Edward the Confessor, if not by some earlier Saxon monarch. Documentary evidence is preserved of the progress of domestic architectural works, and payments for the same, during the reigns of Henry II., Richard I., John, Henry III., Edward I., Edward II., Edward III., and Henry VI. Extracts of this kind may be found in great number and variety in Britton and Brayley's *History of the Ancient Palace at Westminster*, showing the nature and value of the materials used and the artisans engaged. The palace was partly burnt in the year 1263, and was also damaged by insurgents in 1269. The expenses of the royal household also appear from another set of accounts pertaining to the last two reigns just enumerated. Henry VIII. erected a new palace at York Place and St. James, in the neighborhood, but at some distance from the old buildings occupied by his predecessors. Whitehall was the name given to the new palatial abode, and the former one, deserted by the royal family and household, came to be employed for public business. The Houses of Lords and Commons assembled within the old walls. The former met in a portion of the building which underwent changes and received different names. The latter began to meet in St. Stephen's chapel in the reign of Edward VI. St. Edward's, or the Painted Chamber, was used by the Lords and Commons when they came together for conferences. In the year 1834 a terrible fire destroyed the whole pile, so long interwoven with the royal and national history of England. We well remember the occurrence of that immense conflagration, and the excitement it produced throughout the country. Immediately afterward temporary accommodation was provided for the legislature, and the carrying on of affairs connected with it, and in 1840 the first stone of the new houses was laid.

(2) The new palace of Westminster occupies the site of the old one, and is the most magnificent pile of buildings for legislative purposes in the whole world. It has four fronts. The E. or river front, which is the principal, presents a façade of 900 feet, divided into compartments, panelled with tracery and decorated with statuary and coats-of-arms. The other fronts are in the same style, and exhibit the same profusion of ornament. Three principal towers crown the outspread edifice—the Royal Victoria tower, the central tower, and the clock tower. The first is 340, the second 300, and the third 320 feet in height. The present chambers occupied by the two houses are richly decorated, and all the appurtenances are of a harmonious description. The royal entrance, the royal gallery, the central hall, the passages and the libraries, are all on a scale of the greatest magnificence, and wherever it is appropriate the walls are adorned with statues and frescoes. Of course the new houses far surpass in architecture, sculpture, and painting the previous buildings, but of necessity the new lack the glories thrown around the old by the battles for liberty fought for three centuries in St. Stephen's chapel.

JOHN STOUGHTON.

Westminster School, as it now exists, was founded by Queen Elizabeth in 1560, but there was an abbey school long before. The establishment is called St. Peter's College, consisting of the dean of Westminster, 12 prebendaries, 12 almsmen, and 40 scholars, with a master and usher. But to the 40 royal scholars many more have since been added, and the masters have multiplied on a corresponding scale. The boys on the foundation, however, used to be separated from the rest by a bar or curtain. The school-room was a dormitory of the abbey, and the college hall was the abbot's refectory, built by Abbot Litlington under Edward III. The dormitory was built by the earl of Barlington in 1722. According to an old custom, the boys at Christmas still perform one of Terence's plays, with a prologue and epilogue written for the occasion and suited to the times. Westminster School can boast of distinguished men amongst its masters and pupils. Of the former, were Camden the antiquary, and Busby of wonderful fame as a schoolmaster, who would not take off his hat in the king's presence before the school, lest he should diminish his authority with the boys. The scholars include *poets*—Ben Jonson, George Herbert, Giles Fletcher, Cowley, Dryden, Prior, Churchill, Cowper, Southey; *statesmen*—Sir Harry Vane, Halifax, Warren Hastings, marquis of Lansdowne, Burdett, Graham, and Earl Russell; *warriors*—marquis of Anglesey, Lord Combermere, Lord Raglan; and other *celebrated men*—Locke, South, Christopher Wren, Atterbury, Gibbon.

JOHN STOUGHTON.

Westminster Standards. Under this title are sometimes comprehended all the church books drawn up by the Westminster Assembly, at others only those relating to doctrine; and accordingly, though these were drawn up last, we proceed to treat of them first.

(1) *Confession of Faith.*—A committee was appointed by the Assembly "to prepare matter for a joint confession of faith" as early as Aug. 20, 1644. It consisted of Drs. Gouge, Temple, and Hoyle, Messrs. Gataker, Arrowsmith, Burroughs, Burgess, Vines, and Goodwin, together with the Scotch commissioners. A fortnight later, Dr. Smith and Messrs. Palmer, Newcomen, Herle, Reynolds, Wilson, Tuckney, Young, Ley, and Sedgewick were added to the committee. In all probability, the material afterward embodied in the Confession was in part, at least, prepared by this committee. But the digesting of the matter into a formal "draught" was, on May 12, 1645, entrusted to a small committee consisting, apparently, of Drs. Temple and Hoyle, Messrs. Gataker, Harris, Burgess, Reynolds, Herle, and the Scotch commissioners. On July 7, 1645, Dr. Temple "made report of that part of the Confession of Faith touching the Scriptures," and it was read and debated. The following day Messrs. Reynolds, Herle, and Newcomen (to whom were afterward added Messrs. Tuckney and Whitaker) were appointed a committee to "take care of the wording of the Confession," as its articles should be voted in the several sessions. On July 16 report was made from the committee of the heads of the Confession, and these were distributed among the three large committees of the Assembly, to be by them elaborated and prepared for more formal discussion. All were repeatedly read and debated, paragraph by paragraph, and sometimes word by word, in the Assembly. On Sept. 25, 1646, the first nineteen chapters, and on Dec. 4 of that year the whole Confession, were finally passed, and then presented to the Houses of Lords and Commons. They gave orders that 600 copies should be printed for the use of members of Parliament and of the Assembly, and that Scripture proofs should be added to the Confession, which was accordingly done. In 1647 the Confession was approved by the Church of Scotland in the form in which it had passed the Assembly, and it was subsequently ratified by the Scottish Parliament. In 1648, under the title of "Articles of Christian Religion," and with certain changes, most of which were afterward adopted by the Savoy Conference, it was passed by the English Parliament.

Sources and Character of the Confession.—It has been maintained that the Assembly's Confession was derived mainly from foreign sources, and even that it "bears unmistakably the stamp of the Dutch theology in the sharp distinctions, logical forms, and juridical terms into which the Reformed doctrine had gradually moulded itself under

the red heat of the Arminian and Socinian controversies." But there is conclusive evidence that in its general plan, and in the tenor and very words of its more important articles, it was derived not from foreign but from native sources. It may confidently be traced up to those confessedly Calvinistic or Augustinian Articles which are supposed to have been prepared by Ussher, and in 1615 were adopted by the convocation of the Irish Church. This was before the Synod of Dort had met, or the bitterness and heat which the debate of the Arminian controversies occasioned had extended to Britain. In these Articles I am satisfied we have the main sources of the Assembly's Confession of Faith, and almost its exact prototype in its statement of all the more important and essential doctrines of Christianity. In the order and titles of many of its chapters, as well as in the language of whole sections or subdivisions of chapters, and in many single phrases, and *voces signatæ* occurring throughout their Confession, the Westminster divines appear to me to have followed very closely in the footsteps of Ussher and his Irish brethren. I do not venture to assert that in no case do they determine points which the Irish convocation had left open. But I do say that these points are not many nor important, and that it is clear the Assembly took the greatest possible pains to express its views in such a way as to obviate objections which had been, or might have been, taken either to the words or to the matter of the Irish Articles. The minutes clearly show that the attempt to determine questions left open by the Synod of Dort was seldom made, and that when it was made it was strenuously resisted by the pupils and successors of the English divines, who claimed to have moderated the conclusions of that synod. With respect to the doctrine of the covenants, and the juridical phraseology which some assert were imported into England through Cocceius (whose chief work on the subject, however, was not published till after the Confession had been framed), there is nothing taught by the Westminster divines which had not in substance been found by Rollock in Scotland and Cartwright in England half a century before, while there is an advance on what is taught in the Dutch *Synopsis Purioris Theologiæ* of 1642. In regard to the important chapters on "The Holy Scripture," on "God's Eternal Decree," on "Christ the Mediator," and on "The Lord's Supper," which so largely determine the character of the Confession, the resemblance to the Irish Articles both in language and arrangement is so close that hardly a doubt can be entertained either of the sources from which it was derived or of the design of its framers in following in the footsteps of Ussher. They meant their Confession to be in harmony with the *consensus* of the Reformed churches; they desired it to be a bond of union, not a cause of strife, among those who adhere to the sum and substance of the doctrine of the Reformed churches.

The Confession, under the title of *The Humble Advice of the Assembly of Divines now by authority of Parliament sitting at Westminster concerning a Confession of Faith*, etc., was printed at London in Dec., 1646, without proofs, and in May, 1647, with proofs, for the use of the Houses of Parliament and the Assembly. A copy of this last edition was taken to Scotland by the commissioners, and from it 300 copies were printed for the use of the General Assembly there. After being approved by that body, it was *published* in Scotland with the title *The Confession of Faith agreed upon by the Assembly of Divines*, etc., and, to the indignation of the House of Commons (which had not yet approved of it), this was reprinted by a London bookseller in 1648. In the same year it was, with the omission of part of chapters xx. and xxiv., and the whole of chapters xxx. and xxxi., and with some minute verbal alterations, approved by the two houses, and published under the title *Articles of Christian Religion, approved and passed by both Houses of Parliament after advice had with the Assembly of Divines*, etc. But in this instance the Assembly proved too strong for the Parliament, even though the Savoy Conference sided with the latter; and the Confession continues to be printed in Britain in the form in which it was drawn up by the Assembly and approved by the Church of Scotland. Under the title of *Truth's Victory over Error*, Dickson, professor of divinity in Edinburgh, published a brief catechetical exposition of the Confession in 1649. Admirable expositions of it have been published in our own day by Dr. Shaw of Whitburn, Scotland, and Dr. Hodge of Allegheny, U. S.

(2) *Catechisms.*—The catechism which Baillie reports to have been drawn up and nearly agreed to in the end of 1644 was probably that which had been almost completed, and to a considerable extent had been passed, by the Assembly while still occupied with its Confession of Faith. But on Jan. 14, 1646–47, "upon a motion made by Mr. Vines, it was ordered, That the committee for the Catechism do prepare a draught of two catechisms, one more large, and another more brief, in which they are to have an eye to the Confession of Faith and to the matter of the Catechism already begun." The Larger Catechism was first proceeded with. This appears distinctly from the minutes of the Assembly, though the opposite view is still sometimes maintained. It may be admitted that the Shorter one at times embodies more of the materials of the original Catechism, and seems to be less directly drawn from the Confession of Faith, but it was not cast into its present shape till after the Larger one was completed, and all the Scotch commissioners except Rutherford had left the Assembly. Tradition attributes to Gillespie the answer given in it to the question, What is God? but so far as can be ascertained from the minutes the answer to that question, even in the Larger Catechism, was not moulded into its present shape till after Gillespie returned to Scotland, but remained somewhat of the same form as it bears in the original draught and in the catechisms of Ussher and Cartwright. Some suppose that the Smaller Catechism of Cartwright was a good deal followed by the Assembly's committee; but no accurate comparison, so far as I know, has yet been instituted between the Assembly's catechisms and those which had previously appeared in England, especially during the years immediately preceding. Tuckney had the chief share in digesting the Larger Catechism into its present form, and he was also convener of the committee which prepared the Shorter, though some think that in its more concise and severely logical answers they discern traces of the handiwork of Wallis, the mathematician. Both catechisms, as has been well observed by the younger M'Crie, "are inimitable as theological summaries; though when it is considered that to comprehend them would imply an acquaintance with the whole circle of dogmatic and controversial divinity, it may be doubted whether either of them is adapted to the capacity of childhood. But if too little regard has been paid in former days to the *intelligent* training of our youth in such catechisms, . . . experience has shown that few who have been carefully instructed in our Shorter Catechism have failed to discover the advantage of becoming acquainted in early life, even as a task, with that admirable 'form of sound words.'"

Ridgley's *Body of Divinity* is virtually an exposition of the Larger Catechism. Alleine, Vincent, and Flavel in England, and Fisher, Willison, and several others in Scotland, have published expositions of the Shorter Catechism.

(3) *Directory of Public Worship.*—This occupied the attention of the Assembly during the greater part of the year 1644, and received the sanction of the English houses of Parliament on Jan. 3, 1644–45, though one or two alterations were made in March following to meet the views of the Scotch. It was approved by the Scotch General Assembly and Parliament in Feb., 1645, with one reservation. The first English edition bears the date of 1644, but was really published in what, according to our reckoning, would be Mar., 1645. The first Scotch edition bears the date of 1645, and has been recently reprinted by the Messrs. Blackwood with an historical introduction and notes by Dr. Leishman of Linton. From the preface, as well as from the testimony of those engaged in framing it, we may clearly infer that the Directory was not intended to form a new liturgy, the very words of which might be turned by the minister into a fixed and unvarying form of prayer. The meaning of its framers, as themselves tell us, only was that there might be "a consent of all the churches in those things that contain the substance of the service and worship of God," and that the ministers might, "if need be, have *some help and furniture*, and yet so as they become not hereby slothful and negligent in stirring up the gifts of Christ in them, but that each, by taking heed to himself and the flock of God committed to him, and by wise observing the ways of Divine Providence, may be careful to furnish his *heart and tongue* with *further or other* material of prayer and exhortation as shall be needful on all occasions." Its minuter directions have never been regarded as rigidly binding, but it were much to be wished that more heed were given to these wise and weighty counsels.

(4) *Church Government and Discipline.*—Two treatises on these subjects proceeded from the Westminster Assembly. The preparation of the former, to which it set itself shortly after subscribing the Covenant, was attended with many difficulties. It was entitled by its framers *Propositions concerning Church Government*, but it is now generally known as the *Form of Church Government*, and under this title it is still printed, along with Scotch editions of the Confession of Faith. The greater part of it had been drawn up before Feb., 1645, and the same month was presented apparently in manuscript to the Scotch Assembly, which approved of it as far as then completed, with certain reservations, and agreed to carry it out in practice as soon as it should be ratified without substantial alteration by the English Parliament. It never was so ratified. The

best friends of Presbytery in England became satisfied that they must be contented to get the assent of their countrymen to their system as one that was lawful and agreeable to the word of God, and that could be justified by considerations of reason and expediency in many details for which divine warrant could not be claimed. Urged by these and the friends of comprehension generally, the Assembly set itself in 1645 to prepare its "Directory for Church Government" and discipline. Henderson took special interest in the preparation of this, and furnished, in part at least, its materials, and all the Scotch commissioners assented to it. To a large extent it was adopted by the English Parliament in 1648 in their "Ordinance as to the Form of Church Government." It was printed in Scotland in 1647, and reprinted, along with Henderson's *Form and Order of the Government of the Church of Scotland*, in 1690, and use was made of it in drawing up the *Form of Process* in the Church of Scotland in 1707, but it was never formally approved of, nor is it so well known as it deserves to be.

ALEX. F. MITCHELL.

West Mitch'ell, p.-v., Mitchell co., Ia.

West Monroe', p.-v. and tp., Oswego co., N. Y. P. 1304.

West'more, p.-v. and tp., Orleans co., Vt. P. 412.

West'moreland, county in the northern part of England, comprises an area of 758 sq. m., with 65,005 inhabitants. The surface is mountainous, the mountains, of which some rise over 3000 feet, alternating with moorland, heath, and lakes. Useful minerals abound, and coal, lead, and copper mines are worked. Agriculture is in a backward state and of small consequence; the rearing of sheep and geese is one of the principal occupations. Manufactures of woollens are carried on.

Westmoreland, the easternmost county of New Brunswick, bounded N. E. by Northumberland Strait, and on the S. E. reaching to Chignecto Bay. It is generally very fertile and well cultivated, and is traversed by Intercolonial Railway. Cap. Dorchester. P. 29,335.

Westmore'land, county of S. W. Pennsylvania, bounded N. W. by Alleghany River, watered by many of its affluents, skirted along its N. border by Pennsylvania Canal, and traversed by Pennsylvania, Pittsburg Washington and Baltimore, and Alleghany Valley R. Rs. The S. E. part is mountainous, with an unproductive soil; the other parts are hilly, but fertile. Bituminous coal, iron ore, and salt are plentiful throughout. There are flour-mills, saw-mills, planing-mills, numerous tanneries and currying establishments, distilleries, and manufactories of agricultural implements, carriages, saddlery, iron castings, railway cars, brick, paper, and woollen goods. Horses, cattle, and sheep are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Greensburg. Area, 1040 sq. m. P. 58,719.

Westmoreland, county of E. Virginia, separated from Maryland by Potomac River, and occupying a part of the peninsula between the Potomac and the Rappahannock. The surface is diversified by hills and valleys, and the soil along the streams is very fertile. In this county were born many men noted in American history, among whom are George Washington, James Monroe, and the entire Lee family of Virginia, including Robert E. Lee, the Confederate commander in the civil war. Staples, Indian corn, wheat, oats. Cap. Montross. Area, 316 sq. m. P. 7682.

Westmoreland, p.-v. and tp., Cheshire co., N. H. P. 1256.

Westmoreland, p.-v. and tp., Oneida co., N. Y. P. 2952.

Westmoreland (JOHN **Fane**), D. C. L., ELEVENTH EARL OF, and BARON BURGHERSH, b. in England Feb. 3, 1784, son of John, the tenth earl (1759–1841), who was lord lieutenant of Ireland 1790–95 and lord privy seal 1798–1806; entered the army 1803; participated in the passage of the Dardanelles by Admiral Duckworth 1806, and in the storming of Rosetta, Egypt, 1807; joined the army in the Peninsula 1808; was at the battles of Vimeira and Talavera; served as aide-de-camp to Wellington and as military commissioner to the head-quarters of the allies Sept., 1813; took part in the invasion of France 1814; was minister at Florence Aug., 1814; served in the campaign against Naples 1815; became a privy councillor 1822; minister at Berlin 1841, and at Vienna 1851; was raised to the full rank of general 1854, and was special plenipotentiary at the Congress of Vienna for the consideration of the "Eastern question," Feb. to Nov., 1855. D. at Apthorpe House, London, Oct. 16, 1859. He left in MS. a work on *The Great European Congresses.*

Westmoreland (RALPH **Neville**), FIRST EARL OF, b. in England about the middle of the fourteenth century; was an able military commander and a shrewd politician, displaying great dexterity in maintaining himself in power in a time of frequent revolutions; promoted the downfall of the duke of Gloucester, and was created earl by Richard II. 1397; joined Henry of Lancaster (Henry IV.) July, 1399, and was by him made earl marshal of England and governor of the Tower of London; was subsequently lord warden of the Scotch Marches; filled other high offices of state, and was captor of Mowbray, earl of Nottingham, and of Scrope, archbishop of York, May, 1405. D. Oct. 21, 1425. His second son, RICHARD (b. 1400), became earl of Salisbury 1442; was the most prominent of the early Yorkist leaders, and was beheaded at Pontefract after the battle of Wakefield (Jan. 1, 1461); and his grandson, RICHARD, was the celebrated "Kingmaker." (See WARWICK, EARL OF.)—CHARLES NEVILLE, head of the family in the time of Queen Elizabeth, was associated with the earl of Northumberland in his attempted insurrection of 1569 in favor of the queen of Scots.

West Mount Ver'non, v., East Chester tp., Westchester co., N. Y. P. 1200.

West Munt'meal, tp., Chester co., Pa. P. 1070.

West New Brigh'ton, p.-v., Richmond co., N. Y., on the S. side of Kill Van Kull, opposite Bergen Point, N. J., contains 4 churches, good schools, a paper-hanging factory, the New York dyeing and printing establishment, the largest of its kind in the U. S.; the New York fancy dyeing establishment, 1 newspaper, and 1 horse-railway.

J. J. CLUTE, ED. "NORTH SHORE ADVOCATE."

West New'bury, p.-v. and tp., Essex co., Mass. P. 2006.

West New'ton, p.-v., Middlesex co., Mass.

West Newton, p.-v. and tp., Nicollet co., Minn. P. 703.

West Newton, p.-b., Westmoreland co., Pa. P. 992.

West North'field, p.-v., Franklin co., Mass.

West Not'tingham, tp., Chester co., Pa. P. 879.

West'on, p.-v., York co., Ont., Canada, on Grand Trunk, Canada Northern, and Toronto Grey and Bruce railways, 9 miles W. of Toronto, has a large grain-trade. P. about 1300.

Weston, p.-v. and tp., Fairfield co., Conn. P. 1054.

Weston, v., Webster co., Ga. P. 66.

Weston, p.-v., McLean co., Ill., on Toledo Peoria and Warsaw R. R., has 4 churches, good schools, and 3 grain warehouses. The neighboring section is well adapted to the cultivation of corn. P. 250.

R. M. SPURGIN, ED. "YE LOCAL."

Weston, p.-v. and tp., Aroostook co., Me. P. 394.

Weston, p.-v. and tp., Middlesex co., Mass. P. 1261.

Weston, p.-v. and tp., Platte co., Mo., on Kansas City St. Joseph and Council Bluffs R. R., and on Missouri River, 3 miles from Fort Leavenworth, contains 9 churches, a handsome public school, 1 newspaper, 1 furniture-factory, 1 brewery, a pork-packing establishment, 2 banks, 3 saw-mills, and excellent water-power. P. of v. 1614; of tp. 2453.

Weston, tp., Johnson co., Neb. P. 192.

Weston, p.-v. and tp., Wood co., O. P. 1833.

Weston, p.-v., Collin co., Tex. P. 157.

Weston, p.-v. and tp., Windsor co., Vt. P. 931.

Weston, p.-v., cap. of Lewis co., West Va., 81 miles from Charlestown, has 4 churches, 1 academy, 1 bank, 1 newspaper, a hospital, and 4 hotels. Business, mechanical pursuits. P. 1111. J. W. WOFFINDIN, ED. "DEMOCRAT."

Weston, tp., Clark co., Wis. P. 500.

Weston, p.-v. and tp., Dunn co., Wis. P. 339.

Weston, tp., Marathon co., Wis. P. 265.

Weston (HENRY G.), D. D., b. Sept. 11, 1820, at Lynn, Mass.; graduated at Brown University in 1840; entered the Baptist ministry; preached in Peoria, Ill., and in New York City, and has been since 1868 president of Crozer Theological Seminary, Upland, Pa, and editor of *Baptist Quarterly Review.*

Weston (Sir RICHARD), b. at Sutton, Surrey co., England, about 1580, was sent by James I. as ambassador to the elector-palatine and king of Bohemia 1619, and by his example and his pen "laid the foundation of the improved agriculture of Britain." D. about 1650. Author of *The Discourse of Husbandry used in Brabant and Flanders* (1645), published under the name of "Samuel Hartlib," and of *Brief Discoveries of Ways and Means for Manuring and Improving Land* (1646).

Weston (STEPHEN), b. at Exeter, England, in 1747; educated at Eton and at Exeter College, Oxford, of which

he became a fellow; took orders in the Church of England, and held the livings of Mamhead (1777–90) and Little Hempston, Devonshire (1786–90), after which he devoted himself to travels on the Continent and to literature, being distinguished as a classical and Oriental scholar. D. in London Jan. 8, 1830. He published translations from the Chinese and Persian, *Specimen of the Conformity of the European with the Oriental Languages* (1802), *Specimen of a Chinese Dictionary* (1812), and several works of travel and biblical criticism.

Weston (Thomas), b. in England about 1575; became a merchant in London; advanced £500 to the agents of the Leyden Pilgrims 1620 when fitting out the Mayflower expedition, but soon abandoned his connection with them as unprofitable, and personally commenced in 1622 another settlement at Wessagussett under a grant given by the king to Sir Ferdinando Gorges. His settlers were improvident, and soon had to be supported by the Pilgrims at Plymouth, and most of them, like Weston himself, soon returned to England.

Weston (William), b. in England about 1700; graduated at and became fellow of St. John's College, Cambridge; took orders in the Church of England, and was many years rector of Campden, Gloucestershire, England, where he d. in 1760. Author of a learned work, *An Enquiry into the Rejection of the Christian Miracles by the Heathens* (Cambridge, 1746), which involved him in a polemic with Richard Hurd; of *Dissertations on some of the Most Remarkable Wonders of Antiquity* (1748), and other treatises.

West Or'ange, tp., Essex co., N. J. P. 2106.

West'over, p.-v., Somerset co., Md.

West Penn, p.-v. and tp., Schuylkill co., Pa. P. 1980.

West Penns'borough, tp., Cumberland co., Pa. P. 2180.

West Per'ry, tp., Snyder co., Pa. P. 585.

Westpha'lia, province of Prussia, bounded by Rhenish Prussia, Holland, Hanover, Brunswick, Hesse, and Nassau, comprises an area of 7848 sq. m., with 1,775,175 inhabitants, of whom 806,464 are Protestants and 949,118 Roman Catholics. The surface is a low plain in the eastern part of the province, more elevated and hilly toward the N. and W. The soil is fertile and very well cultivated. Wheat, rye, barley, oats, potatoes, and excellent flax, hemp, and hops are raised; coal, iron, lead, copper, and salt are produced, and an important manufacturing industry carried on, especially in articles of iron, steel, flax, and wool. It became a Prussian province in 1815 at the Congress of Vienna.

Westphalia, p.-v. and tp., Clinton co., Mich. P. 1499.

Westphalia, p.-v., Osage co., Mo.

Westphalia, Treaty of, in 1648, put an end to the Thirty Years' War (which see).

West Pike'land, p.-v. and tp., Chester co., Pa. P. 1201.

West Pike Run, tp., Washington co., Pa. P. 1252.

West Pitts'ton, b., Luzerne co., Pa. P. 1416.

West Plains, p.-v., Howell tp., cap. of Howell co., Mo. P. 130.

West Point, p.-v., Troup co., Ga. P. 1405.

West Point, tp., Stephenson co., Ill. P. 2602.

West Point, p.-v., Wayne tp., Tippecanoe co., Ind. P. 246.

West Point, tp., White co., Ind. P. 611.

West Point, tp., Butler co., Ia. P. 320.

West Point, p.-v. and tp., Lee co., Ia. P. of v. 794; of tp. 1894.

West Point, p.-v., Hardin co., Ky. P. 206.

West Point, p.-v., cap. of Clay co., Miss., on Mobile and Ohio R. R., has 5 churches, fine public buildings, 2 colleges, 1 bank, 1 newspaper, 2 hotels, 1 wagon and carriage factory, and 2 large mills. Principal business outside of village, cotton-growing. P. about 2500.

D. L. Love, Ed. "Southern Advertiser."

West Point, p.-v., cap. of Cuming co., Neb., on Sioux City and Pacific R. R., contains good schools, 2 banking-houses, 1 newspaper, woollen, paper, and grist mills, 1 foundry, a furniture-factory, 2 carriage establishments, 2 lumber-yards, 1 brewery, an elevator, stock-yards, and 3 hotels. P. 520. C. F. Bayha, Ed. "Republican."

West Point, v., Rio Virgin tp., Lincoln co., Nev. P. 138.

West Point, a military post and the seat of the U. S. Military Academy, is on the W. bank of the Hudson River, between the towns of Highlands and Cornwall, Orange co., N. Y., 52 miles from New York City and 94 miles from Albany. The river, bending a little at Newburg, thence flows nearly due S. through a gorge between abrupt and lofty hills for about 8 miles, then turns suddenly to the E. for about one-fourth of a mile, and as suddenly resumes its southward course, leaving West Point in the southern angle of the bend and in the midst of the Highlands of the Hudson. The eastern side of the Point is a nearly straight, precipitous shore, while the northern side, curving so as to form a bay at its western extremity, has a comparatively gentle slope, and commands a fine view up the river. On the north-western part of this slope is Camp Town, containing barracks for soldiers, storehouses, etc. Farther N., at the extremity of a plain called the German Flats, is the cemetery, the burial-place of many distinguished officers of the army, including Gen. Scott; and still a little to the N. is Washington's Valley, where stood the house occupied by Washington in 1779. The Military Academy is situated on a level plateau 160 feet above the river, flanked on the W. by rocky heights, of which that on which stand the ruins of Fort Putnam is the nearest and most prominent. On the S. the heights approach the river, leaving only room for a road southward, leading to the village of Highland Falls and to Forts Montgomery and Clinton. A road westward over the mountains leads to Newburg and the surrounding country. The principal buildings of the Academy are at the southern end of the plateau; the quarters of the officers and professors are on the W. side and along the roads leading southward and westward. In the northern angle of the bend, opposite the Point, is Constitution Island, a rocky mass rising 130 feet above the river, connected by a broad marsh with the E. bank. Just N. of the island are the West Point Foundry and the village of Cold Spring; farther N. rises the lofty Bull Hill, with Breakneck in the distance. N. W. of the Point, on the W. side of the river, are Crow Nest and Butter Hill, and beyond is the town of Newburg at the extremity of the upper reach of the river, which viewed from West Point appears like a mountain-lake. On the same side of the river, 1½ miles S. of the Point, is the village of Highland Falls, and 4½ miles farther S., on Pooplopen's Creek, are the ruins of Forts Montgomery and Clinton. Six miles still farther S. is the memorable Stony Point. E. of West Point, on the opposite bank, is a high, narrow, nearly level plain, from which there is a gradual rise to the hills beyond. Near the southern end of this plain, about 2 miles below the Point, still stands the Robinson House, Arnold's head-quarters. Just beyond is Sugar-loaf Hill, and farther to the S., projecting into the river, Anthony's Nose. One mile S. of the Nose was Fort Independence. Verplanck's Point is nearly opposite Stony Point, with which it is connected by King's Ferry.

The government tract of land at West Point contains about 2100 acres, most of which was purchased in 1790 from the son of one of the original patentees; the rest was purchased in 1824. Jurisdiction was ceded by New York to the U. S. over a part of the tract in 1826, and over the remainder in 1875.

In the war of the Revolution, to obtain control of the navigation of the Hudson, which gave a very important line of communication from New York City to Canada and Western New York, and thereby to separate the eastern part of New York and the whole of New England from the rest of the colonies, was a favorite project of the British. To thwart this project by obstructing the navigation of the river, and retaining the control of at least a portion of it, was the object which the colonies sought to attain by strongly fortifying and occupying the Highlands through which the river flows for several miles. The importance of West Point as a military position for this purpose, at first not appreciated, eventually became capital. The first fortifications were commenced on Constitution Island and at Forts Montgomery and Clinton on Pooplopen's Creek in 1775. These were taken and demolished by the British advancing from New York City in 1777, but were abandoned by them after the surrender of Burgoyne's army. The subject of again fortifying the Highlands received immediate attention, and West Point having been recommended by a commission as the best place to obstruct the navigation of the river, fortifications were here commenced early in 1778 under the supervision of Gen. Putnam, with Lieut.-Col. Radière as engineer. From this time forward great exertions were made to complete and strengthen the works. The Polish hero Kosciusko relieved Radière as engineer at this place Mar. 26, 1778. At the time of Arnold's treason in 1780 these works, though unfinished, had cost more than two years' labor of the army and $3,000,000. The place was esteemed of great strength, secure against any army the British were able to bring against it. The fortifications were never fully completed, although work upon them was continued until 1791. The principal of

these were Fort Putnam, commanding the plateau and the other works; Forts Webb, Wyllis, and Meigs, on eminences nearer the river; and Fort Clinton, at the north-eastern angle of the plateau. There were also several additional redoubts and batteries at various important points, and a strong boom and chain stretched across the river from the Point to Constitution Island. Both sides of the river were occupied by the army. To the command of this most important post some of the most distinguished officers were at different times assigned; among whom were Gens. Clinton, Putnam, Parsons, McDougall, Heath, Howe, Greene, and Knox. Washington himself established his head-quarters here in 1779, and with La Fayette and other officers often visited the place. He was here present at the celebration of the birth of the dauphin of France, May 31, 1782. Arnold took command Aug. 5, 1780, and continued negotiations already commenced with the British to betray his trust. It is quite probable that the success of the plot, and consequent loss of West Point, would have been fatal to the cause of the colonies. The interview between Arnold and André to arrange the details of the plot took place Sept. 22, 1780, on the W. bank, about 2½ miles below Stony Point. André was captured the next day on the E. bank, while attempting to return to New York. He was taken to West Point on the 26th, where he remained until the 28th. On the morning of the 25th, Arnold, while seated at the breakfast-table at the Robinson House, with two of Washington's aides who had been sent forward to announce the arrival of the chief, received the note announcing the capture of André. Feigning a pretext, he at once left the table and the house, dashed down the river-bank, and taking a boat succeeded in reaching the British war-vessel, the Vulture.

The ruins of the principal fortifications are still to be seen. Fort Clinton has been partially restored; Fort Putnam, though in ruins, still looks down upon the river and plain beneath, and from its summit may be had an extensive view of this interesting locality. Within the parapet of Fort Clinton stands a monument sacred to Kosciusko, and on the E. side of the plain, a secluded spot, a shelf of the precipice, known as Kosciusko's Garden, is said to have been his favorite resort while engineer of the works at this place. Placed in the midst of attractive scenery, comparatively isolated from the surrounding country, and favorably situated for retirement and study, hallowed by the footsteps of Washington, La Fayette, and other heroes of our Revolution, associated with some of the most stirring events of our national history, West Point may well be the place consecrated to training the youth of the nation for the military service of their country. (For further information see Boynton's *History of West Point.*) (See MILITARY ACADEMIES.)

GEORGE L. ANDREWS.

West Point, p.-v., Cornwall tp., Orange co., N. Y., on Hudson River, 49 miles N. of New York, is the seat of the U. S. Military Academy. P. 942.

West Point, p.-v. and tp., King William co., Va., on Richmond York River and Chesapeake R. R., 38 miles E. of Richmond, and 35 miles from Chesapeake Bay, has good schools, 1 newspaper, a steamboat line to Baltimore, 2 hotels, 1 mill. P. 2193.

S. ROSZEL DONOHOE, ED. "STAR."

West Point, p.-v. and tp., Columbia co., Wis. P. 919.

West'port, p.-v. and tp., Fairfield co., Conn. P. 3361.

Westport, p.-v. and tp., Lincoln co., Me. P. 699.

Westport, p.-v. and tp., Bristol co., Mass. P. 2724.

Westport, tp., Pope co., Minn. P. 238.

Westport, city and tp., Jackson co., Mo. P. of city, 1095; of tp., exclusive of city, 1051.

Westport, p.-v. and tp., Essex co., N. Y. P. 1577.

Westport, tp., Dane co., Wis. P. 1589.

West Prov'idence, tp., Bedford co., Pa. P. 970.

Westra'lia, v. and tp., Montgomery co., Kan. P. of v. 101; of tp. 1117.

West Ran'dolph, p.-v., Orange co., Vt., on Central Vermont R. R., 25 miles S. of Montpelier, has 10 churches, an academy and normal school, 1 bank, 1 newspaper, and 4 hotels. P. 3000.

LEWIS P. THAYER, ED. "GREEN MOUNTAIN HERALD."

West Ridg'way, v., Boke's Creek tp., Logan co., O. P. 100.

West Riv'er, tp., Randolph co., Ind. P. 1612.

West River, p.-v., Anne Arundel co., Md.

Wes'tropp (HODDER M.), b. in England about 1825; studied art in Italy, giving especial attention to religious archæology; is author of *Epochs of Painted Vases, an Introduction to their Study* (1856), of *A Handbook of Archæology, Egyptian, Greek, Etruscan, and Roman* (1867), and, with C. Staniland Wake, of *Ancient Symbol Worship—Influence of the Phallic Idea in the Religions of Antiquity* (London, 1873), which was edited in New York, with an *Introduction, Additional Notes, and an Appendix* (1874), by Alexander Wilder, M. D.

West Rox'bury, formerly a township in Norfolk co., Mass., but in 1873 annexed to Boston. P. 8683.

West Rush'ville, p.-v., Richland tp., Fairfield co., O. P. 189.

West Rut'land, p.-v., Rutland co., Vt.

West St. Paul, p.-v. and tp., Dakota co., Minn. P. 1103.

West Salaman'ca, p.-v., Cattaraugus co., N. Y.

West Sa'lem, p.-v., Wayne co., O., on Atlantic and Great Western R. R., has 4 churches, a fine school building, 1 bank, 1 newspaper, flax and grist mills, 2 brickyards, 1 grain elevator, 1 tannery, a foundry, a lumber-yard, and 2 hotels. Principal business, farming, dairying, stock raising. P. 713. F. G. MCCAULEY, ED. "BUCKEYE FARMER."

West Salem, tp., Mercer co., Pa. P. 2082.

West Salem, p.-v., La Crosse co., Wis.

West Sand Lake, p.-v., Rensselaer co., N. Y. P. 315.

West Sen'eca, p.-v. and tp., Erie co., N. Y. P. 3196.

West Shenan'go, tp., Crawford co., Pa. P. 357.

West Spar'ta, tp., Livingston co., N. Y. P. 1211.

West Spring'field, p.-v. and tp., Hampden co., Mass. P. 2606.

West Stock'bridge, p.-v. and tp., Berkshire co., Mass. P. 1921.

West Swan'zey, p.-v., Cheshire co., N. H.

West'town, tp., Chester co., Pa. P. 818.

West Town'send, p.-v., Middlesex co., Mass.

West Town'ship, p.-v., Albany co., N. Y.

West Troy, p.-v., Albany co., N. Y., on Hudson River, opposite Troy, with which it is connected by an iron bridge and two steam-ferries, and on Rensselaer and Saratoga R. R., 6 miles N. of Albany. It is at one of the entrances of the Erie and Champlain canals into the Hudson, at the head of navigation, and connected by river and canals with Lakes Erie, Ontario, and Champlain. It is wholly built on the bottom-lands of the Hudson, extending back nearly a mile from the river to a slight elevation, on which are situated some of the most beautiful residences in the town. Its streets are finely laid out, and a company has been formed with a capital of $200,000 to supply the village with water from the Mohawk River. West Troy has 9 churches, a national bank, and 1 newspaper. A tract of land near the centre of the village has been appropriated for the erection of buildings suitable for a public market, which will be erected during the summer of 1876. It is the largest village in New York, and several attempts have been made to obtain a city charter, annexing to it the neighboring village of Green Island, but they have all signally failed through the opposition of the citizens of the two towns. Its principal business is in lumber, which is brought from Michigan by way of the lakes and Erie Canal. Its citizens are also extensively engaged in the manufacture of bells, patent car-boxes, Scotch woollen shawls, butts and hinges, horse cars, lime and cement, stoves and hollow ware, and many other manufacturing interests. The Watervliet U. S. arsenal and grounds, established in 1807 by a grant of the land by the State to the U. S. government, containing 105 acres, is situated here. The grounds are finely laid out, and contain many fine buildings, including the officers' residences, magazines, the arsenal building, iron and artillery storehouses. The village has a very efficient fire department. The Watervliet horse-car railroad connects it with Albany. P. 10,693.

ALLEN COREY, ED. "ALBANY COUNTY DEMOCRAT."

West Tu'rin, tp., Lewis co., N. Y. P. 2111.

West U'nion, p.-v. and tp., cap. of Fayette co., Ia., on Milwaukee division of Burlington Cedar Rapids and Minnesota R. R., has 5 churches, 1 bank, a good school, 2 newspapers, 1 flouring-mill, 1 wagon-factory, and 3 hotels. Excellent farming and grazing country. P. of v. 1189; of tp. 2032. C. H. TALMADGE, ED. "GAZETTE."

West Union, p.-v. and tp., Todd co., Minn. P. 307.

West Union, p.-v. and tp., Steuben co., N. Y. P. 1261.

West Union, p.-v., Tiffin tp., cap. of Adams co., O. P. 486.

West Union, p.-v. and tp., cap. of Doddridge co., West Va., on Parkersburg branch of Baltimore and Ohio R. R., 54 miles E. of Parkersburg, contains 3 churches, a graded school, court-house, jail, 2 weekly newspapers, 1

flouring and 1 saw mill, and 1 hotel. Principal trade, lumber, staves, hoops, coal, and country produce. P. 1128.
DAVID GOSORN, ED. "BAPTIST MESSENGER."

West U'nity, p.-v., Brady tp., Williams co., O. P. 537.

West Up'ton, p.-v., Worcester co., Mass.

West Vien'na, p.-v., Oneida co., N. Y. P. 113.

West'ville, p.-v., Pictou co., N. S., 14 miles S. from Pictou, has extensive and valuable coal-mines. Coal-Mines R. R. Station is 2 miles distant. P. about 1000.

Westville, tp., Dale co., Ala. P. 1014.

Westville, p.-v., New Haven co., Conn.

Westville, p.-v., Laporte co., Ind.

Westville, p.-v., cap. of Simpson co., Miss., 13 miles from Pearl River, has 1 church, 2 schools, fine court-house, 1 newspaper, 1 tannery, 1 hotel, and 2 mills. Principal business, farming. P. 100. J. L. MEADE, ED. "NEWS."

Westville, tp., Franklin co., N. Y. P. 1658.

Westville, tp., Matthews co., Va. P. 2476.

Westville City, p.-v., Laporte co., Ind. P. 640.

West Vin'cent, p.-v. and tp., Chester co., Pa. P. 1256.

West Virgin'ia, one of the central States of the American Union, set off from Virginia in 1863, including a portion of the Appalachian Valley, the western slope of the Appalachian range, and a part of the upper valley of the

Obverse.

Reverse.

The Seal of West Virginia.

Ohio. It lies between the meridians of 77° 40′ and 82° 35′ W. lon. from Greenwich, and, including the "Panhandle," between the parallels of 37° 6′ and 40° 40′ N. lat. It is the most irregular State in form in the Union, and is thought, perhaps fancifully, to bear a rude resemblance to a tortoise, the "Panhandle" being the stiffly-projecting tail, McDowell co. the rounded head, and the counties lying on and near the Potomac its hind feet and claws. It is bounded on the N. W. by Ohio; on the N., N. E., and E. N. E. by Pennsylvania and Maryland; on the E., S. E., and S. by Virginia; and on the S. W. by Virginia and Kentucky. Its area is estimated at 23,000 sq. m., or 14,720,000 acres.

Topography and Physical Geography.—The counties lying on the Potomac River, especially Berkeley and Jefferson, form a part of the Shenandoah Valley or Valley of Virginia, somewhat elevated, but very fertile, and drained by the Shenandoah, Opequan Creek, and other smaller affluents of the Potomac. W. of these, Morgan, Hampshire, Mineral, Grant, Hardy, and Pendleton cos. are all drained by tributaries of the Potomac, but form portions of the "Appalachian Country" described under Virginia. They consist of high mountain-ridges, with narrow but fertile valleys between, sloping to the N. E., and belonging strictly to the Potomac River system. W. of these, but adjacent to them, and extending in a narrow belt S. W. to the Big Sandy River, lies what the West Virginia geologists call "the Mountain Region," forming the western ridges of the Appalachian chain, the mountains lying in nearly parallel folds, capped originally with a hard sandstone, but having softer and more easily-eroded rocks beneath. So sharp were some of these anticlinals that the sandstone at the summit was rent and fissured, and the torrents of rain and snow, forcing their way through, dissolved and broke down the underlying shales and limestones, and carved for themselves deep cañons, through which they forced their way to the larger streams emptying into Monongahela and Cheat rivers. Some of these cañons are nearly 1000 feet deep. From the western border of this Mountain Region stretches to the Ohio a much wider tract, called by the geologists "the Hilly Region," though some of its summits are higher than any in the Mountain Region, except Panther Knob in Pendleton co., which is said to be 4000 feet, and Haystack Knob, near the line of Pocahontas and Randolph cos., which is 3800 feet. More than twenty of the summits of the so-called Hilly Region rise from 2200 to 3700 feet. In this region the streams flow from E. to W., and carry their waters directly to the Ohio. The hills and river-valleys have generally an E. to W. direction, and where they do not, the rivers cross them in deeply-eroded valleys and cañons. One of these, the cañon of New River, is nearly 500 feet deep. Many of these valleys have sharp, abrupt, almost perpendicular sides, and no alluvial bottom-lands; others slope more gently, with a considerable breadth of alluvium at their bases, and the summits are flat-topped, gently-undulating plains. This region slopes moderately to the Ohio River, and along its banks has an elevation of from 550 to 700 feet above tide-water. This region is drained by Fishing Creek, Middle Island Creek, the Little Kanawha, the Great Kanawha, the Guyandotte, the Big Sandy and its eastern branch, the Tug Fork. There are no considerable lakes in West Virginia, but its cañons, its deeply-eroded valleys, and its undermined strata make the State attractive to travellers from its numerous objects of interest.

Geology and Mineralogy.—The only Eozoic rocks in the State are those on the eastern edge of Jefferson co., the most eastern county of the State. Next to these, both in geological order and in the order of its occurrence, are the Lower Silurian limestone, and the Hudson River shales which overlie it in Jefferson and Berkeley cos. This is followed by the Medina sandstone, the hard and massive sandstone which forms the crowning summit-rocks of the Mountain Region, and which produces the arches and natural bridges of that region by the erosion of the softer strata beneath it. The Clinton and Onondaga groups, soft slates and shaly sandstones, come next in order, are easily disintegrated, and form the surface-rocks of Hampshire and Hardy cos. The Lower Helderberg limestone overlies the last-mentioned groups in several counties, and furnishes the needed element of lime to the soils. The Oriskany sandstone, another hard and firm sandstone, forming some of the arches and natural bridges, like those at the Hanging Rocks near Romney, is the crowning rock of the summits of the western ridges of the Mountain Region, while the Hamilton and Portage groups, soft shales and clay-slates, overlie the sandstone on the mountain-slopes and valleys, the region about the White Sulphur Springs in Greenbrier co. and for some distance N. being mainly composed of them. They are the normal deposits for mineral springs from the amount of iron pyrites, carbonaceous and other salts which they contain, as well as from their contorted and broken condition. Next above these come the Chemung and Catskill groups, soft sandstones and shales, the Chemung group predominating in West Virginia. Leaving with these the Devonian system, we come to the sub-Carboniferous, which is developed here, according to Prof. Rogers's nomenclature, in the Vespertine and Umbral strata, the former consisting of coarse sandstone and conglomerates, of a finer and harder sandstone, and of red crumbling shales; the latter of a dark bluish limestone and clayey sandstones and shales of a deep-red color. These strata occupy a narrow tract in the N., and spread out in the lower counties into a broad area, overspreading most of Greenbrier, Pocahontas, Summers, Mercer, and Monroe cos. The Umbral strata when broken down produce an excellent soil. The next formation, the Carboniferous, overspreads all the remainder of the State, the Appalachian coal-field covering 16,000 sq. m. in the State. The river-bottoms are, indeed, generally diluvial or alluvial, but high

up the steep cliffs and cañons which line their banks the coal in bands of from 8 to 16 feet in thickness crops out. This Appalachian coal-field forms an immense basin, of which West Virginia comprises more than half the breadth, and Ohio and Eastern Kentucky about two fifths, the Ohio River passing through the basin a little W. of its middle line, and finally penetrating its western edge. In this basin (and within the limits of West Virginia) are found every one of the coal-deposits except anthracite lying between the conglomerate which underlies the lower coal-measures, and the Permian rocks which cap the upper coal-measures. Among these are every quality of cannel, splint, coking, block, and bituminous coals yet discovered, and all of them in thick and easily-worked veins. Throughout this whole region iron ores, red and brown hæmatite, black manganiferous carbonates, black band, red and brown oxides, protocarbonate or Olyphant blue lump, and other ores abound in veins easily worked, and accompanied by limestone and other fluxes, which make the production of iron very much cheaper than elsewhere. Salt also, a usual deposit in the coal measures, is found here in springs of great strength and purity of brine, and at numerous points on the Great Kanawha, Little Kanawha, New, Big Sandy, and Elk rivers and Otter Creek there are saltworks, some of them of great extent. The Kanawha salt has the very highest reputation in the market, being more free from sulphate of lime, more pungent and penetrating in its action, and from its greater strength more economical, than any other salt. The production has ranged for many years past at from 1,000,000 to 3,000,000 bushels per year. Petroleum, both the light and heavy oils, is largely produced in the State, there being 292 producing wells of the former, and over 100 of the latter. Common tufa, hydraulic, and building limestones of great beauty, and other building-stones, especially the Mahoning sandstone, a beautiful gray and fine sand or free stone, fire-clay, potter's clay, glass-sand, ochre, barytes, black oxide of manganese, saltpetre are found abundantly, and zinc, copper, and lead in moderate but not profitable working quantities. The mineral springs of West Virginia include the larger portion of the Virginia springs which have been so famous for more than a hundred years, as well as several new springs of considerable merit. They comprise sulphur waters of differing composition—chalybeates simple and compound, acidulous or carbonated, saline and aluminated chalybeates. Several of them are thermal waters, the highest having a temperature of about 107° F. They are situated in Morgan, Jefferson, Hampshire, Monroe, Fayette, and Greenbrier cos., by far the larger number being in the last-named county.

Soil, Vegetation, and Botany.—The soils of the State may be classed as *clay soils*, containing 75 per cent. or more of clay, stiff, and not very productive, found in limited areas in the eastern and southern portions of the State; *sandy soils*, containing 75 per cent. or more of sand, not productive, and occurring mainly in the N. E. mountain counties; *loams*, containing about equal quantities of clay and sand, and 25 per cent. or more of humus or vegetable matters; these are very productive and often enriched by the disintegration of the shales or limestones which crop out from the surface; the greater part of the coal-measures are covered by these soils; *calcareous soils*, in which lime forms a large constituent; these are excellent soils, and are found on the mountain-slopes and in some of the higher valleys; *stream and upland alluviums*, found in the river-bottoms and in the valleys and on the gentler slopes of the mountains; these possess wonderful fertility and yield immense crops, or, where they are covered with forests, the most gigantic trees. The principal forest trees are the white, black, or water, blue, green, and mountain ash (the latter not really an ash at all); the aspen, beech, water-beech, black and red birch, fetid and sweet buckeye; cedar, wild-cherry, chestnut, Kentucky coffee tree, cottonwood, cucumber tree, dogwood, negundo or box elder, red or slippery, white, and witch elm; black and southern balsam, fir, and the hemlock spruce; the black or sour gum and the sweet gum or liquid-amber; three species of hickory; the white, red, and bitter nut; the holly, hackberry, and ironwood or hop hornbeam; the red, green, white, and honey locust; the linden; the sugar, silver, and red maple; red mulberry; twelve species of oak, three of pine; the poplar or tulip tree; the red-bud, the sassafras, sour-wood, and sycamore; black walnut and butternut; the mountain and smooth alder; crab-apple, chinquapin, elder, persimmon, magnolia, haw, mountain-laurel, rhododendron, shadbush, spice-wood, and all the species of sumach, and the bush or shrub willows and osiers. West Virginia abounds in medicinal plants, some of them not found elsewhere. Over 9,000,000 acres of land in the State are in the original forest.

Zoology.—The wild animals of the State are those common to the Appalachian range of mountains. They include the panther, wild-cat, lynx, wolf, black bear, raccoon, opossum, ground hog, etc.; the elk, deer, rabbit, and hare; squirrels of several species, and the smaller rodents; the beaver, mink, and muskrat, weasel, skunk, etc.; and among game birds the wild turkey, two or three species of grouse, snipe, woodcock, etc.

Climate.

Meteorological Data.	Wheeling. lat. 40° 4′, lon. 80° 44′ W. elev. 675 feet	Kanawha Salines. lat. 38° 16′, lon. 81° 30′, elev. abt. 570 feet	Lewisburg. lat. 37° 50′, lon. 80° 27′, elev. abt. 2,34[illegible] feet	Morgantown. lat. 39° 36′, lon. 79° 52′, elev. 904.25 ft	Marietta, Ohio. lat. 39° 24′, lon. 81° 29′, elev. abt. 580 feet
Temperature.					
Mean annual temp.	52.08	54.72	52.22	52.70	54.46
Highest temp. of year	104	99	98	97	102
Lowest " "	15	4	5	-1	23
Range of " "	119	103	103	98	79
Mean temp. of spring	51.00	53.77	51.79	50.83	[illegible]
" " summer	71.54	72.94	71.78	71.44	71.[illegible]
" " autumn	52.72	54.87	52.47	52.03	52.7[illegible]
" " winter	32.08	37.21	32.7[illegible]	34.63	35.01
Rainfall.	Inches.	Inches.	Inches.	Inches.	Inches.
Average an. rainfall	41.95	55.81	55.7[illegible]	49.24	44.[illegible]
Rainfall of spring	10.90	12.92	7.39	10.51	10.[illegible]
" " summer	12.94	12.03	9.21	15.07	14.[illegible]
" " autumn	9.57	16.18	9.60	11.86	9.7[illegible]
" " winter	9.36	14.71	9.55	10.68	9.24
Winds, prev. direction					
In spring	S. W., N. W., N., W.	S. W., W., N. W., N.	W., N. W., N., S. W., S. E.	W., S. W., N. W., S. W.	N., S. W., S. W., N. W., S. E., E.
In summer	S. W., N. W., N., S. S. E.	S. W., S., N. W., W.	S. W., N. W., N. W., S. E.	S. W., S. W., N. W.	S. W., N., S. W., N., E., E., N., S. W.
In autumn	S. W., N. W., W., N., S.	S. W., N. W., N., N. E., W.	N., N. W., S. W., S. E., S.	S. W., S. W., N. W.	S. W., S. E., N. W., E., N. E.
In winter	N. W., S. W., N., W., S. E., E.	N. W., N., W., S. W., S., E.	N., N. W., N. E., S. E., S. W., W.	S. W., S. W., W.	S. W., N., W., S., S. E., E., N. E.

The mean annual temperature of the State, as deduced from forty years' observations, is that of Marietta, O., which is in the latitude of the middle of the State, and only separated from it by the Ohio River. It is 52° 46′. The warm season is long, but the heat is not intense. Ploughing and planting begin, except in the most mountainous districts, from Mar. 15 to Apr. 1, and the first white frosts occur from Oct. 1 to 15, but cattle are not housed or fed from Mar. 15 to Nov. 15.

Agricultural Productions.—According to the census of 1870, there were 8,528,394 acres of land in farms in the State, of which 2,580,254 acres only were improved lands. The total value of farms was $101,604,381, and of farming implements and machinery, $2,112,937. The value of farm products was $23,379,692; of animals slaughtered or sold for slaughter, $1,914,792; of home manufactures, $615,412; of forest products, $363,668 (evidently an under-estimate, as single counties sent to market tan-bark, slippery elm bark, timber, charcoal, and ashes in larger amounts than this); market-garden products, $69,974; orchard products, $848,773 (an under-estimate); wages paid, $1,903,788. Of the crops, wheat was grown to the amount of 2,483,513 bushels; rye, 277,746; Indian corn, 8,497,865; oats, 2,413,749; buckwheat, 82,916 (the production of Preston co. alone was 95,857 bushels a year or two earlier); cotton, 2 bales; hemp, 37 tons; flax, 82,276 pounds; hops, 1031 pounds; wool, 1,593,541 pounds; hay, 224,161 tons; tobacco, 2,046,452 pounds (in 1873, 13,500,000 pounds were sent to market from West Virginia); Irish potatoes, 1,053,507 bushels; sweet potatoes, 46,981 bushels (both these amounts are under-estimates); maple-sugar, 490,606 pounds; maple-syrup, 20,209 gallons (both under-estimates; at least one-third too low); sorghum-syrup, 780,829 gallons; honey, 376,997 pounds; beeswax, 9917 pounds; domestic wine, 6093 gallons (an under-estimate, as the wine from the vineyards of Ohio, Wood, Ritchie, and Doddridge cos. in 1874 was valued at nearly $200,000). The dairy products in 1870 were—5,044,475 pounds of butter, 32,429 pounds of cheese, 144,895 gallons of milk sold. The value of live-stock in 1870 was stated at $17,175,420; the number of horses at 99,362; of mules and asses at 2139; of neat cattle at 337,881, of which 104,434 were reported as milch cows; of sheep at 552,327; and of swine at 268,031. At the close of 1874 there were reported 116,877 horses, mules, asses, etc., in the State; the number of neat cattle was 361,900, of which 124,300 were milch cows; of sheep, 539,200; and of swine, 310,600; and the entire value of live-stock (partly estimated) was $18,948,283. The report of the agricultural department for the year 1874 gives the principal crops of the State as follows: Indian corn, 8,803,000 bushels; wheat, 3,268,000; rye, 268,000; oats, 1,684,000; barley, 50,000; buckwheat, 62,000 (an under-estimate); Irish potatoes, 782,000; tobacco, 1,6[illegible],000 pounds (a blunder); hay, 167,800 tons.

Manufactures.—The latest accessible statistics are those of the census of 1870, but the manufactures of the State,

which even then were inadequately reported, have since increased with great rapidity. There were in that year 2444 manufactories reported, employing 11,672 hands (10,728 men, 287 women, and 657 children), having an estimated capital of $11,084,520, paying $4,322,164 wages, using $14,503,701 worth of raw material, and producing manufactures valued at $24,102,201. Of this amount more than one-third was in some form of iron production—pig, forged and rolled, castings, nails and spikes, etc.; 46 establishments produced to the amount of $9,833,892. Next in order were flouring-mill products, 68 mills producing $2,239,799; lumber, 144 saw-mills producing $1,344,512; 18 saltworks, $1,507,605; leather tanned and curried, in 178 tanneries, to the amount of $840,245. The census reports but 1 glassworks, manufacturing glass worth $200,000. At that very time there were 4 glass-factories in the city of Wheeling, besides others in the State. Cooperage, in 101 shops, produced $488,476. Coal-oil rectifying-works, ready-made clothing establishments, woollen-factories, carriage-shops, and tobacco and cigar factories were the other principal industries; the last named has greatly increased since 1870.

Mining.—In 1870 there were reported 185 mines, quarries, etc., in the State, employing 1527 hands (1430 men, 97 boys), with a capital of $2,554,499, and producing annually $2,538,531, mainly coal and iron ores. These industries have since greatly increased.

Railroads.—Until 1870, West Virginia had no important railway except the Baltimore and Ohio, which, with its Parkersburg branch, traversed 263 miles of her territory; the completion of the Chesapeake and Ohio to Huntington brought the central and southern counties into connection with Eastern and Western markets; there are also several trunk-roads crossing or traversing the Panhandle and the counties lying on the Potomac. There are two or three projected roads, partly finished, of considerable importance. One of these starts from the Pittsburg Cincinnati and St. Louis road at Holliday's Cove in Hancock co., and passes down the E. bank of the Ohio to the Kentucky line, developing all the Ohio River counties. Others are intended to develop the resources of the Guyandotte and Big Sandy rivers. Poor's *Manual* reports 629 miles of railway as in operation in 1875, but not more than 575 are yet completed.

Finances, Commerce, etc.—The balance in the treasury Oct. 1, 1874, was $282,364.12, the receipts from all sources during the year, $547,426.26, making a total of $829,790.38; and the disbursements of the year were $576,171.97, leaving a balance in the treasury Oct. 1, 1875, of $253,618.41, besides a very considerable sum in arrears from the county officers. Since its organization the State has contracted no debt, but the State of Virginia claims that it should assume somewhat more than one-third of the general debt of that State before the separation. West Virginia acknowledges a measure of obligation, but contends that as almost the entire debt was incurred for the benefit of the eastern counties she should not be required to assume so large a share of it. On what basis it will eventually be settled is as yet uncertain. West Virginia being wholly an inland State, its commerce is conducted wholly by its railways and navigable rivers. The amount is large and increasing.

Banks, Savings Banks, and Insurance Companies.—In 1875 there were 17 national banks in operation in the State, having an aggregate paid-up capital of $2,145,000, bonds on deposit to the amount of $2,093,600, and outstanding circulation to the amount of $2,385,430; there were 10 State banks, reporting an aggregate capital of $975,000; 7 other banks, not reporting their capital or assets; 2 savings banks, with a capital of $100,000. There were on Jan. 1, 1875, 14 fire and marine insurance companies (one of them having also a life insurance charter) in the State, having an aggregate paid-up capital of $1,438,450, and reporting assets amounting to $2,321,858.96. Seven of the number reported liabilities amounting to $111,516.58. There are no distinctive life insurance companies chartered by the State.

Population of West Virginia, and of the Counties which now constitute the State, in former censuses.

Census year.	Total population.	Males.	Females.	Whites.	Free colored.	Slave.	Natives.	Foreign.	Density.	Ratio of increase.	Number of families.	Persons to a family.	Number of dwellings.	Persons to a dwelling.	Illiteracy.	Of school age, 5 to 20.	Of military age, 18–45, males.	Of voting age, 21 and upward, males.	Citizens, males.
1790	55,873	.....	.....	50,593	612	4,668	.....	.....	2.43										
1800	78,592	.....	.....	70,894	526	7,172	.....	.....	3.42	40.68									
1810	105,469	.....	.....	93,355	1,278	10,836	.....	.....	4.58	34.19									
1820	136,808	.....	.....	120,236	1,413	15 119	.....	.....	5.95	30.65									
1830	176,924	.....	.....	157,084	2,167	17,673	.....	.....	7.69	29.32									
1840	224,537	.....	.....	203,016	3,033	18,488	.....	.....	9.76	26.94									
1850	302,313	.....	.....	278,731	3 082	20,500	.....	.....	13.14	34.63	.....	....	.....	....	.....	115,886	52,542	65,779	
1860	376,688	.....	.....	355,526	2,733	18,371	360,143	16,545	16.37	24.60	.....	....	.....	....	.....	144,393	65,468	81,214	
1870	442,014	222,843	219,171	424,033	17,980	.....	424,923	17,091	19.22	17.34	78,474	5.63	78,854	5.61	81,490	169,428	76,832	95,317	93,435

Education.—The free-school system of the State, though of recent origin, seems to be in very efficient operation. For school purposes each county is divided into districts (corresponding with the townships in other States), and each of these into sub-districts. Each district is controlled by a board of education consisting of a president and two commissioners, and each sub-district is under the management of one trustee. These officers are chosen by the electors of the district every two years. On Sept. 1, 1875, the permanent school fund amounted to $325,243.34, the current teachers' fund to $541,358.83, the current building fund to $255,233.29, and the aggregate amount expended for school purposes for that year to $796,592.12. The scholastic age in the State is from six to twenty-one years, and 179,897 youth between those ages were enrolled. The attendance on the free schools is about 49 per cent. of this number; the general average daily attendance in 1874 was 61,244, and was said to have been considerably greater in 1875. The whole number of schools in 1875 was 3231; of school-houses, 2959; of teachers, 3461; the value of school property was $1,605,627. In all these particulars the increase within ten years had been from ten to thirty fold. The State apportionment for school purposes from the tax was $214,791.32; about $500,000 is raised by district levies, and the remainder from other sources. The average duration of schools was about four and a half months; average wages of teachers, males $35.70, females $29.55; average cost of pupil for tuition per year, $7.03.

Normal Schools.—The West Virginia State Normal School, or Marshall College, is at Huntington, Cabell co., and had a high reputation as Marshall Academy before its transfer to the State for a normal school in Feb., 1867. There are 5 branch normal schools in the State, all connected with the parent institution—viz. Fairmont, Marion co.; West Liberty, Ohio co.; Glenville, Gilmer co.; Shepherdstown, Jefferson co.; and Concord in Mercer co. These schools have graduated about 175 teachers, and probably four times that number of their pupils have been engaged continuously in teaching. The number of teachers in attendance in 1875 was about 625. The value of the State's property in them is somewhat more than $100,000, but tuition is required, and the legislature has withheld appropriations in aid of them for some years. Teachers' institutes are held in different parts of the State, under the encouragement and aid of the Peabody Fund. This fund in 1874 apportioned to West Virginia, for the support of teachers, $14,600. There are a considerable number of private schools, some of them of high grade, in the State. The Centennial commissioners enumerate 15 of these, having an aggregate of about 2500 pupils.

Higher Education.

Colleges, Universities, and Professional Schools.	Location.	Date of organization.	No. of professors and instructors.	Students. Preparatory.	Collegiate.	Male.	Female.	Under what control.	Value of buildings, grounds, apparatus, etc.	Amount of productive endowment.	Income from endowment.	Income from all sources.	Amount of scholarship funds.	Volumes in library.
Bethany College	Bethany, Brooke co.	1841	9	..	123	123	..	Disciples	$250,000	$60,000	$4,500	$6,500	$	3,500
West Virginia College	Flemington	1868	5	61	7	55	15	Free-Will Baptists	15,000	.....	.....	.....	....	537
West Virginia University	Morgantown	1867	12	50	76	126	..	State	150,000	110,000	6,600	31,828	....	3,500
School of Science.														
Agricultural dept. of West Virginia Univ.	Morgantown	1867	..	23	24	47	..	State	With the Univ	ersit	y.			
School of Theology.														
St. Vincent's College	Wheeling	1865	3	..	43	43	..	Roman Catholic	20,000	.....	.....	.....	....	3,000

Charitable Institutions.—The West Virginia institution for the deaf and dumb and the blind is located at Romney. It has 7 professors and instructors, and 7 other employés, and had in Nov., 1875, 106 pupils—about 80 deaf mutes and 26 blind. Its current expenses are a little more than $25,000, and it has been adding to its buildings. The West Virginia hospital for the insane at Weston has 2 medical and 4 other officers and employés, and had Oct. 1, 1875, 349 patients, its daily average being 331. It reported 18 discharged cured during the year. Its current expenses are $56,160 per year, aside from transportation of patients.

Prisons.—The West Virginia penitentiary is at Moundsville. It seems to be well conducted, but is not yet self-sustaining, though efforts are making to secure that result. There were Oct. 1, 1875, 105 convicts in the prison: 31 had been discharged, 2 pardoned, and 2 died; there had been no escapes. Strict attention is paid to the moral and religious instruction of the convicts. The county jails are much like those of other States, a few well managed, but most of them needing radical improvement.

Newspapers.—In 1870 there were 59 newspapers in the State, having an aggregate circulation of 51,152, and an annual issue of 4,012,400 copies. Of these, 1 were dailies, 2 tri weeklies, 18 weeklies, 2 semi monthly, and 3 monthly. In 1876 the number had increased to 72, of which 5 were daily, 2 tri-weekly, 63 weekly, and 2 monthly.

Churches.

Denominations.	Organizations, 1870.	Church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Organizations, 1875.	Church edifices, 1875.	Ministers, 1875.	Church members or communicants, 1875.	Adherent people, 1875.	Church property, 1875.
All denominations*	1529	1018	297,315	$1,835,720	1666	1296	841	93,264	428,960	$2,319,600
Baptists (regular)	392	205	58,400	191,805	339	287	206	25,658	120,000	274,300
Baptists (other)	23	18	4,450	9,050	30	24	20	1,856	9,000	12,800
Christian Connection and Disciples	36	23	6,400	37,550	51	35	27	3,124	15,700	61,400
Protestant Episcopalians	21	19	7,355	166,500	25	21	20	1,987	9,300	190,300
Evangelical Association	2	1	300	1,000	4	3	2	240	1,200	2,500
Lutherans	22	21	7,300	93,300	30	26	17	1,525	7,500	112,500
Methodists	879	552	152,865	723,015	983	677	398	45,629	187,500	956,000
Presbyterians	87	76	27,320	328,050	118	98	65	8,083	40,500	499,500
Reformed (late German)	2	2	600	15,000	5	4	3	400	2,000	23,400
Roman Catholics	40	37	16,800	221,950	45	42	30	.....	16,000	250,000
United Brethren in Christ	94	52	13,800	42,450	124	66	42	4,236	18,000	59,400
Universalists	4	1	300	1,000	2	2	3	55	260	2,000
Union	11	11	1,425	5,050	10	11	8	500	2,000	5,200

Counties.—There are fifty four counties, as follows:

Counties.	Total pop., 1870.	Males, 1870.	Females, 1870.	Total pop., 1860.	True valuation, 1870.	Assessed valuation, 1871.
Barbour	10,312	5,197	5,115	8,958	$3,882,280	$2,020,801
Berkeley	11,900	7,411	7,489	12,525	7,374,664	6,142,387
Boone	4,553	2,343	2,210	4,840	810,419	595,732
Braxton	6,480	3,316	3,164	4,992	2,000,000	1,472,916
Brooke	5,464	2,685	2,779	5,494	8,090,134	2,739,773
Cabell	6,429	3,290	3,139	8,020	2,018,820	2,902,466
Calhoun	2,939	1,510	1,429	2,502	577,791	513,972
Clay	2,196	1,149	1,047	1,787	347,689	399,880
Doddridge	7,076	3,617	3,459	5,203	2,567,851	1,106,560
Fayette	6,647	3,357	3,290	5,997	1,647,242	1,440,840
Gilmer	4,398	2,188	2,150	3,759	919,133	886,171
Grant	4,467	2,277	2,190	.....	2,436,000	1,835,533
Greenbrier	11,417	5,675	5,742	12,211	5,711,101	4,524,563
Hampshire	7,643	3,816	3,827	13,913	2,531,198	2,542,409
Hancock	4,363	2,183	2,180	4,415	4,060,127	2,052,676
Hardy	5,618	2,746	2,872	9,864	3,057,547	2,312,491
Harrison	16,714	8,333	8,381	13,790	8,500,000	7,331,486
Jackson	10,300	5,251	5,046	8,306	2,511,026	2,342,559
Jefferson	13,219	6,546	6,673	14,535	12,206,135	7,434,310
Kanawha	22,349	11,697	10,852	16,150	7,953,876	6,430,051
Lewis	10,175	5,120	5,055	7,999	3,327,800	2,616,650
Lincoln	5,053	2,546	2,507	.....	1,848,390	1,073,901
Logan	5,124	2,610	2,484	4,938	827,414	604,851
Marion	12,107	6,080	6,027	12,722	5,280,000	4,169,099
Marshall	14,941	7,662	7,279	12,997	7,543,945	4,364,713
Mason	15,978	8,077	7,901	9,173	7,900,000	6,207,711
McDowell	1,952	968	984	1,535	196,754	303,878
Mercer	7,064	3,546	3,518	6,819	1,370,861	660,895
Mineral	6,332	3,216	3,116	.....	3,798,256	2,463,455
Monongalia	13,547	6,698	6,849	13,018	4,145,727	4,597,207
Monroe	11,124	5,428	5,696	10,757	4,854,509	2,891,953
Morgan	4,315	2,254	2,061	3,732	1,922,698	1,082,355
Nicholas	4,458	2,301	2,157	4,627	1,654,391	990,847
Ohio	28,831	14,029	14,802	22,422	17,535,518	15,104,740
Pendleton	6,455	3,222	3,233	6,164	2,099,950	1,559,436
Pleasants	3,012	1,590	1,442	2,945	794,399	784,842
Pocahontas	4,069	2,056	2,013	3,958	1,721,080	1,405,463
Preston	14,555	7,338	7,217	13,312	5,871,378	3,106,778
Putnam	7,794	3,981	3,813	6,301	2,223,890	1,823,624
Raleigh	3,673	1,889	1,884	3,567	663,208	730,862
Randolph	5,564	2,872	2,694	4,999	2,062,602	1,561,101
Ritchie	9,055	4,673	4,382	6,847	2,454,267	1,881,650
Roane	7,232	3,685	3,547	5,381	1,469,196	1,022,767
Summers	New	county.	.....	.....	.....	752,711
Taylor	9,367	4,720	4,647	7,463	7,230,818	4,058,763
Tucker	1,907	990	917	1,428	505,285	377,111
Tyler	7,832	3,950	3,882	6,517	2,287,738	1,839,126
Upshur	8,023	4,027	3,996	7,292	2,900,595	2,353,009
Wayne	7,852	4,016	3,836	6,747	1,874,318	1,965,714
Webster	1,730	880	850	1,555	551,005	543,192
Wetzel	8,595	4,376	4,219	6,703	1,857,159	1,633,764
Wirt	4,804	2,532	2,272	3,751	1,064,379	1,035,798
Wood	19,000	9,544	9,456	11,046	10,000,000	6,959,263
Wyoming	3,171	1,627	1,544	2,861	873,025	955,378
Totals	442,014	222,843	219,171	376,688	$190,651,491	$141,867,819

Principal Towns.—Wheeling, now the capital of the State, in 1870 had 19,280 inhabitants; a local census taken in 1876 gives it a little more than 30,000. Parkersburg in 1870 had 5546 inhabitants, and is now (1876) estimated as exceeding 8000; Martinsburg had 4863 in 1870; Charleston, 3162; South Wheeling, Huntington, Grafton, and Morgantown are thriving towns of from 2000 to 4000 inhabitants.

Constitution, Courts, Government, Representatives in Congress.—The first constitution of the State was adopted in May, 1862; it was modified to some extent prior to the admission of the State into the Union, and the modifications ratified in Apr., 1863. A new constitution was adopted and ratified in 1872. By this constitution all male citizens are entitled to vote at all elections who have resided in the State one year and in the county in which they offer to vote sixty days next preceding an election. The legislative power is vested in the legislature of West Virginia, which consists of a senate of 24 members, elected for four years, and a house of delegates of 65 members, elected for two years. The executive department consists of a governor, secretary of state, State superintendent of free schools, auditor, treasurer, and attorney-general, who is also *ex-officio* reporter of the court of appeals. All these are elected by the legal voters of the State for four years, commencing on the 4th of March next after their election. The judicial power is vested in (1) a supreme court of appeals, consisting of four judges, elected by the voters of the State for twelve years; it has both original and appellate jurisdiction: (2) in nine circuit courts, one for each circuit district, each presided over by a judge elected for eight years by the voters of the district, and having original jurisdiction in all except petty causes, and appellate jurisdiction from the inferior courts; (3) in county courts, 54 in number, each presided over by a president and two justices of the peace. The president is elected by the voters of the county for four years, and the justices of the peace for the same time by the voters of the several districts of the county which they represent. These courts hold six sessions a year. West Virginia is entitled under the apportionment of 1872 to 3 members of Congress.

History.—West Virginia formed the W. and N. W. portion of the commonwealth of Virginia until the latter seceded from the Union in 1861, but three-fourths of the population being in the eastern counties, the western had been constantly outvoted and denied any participation in the improvements of railroads and canals for which the State pledged its credit. In June, 1861, delegates assembled from Wheeling from thirty-nine of these western counties to protest against the secession ordinance and to form a provisional government. Another convention met in Aug., 1861, and ordered an election in October of that year to decide upon the question of organizing a new State embracing these 39 counties, to be called the "State of Kanawha." Their vote was substantially unanimous, and a constitution was prepared and ratified by the people in May, 1862. Before they could be admitted to the Union it was necessary that the consent of Virginia, as a loyal State, to the division should be obtained. There were at this time two governments in Virginia—a loyal one, having its capital and holding its legislative sessions at Alexandria, and the disloyal one, which then held Richmond as its capital. The loyal legislature consented to the separation, and after the passage of certain amendments required by Congress—among others the change of name to West Virginia—West Virginia came into the Union June 20, 1863. The energies of the State, so long repressed, immediately manifested themselves. The young State sent 26,540 men to the Union armies out of a total enrolment

*There are also included in this enumeration 3 Second Advent, 2 Cumberland Presbyterian, and 1 Jewish society, of which there is no further information as to church edifices, sittings, or church property.

of 33,744. In Jan., 1866, the counties of Jefferson and Berkeley, lying on the Potomac, were added to the State, which had previously consisted of 50 counties. The progress of the State in education, commercial enterprise, and railroad development, and its moral and religious advancement, have been very remarkable since the date of its admission to the Union.

Governors of West Virginia.

Arthur J. Boreman.....	1863–69	John J. Jacob.....	1871–77
William E. Stevenson	1869–71	Henry M. Matthews....	1877–

Electoral and Popular Vote for President and Vice-President.

Elect. year.	Candidates who received the electoral vote.	Elect. vote.	Pop. vote.	Opposition candidates.	Pop. vote.	Third-party candidates.	Pop. vote.
1864	Abraham Lincoln P..... / Andrew Johnson V.-P.....	5	23,152	George B. McClellan P.... / Geo. H. Pendleton V.-P...	10,438		
1868	Ulysses S. Grant P..... / Schuyler Colfax V.-P.....	5	29,175	Horatio Seymour P..... / Francis P. Blair, Jr., V.-P.	20,306		
1872	Ulysses S. Grant P..... / Henry Wilson V.-P.....	5	32,103	Horace Greeley P..... / Benj. Gratz Brown V.-P..	29,453	Charles O'Conor P.....	600
1876	Samuel J. Tilden P..... / Thos. A. Hendricks V.-P..	5	17,911	Rutherford B. Hayes P... / William A. Wheeler V.-P.	16,076	Peter Cooper P..... / Samuel F. Cary V.-P.....	576

(The writer acknowledges his obligations to His Excellency Gov. J. J. Jacob for valuable documents used in the preparation of this article, and to A. J. Sweeney, Esq., chairman of the board of Centennial managers at Wheeling, for the valuable volume on *The Resources of West Virginia*, prepared under the direction of that board.) L. P. Brockett.

West War'ren, p.-v., Worcester co., Mass.

West Wa'terville, p.-v., Kennebec co., Me.

West Wheat'field, tp., Indiana co., Pa. P. 1318.

West Wheel'ing, v., Pultney tp., Belmont co., O. P. 407.

West White'land, p.-v. and tp., Chester co., Pa. P. 1177.

West Wind'sor, tp., Mercer co., N. J. P. 1428.

West Windsor, tp., Windsor co., Vt. P. 708.

West Win'field, p.-v., Herkimer co., N. Y., on Delaware Lackawanna and Western R. R., 21 miles S. of Utica, contains 3 churches, an academy and normal business institute, 1 newspaper, 1 bank, 1 grist and 2 planing and saw mills, and 2 hotels. Principal business, farming and dairying. P. 640. R. W. Ackerman, Ed. "Standard."

West Win'sted, p.-v., Litchfield co., Conn.

West'wood (John Obadiah), F. S. A., b. at Sheffield, England, in 1805; educated at Lichfield; devoted himself to natural history and archæology; was long secretary, and subsequently president, of the Entomological Society of London, and has been since 1861 Hope professor of zoology at Oxford. Author of numerous publications on entomology, of *Palæographia Sacra Pictoria* (1845), *Illuminated Illustrations of the Bible* (1849), and *The Miniatures and Ornaments of Anglo-Saxon and Irish Manuscripts* (1868).

Westwood (Thomas), b. at Enfield, Middlesex, England, Nov. 26, 1814; has been for twenty-five years director of a railway company in Belgium; has been a frequent contributor of verse to the London *Athenæum* and *Gentleman's Magazine*; is author of several volumes of poems, *Beads from a Rosary* (1843), *The Burden of the Bell, and other Lyrics* (1850), *Berries and Blossoms, a Verse-Book for Young People* (1855), *Foxglove-Bells, a Book of Sonnets* (1856), and *The Quest of the Sangreall* (1868); also of *Bibliotheca Piscatoria* (1861) and *The Chronicle of the "Compleat Angler" of Izaak Walton and Charles Cotton, being a Bibliographical Record of its various Phases and Mutations, Editions and Illustrations* (1864).

West Zanes'ville, p.-v., Falls tp., Muskingum co., O. P. 1744.

Weth'erall (Sir George Augustus), G. C. B., b. in England in 1788, son of Gen. Sir F. Wetherall; educated at Hyde Abbey School and at the Royal Military College, Farnham; entered the army 1803; served at the Cape of Good Hope and at the conquest of Java, where he acted as aide-de-camp to his father; was military secretary to the commander-in-chief at Madras 1822–25; became deputy judge-advocate-general in India 1826; served as lieutenant colonel of the 1st Foot in India, and afterward in Canada, where he aided in suppressing the rebellion of 1837–38; was deputy adjutant-general in Canada 1843–50, and in England 1850–54; was appointed adjutant-general in the latter year; filled that post through the Crimean war and the Indian mutiny, rendering services for which he was knighted 1856; resigned in 1860, when he was appointed to the command of the northern district; attained the rank of full general and colonel of the 84th Foot Oct. 23, 1863, and was appointed in Aug., 1866, governor of the Royal Military College at Sandhurst, where he d. Apr. 8, 1868.

Weth'erell (Sir Charles), D. C. L., b. in England in 1770; graduated in 1790 at University College, Oxford (of which his father was master for more than half a century); was called to the bar at the Inner Temple 1794; practised for many years with eminent success at the common-law bar; entered Parliament for Shaftesbury 1818; sat for Oxford 1820–26; was knighted and made solicitor-general Jan., 1824; was attorney-general 1826–27, and again under the duke of Wellington from Jan., 1828, to May, 1829, distinguishing himself by inveterate hostility to Roman Catholic emancipation and to parliamentary reform; was recorder of Bristol, and there assaulted by a mob at Michaelmas session 1831, being rescued with difficulty by the authorities, and sat in Parliament for Boroughbridge 1830–32, until that village was disfranchised by the Reform act (June, 1832), when, "amidst a torrent of eloquence, learning, drollery, and enthusiasm, he closed his senatorial life, exclaiming, 'This is the last dying speech and confession of the member for Boroughbridge.'" D. at Preston Hall, Kent, Aug. 17, 1846.

Weth'ersfield, p.-v. and tp., Hartford co., Conn. P. 2693.

Wethersfield, p.-v. and tp., Henry co., Ill. P. 1247.

Wethersfield, p.-v. and tp., Wyoming co., N. Y. P. of v. 170; of tp. 1219.

Wet'more, county of E. Dakota, formed since the census of 1870. Area, about 700 sq. m.

Wetmore, tp., McKean co., Pa. P. 721.

Wetmore (James), b. in Connecticut about 1690; graduated at Yale College 1714; studied divinity; was ordained the first Congregational minister of North Haven Nov., 1718; became converted to Episcopalian sentiments Sept., 1722; went to England to obtain orders in the Church of England 1723; returned the following year as a missionary of the Society for Propagating the Gospel in Foreign Parts, and was rector of a church at Rye, N. Y., from 1726 until his death, May 14, 1760. Author of *A Vindication of the Professors of the Church of England in Connecticut* (1747), and other polemical treatises, chiefly in reply to Rev. Noah Hobart.

Wetmore (Prosper Montgomery), b. at Stratford, Conn., Feb. 14, 1798; removed in childhood to New York City, where he entered a counting-room; became a merchant; began to write for the magazines 1816; published a volume of poems 1830; was associated with the literary and dramatic circles of the city; also with the cause of education and several philanthropic enterprises, having been chosen a regent of the University of New York 1833; was a member of the legislature and chairman of the committee on colleges and academies 1834–35; was president and a prominent supporter of the American Art-Union, a member of the New York Chamber of Commerce, a director of the institution for the deaf and dumb, an active member of the New York Historical Society, and many years paymaster-general of the State militia. In 1838 he edited the poems of James Nack, with biographical notice, and in 1847 published *Observations on the Origin and Conduct of the War with Mexico*. D. at Great Neck, L. I., Mar. 16, 1876.

Wet'stein (Johann Jacob), b. at Bâle Mar. 5, 1693; studied theology; was appointed field-preacher to a Swiss regiment in the Dutch service, and in 1717 dean in the Reformed church of his native city. From this office he was dismissed in 1730 on account of deviations from the accepted Reformed creed, and went in 1733, as professor of church history, to Amsterdam, where he d. Mar. 23, 1754. His principal works are *Prolegomena ad Novi Testamenti Græci Editionem accuratissimam* (1730) and a critical edition of the New Testament (2 vols., Leyden, 1751–52).

Wette, de (Wilhelm Martin Leberecht). See De Wette.

Wet'ter, the second largest lake of Sweden, is 80 miles long, 13 miles broad, and covers an area of 850 sq. m. It is 275 feet above the sea, and sends its surplus water to the Baltic through the Motala. It is connected with Lake Wener by canal, and is of great commercial consequence, as it forms the inland communication between the Baltic and the Cattegat.

Wet'teren, town of Belgium, province of West Flanders, has oil and powder mills, breweries, and manufactures of lace and different kinds of linen fabrics. P. 9463.

Wetump'ka, p.-v. and tp., cap. of Elmore co., Ala., on Coosa River, 11 miles from Montgomery, contains 3 churches, 3 schools, 1 newspaper, 1 hotel, and the State prison. It has fine facilities for manufacturing. P. of v. 1137; of tp. 3820. J. L. Burch, Ed. "Constitution."

Wet'zel, county of N. West Virginia, bordering on Pennsylvania, bounded N. and W. by Ohio River, and traversed by Baltimore and Ohio R. R.; surface hilly, with much iron ore, bituminous coal, and limestone. Staples, Indian corn, oats, wheat, tobacco, and wool. Cap. New Martinsville. Area, 360 sq. m. P. 8595.

Wetz'lar, town of Rhenish Prussia, on the Lahn, has breweries, distilleries, and linen weaving factories. P. 5204.

Wex'ford, county of Ireland, province of Leinster, bordering E. on St. George's Channel and S. on the Atlantic, comprises an area of 900 sq. m., with 132,666 inhabitants, of whom 51,689 are unable to read and write. In the northern part the surface is elevated, and rises in Mount Leinster and Blackstairs, but from this ridge it gradually slopes down into a level plain, which along the coast is fringed with swamps and marshes. The soil is fertile, and better cultivated than in most parts of Ireland. Good crops of wheat, barley, oats, and potatoes are gathered, and cattle-breeding, dairy-farming, and fishing are carried on with success. Since 1851, 47,051 persons have emigrated from this county.

Wex'ford, town of Ireland, capital of the county of Wexford, on the right bank of the Slaney, which here is lined with a handsome quay, 85 miles S. of Dublin. Its harbor is shallow, and accessible only for small craft, still its export trade in agricultural and dairy produce is important, and so are its shipbuilding and fishing. P. 12,077. It was an early and important Danish settlement, and was also one of the earliest landing-places of the Anglo-Norman invaders.

Wex'ford, county of N. W. Michigan, drained by Manistee River and its affluents. The surface consists of alternate prairie and woodland, interspersed with several small lakes. Staples, Indian corn, wheat, and potatoes. Cap. Sherman. Area, 625 sq. m. P. 650.

Wex'ford, p.-v. and tp., Wexford co., Mich. P. 259.

Weyauwe'ga, p.-v. and tp., Waupaca co., Wis., on Wisconsin Central R. R. and on Wolf River, 40 miles N. W. of Oshkosh, is surrounded by an excellent grain and fruit-growing country, and contains 5 churches, a large school-house, public library, fine water-power, 1 newspaper, an exchange bank, several charitable institutions, 1 tannery, flouring, lumber, and shingle mills, 1 foundry and machine-shop, plough-factory, 1 paper-mill, a pottery, and 2 breweries. An extensive lumbering-business is carried on. P. 1213.
F. W. Sackett, Ed. "Times."

Wey'bridge, tp., Addison co., Vt. P. 627.

Weyer's Cave, a stalactitic cavern in the north-eastern part of Augusta co., Va., in a low spur of the Blue Ridge Mountains, contains several beautiful apartments, of which the so-called Washington Hall is the largest and most remarkable—about 250 feet long, and 90 feet high. It was discovered in 1804 by Bernard Weyer, from whom it received its name.

Wey'mouth, p.-v., Digby co., N. S., on St. Mary's Bay, at the mouth of Sissiboo River, 20 miles S. of Digby. This place and Weymouth Bridge, near by, do a large business in shipbuilding and exporting to the U. S. and West Indies. P. of sub-district, 1440.

Weymouth, p.-v. and tp., Norfolk co., Mass., on South Shore R. R., 11 miles S. of Boston, is the second oldest settlement in the State (1626), and contains a hygienic institute, 2 national and 3 savings banks, 1 newspaper, 6 printing establishments, ironworks, good schools, drug, box, and saw mills, and 1 boot and shoe manufactory. P. 9010.
C. G. Easterbrook, Ed. "Gazette."

Weymouth, p.-v. and tp., Atlantic co., N. J. P. 810.

Whale [Ang.-Sax. *hwæl*], a name given to large Cetaceans, representing several different families, and even different sub-orders. The only character shared in common by them, independent of those characteristic of the order, is the large size. The families to which the forms thus distinguished belong are, of the whalebone whales or Mysticete, the families Balænopteridæ and Balænidæ; and of the toothed-whales, the families Physeteridæ and Ziphiidæ. The large species of Delphinidæ are also known as whales—*e. g. Delphinapterus beluga*, called the white whale, and the species of *Globicephalus*, generally designated as blackfish, etc. (See also Whalebone Whales.)
Theodore Gill.

Whale'bone [*baleen*; Fr. *baleine*; Ger. *Fischbein*], the horny, elastic lamina obtained from the whale, especially the *Balæna mysticetus*. It is placed along the sides of the mouth, thus forming a sort of filter through which the water passes as it is expelled from the jaws, the small fish, etc., which comprise the food of the animal being thus retained. Its fibres have very little lateral cohesion, and can easily be removed in the form of long filaments; the blades, 300 of which are sometimes present on each side of the mouth, are arranged in parallel series, resembling somewhat the roof of a house in shape; they are usually about 12 feet in length, 10 to 12 inches in breadth, and ½ inch in thickness. In the manufacture of useful articles from whalebone the blade is first cut in parallel prismatic slips, which are then dried and levelled by planing, the shavings being sometimes utilized as a stuffing for mattresses. When heated by steam, it softens, and can then be bent or moulded in forms which it retains if allowed to become cool under pressure. The essential constituent of whalebone appears to be albumen, its hardness being probably increased by the small proportion of phosphate of lime. According to Frémy, the composition of the organic part is—C. 50.8, H. 7.4, N. 16.5, S., O., etc., 25.3. Whalebone has been employed for the ribs of umbrellas and parasols, stiffening of stays, framework of hats, and in the manufacture of whips, canes, ramrods, archery bows, fans, screens, etc.; but steel rods have been substituted for it for several of these purposes of late years, with improved results.
J. P. Battershall.

Whalebone Whales, whales distinguished by the possession of whalebone. This substance is a peculiar epidermal development arising from each side of the median line of the roof of the mouth, and may be looked upon as modified hair. Teeth are existent in a rudimentary condition in the fœtus, but are not functionally developed, and are absorbed and disappear before birth; the supramaxillary bones are not extended backward over the frontal bones, but are produced outward in front of the orbits; the olfactory organ is distinctly developed, and the nasal bones project forward, and are not overlapped at their distal ends; the lower jaw has its rami bowed out, and connected at their simphyses by fibrous tissue, and not by suture. In external appearance the animals are piseiform, and are distinguished from the toothed whales chiefly in that the head is more depressed above toward the margin of the jaw, the eyes situated nearly above the angle of the mouth, and the lower jaw and throat more bag-like. The forms thus combined exhibit two primary modifications of structure, which by some are considered as of family value, but by others as indicative of only sub-family rank:

(1) The typical whalebone whales (Balænidæ) have the skull greatly arched at the maxillary region, and the rostrum narrow and compressed at the base; the frontals have the orbital processes prolonged, and extremely narrow and rounded on the upper surface; the supramaxillary bones are entire at their posterior margins; the tympanic bones large and ovoid; the lower jaw has the coronoid processes almost obsolete; the cervical vertebræ are coalesced together; and the manus is comparatively broad, and has five fully-developed fingers.

(2) The finback, humpback, and scrogg whales (Balænopteridæ) have the skull but slightly arched at the maxillary region; and the rostrum broad at the base, depressed, and gradually tapering; the frontals have the orbital processes moderately prolonged, broad, and flat on the upper surface; the supramaxillary bones are deeply excavated at their posterior margins; the tympanic bones elongated and ovoid; the lower jaw has the coronoid processes more or less developed; the cervical vertebræ in whole or in part separated; and the manus is narrow, and only four digits are developed, the first being wanting.

To the family Balænidæ belongs the bowhead or Greenland whale, and several distantly-related species inhabiting warmer and Antarctic waters, which have been differentiated, but probably on insufficient grounds, into as many as six genera. The bowhead is the most valuable of all the whales in a commercial point of view, and is the species especially hunted by the whalemen fitted out for the Arctic seas. Although not the longest, it is the stoutest of known species; its head is proportionately larger and more ungainly than any other of the sub-order, and forms about one-third of the animal's entire length. Individuals occasionally reach a length of sixty or seventy feet, although not often found much exceeding fifty. In proportion to its size, it is the richest in oil-giving characters; individuals have been known to yield nearly 300 barrels. Its whalebone, which is of a black color, and developed in strips gradually attenuated toward the end, is also the most esteemed of any, and 3500 pounds or more have been obtained from a single individual. It is a timid animal, and rarely turns upon its pursuers, as do some of the spe-

cies of Balænopteridæ. "Sometimes, when engaged in feeding, it remains down for twenty-five minutes or more. The depth to which the animal descends when pursued is not accurately known, for, as a general rule, it has been captured 'on soundings' in the Arctic Ocean and Behring Sea, as well as in the Sea of Okhotsk, where the depths in places do not exceed 100 fathoms, and from that to less than 50. Sometimes it has been taken in very shallow water; yet this animal when in deep water has been known to 'sound out' a line, in its descent and return, equal to a mile in length." (*Scammon.*) The species is now sought for chiefly in Behring Sea, and in the Arctic Ocean N. of it. According to Scammon, "the bowheads of the Arctic may be classed as follows: 1st class—the largest whales, of a brown color; average yield of oil, 200 barrels; 2d class—smaller, color black; yield of oil, 100 barrels; 3d class—the smallest, color black; yield of oil, 75 barrels. Those belonging to the last-named class are generally found among the broken floes, the first of the season, and they have been known to break through ice three inches in thickness that had been formed over water between the floes. They do this by coming up under and striking it with the arched portion of their heads." "Hence they have been called 'ice-breakers.'" The whalers strive to be on their hunting-grounds in the early summer, and they frequently reach the latitude of 72° N., and sometimes, in open seas, even beyond.

The family of Balænopteridæ is much richer in forms and decided contrasts than the Balænidæ. There are three primary types. In the Balænopterinæ the throat is longitudinally plicated; a high, erect, and more or less falcate dorsal fin exists; the frontal bones have orbital processes nearly as broad at the outer extremity as the base, and somewhat narrowed; the manus is moderate, and has four digits, none of which have more than six phalanges. These are mostly very large whales, which have been grouped under the generic names *Balænoptera*, *Physalus*, *Sibbaldius*, and *Rudolphius*. The Megapterinæ have also the throat longitudinally plicated, but the dorsal fin developed as a mere hump; the manus is very long, and the digits are segmented into many phalanges; these are the humpback whales, which have been grouped under the genera *Megaptera*, *Poescopia*, and *Eschrichtius*. Finally, the Agaphelinæ are characterized by the plications of the throat being obsolete, and not more than two in number, and by the dorsal fin being entirely undeveloped. To this group belong the genera *Agaphelus* of the Atlantic Ocean and *Rhachianectes* of the Pacific. The most gigantic of known cetaceans belong to this family and to the genera *Physalus* and *Sibbaldius*. The *Sibbaldius sulfureus* of the western coast of America has been reported to reach an equally great length. The body in these animals is relatively slender, and they are capable of very great speed. Fourteen species are found on the American coasts. On the eastern coast are eight—viz. of the family Balænidæ, (1) *Eubalæna cisarctica*, the right whale, and (2) *Balæna mysticetus*, the bowhead whale; of the family Balænopteridæ, (3) *Balænoptera rostrata*, the grampus, (4) *Sibbaldius borealis*, the sulphur-bottom whale, (5) *S. tuberosus*, the finback whale, (6) *Eschrichtius robustus*, the Gräsö whale, (7) *Megaptera osphyia*, the humpback whale, and (8) *Agaphelus gibbosus*, the scragg whale. On the western coast are six—viz. of the family Balænidæ, (1) *Eubalæna callamach*, the right whale; of the family Balænopteridæ, (2) *Balænoptera Davidsonii*, the sharp-headed finner whale, (3) *B. velifera*, finback whale, or Oregon finner, (4) *Sibbaldius sulfureus*, the sulphur-bottom whale, (5) *Megaptera versabilis*, the humpback whale, and (6) *Rhachianectes glaucus*, the gray whale. THEODORE GILL.

Whale Fishery, an old and, at one time, a flourishing industry. The increasing scarcity of the animal, however, and the extensive use of gas and mineral oils, have now made it less remunerative, and caused it to be abandoned by nations which formerly pursued it as one of the principal branches of their trade; the U. S. is the only nation which still carries it on with vigor. As early as the twelfth century there existed a whale fishery in the Biscayan Sea, and in the thirteenth and fourteenth centuries it became of considerable importance; but it was a smaller species of whale which was caught here, and in the fifteenth and sixteenth centuries this animal became extinct or left the grounds, and the industry died out. By the Dutch explorations of the northern seas in the latter part of the sixteenth century extensive whaling-grounds were discovered near Spitzbergen. The Dutch founded a village called Smeerenberg on the island, whither the blubber was brought for boiling, and a considerable trade sprang up. Soon, however, the whales were driven off, and betook themselves to the coasts of Greenland. The Dutch followed; the blubber was brought to Holland for boiling, and the Dutch oil trade flourished for more than a century. In 1680, 260 Dutch ships and about 14,000 sailors were engaged in the whale fishery, but from that period the industry began to decline in Holland, and in the present century it has been given up altogether. The English followed in the track of the Dutch, but they never developed this trade to any high degree of prosperity, and they are now about abandoning it. In 1815 they had 164 ships; in 1833 only 129 engaged in the fishery; in 1842 the number sank to 75, and at present it is hardly 20. The industry was taken up early by the New England colonies, and at first the fishery was prosecuted by boats from the shore. In the first part of the eighteenth century, however, the whales had been driven off, and vessels were now fitted out for their pursuit from Nantucket, Cape Cod, Martha's Vineyard, New Bedford, etc. In 1854 the traffic reached its culmination. In 1830 there were 102,000 tons of shipping engaged in the trade, and this amount increased in 1840 to 137,000 tons, in 1850 to 171,484, and in 1854 to 208,399. But then began the decline. The amount of shipping decreased in 1860 to 176,842 tons, in 1865 to 79,690, in 1870 to 73,137, and in 1876 to 38,883. New Bedford is the principal place from which the fishery is now carried on; it sent out 110 vessels of 31,691 tons in 1876.

Whale-Louse, a popular name for the sessile-eyed crustaceans of the genus *Cyamus*, parasitic organisms which infest the whales, the mackerels, etc. They are placed in a family, Cyamidæ, which is by some considered to form a separate order, Læmodipoda. They have the abdomen very small indeed, and the head fused with the thorax.

Whale Oil [Ger. *Wallfischthran*], the liquid portion of the fat of the common whale, differing from that obtained from the *Physeter macrocephalus* (sperm oil) in possessing a darker color and more disagreeable odor. It possesses a sp. gr. of 0.927, contains small quantities of spermaceti, and does not become solid above 32° F., while sperm oil has a sp. gr. of 0.868, and remains semi-solid at 44.6° F. Whale oil can be deodorized by agitation with chloride of lime (bleaching-powder) (see HYPOCHLOROUS ANHYDRIDE), about 112 pounds of the oil requiring 1 pound of the salt, mixed with 12 pounds of water.

J. P. BATTERSHALL.

Whale's Back, The, a small island or ledge on the N. E. side of the entrance to Portsmouth harbor, N. H. It has a lighthouse of stone rising 69 feet, and another stone tower with a fog-bell. Lat. 43° 3′ 30″ N., lon. 70° 41′ 28″ W.

Wha'leysville, p.-v., Berlin tp., Worcester co., Md. P. 150.

Whal'ley (GEORGE HAMMOND), b. at Gloucester, England, in 1813; was called to the bar 1836; settled in Wales; was high sheriff of Carnarvonshire 1852; was a magistrate for Montgomeryshire and Denbighshire, and deputy lieutenant for the latter county; was elected to Parliament for Peterborough as a Liberal 1852, and in 1876 still represented that borough, being noted in Parliament for his hostility to Roman Catholicism. He published some legal treatises. D. Oct., 1878.

Whang-Hai. See YELLOW SEA.

Wharf and Wharfing. A wharf is a broad plain space or surface resting upon the shore of a harbor or a navigable stream, and generally projecting out beyond the lowest ebb of the tide, so that vessels may moor at its sides or end. Its purpose is to afford a convenient place at which vessels may load and unload—that is, on which goods may be deposited when taken out of a ship or preparatory to being put on board a ship. In the U. S. wharves are generally constructed by driving piles into the bed of the harbor or river, and covering them with a flooring of timber-work and plank; but they are sometimes built of stone upon abutments and piers. It is plain that a wharf must necessarily abut upon the space where the tide ebbs and flows, and that it may extend beyond that space. It is a settled doctrine of the common law that this portion of land between high and low tide, called the "shore," belongs to the government, and that the harbor or river beyond the lowest ebb is under the exclusive control of the government. A wharf, therefore, built without governmental authority would be a public nuisance. In Great Britain the Crown, in the U. S. the States, hold the power to authorize and regulate the construction and use of wharves. As a matter of fact, this authority has been frequently ceded away, either to municipal corporations or to private persons. The State of New York has granted the shore of Manhattan Island to New York City, and that city owns the wharves which fringe its territory, and which it leases to individual occupants. In other States the shore and the right to construct wharves thereon have often been conveyed to the proprietors of the adjacent uplands.

Wharfing is the business carried on by the occupant of a

wharf, either owner or lessee, who is termed a wharfinger. He is a bailee for hire, for he receives and keeps the goods placed in his custody. He is entitled to demand a compensation, called wharfage, for the privilege of mooring a vessel at his wharf, and there receiving or discharging her cargo, and for the storage of goods. The amount of these fees, since the business is one of a quasi-public nature, is often regulated by statute. The wharfinger is bound to exercise ordinary care and diligence in respect of the goods placed in his custody—that is, deposited on his wharf—and is responsible for losses caused by ordinary negligence. Unlike the warehouseman and most other bailees, he has a general lien on the goods of a customer for any balance due him on account. (See LIEN.) JOHN NORTON POMEROY.

Wharfingers. See WHARF AND WHARFING.

Wharn'cliffe (JAMES ARCHIBALD **Stuart-Wortley Mackenzie**), BARON, b. in England Oct. 6, 1776; served in the army 1791–1801; entered Parliament 1797; was created Baron Wharncliffe, July 12, 1826; was lord privy seal Dec. 15, 1834, to Apr., 1835, and became president of the council 1841. D. in London Dec. 19, 1845. He was a great grandson of the celebrated Lady Mary Wortley Montagu, whose *Letters and Works* (5 vols., 1837) he edited.—His son, JOHN STUART WORTLEY, second baron, b. in 1801, published several pamphlets on political and agricultural topics, and translated and edited Guizot's *Memoirs of George Monk, Duke of Albemarle* (1838). D. Oct. 22, 1855.

Whar'ton, county of S. E. Texas, bounded N. E. by San Bernard River, intersected by the Colorado, and crossed in the N. part by Galveston Harrisburg and San Antonio R. R.; surface generally level, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Wharton. Area, 1091 sq. m. P. 3126.

Wharton, tp., Fayette co., Pa. P. 1478.

Wharton, p.-v. and tp., Potter co., Pa. P. 287.

Wharton, p.-v., cap. of Wharton co., Tex.

Wharton (CHARLES HENRY), D. D., b. in St. Mary's co., Md., June 5, 1748; educated at the Jesuit colleges at St. Omer and Bruges; became a tutor at Liege; was ordained priest 1772; officiated several years as chaplain at Worcester, England; returned to Maryland 1783; professed himself a Protestant, and printed a *Letter to the Roman Catholics of the City of Worcester* (1784), explaining his change of creed; was pastor of Episcopal churches at Newcastle and Wilmington, Del., and became in 1798 rector of St. Mary's at Burlington, N. J., retaining that post until his death, July 22, 1833. He was chosen president of Columbia College, New York, in 1800, but declined that office. Author of *An Inquiry into the Proofs of the Divinity of Jesus Christ* (1796), *A Concise View of the Principal Points of Controversy between the Protestant and Roman Churches* (1817), and other miscellaneous theological writings, chiefly in a *Quarterly Theological Magazine*, which he edited at Burlington and Philadelphia (3 vols., 1813–14). His *Remains* (2 vols., 1834) were edited, with a *Memoir*, by Rev. Dr. G. W. Doane.

Wharton (FRANCIS), D. D., LL.D., son of Thomas I., b. at Philadelphia, Pa., in 1820; graduated at Yale College 1839; practised law many years in Philadelphia; was professor of logic and rhetoric in Kenyon College, O., 1856–63; was ordained in the Protestant Episcopal Church as rector of St. Paul's, Brookline, Mass., 1863, and became professor in the Cambridge (Episcopal) Divinity School 1866. Author of *A Treatise on the Criminal Law of the U. S.* (Philadelphia, 1846; 6th ed., 3 vols., 1868), *State Trials of the U. S. during the Administrations of Washington and Adams* (1849), *Precedents of Indictments and Pleas*, etc. (1849), *A Treatise on the Law of Homicide in the U. S.* (1855), *A Treatise on Theism and Modern Skeptical Theories* (1859), *The Silence of Scripture, a Series of Lectures* (1867), *A Treatise on the Conflict of Laws* (1872), and *The Law of Agency and Agents* (1876); was joint author with Dr. Moreton Stillé of *A Treatise on Medical Jurisprudence* (1855; revised ed. 1860); was for a time co-editor of the *Episcopal Recorder*; wrote for many magazines and periodicals, and edited several volumes of law reports.

Wharton (GRACE and PHILIP). See THOMSON (KATHARINE BYERLEY).

Wharton (HENRY), b. at Worstead, Norfolk, England, Nov. 9, 1664; graduated as senior wrangler at Caius College, Cambridge, 1684; was a favorite pupil of Newton; took orders in the Church of England 1687; became chaplain to Archbishop Sancroft Sept., 1688; was assistant to Dr. William Cave in the preparation of his *Scriptorum Ecclesiasticorum Historia Literaria* (2 vols., 1688–89); was patronized by Archbishop Tenison, who made him vicar of Minster Thanet and rector of Chartham 1689. D. of excessive literary work at Newton, Cambridgeshire, Mar. 5, 1695. Author of *A Treatise of the Celibacy of the Clergy* (1688), *Anglia Sacra*, etc. (2 vols., folio, 1691), being biographies of English prelates, and *A Defence of Pluralities*, etc. (1692); aided in the preparation of many other works; edited the works of Reginald Peacock (1688), Bede (1693), the *Remains of Laud* (1695), Beccatelli's *Vita Reginaldi Poli* (1696), and left important MSS., preserved in the archiepiscopal library at Lambeth, including a Latin *Life* of Capt. John Smith. His *Historia Episcopis et Decanis Londinensibus* (1695) was posthumously published, as also *Sermons preached in Lambeth Chapel, with an Account of the Author's Life* (2 vols., 1698–99). Considering the age at which he died (thirty years), the vast amount of his labors, and the extent of his acquisitions, he was justly considered a prodigy, and his death was deplored as an irreparable loss to letters.

Wharton (PHILIP), DUKE OF **Wharton,** son of Thomas, the first marquis, b. in Dec., 1698; made a secret marriage at the age of sixteen; succeeded to the marquisate Apr., 1715; studied under a strict Calvinistic tutor at Geneva 1716, but ran away to Avignon, where he recognized the Pretender and received the title of duke of Northumberland; proceeded to Paris; borrowed £2000 from the queen-dowager, widow of James II.; took a seat in the Irish House of Peers 1716; distinguished himself in debate; was made duke of Wharton in the English peerage Jan. 28, 1718; entered the British House of Lords 1720; distinguished himself against the ministry; soon impoverished himself by his extravagance; edited a semi-weekly paper, *The True Briton*, 1721; went to Vienna, and thence to Madrid, 1726; took service under the Pretender; was aide-de-camp to the count of Torres at the siege of Gibraltar; was made colonel of an Irish regiment in the Spanish service; was attainted of treason in England, and his property confiscated; visited Rome, Paris, and other parts of Europe, and d. in poverty at Tarragona, Spain, May 31, 1731. His *Life and Writings* appeared in the following year (2 vols., 1732). His *Poems* had been published in 1727.

Wharton (THOMAS), D. C. L., MARQUIS OF **Wharton,** b. in England about 1640, eldest son of Philip, fourth Baron Wharton; entered Parliament soon after the Restoration; took a prominent part in the opposition to Charles II.; was sent to the Tower for joining in the complaint against the long prorogation of Parliament Feb. 17, 1677; was one of the first to join the prince of Orange 1688; was appointed comptroller of the royal household and privy councillor Feb., 1689; succeeded to the family title 1696; was made chief-justice in eyre 1697; fought a duel with Viscount Cheyney 1697; was commissioner to negotiate the union with Scotland, for which service he was rewarded with the titles of Viscount Winchendon and Earl Wharton Dec. 23, 1706; was lord lieutenant of Ireland 1708–10, with the Irish titles of Earl Rathfarnum and Marquis Catherlogh, and had Addison for his secretary, and became privy seal on the accession of George I., Sept., 1714, and marquis of Wharton and Malmesbury Feb. 15, 1715, having been a zealous Whig and supporter of the Hanoverian succession, and a skilful party manager, though notorious for immorality. D. in London Apr. 12, 1715. He was the reputed author of the famous Irish ballad "Lillibulero."

Wharton (THOMAS, JR.), b. in Philadelphia in 1735; became a merchant; was president of Pennsylvania 1777–78. D. at Lancaster, Pa., May 23, 1778.

Wharton (THOMAS I.), b. at Philadelphia, Pa., in 1791; was many years a distinguished member of the Philadelphia bar and reporter of the Pennsylvania supreme court. D. at Philadelphia Apr. 9, 1856. Author of *A Digest of Cases in the Circuit Court of the U. S., Third District*, etc. (1822; 6th ed., 2 vols., 1853), *A Digested Index to the Reported Decisions of the Several Courts of Law in the Western and Southern States* (1824), *Reports of Cases in the Supreme Court of Pennsylvania, Eastern District* (6 vols., 1836–41), of several historical or anniversary discourses, and a *Memoir of William Rawle, LL.D.* (1840); was associated with Thomas Sergeant and others in the editorship of the *Law Library* (1833), and with Henry Wheaton in editing the 5th American ed. of Selwyn's *Abridgment of the Law of Nisi Prius* (1839); edited with copious notes the reissue of A. J. Dallas's *Reports*, and wrote a number of biographical sketches, which were republished in the volume of *Eminent Philadelphians* (1859).

Wharton's Creek, tp., Madison co., Ark. P. 81.

What'com, county of N. W. Washington Territory, bounded N. by British Columbia, W. by Washington Sound, lying between the Gulf of Georgia and Fuca Strait. The interior is covered with dense forests, and is crossed in the E. part by high, rugged mountains, the culminating point of which is Mount Baker, about 10,000 feet above the sea.

Lumber is as yet the principal product, although much of the soil is adapted for tillage. Cap. Whatcom. Area, about 4000 sq. m. P. 534.

Whatcom, p.-v., cap. of Whatcom co., Wash. Ter.

Whate'ly, p.-v. and tp., Franklin co., Mass. P. 1068.

Whately (Richard), D. D., b. in London, England, Feb. 1, 1787; graduated at Oriel College, Oxford, 1808; became a fellow there 1811; took orders in the Church of England; was intimately associated at Oriel with Keble, Arnold, Pusey, John Henry Newman, and others destined to become innovators in British theology; was noted for his wit, his freedom of thought and action, and fondness for debate; was Bampton lecturer 1822; rector of Halesworth, Sussex, 1822–25; principal of St. Alban's Hall, Oxford, 1825–30; professor of political economy in the University of Oxford 1830–31, and was appointed by Earl Grey archbishop of Dublin 1831, in which capacity he was charged with the difficult task of carrying out, in the details of social, political, and religious life, the principles embodied in the recent Roman Catholic Relief act. He was for twenty years the leading member of the Irish national board of education, for which he wrote several educational books; endowed the professorship of political economy in the University of Dublin; promoted the extension of the "national system" of unsectarian education in Ireland; won the confidence and co-operation of the Roman Catholic archbishop Murray, but resigned his seat at the board in 1853 from inability to work in harmony with the new archbishop (now cardinal), Cullen, and from the covert opposition of illiberal clergymen of the Church of England. He filled the posts of bishop of Kildare, visitor of Trinity College, president of the Royal Irish Academy, and chancellor of the order of St. Patrick. His family, which had been educated by the celebrated Joseph Blanco White 1832–35, took an active part in the promotion of Irish church missions, ragged schools, refuges, and other charitable institutions. Archbishop Whately was regarded as one of the founders of the "Broad Church" party, and was distinguished for "large munificence, genial hospitality, ever-ready wit, and solid common sense." D. at Dublin Oct. 8, 1863. Among his numerous works are—*Historic Doubts relative to Napoleon Bonaparte* (1819), *The Use and Abuse of Party Feeling in Matters of Religion* (Oxford, 1822), being the Bampton lectures for that year, *Essays on some of the Peculiarities of the Christian Religion* (1825), *Elements of Logic* (1826), *Elements of Rhetoric* (1828), *Essays on some of the Difficulties in the Writings of the Apostle Paul, and in other Parts of the New Testament* (1828), *View of the Scripture Revelations concerning a Future State* (1829), *The Errors of Romanism traced to their Origin in Human Nature* (1830), *Introductory Lectures on Political Economy* (1831), *Essay on the Omission of Creeds, Liturgies, and Codes of Ecclesiastical Canons in the New Testament* (1831), *Essays on some of the Dangers to Christian Faith which may arise from the Teaching or Conduct of its Professors* (1839), *The Kingdom of Christ delineated* (1841), *Introductory Lessons on Christian Evidences* (1841), *Introductory Lessons on the Study of St. Paul's Epistles* (1849), *Scripture Revelations concerning Good and Evil Angels* (1851), *English Synonyms* (1851), *Cautions for the Times* (1853), *Bacon's Essays, with Annotations* (1856), *Introductory Lessons on Morals* (new ed. 1860), *Introductory Lessons on Mind* (1859), *Introductory Lessons on the British Constitution* (1859), *Lectures on some of the Parables* (1859), *Lectures on Prayer* (1860), *Thoughts on the Proposed Revision of the Liturgy* (1860), *A General View of the Rise, Progress, and Corruptions of Christianity* (1860), and *Miscellaneous Lectures and Reviews* (1861). Since his death have appeared *Miscellaneous Remains* (1864) and *Earlier Remains* (1864), both edited by his daughter, Miss E. Jane Whately, who has also published her father's *Life and Correspondence* (2 vols., 1866). Two volumes of *Memoirs* (1864) were published by William J. Fitzpatrick.

Porter C. Bliss.

Wheare (Degory), b. at Jacobstow, Cornwall, England, in 1573; educated at Broadgate Hall, Oxford; took orders in the Church of England; became fellow of Exeter College 1602, and Camden professor of ancient history at Oxford 1622, and was principal of Gloucester Hall (afterward Worcester College) from Apr., 1626, until his death, Aug. 1, 1647. Author of *Lectiones Hiemales, de Ratione et Methodo Legendi Historias Civiles et Ecclesiasticas* (1623; 5th ed. 1684; translated into English by Edward Bohun, 1685; 3d ed. 1698), and other works.

Wheat [Ang.-Sax. *hwete*], the most valuable and, next to maize, the most productive of all the cereal grasses, belongs to the genus *Triticum*, and is distinguished by a spike with many-flowered spikelets seated on opposite sides of a hollow and jointed stem, which rises zigzag and forms notches at each joint; by awned or awnless palets; and by grains with a longitudinal furrow on one side, turgid on the other, and hairy at the top. It is not known in a wild state, but most botanists are inclined to believe that it had its home in the central parts of Asia. It was very early cultivated, and has formed the principal breadstuff of all civilized nations since long before the historical era. The Bible and the Egyptian and the Chinese records testify to the antiquity of its cultivation. In proportionate altitude it may be cultivated very near the equator, but the proper limit for its cultivation is between lat. 20° and 25°. The lowest mean temperature in which it will ripen is 57.2°. The principal wheat-exporting countries are the U. S., Russia, Hungary, Denmark, Turkey, and Chili: 309,102,700 bushels were produced in the U. S. in 1874 from 24,967,027 acres, averaging 12.3 bushels to the acre. In England the average yield of an acre is 33½ bushels; in Denmark, 27½. This difference, however, does not refer to any difference in climate and soil—which, generally speaking, are much more favorable to the cultivation of wheat in the U. S. than in any of the two above-mentioned countries—but to a difference in the agricultural systems which are pursued. In the State of New York land which fifty years ago yielded from 20 to 30 bushels to an acre yields now only from 5 to 7; and the same fact has been observed in Ohio. The explanation is, that in such places the soil has become exhausted, no fertilizers having been applied to it; and generally the farmer has moved farther West in order to occupy fresh and hitherto uncultivated soil. The production of the chief wheat-growing States was in 1873—Iowa, 34,600,000 bushels; Illinois, 28,417,000; Minnesota, 28,056,000; Wisconsin, 26,322,000; California, 21,504,000; Indiana, 20,832,000; Ohio, 18,567,000; Pennsylvania, 15,548,000; Michigan, 14,214,000; Missouri, 11,927,000; Tennessee, 7,414,000; Kentucky, 7,225,000; New York, 7,047,000; Virginia, 5,788,000; Maryland, 5,262,000; Kansas, 4,330,000; Nebraska, 3,584,000; Oregon, 3,127,000; North Carolina, 2,795,000; West Virginia, 2,657,000; Georgia, 2,176,000; and New Jersey, 1,948,000.

Wheat, Chemistry of. See Flour, by Prof. E. N. Horsford, M. D., and Bread, by Prof C. F. Chandler, Ph. D., M. D., LL.D.

Wheat'ear, or **Fallowchat,** the *Saxicola œnanthe*, a European bird of the family Sylviadæ, allied to the Chat (which see), ranges from Africa in winter to the N. of Europe in summer, is six and a half inches in length, generally colored ash-brown and buff, marked with white and black, and is easily trapped as a delicacy for the table. It feeds on worms and insects, and the male sings well in confinement.

Wheat'field, tp., Jasper co., Ind. P. 103.

Wheatfield, tp., Ingham co., Mich. P. 781.

Wheatfield, tp., Niagara co., N. Y. P. 3406.

Wheatfield, tp., Perry co., Pa. P. 780.

Wheat-Fly. See Midge.

Wheat'head, tp., Will co., Ill. P. 1133.

Wheat'land, tp., Bureau co., Ill. P. 492.

Wheatland, tp., Fayette co., Ill. P. 871.

Wheatland, tp., Macon co., Ill. P. 1336.

Wheatland, p.-v., Spring Rock tp., Clinton co., Ia., at the junction of Chicago and North-western and Davenport and St. Paul R. Rs., has 3 churches, a graded school, library, hotel, and 1 newspaper. P. 788.

Frank L. Dennis, Pub. "Weekly News."

Wheatland, tp., Hillsdale co., Mich. P. 1513.

Wheatland, tp., Mecosta co., Mich. P. 400.

Wheatland, p.-v. and tp., Rice co., Minn. P. 681.

Wheatland, p.-v., Montgomery tp., Hickory co., Mo. P. 80.

Wheatland, tp., Monroe co., N. Y. P. 2565.

Wheatland, p.-v., Mercer co., Pa.

Wheatland, p.-v. and tp., Kenosha co., Wis. P. 843.

Wheatland, tp., Vernon co., Wis. P. 697.

Wheatland (Henry), M. D., b. at Salem, Mass., Jan. 11, 1812; graduated at Harvard 1832; studied medicine, but never practised; was an original member of the American Association for the Advancement of Science; one of the founders of the Essex Natural History Society and of the Essex Institute; is president of the latter body, vice-president of the Peabody Academy of Science, and director of the Salem Public Library, which has owed much of its prosperity to his efforts.

Wheat'ley (Henry B.), b. in England about 1835; is honorary secretary of the Early English Text Society, for which he has edited, from the original MS., Alexander Hume's quaint treatise, *Of the Orthographie and Congruitie*

of the Britan Tongue (1865), *Merlin, or The Early History of King Arthur, a Prose Romance* (part i., 1866), and Peter Levins's *Manipulus Vocabulorum, a Rhyming Dictionary* (1868); has compiled a *General Index to the Works of Thomas de Quincey* (1863); is author of a curious essay entitled *Of Anagrams, a Monograph treating of their History from the Earliest Ages to the Present Time, etc.* (Hertford, 1862), and of *Round About Piccadilly and Pall Mall, or a Ramble from the Haymarket to Hyde Park, a Retrospect of the Various Changes that have occurred in the Court End of London* (1870).

Wheatley (Phillis), a negro poetess, b. in Africa about 1750; was brought as a slave to Boston 1761; was taught to read by the family of her master, Mr. John Wheatley; made rapid progress in letters; soon displayed so much poetical talent, stimulated by the reading of Pope's *Homer*, that a volume of her verses was printed in London 1773, with a copper-plate portrait and a dedication to the countess of Huntingdon. She visited England in that year; wrote some notable verses to Gen. Washington, whom she visited at his head-quarters at Cambridge; was treated by him with great politeness, writing her a letter dated Feb. 2, 1776, and her poem was printed by his direction in the *Pennsylvania Magazine* for Apr., 1776. She married a colored man named John Peters, who seems to have fallen into great poverty during the Revolution. D. at Boston Dec. 5, 1784. Her *Letters* were privately printed in 1864.

Wheat'ly (Charles), b. in London, England, in 1686; educated at Merchant Taylors' School and at St. John's College, Oxford, of which he became fellow; took orders in the Church of England; was lecturer of St. Mildred's, London, and afterward vicar of Brent and Furneaux Pelham, Hertfordshire, where he d. May 13, 1742. Author of *The Church of England Man's Companion, being an Illustration of the Book of Common Prayer* (Oxford, 1710), subsequently enlarged and published as *A Rational Illustration of the Book of Common Prayer* (1714), *The Nicene and Athanasian Creeds, etc.* (1738), *Fifty Sermons* (3 vols., 1716), and other theological writings.

Wheat'-Moths. There are several lepidopterous insects which devour grain in the bin. Of these the best known is *Tinea granella*, an insect closely allied to the ordinary clothes-moth. Its larva devours the flour out of kernels of wheat, and covers the shells with its thick web. Thorough cleanliness, whitewashing, and the use of coal oil tend to prevent its ravages, and the grain should be frequently shovelled over. An open lamp will also allure many of the flying moths to their own destruction. The Angoumois grain-moth (*Gelechia cerealella*) is another similar insect of the same family.

Whea'ton, p.-v., cap. of Du Page co., Ill., on Chicago and North-western R. R., 25 miles from Chicago, contains 4 churches, Wheaton College, a public school, 1 bank, 1 newspaper, and 3 hotels. Principal business, farming and dairying. P. 998. J. Russell Smith, Ed. "Illinoian."

Wheaton, v., Wayne tp., Tippecanoe co., Ind. P. 87.

Wheaton, tp., Chippewa co., Wis. P. 799.

Wheaton (Henry), LL.D., b. at Providence, R. I., Nov. 27, 1785; graduated at Rhode Island College (now Brown University) 1802; studied law; was admitted to the bar 1805; spent eighteen months at the law school at Poictiers, France, 1805–06; studied some months at London 1807; practised law at Providence 1807–12; settled in New York in 1812; edited the *National Advocate*, the organ of the administration party, 1812–15, in which he published some notable articles on the question of neutral rights in connection with the then existing war with England; became division judge-advocate of the army Oct. 26, 1814; was justice of the marine court of the city of New York May, 1815–July, 1819; reporter of the Sopreme Court of the U. S. 1816–27; delegate to the convention for forming a new constitution for New York 1821; member of the New York assembly 1823; was associated with Benjamin F. Butler and John Duer in a commission for revising the statute law of New York 1825; was U. S. chargé d'affaires to Denmark 1825–37; displayed great diplomatic skill in the settlement of the vexed question of the Sound dues, and acquired a high reputation by his researches into Scandinavian history, languages, and literature; was appointed minister resident at the court of Prussia 1835; was soon promoted to minister plenipotentiary 1837, filling that post until 1846, during which period he became honorably distinguished by his writings on international law and by his settlement of the questions relating to the Scheldt dues, the tolls on the Elbe, and the rights of American naturalized citizens; was chosen a corresponding member of the French Institute 1813, and a foreign member of the Royal Academy of Science at Berlin 1846; signed an important treaty with Germany (1844), which was rejected by the U. S. senate for political reasons, but has served as the basis of later treaties, and was requested to resign in 1846 by Pres. Polk, much to the "astonishment and indignation of both parties at home and all parties abroad," was complimented with public dinners in New York and Philadelphia on his return to the U. S. 1847, and was immediately chosen lecturer on international law at Harvard University. D. at Dorchester, Mass., Mar. 11, 1848. Author of *A Digest of the Law of Maritime Captures and Prizes* (1815), *Reports of Cases Argued and Adjudged in the Supreme Court of the U. S. 1816–27* (New York and Philadelphia, 12 vols., 1826–27), *A Digest of the Decisions of the Supreme Court of the U. S. from its Establishment in 1789 to 1820* (2 vols., 1820–29), *The Life of William Pinkney* (1826), *A History of the Northmen, or Danes and Normans, from the Earliest Times to the Conquest of England by William of Normandy* (London, 1831), *The Elements of International Law, with a Sketch of the History of the Science* (Philadelphia, 1836; London, 2 vols., 1836), *Histoire du Progrès du Droit des Gens en Europe depuis la Paix de Westphalie jusqu'au Congrès de Vienne, avec un Précis historique du Droit des Gens européens avant la Paix de Westphalie* (Leipsic, 1841), written in unsuccessful competition for a prize offered by the French Institute, and translated into English by William B. Lawrence under the title *A History of the Law of Nations in Europe and America from the Earliest Times to the Treaty of Washington* (New York, 1845); *An Inquiry into the Validity of the British Claim to a Right of Visitation and Search of American Vessels suspected to be engaged in the Slave-Trade* (1842); contributed to Dr. Andrew Crichton's *History of Scandinavia* (1838), and published many articles in the *North American Review* and other periodicals, and numerous historical, political, and literary addresses or essays, of all which a collective edition in 3 or 4 vols. was contemplated by Mr. Wheaton, but has never appeared. His great work on *International Law* has become a recognized standard in the English language, and has been edited by rival commentators, Mr. William Beach Lawrence (1855) and Mr. Richard H. Dana, Jr. (1866). The former gentleman added a *Biography* of Mr. Wheaton, and has since published in French a *Commentaire* on this work (Leipsic, 1868 *seq.*). Porter C. Bliss.

Wheaton (Nathaniel Sheldon), D. D., b. at Washington, Conn., Aug. 20, 1792; graduated at Yale College 1814; took orders in the Protestant Episcopal Church; was rector of Christ church, Hartford, 1818–31, president of Trinity College 1831–37, and rector of Christ church, New Orleans, 1837–44, and visited Europe 1823–24, and again 1844. D. at Washington, Conn., Mar. 18, 1862. He was one of the chief founders of Trinity College, for the endowment of which he raised $40,000, and bequeathed to it $20,000 more. Author of a *Journal of a Residence in London, etc.* (1830), and of several religious publications.

Wheaton College, in Wheaton, Ill., 25 miles W. of Chicago, on the Galena division of the North-western R. R., was founded in 1850 by the Illinois annual conference of the Wesleyan Methodists. The first trustees were appointed in 1851, and in 1853 a school was opened in the lower story of an unfinished stone building, under the care of Rev. John Cross. In 1855 the Rev. L. C. Matluck was chosen the first president of what was then called the "Illinois Institute." On account of a pecuniary crisis, the founders proposed to the Congregationalists that they should take the control of the institution, and in 1860 the Rev. J. Blanchard was chosen president of what is now called "Wheaton College." In the same year the first class of seven young men graduated. The college is now in possession of a commodious and beautiful stone edifice, and of property to the value of $100,000 above its liabilities. Its faculty consists of 11 members, besides assistant teachers, and the number of its students is 230. All the benefits of the regular college course are extended to both sexes. O. F. Lumry.

Wheat'stone (Sir Charles), F. R. S., LL.D., b. at Gloucester, England, in 1802; was in early life a manufacturer of musical instruments; was led by his profession to investigate the laws of sound and their application to music—subjects on which he published papers in the *Annals of Philosophy* (1823 *seq.*) and the *Quarterly Journal of Science*; contributed papers to the *Philosophical Transactions* on Chladni's figures (1833) and *An Account of some Experiments to measure the Velocity of Electricity and the Duration of Electric Light* (1834); became in the latter year professor of experimental philosophy in King's College, London; was chosen a fellow of the Royal Society 1836; read to that body his *Contributions to the Physiology of Vision*, as a consequence of which researches he soon afterward (1838) invented the stereoscope; began in June,

1836, with Mr. William Fothergill Cooke, a series of successful experiments in electro-magnetism, with a view to the transmission of intelligence over copper wires; took out, along with Cooke, in May, 1837, a patent for a magnetic telegraph, which was not, however, practically operated until after that of Morse; invented also an electro-magnetic alarum and various instruments for registering thermometrical and barometrical indications and transit observations in astronomy; was one of the jurors in the class for health, light, and electricity at the Paris Universal Exposition of 1855; received from Napoleon III. the cross of the Legion of Honor; was awarded Ampère's medal by the French Society for the Encouragement of National Industry; was knighted by Queen Victoria 1868; received in the same year the Copley medal of the Royal Society for his researches in acoustics, optics, electricity, and magnetism; was made LL.D. by the University of Edinburgh Apr. 12, 1869, and elected foreign associate of the French Academy of Sciences June 30, 1873, to fill the vacancy caused by the death of Baron Liebig. D. at Paris Oct. 19, 1875. An English official commission, consisting of Sir Mark I. Brunel and J. F. Daniell, declared under date of Apr. 27, 1841, that Mr. Wheatstone was the person to whose scientific researches the practical application of the telegraph was due. He was author of papers on *The Physiology of Vision* (1852), *The Binocular Microscope* (1853), *Fessil's Gyroscope* (1854), *Powers for Arithmetical Progression* (1854–55), and *Automatic Telegraphy* (1859).

PORTER C. BLISS.

Whe'don (DANIEL DENISON), D. D., LL.D., b. at Onondaga, N. Y., Mar. 20, 1808; graduated at Hamilton College 1828; studied law; was professor of ancient languages at Wesleyan University, Middletown, Conn., 1832–43; became a preacher of the M. E. Church 1836; was professor of rhetoric, logic, and history at the University of Michigan 1845–53, and became in 1856 editor of the *Methodist Quarterly Review* and general editor of the publications of the Methodist Book Concern, New York. Author of *Public Addresses, Collegiate and Popular* (1856), *A Commentary on Matthew and Mark* (1860), *The Freedom of the Will as a Basis of Human Responsibility, etc.* (1864), and a *Commentary on the New Testament* (5 vols., 1866 *seq.*) of a strongly anti-Calvinistic character.

Wheel. See WHEEL-AND-AXLE and WHEELWORK.

Wheel, an instrument of torture and death, was used in Germany before 1400, and was employed in Prussia as late as 1841. The prisoner was bound upon a large wheel, with his arms and legs extended, and each limb was fractured as the wheel revolved by the blows of an iron rod, both above and below the knees and elbows. In France, *coups de grace*, or merciful blows, were often administered upon the head and chest, so as to shorten life: but frequently the victim was allowed to lie upon the wheel and die of pain and neglect. This punishment was introduced into France by Francis I. Persons so punished were usually traitors, parricides, etc. Hence the term *roué* ("broken on the wheel") applied to persons guilty of odious practices by which their energies are exhausted.

Wheel-and-Axle, one of the so-called mechanical powers, is an application of the principle of the lever. There are two cylinders with a common axis, with differing radii—the smaller being termed the *axle*, the larger the *wheel*. Suppose a cord is wound around the wheel in one direction, and another cord around the axle in the contrary direction. The condition of equilibrium of weights attached to these cords is that the product of each of the weights into their respective radii should be equal.

Wheel-Animalcule. See ROTIFERA.

Wheel'er, p.-v. and tp., Gratiot co., Mich. P. 231.

Wheeler, p.-v. and tp., Steuben co., N. Y. P. 1330.

Wheeler, or **Wheler** (Sir GEORGE), D. D., b. at Breda, Holland, in 1650, of English parentage; settled in Kent, England, in childhood; was educated at Lincoln College, Oxford; travelled on the Continent with Dr. James Spon of Lyons, extending their tour to Dalmatia, Greece, and Asia Minor 1675–76; presented to the University of Oxford a valuable collection of MSS.; was knighted, and took orders in the Church of England 1683; became prebendary of Durham 1684, and subsequently vicar of Basingstoke, Hampshire, and rector of Houghton-le-Spring, where he d. Feb. 18, 1724. Author of *A Journey into Greece* (1682), which was translated into French, *An Account of the Churches or Places of Assembly of the Primitive Christians* (1689), and *The Protestant Monastery, or Christian Economics* (1698).

Wheeler (JOHN H.), b. at Murfreesboro', N. C., in 1806; graduated at Columbian College, Washington, 1826; became a lawyer, member of the North Carolina Assembly, and a prominent Democratic politician; was appointed by Pres. Jackson superintendent of the U. S. mint at Charlotte 1836; was treasurer of North Carolina 1842–44; minister resident of the U. S. in Nicaragua 1854–57, where he hastened to recognize the presidency of William Walker; was in 1859–61 employed in the statistical department of the ministry of the interior at Washington; took part in the rebellion, and has since been a resident of that city, engaged in condensing and collating the debates of Congress, and also employed in statistical labors. Author of *Historical Sketches of North Carolina* (1851) and *A Legislative Manual for North Carolina* (1874), and editor of Col. David Fanning's *Autobiography, etc.* (Richmond, 1861).

Wheeler (NATHANIEL), b. in Watertown, Conn., in 1820. After receiving a good public-school education, he began life as a manufacturer in a small way, and in 1850 made the acquaintance of Mr. Allen B. Wilson, who was engaged in perfecting a sewing-machine, but needed aid in patenting his invention and introducing it to the public. After a careful examination of its merits, Mr. Wheeler joined him in the enterprise, and, enlisting the interest of others in it, the machine was patented in 1852 (see SEWING-MACHINES), and the firm of Wheeler, Wilson & Co. (changed a year later to "The Wheeler and Wilson Manufacturing Co.") was founded. Mr. Wheeler's thorough knowledge of machinery and his remarkable ability as an organizer enabled him to expand the sewing-machine manufacture from its small beginnings in the little factory which could turn out one machine a day to the vast establishment which has facilities for producing 600 per diem. But he has, since 1850, as president of the Wheeler and Wilson Manufacturing Co., also accomplished the much more difficult work of creating a market for more than 1,200,000 sewing-machines, and demonstrating that the sewing-machine is a prime necessity in every household. L. P. BROCKETT.

Wheeler (RAYALL T.), b. in New Hampshire in 1810; was educated at Kenyon College, O.; taught school and an academy; studied law in Kentucky, and graduated B. L. in the Cincinnati Law School Mar. 27, 1837; went to Arkansas, and there practised his profession and married; in 1839 removed to Texas; became judge in 1845, and rose to the supreme bench. D. Nov. 8, 1864.

Wheeler (WILLIAM A.), LL.D., b. June 30, 1819, in Malone, Franklin co., N. Y.; entered the University of Vt. in the class which graduated in 1842, but the sudden death of his father compelled him to leave his collegiate course uncompleted. He commenced the study of law with Col. Asa Hascall, and was at different times employed as a schoolteacher. Soon after his admission to the bar he rose rapidly in the legal profession, and was made district attorney for Franklin county, holding the position until he declined to retain it longer. For several years he was superintendent of schools for Franklin county. In 1850 and 1851, Mr. Wheeler represented Franklin county in the New York house of assembly: was a member of the senate of New York in 1858 and 1859, and president *pro tem.* of that body. He was a member and the president of the New York constitutional convention in 1867–68; was elected a Representative in Congress to the 37th, 41st, 42d, 43d, and 44th Congresses, and in June, 1876, was unanimously nominated for the Vice-Presidency of the U. S. by the Republican national convention at Cincinnati. For several years he was much engaged in banking and railroad affairs. He was one of the organizers of the bank of Malone, and held the position of cashier and chief managing director. He was trustee of the Northern New York Railway Co. In the political complications which arose in Louisiana during the session of the 43d Congress, Mr. Wheeler was conspicuous, he having been chairman of the special committee of the House of Representatives that visited Louisiana, and finally adjusted the difficulties existing there on the basis of what is known as "the Wheeler compromise." Elected V.-P. of U. S. Mar. 2, 1877. Z. K. PANGBORN.

Wheeler (WILLIAM ADOLPHUS), b. at Leicester, Mass., Nov. 11, 1833; graduated at Bowdoin College 1853; was an assistant to Dr. Joseph E. Worcester in the preparation of his quarto *Dictionary* (1856–59); contributed to the new illustrated edition of Webster's *Dictionary* (1864), published separately, *A Dictionary of the Noted Names of Fiction, etc.* (Boston, 1865), edited a *Dickens's Dictionary* and Hole's *Brief Biographical Dictionary* (1866); began a *Shakspearian Cyclopædia*; aided Richard Soulé, Jr., in his manuals of spelling and reading: became in 1867 assistant superintendent of the Boston Public Library. D. at Roxbury Oct. 28, 1875. He left unfinished an index to anonymous literature, entitled *Who Wrote It?*

Wheele'ra Eb'enus, a West Indian leguminous tree, whose dark-green, heavy, handsome wood is much used by joiners under the incorrect name of West India ebony.

Wheel'ersburg, p.-v., Porter tp., Scioto co., O. P. 358.

Wheel'ing, p.-v. and tp., Cook co., Ill. P. 1835.
Wheeling, p.-v. and tp., Rice co., Minn. P. 861.
Wheeling, p.-v. and tp., Livingston co., Mo. P. 219.
Wheeling, tp., Belmont co., O. P. 1240.
Wheeling, p.-v. and tp., Guernsey co., O. P. 1090.

Wheeling, city and port of entry, cap. of West Virginia and seat of justice of Ohio co. in that State, on both sides of Wheeling Creek, on the eastern bank of Ohio River, on the Baltimore and Ohio R. R., and on the Hempfield connection of this road and its Connellsville branch, 92 miles below Pittsburg, Pa. The city is principally a manufacturing place, the surrounding country containing enormous deposits of bituminous coal; 7 nail factories, 5 blast furnaces, a rail-mill, bar and sheet iron mill, several glass-factories, 2 paper-mills, a number of foundries and machine-shops, 1 hinge and 1 tack factory, and several other manufacturing establishments are in operation. The trade, however, carried on by way of the river and the railway lines is very considerable. During the year ending June 30, 1875, 11 steamers of 2067 tons and 17 barges of 13,336 tons were built, and the total shipping belonging to the port amounted on that date to 73 steamers of 8508 tons and 128 barges of 1383 tons. The city is divided into eight wards, but the division most commonly known is that into North, East, Centre, and South Wheeling, and Zane's Island, which is more than a mile long, contains 400 acres, and is connected with the city by a fine suspension bridge. Each ward has a public school, in which both German and English are taught. The city also contains 2 seminaries, 21 churches, a public library with reading-room, 3 daily and 5 weekly papers, etc. Among its public

Capitol and Court-house, Wheeling, West Va.

buildings the most noteworthy are the custom-house, the new court-house, the theatre, etc. Wheeling was settled in 1774, incorporated in 1806, made the capital of West Virginia in 1863, and again in 1875. It had 11,435 inhabitants in 1850, 14,083 in 1860, 19,280 in 1870; and 30,000 in 1876, according to local estimation.

A. W. Campbell, Ed. "Intelligencer."

Whee'lock (Eleazar), D. D., b. at Windham, Conn., Apr. 22, 1711; graduated at Yale College 1733; was ordained pastor of the Second Congregational church at Lebanon, Conn., Mar., 1735, remaining there thirty-five years; established a school 1754; had as a pupil an Indian boy, Samson Occom (see Occom, Samson), whose proficiency led to the establishment of Moor's Indian Charity School, which grew into Dartmouth College (which see), for which he obtained a large tract of land in New Hampshire, and removed thither as first president of the college Aug., 1770. One of his pupils at Lebanon was the celebrated Joseph Brandt. D. at Hanover, N. H., Apr. 24, 1779. He published several *Narratives of the Indian Charity School* (1762–75), together with an abstract of McClure and Frisbie's mission to the Delaware Indians W. of the Ohio, and some sermons. A *Memoir* by Rev. Drs. Elijah Parish and David McClure appeared in 1810.

Wheelock (John), D. D., LL.D., son of Dr. Eleazar, b. at Lebanon, Conn., Jan. 28, 1754; entered Yale College 1767; went to Hanover, N. H., with his father 1770, and graduated with the first class at Dartmouth College 1771; was tutor there 1772–74; represented Hanover in the legislature 1775; served as major and lieutenant-colonel in the army of the Revolution, and was a member of Gen. Gates's staff; was chosen successor to his father as president of Dartmouth College 1779, though only twenty-five years of age; visited England to raise funds 1783; was partially successful, but lost the money and papers by shipwreck off Cape Cod; was removed from office 1815 in consequence of an ecclesiastical controversy, but restored 1817. D. at Hanover Apr. 4, 1817, leaving half his estate to Princeton Seminary. Author of a *Eulogy on Prof. John Smith, D. D.* (1809), and *Sketches of Dartmouth College* (1816).—His only daughter, Maria Malleville Wheelock, married Pres. William Allen of Bowdoin College.

Wheelocke, or **Whelock** (Abraham), b. at Loppington, Shropshire, England, about 1592; educated at Trinity College, Cambridge; became a fellow at Clare Hall; was appointed first professor of Arabic, and also of Anglo-Saxon, at Cambridge 1632; was minister of St. Sepulchre's 1622–42, and was, by presentation of Sir Henry Spelman, vicar of Middleton, Norfolk. D. in London in Sept., 1653. He edited and translated Bede's *Ecclesiastical History* (1641), Lambarde's *Old Saxon Laws* (1644), the *Anglo Saxon Chronicle* (1644); printed the Gospels in Persian and Latin (1657), and labored on Walton's *Polyglot*.

Wheel'work, or **Gearing.** These terms are applied to trains of toothed wheels, a common arrangement of mechanism by which continuous rotation is communicated from one revolving axis to another. It is not even necessary for the communication of motion that the wheels should be supplied with teeth, frictional gearing being that kind of wheelwork in which motion is transmitted from one wheel to another by the mere contact of the rims of the wheels. This requires, however, that the smooth edges of the wheels shall be constantly pressed together, circular V-shaped grooves and projections being generally provided to make the friction more effective. Teeth are generally provided, however, which, by interlocking, render the slipping of one circumference upon another impossible. Wheelwork usually receives a special designation, depending on the relative positions of the axes of the wheels. When the axes are parallel, it is called *spur-gearing;* when the axes intersect, *bevel-gearing;* and when the axes are not parallel, and do not intersect, *skew-bevel* and *screw-gearing*.

One of the most important requirements in wheelwork is that smooth and continuous motion shall be communicated from the driver to the follower. In frictional gearing this always takes place, but in toothed gearing a constant ratio of the angular velocities of the two wheels in gear, without shocks, can only be attained by special forms of teeth; the investigations for the development of these forms of teeth have occupied geometricians for a long period. The forms of cross-section which have been found to produce a constant ratio of the angular motions are found generally by the rolling of curves on the pitch-circles of the wheels, tracing points in the rolling curves producing epicycloidal forms of teeth, which remain in contact with a limited amount of sliding between the curved faces of the teeth. These forms are also often involutes of the circles which form the bases of the teeth; the difference between involute teeth and epicycloidal teeth being that the curves of the former are single continuous curves, forming the entire sides of the teeth, while in epicycloidal teeth the curve of a tooth is made up of two separate curves joined at the pitch-circle.

In common gearing, where great accuracy is not required, the curves of the teeth are often composed of arcs of cir-

eles drawn according to special geometric rules, these resulting curves being a sufficient approximation to the epicycloids which are traced in the more exact constructions. The ratio of the angular velocities in spur and bevel gearing is always inversely proportional to the radii of the pitch-circles of the wheels or to the numbers of teeth in the wheels. In skew-bevel gearing this ratio is inversely proportioned to the radii at the throats or smallest parts of the hyperboloids which form the bases of the wheels; and in screw-gearing the angular velocities are inversely proportional to the number of threads. In two wheels which work continuously together during a complete revolution the pitch of the teeth in both wheels must be the same. The pitch must also be an aliquot part of the circumference of each: hence the ratio of the numbers of revolutions in a given time must be expressible in whole numbers. In screw-gearing the normal pitch—*i. e.* the pitch as measured on a helix of the screw cylinder which cuts the teeth at right angles—must be the same in both wheels. The screw and worm wheel is an example of screw-gearing in which the axes are at right angles, the diameter of the screw being much smaller than that of the wheel.

In a train of wheelwork where spur-wheels are employed and the axes parallel, the ratio of the numbers of revolutions of the first and last wheels may be found by multiplying the numbers of teeth in all the drivers for a numerator, and of all the followers for a denominator. The resulting ratio will be that of the number of revolutions of the first wheel divided by the number of revolutions of the last wheel.

The subject of wheelwork is fully developed in Willis's *Principles of Mechanism*, in Rankine's *Machinery and Millwork*, and in other works on mechanism.

W. P. Trowbridge.

Wheel'wright (John), b. in Lincolnshire, England, in 1594; graduated at Cambridge as a classmate of Oliver Cromwell 1614; took orders in the Church of England; was vicar of Bilsby, near Alford, 1623–31; was silenced for nonconformity by Archbishop Laud; came to Massachusetts 1636; was chosen pastor of a church at Braintree; was a brother-in-law of the celebrated Anne Hutchinson, whose religious opinions he defended, on which account, though supported by Gov. Vane, he came into sharp collision with Rev. John Wilson, pastor of the Boston church, especially in consequence of a sermon preached at Boston on Fast Day, 1637, which was declared seditious by the general court; was banished from Massachusetts 1638; removed with his partisans to New Hampshire; founded Exeter on the Squamscott, organizing a church there, and that territory being subsequently claimed by Massachusetts, located with a part of his church at Wells, Me., 1643; was allowed to return to Massachusetts 1646; resided at Hampton 1646–54; was in England 1657–60, and was settled in 1662 as pastor at Salisbury, N. H., where he d. Nov. 15, 1679. He published in 1645, in answer to Thomas Weld, *Mercurius Americanus, or Observations on a Paper entitled Of the Rise, Reign, and Ruin of the Familists, Libertines, etc. in New England*; and in 1654 printed a *Vindication*. The genuineness of an Indian deed to him, covering a large tract of land in New Hampshire, has been the occasion of much controversy, on which subject see Savage's edition of Winthrop's *History*, also Savage's *Genealogical Dictionary*.

Wheelwright (William), b. at Newburyport, Mass., in 1798; was brought up to seafaring pursuits; commanded a trading-vessel on the W. coast of South America as early as 1823; established in 1829 a line of passenger-vessels between Valparaiso and Cobija; planned in 1835 the line of steamers on the W. coast, now running 54 steamers; built the first telegraph-line in South America; suggested in 1842 the railroad from Santiago to Valparaiso, which he subsequently built, as also that from Caldera to Copiapo and Tres Puntos 1849–52; planned a railroad from Caldera across the Andes to Rosario on the Paraná; obtained a concession for the Central Argentine R. R., which he built from Rosario to Cordova 1863–70; finished in 1872 a road from Buenos Ayres to Ensenada, and was identified with many other public works in Chili, Peru, and the Argentine Republic. D. at London Sept. 26, 1873, and was buried at Newburyport. His bust was placed many years before in the Chamber of Commerce at Santiago, Chili. His *Life and Industrial Achievements in South America*, by J. B. Alberdi, was published (in Spanish) at Paris in 1876.

Whe'lan (Richard Vincent), D. D., b. at Baltimore Jan. 29, 1809; educated at Mount St. Mary's College, Emmittsburg, Md., where he became a teacher and was "prefect of studies;" graduated in theology and philosophy at the seminary of St. Sulpice, Paris, 1831; was ordained to the priesthood at Versailles the same year; was professor at St. Mary's College 1832–35; performed mission-work at Harper's Ferry, Martinsburg, and other towns of Virginia and Maryland 1835–40; was consecrated bishop of Richmond Mar., 1850; took the title of bishop of Wheeling on the division of the diocese in 1851; settled at Wheeling, where he built up a seminary for young ladies and a convent at Mount de Chantal, and was active in promoting the interests of his Church; was a member of the Vatican Council of 1869–70, and opposed the dogma of infallibility, but gave in his adhesion after its promulgation. D. at Wheeling July 7, 1874.

Whelk [Ang.-Sax. *hwylca*], a name popularly applied in a vague manner to species of gasteropod mollusks belonging principally to the families Buccinidæ and Muricidæ, but more especially to the former, the type of that family (*Buccinum undatum*) being the common whelk of England. The species of the two families agree in having shells whose body-whorls are inflated, whose spire is moderately exserted, while the aperture is notched and more or less produced forward or canaliculated. The animals have elongated filiform tentacles; the eyes placed outside the tentacles; the odontophore or lingual ribbon long and straight, and armed with three longitudinal rows of teeth; and the foot comparatively short. The representatives of the two families are distinguished by differences in the dentition of the odontophore. In the Buccinidæ the median or rhachidian tooth is flat and lamelliform, and generally armed at its anterior margin with denticles arising directly therefrom, and the lateral teeth are broad and armed with a strong external and at least a weaker internal dentiform lobe. In the Muricidæ the rhachidian tooth is thick, solid, and somewhat prismatic, and armed with denticles which project from its anterior edge over the convexity of the outer surface, and the lateral teeth are comparatively narrow at the base, and have each but a single dentiform lobe arising therefrom. No conchological characters are coordinated with these, and the systematic position of the various genera have therefore to be determined each on its own merits. The most noteworthy species of whelks are those of the genera (1) *Buccinum* (and especially *Buccinum undatum*), (2) *Chrysodomus* or *Neptunea*, (3) *Fulgur* or *Busycon*, (4) *Sycotypus*, and (5) *Purpura*, the first four of which are Buccinidæ, and the last Muricidæ. (1) *Buccinum undatum* and some related species are very common in the colder seas, and form one of the chief elements of the food of the codfishes. In England it is a staple article of food, and sold largely in the markets. According to Jeffries, "Evidence was given before a select committee of the House of Commons in the session of 1866, on the 'Whitstable Oyster-fishery Extension bill,' that the whelk fishery on a sandy flat in that bay yielded £12,000 a year, part of the produce being disposed of in the London market for food, and the rest sent to the codfishing banks for bait." Unless sold the day after they are caught in the summer, they are boiled, and may be then kept for some time. (2) The shell of the almond or red whelk (*Chrysodomus antiquus*) of the market is used in the Shetland Islands and some other places for a lamp, being suspended, mouth upward, by a string around the middle or toward the ends, from a nail in the wall or roof. (3–4) The species of *Fulgur* and *Sycotypus* are common to the Atlantic shores of North America, and are the common large univalve shells of the coasts. (5) *Purpura lapillus* is a very abundant species in the northern seas, and may be found in large numbers clinging to the rocks between tidemarks, as well as lower down, and especially where seaweed is abundant. It secretes a purplish fluid, similar to that of the true purple-bearing mollusks which afforded the ancient Tyrian dye, and hence the generic name applied to it.

Theodore Gill.

Whe'lock, p.-v. and tp., Caledonia co., Vt. P. 822.

Whet'stone, tp., Crawford co., O. P. 1490.

Whew'ell (William), D. D., F. R. S., b. in Lancaster, England, May 24, 1794; graduated at Trinity College, Cambridge, 1816; became a fellow there; took orders in the Church of England; was for many years a highly successful tutor; was professor of mineralogy 1828–32, of moral theology or casuistry 1838–55; was master of Trinity College from 1841, and vice-chancellor of Cambridge University from 1855 to his death, at Cambridge Mar. 5, 1866. He long enjoyed the reputation of possessing more universal information than any other man in England. Author of several textbooks on mathematics, mechanics, and dynamics; *Astronomy and General Physics considered with Reference to Natural Theology* (1833), being the third Bridgewater treatise; *A History of the Inductive Sciences from the Earliest to the Present Time* (3 vols., 1837; 3d ed. 1857); *The Philosophy of the Inductive Sciences* (2 vols., 1849; remodelled in 3 parts, 1858–60); *Lectures on the History of Moral Philosophy in England* (1852); *Of the Plurality of Worlds, an Essay* (1853); *Lectures on Political Economy* (1863), and *The Platonic Dialogues for English*

Readers (3 vols., 1859–61), besides many minor works, translations, essays, reviews, and papers in the *Transactions* of learned societies. An account of his writings, with selections from his correspondence, by Prof. Isaac Todhunter, appeared in 1876.

Whey [Ang.-Sax. *hwæg*; D. *wei* or *hui*; Ger. *Molken*], the serum of MILK (which see), obtained when the caseine of milk is coagulated by means of rennet or acids, as in the manufacture of cheese. It forms a clear, straw-colored liquid, and contains the water and sugar (lactose) of the milk. J. P. BATTERSHALL.

Which'cote (BENJAMIN), D. D., b. in Shropshire, England, Mar. 11, 1610; graduated at Emmanuel College, Cambridge, 1629; became a fellow there 1633; became distinguished as a tutor; took orders in the Church of England 1636; was appointed Sunday lecturer at Trinity church and preacher to the university; became incumbent of North Cadbury, Somersetshire, 1643, provost of King's College 1644, and rector of Milton, Cambridgeshire, 1649; favored the Puritans during the great rebellion and the protectorate; was deprived of his provostship at the Restoration 1661, but obtained the living of St. Anne's, Blackfriars, 1662, and the vicarage of St. Lawrence, Jewry, 1668. D. at Cambridge in May, 1683. He was regarded as "one of the heads, if not the chief founder, of the latitudinarian school of English divines," and enjoyed great fame as a preacher. He published nothing during his lifetime, but his friend, the earl of Shaftesbury, whose genius was kindred to his own, edited his *Observations and Apophthegms* (1688) and his *Sermons* (1698); and Dr. John Jeffery edited his *Moral and Religious Aphorisms* (1703) and his *Discourses* (3 vols., 1701–03), to which Dr. Samuel Clarke added a 4th (1707). An edition of *Sermons* (4 vols., 1751) was accompanied by a *Life* by Drs. Campbell and Gerard.

Whidaw-Finch. See WIDOW BIRD.

Whiff, Sail-Fluke, Marysole, or **Carter** (*Lepidorhombus megastoma*), a fish of the flatfish family (Pleuronectidæ), related to the turbot of the northern European coasts. The body is rather elongated, the height being contained two and two-thirds times in the total length, without including caudal; the scales are small and pectinated; the lateral line describes a semicircular curve above the pectoral; the eyes are on the left side, and close together; the teeth in a band on the jaws, and present also on the vomer, but not on the palatines; the dorsal commences on the snout in advance of the eyes; the ventrals have a long base, but are free from the anal—D. 85–87, A. 67–67. The species does not seem to be a very abundant fish anywhere, although, according to Mr. Couch, it is "well known to the Cornish fishermen, who apply the name of 'carter' to it. It keeps on sandy ground at no great distance from land, and takes a bait, so that it is caught as often as any of the salt-water flatfishes, but is not so highly esteemed for the table, chiefly from being so thin." Its nearest representative on the American coast is the *Citharichthys microstomus* of the sandy shores of the Middle States. THEO. GILL.

Whig [a contraction of *Whiggamore*, a local expression which in South-western Scotland denoted a drover] was first introduced into public use in 1648, when a party of Covenanters from that part of the country attacked Edinburgh. From that time all who opposed the court were called *Whigs*, and in 1679, during the debate on the bill for the exclusion of the duke of York from the succession, the term came into common use in English politics. (See TORY.) During the Revolution the American patriots called themselves Whigs, and later (1832–54) there existed a Whig party in American politics. (See UNITED STATES and REPUBLICAN PARTY.)

Whim'brel [from *whimper*], a species of the genus *Numenius* (*N. phæopus*), related to the common curlew (*N. arquata*), but considerably smaller, and hence also called half-curlew and jack-curlew in England. It is found not only in Europe, but also, in the winter season of the northern hemisphere, in Africa and Asia.

Whin. See DYERS' BROOM.

Whin'chat, or **Furzechat,** the *Saxicola* (or *Pratincola*) *rubetra*, a little European bird of the family Sylviadæ. It considerably resembles the stonechat, but is smaller, and is also considerably less than the wheatear. Like the latter, it is highly prized for the table, and is trapped in great numbers in the autumn, when fat. It is an excellent song-bird in confinement. (See CHAT.)

Whip'ple (ABRAHAM), b. at Providence, R. I., Sept. 16, 1733; in early life commanded a merchant-vessel in the West Indies trade; was captain of the privateer Game Cock during the French war 1759–60, capturing in a single cruise 23 French prizes; headed in June, 1772, the expedition which burned the British revenue-schooner Gaspe in Narragansett Bay; was made commodore of two armed vessels fitted out by the colony of Rhode Island June, 1775; became commander of the Columbus Dec., 1775, and afterward of the schooner Providence, which captured more British prizes than any other vessel, but was itself finally taken by the British; was placed in command of the new frigate Providence, with which he adroitly escaped from the blockade of Narragansett Bay; captured 10 richly laden vessels from the Jamaica fleet 1779, and attempted with a squadron to relieve Charleston, S. C., when besieged by the British, but was captured and held a prisoner until the close of the war. He was subsequently a farmer at Cranston, R. I., until 1788, when he became connected with the Ohio Company, and settled at Marietta, O., where he d. May 29, 1819.

Whipple (AMIEL W.), b. at Greenwich, Mass., 1817; graduated at the U. S. Military Academy July, 1841, and commissioned second lieutenant of artillery; transferred to the corps of topographical engineers in September, he served in the survey of various rivers and harbors until 1844; as assistant astronomer of the commission to determine the N. E. boundary between the U. S. and the British provinces 1844–49; and in the same capacity on the Mexican boundary survey 1849–53. In the latter year he took charge of the party authorized by Congress to make the explorations and surveys necessary to ascertain a railroad route from the Mississippi to the Pacific Ocean, upon which he was engaged until 1856; thence to 1861 employed in the improvement of the St. Clair Flats and St. Mary's River, Mich., performing during the same period the duties of lighthouse engineer. As chief topographical engineer he served on the staff of Gen. McDowell until Apr., 1862, when appointed brigadier-general of volunteers, and commanded a brigade in the defences of Washington until September, in which month he was assigned to command of a division of the 3d corps, Army of the Potomac, which he led at Fredericksburg and at Chancellorsville. On the second day of the latter battle he was fatally wounded. D. at Washington May 7, 1863. Brevet lieutenant-colonel, colonel, brigadier, and major general for gallantry.

Whipple (EDWIN PERCY), b. at Gloucester, Mass., Mar. 8, 1819; educated in the public schools of Salem, where at the age of fourteen he began to write for a newspaper; was for some time a clerk in a bank at Salem; entered a Boston banking-house 1837; became its chief clerk; took an active part in the debates of the Mercantile Library Association, and was superintendent of the reading-room of the Merchants' Exchange from its foundation until 1860, since which time he has devoted himself exclusively to literature, being a frequent contributor to the principal reviews and magazines, and a popular lecturer before lyceums and collegiate literary societies, and enjoying a considerable reputation as a critic. Author of *Essays and Reviews* (2 vols., 1848–49), *Lectures on Subjects connected with Literature and Life* (1849), *Character and Characteristic Men* (1867), *The Literature of the Age of Elizabeth* (1869), originally delivered as lectures before the Lowell Institute, *Success and its Conditions* (1871), and a biographical sketch of Macaulay, prefixed to an edition of his *Essays* (New York, 6 vols., 1860). A complete edition of his works appeared in 6 vols. (1871).

Whipple (HENRY BENJAMIN), D. D., b. at Adams, Jefferson co., N. Y., Feb. 15, 1822; was bred a merchant and took an active part in politics; in 1847 became a candidate for holy orders, and pursued his theological studies with Rev. W. D. Wilson, D. D., now professor in Cornell University; was ordained deacon Aug. 17, 1849, in Trinity church, Geneva, N. Y., by Rt. Rev. W. H. de Lancey, D. D.; took charge of Zion church, Rome, N. Y., Dec. 1, 1849; was ordained priest July 16, 1850, in Sackett's Harbor by Bishop de Lancey; became rector of the church of the Holy Communion, Chicago, Easter, 1857; was chosen bishop of Minnesota June 30, 1859; was consecrated in St. James's church, Richmond, Va., Oct. 13, 1859; Bishops Kemper, De Lancey, Burgess, Whitehouse, Cobb, Scott, H. W. Lee, Clark, and Bowman united in the imposition of hands. In 1860, Bishop Whipple, with Revs. I. L. Breck, S. W. Manney, and E. S. Peake, organized the Bishop Seabury mission, out of which has grown the cathedral of Our Merciful Saviour, the Seabury Divinity School, Shattuck School, and St. Mary's Hall, which have made Faribault one of the educational centres of the Northwest. The bishop has been the friend and defender of the North American Indians, and has planted successful missions among them. He is a warm advocate of free churches, and all but four of the churches in the diocese are free. R. W. LOWRIE.

Whipple (WILLIAM), b. at Kittery, Me., Jan. 14, 1730; was in early life a sea-captain in the West India trade; subsequently a merchant at Portsmouth, N. H., where he acquired a considerable fortune; was a member of the pro-

vincial congress 1775, of the Continental Congress 1776; signed the Declaration of Independence; was brigadier-general of New Hampshire troops at Saratoga 1777; co-operated with Sullivan at the siege of Newport 1778; was again a member of Congress 1778–79; was financial receiver of the State of New Hampshire 1782–84, and judge of the superior court from 1782 to his death, at Portsmouth Nov. 28, 1785.

Whip'-poor-will, the common designation in the U. S. of species of birds of the genus *Antrostomus* of the family Caprimulgidæ. These are characterized by the bill being very small; the nostrils shortly tubular; the gape furnished with long, stiff, and sometimes pectinated bristles, which project beyond the end of the bill; the wings broad, rounded, and with the first quill shorter than the third; the tail broad and rounded; and the tarsi moderate and partly feathered above. The chief distinctive characters, in contrast with the night-hawks, are found in the bristled gape and the form of the tail, and in this respect, as well as others, the species agree with those of the genus *Caprimulgus*, or the typical goatsuckers of the Old World, to which they are, indeed, very closely related. "The common species, and presumably the others, are nocturnal in their habits, remaining silent and keeping within the shady recesses of the forests during the daytime. As soon as the sun has disappeared and the night-insects are in motion" they leave their retreats for exercise and in search of food. In the early part of the evening, and then for only a brief period, they emit the peculiar cry which is intended to be expressed by the popular name. These notes are repeated with great rapidity, but with clearness and power, six or seven times in as many seconds. They are to be heard, however, chiefly in clear weather, and not during rain. In the daytime their haunts are deep ravines, shady swamps, and extensive pine-groves. Their flight is effected "by easy flapping of the wings, with occasional sailings and curving sweeps," and they repeatedly pass and repass over the same area in their search for insects. They lay their eggs upon the ground, generally in the midst of fallen leaves, and make no regular nest. Their eggs are usually two in number, and are white and more or less spotted. By Baird, Brewer, and Ridgway four species are recognized as inhabitants of North America—viz. (1) *A. carolinensis*, inhabiting the Louisianian region of the U. S.; (2) *A. vociferus*, occurring in the eastern provinces generally of North America; and (3) *A. Nuttallii*, representing the genus in the western portions of the U. S. from the Plains to the Pacific; while (4) a species closely related to the *A. vociferus* is the *A. macromystax* of Mexico (variety *Macromystax*) and Cuba (variety *Cubanensis*). THEODORE GILL.

Whirl'wind, the general term applied to such storms as are specifically known as hurricanes, cyclones, typhoons, etc., and whose miniatures are found in the tornado and waterspout. In these storms the air over a large region of the earth is in a state of rotation about a central space within which comparative calm exists. While very many violent storms occur without being well-developed whirlwinds, yet the existence of the latter class of storms is well established. The formulæ connecting the barometric pressure and the velocity of the wind have been given by Ferrel (1861 and 1874), and by Colding (1872) and Hann (1875). The resemblance between these whirlwinds and the movements of water in whirlpools has been dwelt upon by Colding, but the latter are generally so small in extent that the rotation of the earth has but little influence upon them, while it is quite perceptible in the case of the whirlwind. The smaller whirlwinds, such as waterspouts, etc., revolve in either direction with equal frequency; the larger ones, however (the cyclones, etc.), invariably revolve from E. through the N. in the northern hemisphere, and from E. through the S. in the southern hemisphere. These, which are the whirlwinds *par excellence*, usually begin within the tropics, and after moving slowly westward and away from the equator for several days, turn in their course, and advance eastward, still moving away from the equator. The progress of one and the same storm has thus been traced for fifteen consecutive days, though usually they are only traceable for from seven to twelve days. These storms require for their initial development a large area of warm, moist, quiet air and the formation of cloud or rain; and if not fed by currents of moist air, they die out; they are therefore most frequent in the hottest months of the year—*i. e.* from July to November in the North Atlantic, and from January to March in the South Pacific. Extensive catalogues of hurricanes have been compiled by Poey for the Atlantic, and by Meldrum for the Indian Ocean, from which it would appear that a maximum and minimum number of storms occur in those years in which the sunspots have respectively the greatest and the least frequency; this may be an accidental coincidence. If, however, it be a law of nature, it may possibly be explained as due to the greater or less amount of moisture evaporated by the sun's heat, which is perhaps variable to a slight extent. The diameter of the mass of air affected by a rotatory movement about the centre of a whirlwind is occasionally, in an extreme case, 3000 miles at the close of its course, having grown to this dimension from an initial diameter of 50 or 100 miles. After attaining its maximum dimensions, a whirlwind is ordinarily broken up into several smaller storms, owing, generally, to the fact that the winds on its circumference, as they encounter continents and mountains or masses of cold air, are raised up, and by condensation of their moisture give rise to new independent storm-centres. The tornadoes and waterspouts frequently are observed attending large whirlwinds, and usually on the equatorial side of the main storm; both of these seem to have their origin and principal development in the lowest stratum of clouds, and only occasionally set the air below them in motion so as to reach down to the earth. Sandstorms and the whirls that form over extensive fires, on the other hand, originate in the heated air ascending from the surface of the ground. It is probable that a mass of cold air descending nearly vertically and quite uniformly would acquire a rotatory motion; indeed, it is maintained by Faye that this is the general type of summer hailstorms, but this theory has not yet been generally received. It is, however, not denied that downward currents form an important feature in all summer thunderstorms; when heavy falls of rain take place in such storms, the falling rain and hail mechanically carry down with them a considerable amount of cool damp air, but it does not seem certain that any rotatory motion results therefrom. The theory of Faye seems to have been suggested by the phenomena of the solar spots (see SUN), which he attributes to whirlwinds on the solar surface.

The direction of motion of a whirlwind depends, if it be a small one, upon the general movement of the current of air in which it is found, and to a less extent upon the supply of moisture and the process of condensation. In large whirlwinds the conditions are reversed, and the storm as a whole moves toward the region whose topography, winds, relative humidity, and temperature are so related that the condensation is going on most rapidly, or where the greatest condensation is about to be. This principle, announced at Cincinnati in 1869, has been also independently arrived at by Mohn (1871), and is, in fact, a simple consequence of the laws whose discovery is due to Espy (1841, etc.) and Ferrel (1860). According to these, the liberation of latent heat that takes place on the formation of cloud and rain is the motive-power that maintains the air in its motion, while the condensation of the vapor into cloud and rain is a consequence of the mechanical cooling of the air due to its expansion when it is forced or drawn up to greater elevations. By following as closely as our imperfect means will allow the complicated process of evaporation, ascent, cooling, condensation, and evolution of latent heat through which the aqueous vapor of the air circulates in a ceaseless round, we are able to approximately explain from day to day the path of storms as is required in weather-predictions. The latest work explanatory of the whirlwinds and other movements of the atmosphere is an important memoir by Profs. Guldberg and Mohn of Christiania, Norway, entitled *Études sur les Mouvements de l'Atmosphère* (Christiania, 1876). (See also STORMS.) C. ABBE.

Whis'ky, or **Whiskey** [Gaelic and Irish, *uisge*, "water," whence *uisge-beatha*, commonly written *usquebaugh*, "water of life"], the spirituous liquor obtained by distilling fermented infusions of barley, rye, wheat, corn, oats, etc. According to some authorities, the art of distillation was first introduced in England in the reign of Henry II., but it is more probable that it was known and practised in Ireland previous to this date, having been acquired by the inhabitants of that country from India. Directions for preparing *usquebaugh* or *aqua vitæ* are contained in the *Red Book of Ossory*, compiled about 500 years since, at which time it was chiefly used as a medicine, being considered a panacea for all diseases. The term "whisky" appears to have been first confined to the liquor obtained in the Highlands of Scotland from barley, its general application being of a more recent date. Spirits that contain over 60 per cent. of alcohol are termed "high-wines" or common spirits; those containing 90 per cent. of alcohol are known as "cologne spirits," the name whisky being usually given to the product of a former distillation containing about 50 per cent. by weight of alcohol. In Great Britain the largest amount of whisky is made in Scotland and Ireland; in this country the principal supply comes from Illinois, Ohio, Indiana, Kentucky (termed Bourbon whisky, from Bourbon co., Ky.), Pennsylvania (Monongahela co.), and New York, a smaller quantity being manufactured in Tennessee, Missouri, and California; large quantities of whisky

are also made in Canada, near Toronto. The grains used vary greatly in composition. In Scotland and Ireland malted barley is extensively employed, but a mixture of malted barley with raw grains (rye, oats, etc.) is also very largely used. In the preparation of Bourbon whisky a mixture of 50 to 60 per cent. of Indian corn with 40 to 50 per cent. of small grain (containing about 10 per cent. malt, the balance being rye), is taken; for Monongahela whisky only rye is used, it being mixed with 10 per cent. of malt; while in Canada a mixture of rye, wheat, or corn with 5 per cent. of malted barley is chiefly employed. The quantity of alcohol afforded by the different grains is influenced by the proportion of starch, including the small amount of sugar, they contain; 2 pounds of starch will give a quart of spirit containing 30 per cent. of alcohol, or 100 pounds of starch will give 35 pounds of alcohol, equal to 4.375 imperial gallons. One hundred pounds of the following grains afford the following quantities of a spirit containing 45 per cent. of alcohol: Wheat, 40 to 45 pounds; rye, 36 to 42 pounds; barley, 40 pounds; oats, 36 pounds; buckwheat, 40 pounds; maize, 40 pounds. In the manufacture of whisky the starch of the grain is first changed into dextrine and glucose in the process of *mashing*, chiefly by the action of the *diastase* (a peculiar nitrogenous substance formed by the germination of the grain), which, although it exists in malt only in the very small proportion of 0.003 per cent., must be present in order that the conversion shall take place rapidly. Yeast is next added to the saccharine liquid to induce fermentation, by which the sugar is converted into alcohol and carbonic acid; and the alcohol is finally concentrated by distillation. The essential features of the process of whisky-making are therefore the preparation of the vinous mash and the distillation of the alcohol.

Preparation of the Mash.—A quantity of water of a temperature of 150° F. is first run into the mash-tub, which is best made of circular cast-iron plates, and then the ground mixture of malt and grain is added, the intimate mixture of the two being effected by briskly stirring with wooden oars, which, in large establishments, are operated by machinery. The malt used should be lightly kiln-dried by the heat of steam to avoid imparting an empyreumatic smell to the product, although this flavor is agreeable to some persons, and was formerly purposely given to whisky (notably to the famous "poteen whisky" of Ireland) by drying the malt by means of burning turf. During the process of mashing the liquid gradually acquires a sweet taste and a greater specific gravity. When it has attained its maximum density, it is drawn off, and more water, of a temperature of 190° F., added to the residual grain and allowed to infuse with it for one to two hours. This second wort is added to the first, and a third quantity of boiling water poured over the remaining mixture, which is afterward used for the first liquor in the mashing of fresh meal and malt. In beer-making (see BEER, by PROF. C. F. CHANDLER), the brewer does not require complete saccharification, some dextrine being necessary; but the distiller desires to obtain the greatest amount of sugar possible. The mash is next cooled down to the proper temperature for fermentation (70° F.) by passing it through a series of pipes surrounded by cold water, and it is then introduced into the fermentation-vat. Formerly, 4 per cent. of yeast was added to the wort, but at present not over 1 to 1½ per cent. is used, three-fourths of which is added directly, the remainder only after the second day of the process. As fermentation advances, the temperature of the wort increases about 20° F., but it should not be allowed to attain to over 95° F., in order to avoid acetification, which can be detected by an increased density of the wort and by the odor of acetic acid. The time occupied in the process of fermentation varies from three to nine days. Owing to the disappearance of the sugar and the formation of carbonic acid and alcohol, the specific gravity of the liquid decreases, the operation being considered finished when the greatest degree of attenuation has been reached. Distillers strive to reduce the density of the wort to that of water, but even then a considerable quantity of sugar remains undecomposed, sometimes amounting to one-fifth of the entire saccharine matter. This difficulty is due to the fact that the alcohol first formed tends to prevent the further decomposition of the remaining wort into sugar, and can be remedied by removing the alcohol as soon as it is produced by diminishing the pressure in the fermentation-vat with an air-pump, which enables the alcohol to be distilled off at the low temperature of 125° F. In England, however, the use of this device is prevented by the excise law, which prohibits the simultaneous carrying on of fermentation and distillation. When, instead of a mixture of raw grain and malt, only the latter is taken, the process employed is slightly different. Five hundred bushels of the ground malt are first mashed with 9000 gallons of water having a temperature of 160° F., and as soon as saccharification has taken place, 6000 gallons of the wort are drawn off and cooled to 60° F., after which it is run into the fermentation-vat and a mixture of London porter yeast and quick Scotch barm added. The fermentation is usually completed at the end of two or three days, when 1 pound of soap is added for every 100 gallons of the mash, and the mixture introduced into the still. In malt whisky distilleries 1 bushel of malt should yield 2 to 2½ gallons of proof spirits. In localities where potatoes abound, this root is occasionally employed for the preparation of a vinous mash. The dry substances of potatoes constitute about 28 per cent., three fourths of which is starch. The conversion of this starch into glucose can be effected either by the action of malt or by that of dilute sulphuric acid. In the former case, the potatoes, after cleansing, are cut into small pieces and thoroughly incorporated with boiling water, malt (generally a mixture of malted rye and barley) then being added, and the process of mashing and cooling conducted as described above. The proportion of malt used is variable, but 5 per cent. is the average amount employed. In the preparation of the mash by the use of sulphuric acid, the raw potatoes are first converted into a pulp, which is thrown into a large vat containing water. When the starch has settled to the bottom of the vessel, the supernatant liquid, which contains the albumen of the potatoes, is removed by means of a siphon, and the residue transformed into glucose by boiling with a very diluted sulphuric acid for about five hours, the point of complete conversion of the starch being ascertained by the iodine test. The fluid is next run through a wooden strainer, in order to remove the cellular tissue present, and the free acid is neutralized by the addition of chalk. The precipitated gypsum is then allowed to settle, the clear liquid being now ready for the fermentation-vat. The fermentation of potato-mash is carried on in a manner similar to that employed with malt, 4 per cent. of yeast being added, and from sixty to seventy hours required for the operation. One hundred pounds of potatoes afford about 16 pounds by measure of proof spirits. In Germany and Holland, where the sugar-beet is extensively cultivated, the poorer grades of a crop are often converted into spirits by fermentation and distillation, the process of mashing being omitted, as the sugar exists ready formed in the beet-root. Spirits can also be obtained from horse-chestnuts, acorns, etc., by proper treatment; 100 pounds of the former can be made to yield 34 pounds of a spirit containing 36 per cent. of alcohol. In the preparation of alcohol from this source the addition of 10 per cent. of barley malt is advisable. During the fermentation of the mash in the preceding operations it is customary to expose the vats to the action of the atmosphere for the first few days, after which time they are tightly closed, in order to prevent the escape of the carbonic acid and the formation of acetic acid. The products of the fermentation of saccharine solutions include, in addition to carbonic acid and alcohol, small proportions of glycerine ($C_3H_8O_3$) and succinic acid ($C_4H_6O_4$).

Distillation of the Mash.—The fermented wort consists of volatile and non-volatile substances, the former comprising water, alcohol, fusel oil (a mixture of amylic, butylic, and propylic alcohols), small amounts of acetic acid, etc., the latter being vegetable fibre, decomposed and undecomposed yeast, malt, grain, salts, and small quantities of lactic and succinic acids and glycerine. Upon heating it to boiling in a still (see DISTILLATION) these bodies are separated, the vapors given off consisting essentially of alcohol and water. The boiling-point of the mixture is intermediate between that of alcohol and water (173° and 212° F.), but as the process of distillation advances it becomes higher and the proportion of water carried over increases. In Great Britain the fermented mash is removed from the residual grain contained in the fermentation-vat before its introduction into the still; but in this country the entire mash is often taken, by which mode it is asserted that a larger yield of alcohol is furnished. The first distillate from the mash is termed "low-wines" or "singlings" which on redistillation constitute the "faints," the term whisky being usually applied to the spirit obtained by the distillation of the "faints," although diversity exists in the method of separating, purifying, and naming the different grades of spirit. It is not possible by simple distillation to completely separate the water from the alcohol, the purest spirit that can be obtained in this way still containing 11 per cent. of water. By carrying on the distillation to the farthest point, in order to obtain the greatest possible quantity of alcohol, a danger of promoting the formation of fusel oil is incurred, as this mixture boils at a much higher temperature than alcohol. Fusel oil has an unpleasant fiery and nauseous flavor, which is communicated to spirits containing it. Its complete removal can be effected by diluting the contaminated alcohol with water and redistilling, only the first part of the distillate being collected;

but owing to the great expense thus incurred, this is seldom resorted to. Fusel oil is chiefly contained in spirits prepared from potatoes, although it is also often present in that obtained from grain, especially when the solid substances introduced into the still have been allowed to become strongly heated, and undergo destructive distillation. The very numerous improved stills employed at present in the manufacture of spirits effect the separation of the alcohol and water either by causing the mixtures of alcoholic and aqueous vapors to pass through the alcohol at first distilled, by which heat is generated and a secondary evaporation of the alcohol induced, or by cooling the mixed vapors to such a degree that only the water and fusel oil are condensed and returned to the body of the liquid. Coffey's still, which is extensively used in Great Britain, is based upon the latter principle. Whisky-distilleries are frequently of a very large size; at Banagher, Kings co., Ireland, an establishment capable of producing over half a million gallons per annum has lately been erected. The manufacturer of whisky seldom purifies the spirit he obtains, but disposes of it to the rectifying distiller, who frees it from the fusel oil and other noxious impurities present. The nauseous smell and taste of bad whisky are often removed by filtration through, or distillation from, charcoal. Fusel oil can also be removed by oxidation with manganic acid (Attwood's process), by agitating the contaminated spirit with olive oil, or by distilling it from "gray salt" (caustic potash or soda) and "white salt" (pearl-ash); likewise by agitating 665 parts of the spirit with 1 part of bleaching-powder, when a flavor resembling that of brandy is imparted to the product. A very large proportion of the whisky consumed in this country and elsewhere is artificially prepared by reducing the raw products of the distillation of malt or potato spirits with water, and adding certain substances to give a desired flavor. Creosote, for instance, is sometimes added to impart a whisky-flavor to inferior grades of spirit; methylic alcohol is also used, but probably to a less extent. The following are examples of some of the *least harmful* mixtures employed in the fabrication of whisky: For Bourbon whisky, proof spirits, 40 gallons; peach flavoring, ½ gallon; hickory-nut flavoring, ½ gallon; brandy, ½ gallon; wine vinegar, 1 pint; glycerine, 1 pint. For copper-distilled Bourbon whisky, sulphate of copper dissolved in water, 1 drachm; proof spirit, 40 gallons; peach flavor, 1 gallon; brandy flavor, 1 gallon; wine vinegar, 1 pint; glycerine, 1 pound; oil of cognac (a mixture of fusel oil and œnanthic ether), dissolved in alcohol, 12 drops; color with caramel. For rye whisky, proof spirit, 40 gallons; peach flavoring, 2 gallons; white vinegar, 1 pint; oil of cognac, 12 drops. A large amount of inferior whisky is exported to Holland and France, and returned in the form of "gin" and "brandy." The last-named liquors are extensively prepared from the following recipes: For brandy, dilute alcohol to proof, and to every 100 pounds add ½ to 1 pound argol dissolved in water; then add some French raisins and good cognac, and distil (the addition of argol and cognac introduces "œnanthic ether" or ethylic pelargonate), and if a little acetic acid be also added, the characteristic flavor of genuine cognac brandy is obtained; the mixture is then colored by burned sugar, astringency being imparted by means of tannic acid. For gin, add to 900 gallons spirits juniper-berries 95 pounds, coriander seeds 95 pounds, crushed almond-cake 47 pounds, angelica-root 2 pounds, liquorice powder 2 pounds, and distil. Upon adding caustic potash to a sample of whisky that has been prepared from potato spirit, distilling, and treating the residue with sulphuric acid, a disgusting odor is emitted; whisky made by the distillation of fermented grain gives, under the same treatment, a doughy smell. The presence of fusel oil in a liquor will often become apparent on simply removing the alcohol by evaporation; it is also detected by distilling the sample and adding sulphuric acid to the portion that distils between 230° and 240° F., when a red color will be produced; or by treating this portion of the distillate with sulphuric and acetic acids, when amylic acetate will be evolved; likewise by oxidation with bichromate of potash and sulphuric acid, by which the characteristic odor of valerianic acid will be engendered. If a small quantity of nitrate of silver is added to a spirit containing fusel oil, this latter compound separates in the form of a black powder on allowing the mixture to stand exposed to the sunlight for a short time. The presence of creosote can often be detected by its imparting a blue color to ferric chloride. Pure whisky, when recently prepared, is nearly colorless, but if preserved in casks it gradually acquires a brownish color. It contains minute quantities of acetic, butyric, and valerianic acids, and, if distilled from a copper still, traces of this metal may also be present. It has a sp. gr. ranging between 0.922 and 0.94, and should contain from 48 to 56 per cent. (by weight) of absolute alcohol.

In Great Britain and in this country the excise on whisky has for many years been so great a source of revenue to the government that there is no doubt of the fact of this and other spirits being consumed in a much larger quantity than is consistent with health and morality. In the U. S. an excise was first imposed on spirits in 1791. This was removed shortly afterward, but was again restored in 1812. Since then the amount of tax has varied greatly; in 1862 it was 20 cents per proof gallon; in 1864 it ranged from 60 cents to $2; in 1868 it was 50 cents; in 1872, 70 cents; and at present it is 90 cents. During the year ending June, 1875, over 61 million gallons of distilled spirits were manufactured in this country, of which 130,460 gallons were exported. The state of Illinois furnishes the largest amount of the spirits made in the U. S. The following is the value of the production of several States during the year 1875:

Illinois	$14,111,398
Ohio	9,958,116
Kentucky	7,002,786
Indiana	3,954,340
New York	3,237,570
Pennsylvania	1,894,282

Besides its consumption as a beverage, whisky is extensively employed in the preparation of alcohol, which in this country is exclusively obtained from this source. It is also used to some extent in medicine as a substitute for brandy, and if pure it is doubtless to be preferred to the grades of this latter liquor most commonly met with in the U. S. J. P. BATTERSHALL.

Whis'ky Run, tp., Crawford co., Ind. P. 1127.

Whist, a famous and perhaps the most intellectual of all the games played at cards. Its existence in its primitive form is recognized by unmistakable data in English literature for several centuries past, but, like all matters of art and science, its history is traced and marked by many steps in the progress of its development, both in its name and the elementary powers of its combinations. The present name of the game and the country of its origin have both been disputed, but, according to the best authorities, both are due to England. The old English word "whist," meaning silence, eminently distinguishes the character of the game, and furnished a most fitting name for it. One of its fundamental rules is, that there shall be no talking at the table between the parties engaged in the play. The only language there expressed, according to strict rule, is that of the cards as they are exhibited in the order of their presentation. To understand and correctly interpret this language, and act promptly upon its true meaning and import, calls into exercise several of the highest qualities of the human mind, especially those fitting one for the bar. Edgar A. Poe well said: "It is a game of circumstantial evidence."

It is not the object of this article to go into a history of the game, or to give any instructions to novices. It is intended only for those who are well acquainted with the fundamental terms and definitions, as well as the usual rules now prevailing in its practice, and to cite the entirely uninformed to those authorities from which the best information as to minutiæ can be obtained. Suffice it on these points here barely to say that for several centuries whist, under different names, had been slowly developing in its progress in England, as stated, when, for the first time in 1733, it was regularly systematized and actually taught as a science by Edmund Hoyle. This new system, in which he gave lessons as a teacher or professor, was published in 1743, and was eagerly sought after everywhere. It soon passed through many editions, was translated into French and other European languages, and at an early day after its publication found its way into several of the royal courts of the Continent as well as the court of England. Lord Byron truly said that "Troy owes to Homer what whist owes to Hoyle." Several British writers succeeded Hoyle in publications upon the same subject during the first century after the publication of his great work. Of these, Thomas Matthews, Esq., was the chief. In the mean time several books were written upon the same subject in France, where the new game was enthusiastically espoused. It was a great favorite with Louis XV. "The nobles," says a French writer, "had gone to England to learn to think, and they brought back the thinking game with them." Talleyrand, it has been said, was the great player in France in his day. A remark imputed to him has become famous: "You do not know whist, young man? What a sad old age you are preparing for yourself!" None of the works, however, published either in England or France during the period referred to, materially changed or modified the system established by Hoyle. They were all built upon it, and only suggested improvements in practice. But the greatest stride in the progress of the development of the game since the days of Hoyle

has been within the last quarter of a century. This originated, says an able writer in the *London Quarterly Review* for Jan., 1871, with "a knot of young men at Cambridge of considerable ability, who had at first taken up whist for amusement, and found it offer such a field for intellectual study that they continued its practice more systematically with a view to its complete scientific investigation. The result of the labors of this club was the three great modern works upon whist—those of Cavendish, Clay, and Pole. "Taken together, these books (which ought to be combined in one volume)," says the reviewer referred to above, "furnish a complete epitome of the game, presenting it, both theoretically and practically, in the perfect state at which it has now arrived by continued study and practice during the two centuries which have elapsed since it first assumed a definite shape and took its present name." This system, which is now styled in England "the modern scientific game of whist," differs in no essential from that of Hoyle. It is indeed nothing but an improvement on his. Its chief feature is the bringing the two hands of the partners respectively into co-operation with each other, so that they may act in concert as two divisions of an army. This co-operation is brought about by certain signals known as "the language of cards," as stated before, and of close observation of the cards which fall from the hands of their adversaries respectively. To establish this co-operation effectually requires that both partners shall act upon the same general basis in the beginning and progress of the game. The "long-suit" system is adopted as the general basis in the beginning. The first lead, therefore, of any player is an indication to his partner that he holds more cards of that suit than of any other. The first lead of the opposite partner, whether he takes the trick or not, is not to return his partner's lead, but in like manner to indicate *his* longest suit. The joint object now, then, between them both is to get trumps out of the way and bring both their long suits into play. In this system the proper use of trumps is of the utmost importance. On that point Pole should be especially consulted. One point only will here be stated, and that is the signal of one party to the other calling for trumps. This consists in throwing first a higher card upon a lead of a card that cannot be taken, and a lower one upon the next similar lead. For instance, if a right-hand adversary leads an ace, and the second player throws a six upon it, and the first player follows with the king of the same suit, and the second player throws a three upon it, this is an indication to his partner to lead trumps as soon as possible. (For further explanation the student must refer to the authorities above stated.)

Our space will barely allow us to present in succinct form the general rules which govern the system, as set forth by the reviewer referred to. These are as follows: (1) Lead from your most numerous suit. Begin with the lowest, unless you have several high cards, as mentioned in the text.* (2) Lead your own long suit before you return your partner's, *unless he leads trumps*, which return immediately. (3) In returning your partner's suit, if you have only two left, return the *highest*; if more, the lowest. (4) But in any position, if you hold the best card, play it the second round. (5) *Holding five trumps, lead them* or call for them. (6) Look out for your partner's call for trumps, especially if weak in them yourself. If he calls, and you hold not more than three trumps, lead the *highest*; if more, the lowest. (7) Second hand, generally play your lowest. (8) Do not trump a doubtful trick, second hand, if you hold more than three trumps; with three or less, trump fearlessly. (9) Do not force your partner if you hold less than four trumps yourself, but force a strong *adverse* trump hand whenever you can. (10) Discard from your weakest suit. (11) If not leading, always play the lowest of a sequence. (12) Be very careful in the play of even your smallest cards, every one of which will convey information to your partner.

This system applies as well to what is known as long whist as short whist. In long whist the game consists in securing and scoring ten points, and in these points *honors*, as they are styled, enter as an important element in the count. The honors are the four face-cards of the trump suit. If two partners happen to hold all these between them, they score four for "honors," besides the odd tricks they make; that is, all over six, which constitute what is called "the book." If they hold three only between them, then they score two. If each set of partners holds two between them, then honors are said to be "easy," and neither side scores anything for honors. Honors are not counted by either side which has already reached a score of nine. Either side at a score of eight may call for honors; that is, one partner holding two may call upon his copartner "Have you an honor?" or "Can you one?" If he can, or has an honor, the game is ended; but if this call is not made at the proper time—that is, just before the partner calling makes his first lead—then the honors so held avail nothing if the adversary party make their score of ten on that hand by tricks.

In 1800 what is known as "short whist" was introduced into England. In it the game consists of five points instead of ten, and no honors are counted. In this country short whist has been extended to seven points, without counting honors in the score. This is perhaps the most interesting form in which the game is now played in the U. S. The Germans have introduced another modification of whist, which is exceedingly entertaining and interesting. Under this system the old score of ten points for game is retained, without counting the honors. An important feature under their system is that the trump card is not determined by the deal. The partner of the dealer has the right first to name the trump. If he fails to name it, then the dealer has the right to name it, and if he fails to do so, then the left hand adversary has the right to name it. If he fails, then there is a new deal, as it becomes evident that the fourth hand has most of the controlling cards of some suit. Another important feature of this system is, that if the party making the trump fail to make at least one odd trick—that is, one trick over what is called "the book," which, as stated, consists of six tricks in all forms of whist—then they subject themselves to the following forfeitures: to wit, their adversaries will be entitled to score two points for every trick they make over the book. If they make one odd trick, as it is called, they score two points; if two, four; if three, six, etc. This feature requires great caution as well as sound judgment in making the trump, and adds a great deal to the interest of this form of the game.

ALEXANDER H. STEPHENS.

*In the reviewer's text he had stated that in case the long suit contained two or more high cards, such as ace and king or king and queen, etc., then the high cards should be led first.

Whist'ler (GEORGE WASHINGTON), b. at Fort Wayne, Ind., May 19, 1800; graduated at West Point 1819; served on the northern boundary commission 1822–28 as a member of the engineer corps, from which he resigned 1833; was constructing engineer of Baltimore and Ohio and Susquehanna and Western R. Rs., and became in 1842 chief engineer of St. Petersburg and Moscow R. R., Russia, where the rails, locomotives, and cars were constructed under his supervision; and employed in the construction of extensive dockyards and in the improvement of Russian rivers and harbors. D. at St. Petersburg Apr. 7, 1849. —His son, GEORGE WILLIAM, b. at New London, Conn., in 1822, under his father became civil engineer 1849; was connected with railroads in the U. S.; superintendent of the Erie and New York and New Haven R. R.; had considerable knowledge of railway machinery and the management of railways; in 1856 went to Russia, and took charge of and completed the railroad of which his father had been engineer. D. at Brighton, England, Dec. 21, 1869.

Whis'ton (WILLIAM), b. at Norton, Leicestershire, England, Dec. 9, 1667; educated at Tamworth School; graduated at Clare Hall, Cambridge, 1690; obtained a fellowship there, and became a mathematical tutor; took orders in the Church of England 1693; was chaplain to Dr. Moore, bishop of Norwich, 1694–98, and vicar of Lowestoft 1698–1701; became deputy to Sir Isaac Newton in the Lucasian professorship of mathematics at Cambridge 1701, and succeeded to that chair on the resignation of Newton 1703, but was deprived of it and expelled from the university Oct. 30, 1710, in consequence of having expressed Arian views in the Boyle lectures; was pronounced a heretic by the convocation of 1711; was pardoned by an "act of grace" 1715; removed to London, where he gave private lectures on astronomy and natural philosophy; was an active writer on theological subjects; became a Baptist and a Millenarian, and gathered a congregation in his own house to which he expounded "primitive Christianity" and predicted the advent of the millennium and the restoration of the Jews to Palestine in 1766. D. in London Aug. 22, 1752. Author of *A New Theory of the Earth* (1696), *The Accomplishment of Scripture Prophecies* (1708), *Prælectiones Physico-Mathematicæ* (1710), *Primitive Christianity Revived* (5 vols., 1711–12), *A Brief History of the Revival of the Arian Heresy in England* (1711), *Athanasius convicted of Forgery* (1712), *Three Essays on Trinitarianism* (1713), *A Vindication of the Sibylline Oracles, to which are added the Genuine Oracles themselves* (1715), *Astronomical Lectures* (1715), *St. Clement's and St. Irenæus's Vindication of the Apostolical Constitutions, etc.* (1716), *Sir Isaac Newton's Mathematical Philosophy demonstrated* (1716), *Astronomical Principles of Religion, Natural and Revealed* (1717), *A Letter to the Earl of Nottingham concerning the Eternity of the Son of God and of the Holy Spirit* (1719), *The True Origin of the Sabellian and Athanasian Doctrines of the Trinity* (1720), *An Essay towards Restoring the True Text of the Old and New Testa-*

ment (1722), containing translations of the passages in which the Samaritan Pentateuch differs from the Hebrew; *The Literal Accomplishment of Scripture Prophecies* (1724), *A Collection of Authentic Records belonging to the Old and New Testament, translated into English* (2 vols., 1727–28), *Historical Memoirs of the Life and Writings of Dr. Samuel Clarke* (1730), *The Primitive Eucharist Revived* (1736), *The Eternity of Hell Torments considered* (1740), *The Primitive New Testament* (1745), *The Sacred History of the Old and New Testament* (6 vols., 1745), *Memoirs of the Life and Writings of Mr. William Whiston, etc., written by himself* (2 vols., 1749–50), and numerous minor works; edited in Latin Moses of Chorene's *Historiæ Armeniæ* (1736), and made a translation of the *Works* of Josephus (folio, 1737), which, though very inaccurate, has not yet been superseded, except in part.

Whit'aker (Alexander), b. in England about 1585, son of Rev. William Whitaker, D. D., master of St. John's College, Cambridge; graduated at that university; took orders in the Church of England; was for a time minister of a parish in the north of England; settled at Henrico, Va., in 1611; built there a church and parsonage; baptized Pocahontas and married her to John Rolfe. Author of *Good Newes from Virginia* (London, 1613), one of the first works written in Virginia.

Whitaker (Daniel K.), LL.D., grandson of Rev. Nathaniel Whitaker, D. D., and second son of Rev. Jonathan Whitaker, was b. at Sharon, Mass., Apr. 13, 1801; educated at Harvard University, where he obtained the Boylston and Bowdoin prizes for English composition and oratory, and graduated in the class of 1820, distinguished for its eminent scholars; studied law, and moved to South Carolina, where he was received as a partner in the profession by ex-Gov. John Lyde Wilson of that State. His success at the bar was eminent, but his taste was for letters, and he became the founder and editor of several periodicals, among which was the *Southern Literary Journal*, *Whitaker's Magazine*, both monthlies, and the *Southern Quarterly Review*, commenced in 1841, and published in Charleston, S. C. This review maintained a high position until the beginning of the late war. In 1866 he moved to New Orleans, La., where he is now (Sept., 1875) in full intellectual vigor, engaged in editing the New Orleans *Monthly Review*, a periodical established by him, and the only one of the kind in the South-west. He is also corresponding secretary of the New Orleans Academy of Sciences. A. H. Stephens.

Whitaker (John), b. at Manchester, England, about 1730; educated at Oxford, where he became fellow of Corpus Christi College 1753; took orders in the Church of England; was curate of Bray, and subsequently of Newton; was for a short time morning preacher at Berkeley chapel, London, 1773, and became in 1778 rector of Ruan Langborne, where he d. Oct. 30, 1808. Author of a *History of Manchester* (1771; new ed., 3 vols., 1775), *The Genuine History of the Britons* (1772), *Mary Queen of Scots vindicated* (3 vols., 1787), *The Origin of Arianism disclosed* (1791), *The Course of Hannibal over the Alps ascertained* (2 vols., 1794), *The Ancient Cathedral of Cornwall historically surveyed* (2 vols., 1804), *The Life of St. Neot, the eldest Brother of King Alfred* (1809), a *Review* of Gibbon's *History*, and other works.

Whitaker (Joseph), b. at London, England, May 4, 1820; brought up to the business of a bookseller; edited for J. W. Parker the *Morning and Evening Church Services* (2 vols., 1843); projected and edited *Tracts for the Christian Seasons* (2 series, 4 vols., 1849–51) and *Tracts for Parochial Use* (7 vols., 1849–51); founded *The Penny Post* (1849), a Church magazine, *The Educational Register* (1850–53), and *Whitaker's Clergyman's Diary* (1851–53); edited the *Gentleman's Magazine* (new series, vols. i.–vii., 1856–59); commenced in 1858 his valuable bibliographical journal, *The Bookseller*, and in 1868 *Whitaker's Almanac*, a useful annual.

Whitaker (Mrs. Mary Scrimgeour), b. in Beaufort district, S. C., Feb. 22, 1820, daughter of Rev. Samuel Furman, D. D., a distinguished Baptist divine of South Carolina, and wife of Dr. Daniel K. Whitaker. On the mother's side she is a descendant in a direct line from the illustrious houses of Scrimgeour, Montrose, and Dundee. At an early age she was sent to Edinburgh, where she completed her education; in 1850 a volume of her poems was published, which elicited high encomiums from the best American writers; in 1867, *Albert Hastings*, a novel of great merit, made its appearance. From early life she has been devoted to letters, and besides the two works mentioned has contributed largely to the periodical literature of the day. A. H. Stephens.

Whitaker (Rev. Nathaniel), D. D., grandfather of Daniel K. Whitaker, LL.D., was b. at Long Island, N. Y., Feb. 22, 1732; graduated at Princeton College during the presidency of Dr. Burr; entered the ministry, and took charge of a church at Norwich, Conn., where he remained until 1766, when he was deputed by the Scotch Society for the Advancement of Learning (of which there was a branch in Connecticut) to visit Scotland, England, and Wales for the purpose of obtaining donations for the establishment of an institution of learning in America for the education and christianization of the North American Indians. He carried with him Rev. Samson Occom (which see), an educated Indian of the Mohegan tribe, who had been licensed to preach by the Presbyterian denomination. The General Assembly of the Church of Scotland received the visitors with open arms, and warmly sympathized with their plans and purposes. In England the mission also met with favor. The earl of Dartmouth, then secretary of American affairs, received the strangers with great kindness, and generously promoted their object by his benefactions. The king, George III., it is said, contributed £400 to the cause. From different sources there was contributed to the fund, during the two years of Dr. Whitaker's visit to Europe, the sum of £11,000, to which considerable additions were afterward made before the outbreak of the American Revolution. With an endowment so obtained, Dartmouth College at Hanover, N. H., was founded, and was originally organized for the education of the Indian tribes of North America. It bore the name of *Dartmouth*, in honor of the distinguished nobleman who had so liberally contributed to its first endowment. Very few Indians, however, were successfully educated at this institution, and of those that were, Rev. Ebenezer Wheelock, its first president, feelingly lamented the return of most to the primeval habits of savage life. On his return home from Europe, Dr. Whitaker was called to the charge of the Presbyterian church at Salem, Mass., and officiated for a number of years with great distinction for piety, learning, and eloquence in what was known as the "Tabernacle church," built and owned by himself. Many of his sermons were published and extensively circulated throughout New England. He was an ardent Whig, and zealously supported the cause of the colonies in their struggle for independence in 1776. D. in 1794. A. H. Stephens.

Whitaker (Ozi William), D. D., b. May 10, 1830, at New Salem, Mass.; graduated from Middlebury College in 1856; was principal of the North Brookfield (Mass.) High School for four years; graduated from the General Theological Seminary of the Protestant Episcopal Church in 1863; was ordained deacon in Boston in July, and priest in August of the same year; was rector of St. John's church, Gold Hill, Nev., from Oct., 1863, to July, 1865; was rector of St. Paul's, Eaglewood, N. J., from Oct., 1865, to Feb., 1867; became rector of St. Paul's, Virginia City, Nev., in Apr., 1867; was elected missionary bishop of Nevada and Arizona in 1868, and consecrated in New York Oct., 1869.

Whitaker (Thomas Dunham), LL.D., b. at Rainham, Norfolk, England, June 8, 1759; educated at St. John's College, Cambridge; took orders in the Church of England 1785; became perpetual curate of Holme, Lancashire, 1797, vicar of Whalley 1809, and of Blackburn 1818. D. at Blackburn Dec. 18, 1821. Author of a *History of the Original Parish of Whalley and Honour of Clitheroe in the Counties of Lancaster and York* (Blackburn, 4to, 1801), *History and Antiquities of the Deanery of Craven* (1805), *Lordis and Elmete, or an Attempt to Illustrate the Districts described in those Words by Bede* (1816), and a *History of Richmondshire* (2 vols., 1823); edited the *Sermons of Archbishop Sandys, with a Life of the Author* (1812), the *Vision of Piers Plowman* (1810), the *Life and Correspondence of Sir George Radcliffe* (1810), and Ralph Thoresby's *Ducatus Leodensis* (1816). Dr. Whitaker was one of the most popular of modern English topographers. A magnificent edition of his *History of Whalley*, annotated and enlarged by John Gough Nichols, appeared in 1871.

Whitaker (William), D. D., b. at Holme, Lancashire, England, in 1548; educated at St. Paul's School, under his uncle, Dean Alexander Nowell; graduated at Trinity College, Cambridge, where he became a fellow; was appointed regius professor of divinity at Cambridge 1579, chancellor of St. Paul's 1580, and master of St. John's College, Cambridge, 1586; was an able Calvinistic writer, and considered the most learned English champion of Protestantism of his time, having won the admiration of his antagonists, Bellarmine and Stapleton. D. at Cambridge Dec. 4, 1595. He translated the Liturgy into Greek and Latin (1569), and Dean Nowell's Catechism into Latin (1571); wrote Latin refutations of Drs. Nicholas Sanders (1583), William Rainoldes (1585), and the Jesuit Campian (1581), and many other controversial works, and maintained against Bellarmine and Stapleton a famous *Disputation on Sacred Scripture*, published in Latin (1588) and in English (1849). A

collection of his *Opera Theologica* was published at Geneva (2 vols. folio, 1610).

Whitaker's, p.-v., Edgecombe co., N. C.

Whit'brend (Samuel), b. in London, England, in 1758, son of Samuel, a very wealthy brewer, who had married a daughter of the first Earl Cornwallis; was educated at Eton and at St. John's College, Cambridge; travelled on the Continent, accompanied by Archdeacon Coxe, the historian, as his tutor; married Lady Elizabeth, daughter of Sir Charles Grey, 1789; entered Parliament 1790; was a close friend of Fox and a vigorous assailant of Pitt, and conducted the impeachment of Lord Melville 1805-06, and, losing heavily by the burning of Drury Lane Theatre, committed suicide July 6, 1815. To him the memory of Milton was indebted for a monument in the church of St. Giles, Cripplegate.

Whit'by, town of England, county of York, at the mouth of the Esk in the North Sea, has a good harbor, protected by two piers 1000 feet long jutting out into the sea; drydocks for building and repairing ships; manufactures of sailcloth and cordage, and an extensive trade. Jet, alum, and ironstone are exported. P. 13,082.

Whitby, p.-v., cap. of Ontario co., Ont., Canada, on Lake Ontario, and on Grand Trunk and Port Whitby and Port Perry railways. It has a good harbor, 30 miles N. E. of Toronto. It is an important grain and produce market, and has 2 weekly papers. P. exclusive of tp. 2732.

Whitby (Daniel), D. D., b. at Rushden, Northamptonshire, England, in 1638; graduated at Trinity College, Oxford, about 1657; obtained a fellowship there 1661; took orders in the Church of England; became prebendary (1668) and precentor of Salisbury cathedral (1672), and rector of St. Edmund's church, Salisbury, about the same time; was a distinguished commentator, and an ardent controversial writer against Arianism and Roman Catholicism, but was censured for his *Protestant Reconciler* (1683); ultimately became an Arian by the reading of Dr. Clarke's *Scripture Doctrine*, and engaged in a polemic with Dr. Waterland. D. at Salisbury Mar. 24, 1726. Among his numerous books the most important was a *Paraphrase and Commentary on the New Testament* (2 vols., 1703).

Whit'comb (James), b. at Stockbridge, Vt., Dec. 1, 1791; removed with his father to Ohio 1806; graduated at Transylvania University, Ky.; studied law; began practice at Bloomington, Ind., 1821; became prosecuting attorney for the district 1826; was a Democratic State senator 1830-35; became commissioner of the general land-office 1836; resumed the practice of law at Terre Haute 1841; was governor of Indiana 1843-48; became U. S. Senator 1849, and was vice-president of the American Bible Society. D. in New York City Oct. 4, 1852.

Whitcomb (John), b. at Lancaster, Mass., about 1720; was colonel of Massachusetts troops in the campaign against Crown Point 1755; led a regiment to Boston after the battle of Lexington; was appointed by the provincial congress a brigadier-general; was chosen brigadier-general on the Continental establishment June 5, and advanced to major-general in the Massachusetts service June 13, but soon resigned on account of advanced age. D. in 1812.

White. See Colon.

White, county of Central Arkansas, lying E. of White River, intersected by Little Red River and Bayou des Arc, and traversed by Cairo and Fulton R. R. The surface is undulating, much of it being covered by dense forests, which furnish large quantities of lumber. Swine and cattle are the principal live-stock. Staples, cotton, Indian corn, lumber. Cap. Searcy. Area, 1044 sq. m. P. 10,347.

White, county of Northern Georgia, drained by the head-waters of Chattahoochee River; surface undulating, soil moderately fertile. Staples, Indian corn, wool, and tobacco. Cap. Cleveland. Area, 250 sq. m. P. 4606.

White, county of S. E. Illinois, separated from Indiana by Wabash River, intersected by the Little Wabash, and traversed by Cairo and Vincennes, Springfield and Illinois South-eastern, and St. Louis and South-eastern R. Rs.; surface prairie and woodland, soil fertile. Live-stock considerable. Staples, Indian corn, wheat, oats, tobacco, wool, and lumber. Cap. Carmi. Area, 480 sq. m. P. 16,846.

White, county of N. W. Indiana, intersected by Tippecanoe River, and traversed by Louisville New Albany and Chicago and the Pittsburg Cincinnati and St. Louis R. R.; surface generally level, soil fertile. Cattle and sheep numerous. Staples, corn, wheat, oats, hay, and dairy products. Cap. Monticello. Area, 504 sq. m. P. 10,551.

White, county of Central Tennessee, lying upon Caney fork of Cumberland River; surface hilly and wooded. Cattle, sheep, and swine numerous. Staples, Indian corn, tobacco, wool. Cap. Sparta. Area, 672 sq. m. P. 9375.

White, tp., Ashley co., Ark. P. 412.

White, tp., Newton co., Ark. P. 615.

White, tp., Pike co., Ark. P. 401.

White, tp., Polk co., Ark. P. 293.

White, tp., Benton co., Mo. P. 1993.

White, tp., Cambria co., Pa. P. 969.

White, tp., Indiana co., Pa. P. 2121.

White (Albert S.), b. at Blooming Grove, N. Y., Oct. 21, 1803; graduated at Union College 1822; was admitted to the bar at Newburg 1825; removed to Indiana 1829; was several years clerk of the Indiana house of representatives; member of Congress 1837-39, U. S. Senator 1839-45; was a leading promoter of the Wabash and Erie Canal; became president of the Wabash and Indianapolis and Lake Erie Wabash and Indianapolis R. R. Cos.; was again a member of Congress 1861-63; became commissioner of claims against the Sioux Indians 1863, and was appointed district judge of Indiana Jan., 1864. D. at Stockwell, Ind., Sept. 4, 1864.

White (Alexander), b. at Franklin, Tenn., Oct. 16, 1816; removed to Talladega, Ala., when five years of age; studied at Jackson College and at the University of Tennessee at Nashville; studied law under his father, Judge John White; was admitted to the bar 1838; practised at Talladega as the associate of his father, and subsequently (1841-55) as partner of Hon. Lewis E. Parsons; was elected to Congress for the term 1851-53 on the Union platform, after an exciting contest in a district overwhelmingly Democratic; settled at Selma 1856; supported Bell and Everett in 1860, and earnestly opposed secession, but acted with his State during the civil war; was a leading member of the Alabama State convention of 1865, and of that of June, 1866, which chose delegates to the Loyalists' convention at Philadelphia; sat in the general assembly of 1872; was again a member of Congress 1873-75; was distinguished for oratorical powers and skill as a debater, and was U. S. associate justice for Utah 1875.

White (Andrew Dickson), LL.D., b. at Homer, N. Y., Nov. 7, 1832; removed in childhood to Syracuse; graduated at Yale College 1853; travelled in Europe; was for several months an attaché of the U. S. legation in Russia; studied at the University of Berlin 1854-55; was professor of history and English literature at the University of Michigan 1857-62; visited England 1863; returned to Syracuse; was State senator 1863-66; introduced the bills which codified the school laws, created the new system of normal schools, and incorporated Cornell University; was chosen first president of that institution 1866; visited Europe to purchase for it books and apparatus and to study modern educational methods; has been a liberal contributor to the funds for the foundation of the university, in which, besides the presidency, he fills the chair of modern history; was one of the commissioners sent by Pres. Grant to Santo Domingo to study the question of annexation 1871, and has taken a prominent part as a Republican in the recent politics of New York. Author of *Lectures on Mediæval and Modern History* (Detroit, 1861), *A Word from the North-west* (1863), in reply to Dr. W. H. Russell; *The Plan of Organization for Cornell University* (1868), *The New Education* (1868), being his inaugural address; a *Report on the Co-education of the Sexes* (1871), *The Warfare of Science* (1876), etc. He was U. S. minister at Berlin 1879.

White (Charles), D. D., b. at Randolph, Vt., Dec. 28, 1795; graduated at Dartmouth College 1821; studied two years at Andover (1821-23); was settled at Thetford, Vt. (Congregational), 1825-29; at Cazenovia, N. Y. (Presbyterian), 1829-33; wrote for the *National Preacher*, the *Biblical Repository*, and the *Bibliotheca Sacra* at Oswego, N. Y., 1834-41; and from 1841 to 1861 was president of Wabash College, Crawfordsville, Ind., where he d. Oct. 29, 1861. Author of *Essays in Literature and Ethics* (1853).

White (Charles J.), D. D., b. at Baltimore, Md., in 1807; graduated at St. Mary's College 1823; became a Roman Catholic priest; edited the *Catholic Almanac* (1831-57); founded and edited the *Religious Cabinet* (1842), a monthly magazine which was soon replaced by the *U. S. Catholic Magazine* (1843-49), and this by the *Catholic Mirror* (1849), a weekly paper; translated and edited Balmes's *Protestantism and Catholicity compared in their Effects on the Civilization of Europe* (1850) and Chateaubriand's *Genius of Christianity* (1856), and is author of a *Life of Mrs. Eliza A. Seton*, (1853; 5th ed. 1865).

White (Daniel Appleton), LL.D., b. at Lawrence (then a part of Methuen), Mass., June 7, 1776; graduated at Harvard 1797; was teacher of the Medford grammar school 1797-99, Latin tutor in Harvard 1799-1803; studied law; was admitted to the bar 1801; began practice at Newburyport; sat in the Massachusetts legislature 1810-15; was elected to Congress, but declined the office 1811; be-

came judge of probate for Essex co. 1815; settled at Salem 1817, and was for many years a leading member of the Essex Institute and of the Massachusetts Historical Society, by both of which bodies he was regarded with peculiar attachment on account of his rare social qualities. D. at Salem Mar. 30, 1861. Author of eulogies on Washington (1800), Nathaniel Bowditch (1838), and John Pickering (1846), *A View of the Jurisdiction of the Court of Probate in Massachusetts* (1822), *New England Congregationalism in its Origin and Purity* (1861), of several occasional addresses and other pamphlets, and aided John Pickering in preparing his edition of Sallust (1805). Biographical memoirs were prepared by Pres. James Walker (1863) for the Massachusetts Historical Society, and by Hon. George W. Briggs (1864) for the Essex Institute, to which institution he gave 8000 volumes.

White (Fortune C.), b. at Whitestown, Oneida co., N. Y., in 1787, grandson of Judge Hugh White, the pioneer settler of that county and region, for whom the town (then embracing most of Western New York) received its name; received a classical education; was admitted to the bar at an early age; was captain, and afterward an aide-de-camp to the general-in-chief 1812–14; was many years a leading lawyer of Central New York; was chief judge of common pleas and quarter sessions for Oneida county 1837–43, and was for more than forty years a brigadier-general of State militia. D. at Whitestown Aug. 27, 1866.

White (G. B.), U. S. N., b. Nov. 29, 1836, in Pennsylvania; graduated at the Naval Academy in 1858; became lieutenant in 1861, commander in 1872; served in the Ottawa at the battle of Port Royal, and commended for "coolness and gallantry." Foxhall A. Parker.

White (Gilbert), b. at Selborne, Hampshire, England, July 18, 1720; educated at Basingstoke School and at Oriel College, Oxford, where he graduated 1743; became a fellow there 1744, retaining that position through life; became senior proctor of the university 1752; took orders in the Church of England, but declined ecclesiastical preferment, though officiating as curate at his native village, where he spent most of his life upon his paternal estate, chiefly occupied in those minute observations in natural history on which his fame is based. D. at Selborne June 26, 1793. Author of *The Natural History and Antiquities of Selborne in the County of Southampton* (1789) and *The Naturalist's Calendar, with Observations in Various Branches of Natural History* (1795), a posthumous work made up from his papers by Dr. John Aikin. Among the numerous naturalists who have published annotated editions of these two works (usually published together) may be mentioned Sir W. Jardine (1833), J. Rennie (1833), Capt. Thomas Brown (1835), Edward T. Bennett (1837), Blyth and Madie (1850), Edward Jesse (1850), and Rev. J. G. Wood (1854). The last and best edition is that by Frank Buckland (London, 1875). A volume of his inedited *Letters* was issued by J. E. Harting (1876).

White (Henry Clay), b. in Baltimore, Md., Dec. 30, 1848; graduated at the University of Virginia June 29, 1870, as bachelor of science and civil and mining engineer; professor of St. John's College, Annapolis, Md., 1871–72, and since that time is professor of chemistry and geology in the University of Georgia at Athens. Author of various scientific addresses, reports on *Chemistry of the Cotton-plant*, on *Commercial Fertilizers*, and co-author with W. G. McAdoo of *Elementary Geology of Tennessee*.

White (Henry Kirke), b. at Nottingham, England, Mar. 21, 1785; was apprenticed to a stocking-weaver, and afterward to an attorney, in whose office he found time to study the classics and several modern languages, as well as English literature, drawing, and music; began to write verses for magazines in his fifteenth year; gained several prizes offered by publishers of periodicals; printed a volume, *Clifton Grove, a Sketch in Verse, with other Poems* (1803), which won for him the high regard of Southey and other men of letters, by whom he was encouraged to study for the ministry; obtained a sizarship at St. John's College, Cambridge, 1801; was for two years at the head of his class, and became a tutor in mathematics, but destroyed his health by excessive study, and died of consumption at Cambridge Oct. 19, 1806. His papers were placed in the hands of Southey, who published his *Remains, etc., with an Account of his Life* (2 vols., 1807; vol. iii. 1822), which obtained for him a permanent place in English literature. A tablet to his memory by Chantrey was placed in All Saints' church, Cambridge, by Francis Boott of Boston, Mass. Among the numerous republications of his *Poetical Works*, the "Globe edition" (London and New York, 1869) deserves notice.

White (Hugh Lawson), b. in Iredell co., N. C., Oct. 30, 1773, son of Gen. James (1759–1821), a pioneer settler of Knoxville, Tenn., where he removed 1786; was a volunteer soldier against the Indians 1792; studied at Philadelphia 1794–96; read law at Lancaster, Pa.; began practice at Nashville 1796; was judge of the State supreme court 1801–07 and 1809–15; became U. S. district attorney 1807, State senator 1809 and 1817, president of the State Bank of Tennessee 1815, and commissioner of Spanish claims 1820; was U. S. Senator 1825–35 and 1836–39; president *pro tem.* of that body 1832; received the electoral votes of Georgia and Tennessee for President of the U. S. at the election of 1836, and resigned his seat in the Senate 1839, in consequence of having received from the legislature instructions to vote against his judgment. D. at Knoxville, Tenn., Apr. 4, 1840. A *Memoir, with Selections from his Speeches and Correspondence* (Philadelphia, 1856), was prepared by Nancy N. Scott, one of his descendants.

White (James), b. near Edinburgh, Scotland, about 1804; educated at Glasgow and at Oxford; took orders in the Church of England; was presented by Lord Brougham with a living in Suffolk, which he exchanged for the vicarage of Loxly, Warwickshire, and after inheriting a fortune retired from the ministry to devote himself to literature, writing frequently for *Blackwood's Magazine*. D. at Bonchurch, Isle of Wight, Mar. 26, 1862. Author of three historical dramas, *Feudal Times* (1845), *The Earl of Gowrie, a Tragedy* (1846), and *The King of the Commons* (1846); *Landmarks of the History of England* (1855), *Landmarks of the History of Greece* (1856), *The Eighteen Christian Centuries* (1857), *Robert Burns, a Memoir* (1859), *The History of France from the Earliest Times to 1848* (1859), and *The History of England from the Earliest Times to 1858* (1860). Most of his books were republished in the U. S.

White (John), b. at Stanton, St. John, Oxfordshire, England, in 1574; educated at Oxford; became perpetual fellow of New College 1595, and rector of Trinity church, Dorchester, 1606; was one of the most efficient promoters of the colonization of New England, and especially of Dorchester and Gloucester, Mass., both by his pen and by his personal influence; was known as "the patriarch of Dorchester," and was a member of the Westminster Assembly of divines. D. at Dorchester in 1648. Author of *The Planter's Plea, or the Grounds of Plantations Examined and Usual Objections Answered* (London, 1630), *A Commentary on the Three First Chapters of Genesis* (1656), and other religious publications.

White (John), b. in Kentucky in 1805; was a member of Congress 1835–45; Speaker of the 27th Congress (1841–43), and subsequently judge of the U. S. district court. D. by his own hand at Richmond, Ky., Sept. 22, 1845.

White (John T.), D. D., grand-nephew of Gilbert, b. in England about 1820; educated at Corpus Christi College, Oxford, where he became a fellow; took orders in the Church of England, and is rector of St. Martin's church, Ludgate, London, and head-master of the Latin school of Christ's Hospital. He has edited with English notes Xenophon's *Expedition of Cyrus* (1848) and the *Germania* and *Agricola* of Tacitus (1850); published a series of grammatical textbooks in Latin, and is author, with Rev. Joseph Esmond Riddle, of *A Latin-English Dictionary* (1862), based on Andrews's translation of Freund.

White (Joseph), D. D., b. at Stroud, Gloucestershire, in 1746, son of a weaver; graduated at Wadham College, Oxford, about 1770; became fellow there 1774; was chosen Laudian professor of Arabic 1775; was a highly-successful Bampton lecturer 1785, being aided in the composition of his sermons by Dr. Parr and Mr. Badcock; became prebendary of Gloucester (1788) and of Oxford (1802); regius professor of Hebrew at Oxford 1802, and subsequently canon of Christ church. D. May 22, 1814. Author of *A View of Christianity and Mohammedanism* (Bampton lectures, 1784), *Diatessaron* (1799), being a Greek Harmony of the Gospels, and *Ægyptiaca* (1801); editor of Griesbach's *Greek Testament* and of the Philoxenian Syriac Testament (1778).

White (Joseph Blanco), b. at Seville, Spain, July 11, 1775, of an Irish Catholic family settled for several generations in Spain; was known in Spain as José Maria Blanco y Crespo; was destined for a mercantile career, but left his father's counting-house to study for the Church; was ordained a priest 1799; was endowed with an inquiring mind, and, devoting himself to the study of religious systems, soon lost confidence in Roman Catholicism, though continuing in its priesthood until 1810, when, in consequence of the political crisis in Spain, he proceeded to England; was patronized by Lord Holland, in whose family he became a tutor, and through whom he became known to an influential literary and political circle, to which his religious experiences were an object of interest; wrote several works against Roman Catholicism; conducted

for several years a monthly Spanish paper, *El Español*, rendering services to the cause of Spanish independence which were rewarded by the English government with a life pension of £250; gave his adhesion at first to the Anglican Church, to the ministry of which he intended to devote himself, but was ultimately prevented by doubts in respect to some of its doctrines; resided in London as a man of letters, contributing to leading reviews and periodicals and producing several works in Spanish and English, all bearing more or less directly either upon Spain or upon religious questions; conducted for three years (1822–25) another Spanish journal, *Las Variedades*, and was editor of the short lived *London Review* (1829); was tutor in the family of Archbishop Whately at Dublin 1832–35, after which he avowed himself a Unitarian; settled at Liverpool, where he joined the society to which Rev. John Hamilton Thom was pastor, and resided there, suffering much from an incurable disease, aggravated by religious melancholy, until his death, May 20, 1841. He was never married. Among his publications were *Letters from Spain, by Leucadio Doblado* (1822), *Practical and Internal Evidence against Catholicism* (1825), *The Poor Man's Preservative against Popery* (1825), *Second Travels of an Irish Gentleman in Search of a Religion* (1833), and an instructive autobiography in the form of letters, addressed chiefly to Archbishop Whately, edited by Rev. J. H. Thom as a part of *Life and Correspondence* (3 vols., 1845). Blanco White's *Sonnet to Night* was called by Coleridge the finest in the English language. PORTER C. BLISS.

White (JOSEPH M.), b. in Franklin co., Ky., about 1790; received a good education, becoming familiar with French and Spanish; was for some years a lawyer in Florida Territory, where he was noted for eloquence, and was Territorial delegate in Congress 1823–37. D. at St. Louis, Mo., Oct. 18, 1839. Author of a valuable work, *A New Collection of Laws, Charters, etc., of Great Britain, France, and Spain relating to Concessions of Land, with the Laws of Mexico and Texas on the same Subject* (Philadelphia, 2 vols., 1839).

White (PEREGRINE), celebrated as the first child of English parentage born in New England; was the son of William White and his wife Susanna, passengers in the Mayflower, and was born on that vessel in the harbor of Cape Cod about Nov. 20, 1620; became a citizen of Marshfield; was "vigorous and of a comely aspect;" filled various civil and military offices, and reached a good old age, dying at Marshfield July 22, 1704. His father died during the first winter at Plymouth, and his mother married Gov. Edward Winslow, theirs being the first marriage in New England.

White (PLINY HOLTON), b. at Springfield, Vt., Oct. 6, 1822; was admitted to the bar of Windham co., Vt., in 1843, and practised law for a number of years; was editor of the Brattleborough *Eagle* 1851–52, and of the *Express* at Amherst, Mass., 1857–58; was ordained minister at Coventry, Vt., Feb., 1859; sat in the Vermont legislature 1862–63; was chaplain of the senate 1864–66, and for several years president of the Vermont Historical Society. D. at Coventry, Vt., Apr. 24, 1869. He was the author of a *History of Coventry* (1858), and a frequent contributor to newspapers and magazines. He published a number of addresses and sermons.

White (RICHARD GRANT), b. in New York City May 22, 1822; graduated at the University of New York 1839; studied medicine and law; was admitted to the bar 1845; was associate editor of the New York *Courier and Enquirer* 1851–58, and subsequently of the *World*; has written largely for numerous magazines and periodicals, more especially on grammatical and philological subjects; is the writer of the "Yankee Letters" in the London *Spectator* 1863–67, and for many years was chief clerk of the United States revenue marine bureau in the district of New York. Author, among other works, of *Shakespeare's Scholar* (1854), *The Authorship of the Three Parts of Henry VI.* (1859), *National Hymns, how they are Written and how they are not Written, a Lyrical and National Study for the Times* (1861), *The New Gospel of Peace, according to St. Benjamin* (4 parts, 1863–66), an anonymous political satire which acquired great celebrity; *Memoirs of the Life of William Shakespeare, with an Essay toward the Expression of his Genius, etc.* (1865), which also formed part of the first volume of his splendid annotated variorum edition of Shakspeare (12 vols., 1857–65), and *Words and their Uses* (1870), being essays on the English language, from the *Galaxy* magazine, to which he is still (1876) contributing similar disquisitions, and edited J. H. Burton's *Book-Hunter* (1863) and a volume of selected *Poetry, Lyrical, Narrative, and Satirical, of the Civil War* (1866).

White (ROBERT MEADOWS), D. D., b. in England about 1798; graduated at Magdalen College, Oxford, 1819; took orders in the Church of England 1821; became tutor 1832, and Rawlinson professor of Anglo Saxon at Oxford 1834; visited Denmark for philological purposes 1837; was chosen vice president of Magdalen 1838; was noted as a local antiquary, as the annalist of his college, and as a leading authority in English philology, in which branch he was intimately associated with Dr. Bosworth, Benjamin Thorpe, and Richard Garnett, and, besides many miscellaneous philological and antiquarian papers, devoted much of his time for twenty years to the careful editing of *The Ormulum, Semi-Saxon Homilies in Verse, now first edited from the Original MSS., with Notes and Glossary* (Oxford, 2 vols., 1852). During the latter portion of his life he was rector of Slimbridge, Gloucestershire, where he d. Jan. 31, 1865.

White (Sir THOMAS), b. at Reading, England, in 1492; became a wealthy London merchant; was lord mayor of London 1553; was knighted 1554 for his services in maintaining the peace of the city during Wyatt's rebellion; and acquired a title to remembrance by the foundation of St. John's College, Oxford, in 1555, and by other liberal benefactions. D. in London Feb. 11, 1566.

White (THOMAS), D. D., b. at Bristol, England, about 1550; graduated at Magdalen Hall, Oxford, about 1570; took orders in the Church of England; became incumbent of St. Gregory's and vicar of St. Dunstan's-in-the-West, London; prebendary of St. Paul's, London, 1588; treasurer of Salisbury cathedral 1590; canon of Christ church 1591, and of Windsor 1593. D. Mar. 1, 1624. By his will he founded Sion College, London.

White (WILLIAM), D. D., b. in Philadelphia, Pa., Apr. 4, 1748; graduated at Philadelphia College 1765; studied theology in England; took orders in the Church of England 1770; became rector of Christ church and St. Peter's church, Philadelphia; was chaplain to Congress when in session at York, Pa., 1777; was at that time the only Episcopal clergyman in Pennsylvania; was a friend and pastor of Washington; presided at the first Episcopal convention held in America, Sept. and Oct., 1785; wrote the constitution of the Church then adopted; was chosen bishop of the diocese of Pennsylvania 1786; proceeded to England with his fellow-bishop (of New York), Dr. Samuel Provoost; was consecrated at Lambeth Palace by the archbishop of Canterbury Feb. 4, 1787; was president of the first Bible society established in the U. S., and of several charitable institutions, and with Bishop Seabury of Connecticut revised the *Book of Common Prayer* for the use of the American Episcopal Church. D. at Philadelphia July 17, 1836. Author of *The Case of the Episcopal Churches in the U. S. considered* (1782), *Lectures on the Catechism* (1813), *Memoirs of the Protestant Episcopal Church in the U. S.* (1820), and other works. A *Memoir* by Rev. Dr. Bird Wilson appeared in 1839.

White Ants. See TERMITES, by MRS. S. B. HERRICK.

Whitebait. See APPENDIX.

White Bear. See BEAR and URSIDÆ.

White Bear, tp., Ramsey co., Minn. P. 430.

White Bear Lake, tp., Pope co., Minn. P. 262.

White Breast, p.-v. and tp., Lucas co., Ia. P. 590.

White Breast, tp., Warren co., Ia. P. 1016.

White Chapel, tp., Lancaster co., Va. P. 1669.

White Clay Creek, hd., New Castle co., Del. P. 2620.

White Cloud, p.-v. and tp., Mills co., Ia. P. 562.

White Cloud, p.-v., Iowa tp., Doniphan co., Kan. P. 843.

White Cloud, tp., Nodaway co., Mo. P. 994.

White Copper, an alloy; also called **Packfong.** See NICKEL and PACKFONG.

White Creek, p.-v. and tp., Washington co., N. Y. P. 2881.

White Creek, p.-v. and tp., Adams co., Wis. P. 206.

White Deer, tp., Union co., Pa. P. 1676.

White Eyes, tp., Coshocton co., O. P. 923.

Whitefield, tp., Marshall co., Ill. P. 1205.

Whitefield, p.-v. and tp., Lincoln co., Me. P. 1594.

Whitefield, tp., Kandiyohi co., Minn. P. 77.

Whitefield, p.-v. and tp., Coos co., N. H. P. 1196.

Whitefield (GEORGE), b. in the Bull Inn at Gloucester, Eng., Dec. 16, 1714; in St. Mary's grammar school acquired the rudiments of learning, and there gave indications of extraordinary talent for public speaking in the pieces which he repeated on festivals before the corporation of his native city, and in the skill with which he acted characters assigned to him when dramatic performances took place at

school. The old inn, too, is particularly associated with his early days, inasmuch as in his fifteenth year he went to assist his mother in the performance of her duties as hostess. One day an Oxonian, a servitor of Pembroke, tarried at the inn, and told the landlady how he obtained enough by his services to pay his expenses. "This will do for my son," she exclaimed; and turning to George asked, "Will you go to Oxford?" "With all my heart, mother," he replied. This ended in his entering the university in his eighteenth year as a Pembroke servitor. Having become intimate with the Oxford Methodists, as certain pious students were called, and having undergone a great moral change, he resolved to devote himself to the ministry of the gospel heart and soul. In the choir of Gloucester cathedral he was ordained on Sunday, June 20, 1736, and the following week he preached his first sermon in the church where he had been baptized. On that Sunday there commenced a new era in the history of Whitefield's life and in the history of the English pulpit. That life became devoted to preaching, and that pulpit became filled with new power.

He went to London, at first to read prayers in the Tower chapel, but having begun to preach at Bishopsgate church, his fame soon spread over the city, and shortly he was engaged four times on a single Sunday in addressing audiences of enormous magnitude. Having addressed multitudes in other parts of his native county, he spent some weeks in Bristol, and there the people hung upon the rails, climbed up the leads of the churches, and with their breath made the steam run down the pillars and walls like drops of rain. He sailed for Georgia in a ship full of sailors, who counted him an impostor, but he overcame their prejudices and explained the Scriptures to them twice a day. In Savannah he expounded at five in the morning, at ten read prayers and preached, at three held another service, and at seven in the evening expounded the catechism. Returning to England, the ship was once more turned into a church. And again in the city of Bristol, pondering what a man had said to him there some time before—"What need of going abroad? Have we not Indians enough at home? If you have a mind to convert Indians, there are colliers enough in Kingswood"—he resolved to go amongst that neglected class. "I hasted," he says, "to Kingswood. At a moderate computation there were about 10,000 people. The trees and hedges were full; all was hush when I began. To behold such crowds standing together in such awful silence, and to hear the echo of their singing run from one end of them to the other, was very solemn and striking. As the scene was new, and I had just begun to be an extempore preacher, it often occasioned many inward conflicts. Sometimes, when 20,000 people were before me, I had not, in my own apprehension, a word to say either to God or them; but I was never totally deserted, and frequently (for to deny it would be to sin against God) so assisted that I knew by happy experience what our Lord meant by saying, 'Out of his belly shall flow rivers of living water.' The first discovery of their being affected was to see the *white gutters* made by their tears, which plentifully fell down their black faces—black as they came out of the coal-pits. Hundreds and hundreds of them were soon brought under deep conviction, which, as the event proved, ended in a sound and thorough conversion." Then he visited Wales with Howel Harris, and, beginning at Cardiff, proceeded from town to town, laboring in every place with all his accustomed ardor. The effects produced were very striking, and an excitable people, as were the inhabitants of the principality, yielded to the force of the preacher's appeal and to the power of those divine truths which he proclaimed.

At length a dispute arose between Whitefield and Wesley. The tide for a time turned against the former, "and at Kennington Common," he says, "I had not above a hundred to hear me." He had to begin his work afresh, and was encouraged by Beza's words: "Calvin is turned out of Geneva, but, behold, a new Church arises!" On a common near Braintree he preached to 10,000. Then he went to Scotland, but the churches would not hold the congregations. He continued preaching, always twice, often thrice, and once seven times, a day. We find him in Gloucestershire, and again in Wales, and once more in London. He preached in Moorfield, with little boys and girls sitting round the stand and handing up people's notes, and weeping as they saw the eggs and dirt thrown at him. He returned to Scotland, caused a wonderful revival at Cambuslang, and then reappeared in London, having traversed the country, preaching where he went.

In 1744 he sailed to America for the third time. After untiring labors he recrossed the Atlantic, and was sent for by the countess of Huntingdon to preach in her drawing-room to the nobility, among whom were Chesterfield and Bolingbroke. Scotland was revisited; so was the west of England. From Bristol he writes: "Yesterday God brought me here after having carried me a circuit of about 800 miles, and enabled me to preach to upward of 100,000 souls." Immense consternation was caused in London by the shock of an earthquake in Mar., 1750; people thought the world was coming to an end. Thousands on thousands assembled in Hyde Park and stayed there till midnight. Whitefield went to them, lifted up his clear voice under the clear stars to that dense, awestruck multitude, and told them God's true prophecy of the world's end. Afterward he visited Ireland and Scotland, and then a fourth time crossed the ocean. We find him in England again before the year's end, and, after preaching there, hasting once more to the other side of the Tweed. The Tabernacle and Tottenham Court chapels were built in 1753 and 1756, and there he gathered crowded congregations, hundreds often being turned away from the doors because there was no room to enter. Again and again he repeated his visits to Scotland, filling up the intervals with home engagements. He went to America a fifth, a sixth, and a seventh time. He preached every day at Boston from the 17th to the 20th of Sept., 1770; then travelled to Portsmouth, and preached daily till the 29th. On Saturday morning, the 29th, he set out on his return to Boston, preached at Exeter in the open air, continued his discourse nearly two hours, went to bed on Saturday night complaining of an oppression of the lungs, and on Sunday morning at six o'clock expired in a fit of asthma. An astonishing circumstance in connection with his death is related in Stevens's *History of Methodism*. The hall of the house in which he died was crowded with people as he was going up to bed the last night of his life. Reluctantly leaving them, saying he could not speak a word, he paused at the top of the staircase and delivered a most solemn address. "His voice flowed on until the candle which he held in his hand burned away and went out in its socket." This incident, not related in any of the memoirs of Whitefield, was communicated to Mr. Stevens by the daughter of the Rev. Mr. Parsons, in whose house he died.

Whitefield's dramatic power was amazing. "Aye, sure," said an old man who heard him, "he was a jolly brave man; and what a look he had as he put out his right hand to rebuke a disturber who tried to stop him under a pear tree! The man had been threatening and noisy, but he could not stand the look. Off he rode, and Whitefield said, 'There he goes: empty barrels make most din.'" His voice was marvellously varied, and he ever had it at command—an organ, a flute, a harp, all in one. His intellectual powers were not of a high order, but he had an abundance of that ready talent which makes the popular preacher; and beyond all natural endowments there was in his ministry the power of evangelical truth, and, as his converts believed, the presence of the Spirit of God.

His works have been published in 6 vols. (1771). Dr. Gillies wrote memoirs of his life and character (1772); the Rev. Robert Philip wrote another biography of him in 1837; and in 1866 a book appeared by I. R. Andrews, under the title of *George Whitefield, a Light rising in Obscurity*. The best description of Whitefield's personal peculiarities will be found in the Rev. W. Jay's *Memoirs of Cornelius Winter*. On Sept. 30, 1870, there was a centennial anniversary of Whitefield's death at Newburyport, Mass., when an elaborate commemorative discourse was delivered by the Rev. Dr. Stearns; a public meeting was subsequently held, and several relics of the great preacher were exhibited on the occasion. JOHN STOUGHTON.

Whitefield (JAMES), D. D., b. at Liverpool, England, Nov. 3, 1770; received a good education; was for some time engaged in mercantile pursuits; studied divinity with Ambroise Maréchal; became a Roman Catholic priest 1809; settled at Baltimore, Md., 1817, as minister of St. Peter's church, and succeeded Archbishop Maréchal May 25, 1828. D. at Baltimore Oct. 19, 1834.

Whitefish. See APPENDIX.

White Flux. See FLUX.

White'ford, tp., Monroe co., Mich. P. 1427.

White Fri'ars, an ancient precinct in London, Eng., between Fleet street and the Thames, deriving its name from the church of the Carmelite monks, or "White Friars," founded by Sir Richard Grey in 1241. Salisbury Court, Whitefriars (see ALSATIA), enjoyed for centuries the privileges of a sanctuary—at first for criminals, and subsequently for debtors only—until 1697. Whitefriars Theatre was a flourishing institution during most of the dramatic career of Shakspeare (1580–1613), but was pulled down at the latter date.

White Gun'powder, a compound of chlorate of potash 3 parts, ferrocyanide of potassium 1 part, and white sugar 1 part, each pulverized and carefully mixed. It ex-

plodes from percussion, friction, the touch of a minute quantity of sulphuric acid or of a red-hot iron. It is very violent in its effects, and its preparation is dangerous. It is of no industrial value.

White Hall, p.-v. and tp., Greene co., Ill. P. of v. 1200; of tp. 1600.

White'hall, p.-v., Muskegon co., Mich., on Chicago and Michigan Lake Shore R. R., and on the E. shore of White Lake, 5 miles from Lake Michigan, contains 5 churches, a graded public school, 1 bank, 2 hotels, 1 newspaper, 1 tannery, a wagon factory, and a number of shingle and lath mills. The village was incorporated in 1867. P. 842. C. P. NEARPASS, ED. "FORUM."

Whitehall, p.-v. and tp., Washington co., N. Y., at the head of Champlain Canal, and on Rensselaer and Saratoga and New York and Canada R. Rs., at the S. end of Lake Champlain, contains 5 churches, an excellent graded school, fine water-power, 4 banks, 2 newspapers, 4 transportation companies, an opera house, gasworks, 3 hotels, 9 lumber-yards, 3 saw-mills, 1 door and 1 moulding factory, 8 shipyards, 2 grist-mills, and waterworks (proposed). The village owes its prosperity to the transportation by lake and canal, boatbuilding, and lumber-trade. P. of v. 1322; of tp. 5564. W. A. WILKINS, ED. "TIMES."

Whitehall, tp., Lehigh co., Pa. P. 3318.

Whitehall, tp., Abbeville co., S. C. P. 1516.

Whitehall, tp., Albemarle co., Va. P. 4749.

White'haven, town of England, county of Cumberland, on the Irish Sea, near the entrance of the Solway Frith, is well built, finely situated, and has a good harbor, with slips and drydocks for building and repairing ships. It has manufactures of sailcloth and cordage, iron smelting works and foundries, and exports large quantities of coal from the rich collieries in its neighborhood. P. 18,446.

White Ha'ven, p.-b., Luzerne co., Pa. P. 1321.

White'head (WILLIAM), b. at Cambridge, England, in 1715; educated at Winchester School and at Clare Hall, Cambridge, where he became fellow 1742; wrote the tragedies *The Roman Father* (1750) and *Creusa, King of Athens* (1754), a comedy, *The School for Lovers* (1762), a farce, *The Trip to Scotland* (1770), and a number of poems now forgotten, but which procured him the honor of being appointed poet-laureate on the death of Cibber (1757). He resided many years in the family of Lord and Lady Jersey, first as tutor to their son, whom he accompanied 1754–56 on a European tour, and obtained in 1755, through Lady Jersey, the post of secretary and registrar of the order of the Bath. D. Apr. 14, 1785.

Whitehead (WILLIAM), U. S. N., b. June 12, 1840, in Pennsylvania; graduated at the Naval Academy in 1860; became lieutenant in 1862, commander in 1874; served on the iron-clad Passaic in many fights with the forts and batteries defending Charleston harbor in 1863 and 1864, and commended in official despatches.

FOXHALL A. PARKER.

Whitehead (WILLIAM ADEE), b. at Newark, N. J., Feb. 19, 1810; was collector of customs at Key West, Fla., 1830–38; has since been an officer of the New Jersey R. R. Co. and other railroad enterprises; is a resident of Newark, where he is an officer of an insurance company, and has been since 1871 president of the trustees of the New Jersey normal school. Author of *East Jersey under the Proprietary Governments* (1846), *Early History of Perth Amboy* (1856), of papers in the *Proceedings* of the New Jersey Historical Society on the northern and eastern boundary-lines of New Jersey, on the settlement of Elizabeth, the biography of Gov. William Franklin, and other topics of local history; edited *The Papers of Lewis Morris, Governor of New Jersey 1738 to 1746*, with a memoir (New York, 1852), and prepared an *Index to the New Jersey Colonial Documents*.

White House, the residence of the President of the U. S. (See WASHINGTON CITY.)

White House, p.-v., Hunterdon co., N. J., on Central R. R. of New Jersey, 15 miles W. of New York City, has 2 churches, good schools, 1 newspaper, 2 hotels, horn goods factory, marble-works, and 1 furniture manufactory. Large numbers of live stock are shipped from this place annually. A. J. SHAMPANORE, ED. "FAMILY CASKET."

White House, tp., Robeson co., N. C. P. 681.

White'house (HENRY JOHN), D. D., D. C. L., b. in New York City in Aug., 1803; graduated at Columbia College 1821, and at the (Episcopal) General Theological Seminary, New York, 1824; took orders 1824; was rector of St. Luke's church, Rochester, 1829–44, and of St. Thomas's, New York, 1844–51; consecrated assistant bishop of Illinois Nov. 20, 1851; succeeded to that see on the death of Bishop Chase 1852, and preached the sermon before the Pan-Anglican Council, London, 1867. D. Aug. 10, 1874.

White'hurst (JOHN), F. R. S., b. at Congleton, Cheshire, England, in 1713, son of a watchmaker; became an ingenious mechanician at Derby, where he manufactured thermometers, barometers, and hydraulic machines; removed to London 1775, and became stamper of the money weights at the mint; visited the Giant's Causeway 1783, and wrote treatises on various branches of mechanical science, one of which was *An Inquiry into the Original State and Formation of the Earth* (1778). D. in London Feb. 13, 1788.

White Lake, p.-v. and tp., Oakland co., Mich. P. 1180.

White Lead, the basic carbonate of lead, largely used in the composition of white oil paint, and to some extent in the manufacture of cements. It is made by precipitation, for which purpose carbonic acid is employed to decompose a soluble salt, or by exposing plates of cast lead to the joint action of the vapor of acetic acid, air, and carbonic acid.

White'ly, p.-v. and tp., Greene co., Pa. P. 977.

White'locke (BULSTRODE), b. in London, England, Aug. 2, 1605, son of Sir James (1570–1632), who became a justice of the king's bench; educated at Merchant Taylors' School and at St. John's College, Oxford, but left without a degree; studied law at the Middle Temple; was employed in a subordinate legal capacity at the impeachment of the duke of Buckingham 1626; was elected to the Long Parliament 1640; was chairman of the committee for conducting the impeachment of the earl of Stratford 1640–41, and drew up the charges upon which it was based; was a Parliamentary commissioner to treat with Charles I. at Oxford 1641–42; was deputy lieutenant of Buckinghamshire and Oxfordshire; aided Hampden in dispersing the commissioners of array at Watlington, and took part in the defence of Brentford 1642; was a member of the Westminster Assembly of divines 1643, and opposed the adoption of the Presbyterian doctrine and discipline; became governor of Windsor 1644; rescued from dispersion the royal library and cabinet of medals; opposed the Self Denying ordinance; was a commissioner of admiralty 1645; was a member of the commission sent to Uxbridge to negotiate a treaty of peace 1645; was one of the commissioners of the great seal 1649, but refused to take part in the trial of the king, which he disapproved; was appointed ambassador to negotiate a treaty with Queen Christina of Sweden Sept., 1653; was created by her a knight of the order of Amartha (whence he is sometimes called Sir); became a commissioner of the treasury 1655, Speaker of the House of Commons 1656, and one of Cromwell's lords Dec., 1657; was commissioner of the great seal to Richard Cromwell, whom he assisted in dethroning; president of the council of state during the interregnum, and retired at the Restoration to his estate at Chilton Park, Wiltshire, where he d. Jan. 28, 1676. He left in MS. an autobiography and several other works. Of these there were printed his *Memorials of English Affairs, or an Historical Account of what passed from the Beginning of the Reign of King Charles I. to the Restoration of King Charles II.* (1682; new ed. 1732; last ed., Oxford, 4 vols., 1853), a *Journal of the Swedish Embassy* (2 vols., 1772; new ed., 2 vols., 1845), and other historical and juridical treatises.

White Marsh, p.-v. and tp., Montgomery co., Pa. P. 3151.

White Moun'tains, a group of peaks in the counties of Coos, Carroll, and Grafton, N. H., usually regarded as a part of the Appalachian system. They stand on a plateau whence flow the Saco, Pemigewasset, Ammonoosuc, and other rivers. The western portion of the group is known as the FRANCONIA MOUNTAINS (which see). The White Mountains proper culminate in Mount Washington, the highest peak in the U. S. east of the Mississippi River, excepting Mitchell's High Dome in North Carolina. Its height is 6288 feet. Mount Jefferson reaches 5791 feet; Mount Adams, 5714; Mount Madison, 5365; Mount Clay, 5553; Mount Monroe, 5384, besides many others of lesser height. Of the Franconia group, the only one exceeding 5000 feet is Mount La Fayette, 5290 feet high. The area of the whole is more than 800 sq. m. The White Mountains constitute a favorite summer resort, and are remarkable for their wild and varied scenery. They are readily accessible by several railroad routes, and are well provided with hotels and roads. Not the least remarkable of the sights of this region is the railway by which a locomotive climbs Mount Washington, rising 3625 feet in 3 miles.

White Oak, tp., Franklin co., Ark. P. 2160.

White Oak, tp., Jefferson co., Ark. P. 210.

White Oak, tp., El Dorado co., Cal. P. 751.

White Oak, tp., McLean co., Ill. P. 532.

White Oak, p.-v. and tp., Mahaska co., Ia. P. 1032.

White Oak, tp., Warren co., Ia. P. 685.

White Oak, p.-v. and tp., Ingham co., Mich. P. 979.

White Oak, tp., Harrison co., Mo. P. 872.

White Oak, tp., Henry co., Mo. P. 1357.

White Oak, p.-v. and tp., Bladen co., N. C. P. 1265.

White Oak, tp., Carteret co., N. C. P. 842.

White Oak, tp., Jones co., N. C. P. 959.

White Oak, tp., Wake co., N. C. P. 1680.

White Oak, tp., Highland co., O. P. 1052.

White Oaks, tp., Onslow co., N. C. P. 1280.

White Oak Springs, p.-v. and tp., Lafayette co., Wis. P. 540.

White Pig'eon, p.-v. and tp., St. Joseph co., Mich. P. of v. 922; of tp. 1833.

White Pine, county of E. Nevada, bordering on Utah. The surface is a high plateau, crossed N. and S. by hills and valleys. The mountains are rich in minerals, especially in silver; some of the soil is arable, and much of it adapted for pasturage. Staples, hay, potatoes, and wool. Up to 1870 the silver-mines were largely worked, since which time they have been partially abandoned, and the population decreased by nearly two-thirds between 1870 and 1875. Cap. Hamilton. Area, 6720 sq. m. P. in 1870, 7189.

White Plain, tp., Spartanburg co., S. C. P. 1342.

White Plains, p.-v., Greene co., Ga. P. 374.

White Plains, p.-v. and tp., semi-cap. of Westchester co., N. Y., on Harlem R. R., 25 miles N. E. of New York City, has 2 banks, 4 schools, 6 churches, and 2 weekly newspapers, and was the scene of one of the battles of the American Revolution, in which the British under Gen. Howe drove the Americans from Chatterton Hill, W. of Bronx River, with a loss to the latter of 180 killed, wounded, and prisoners, Oct. 28, 1776. The centennial anniversary was celebrated in 1876. P. 2630.

White Post, tp., Pulaski co., Ind. P. 785.

White Post, p.-v., Greenway tp., Clarke co., Va. P. 192.

White Riv'er rises by several heads in the Ozark Hills of Washington and Madison cos., Ark., takes a circuit of 100 miles in Missouri, returns to Arkansas, and after a course of some 900 miles reaches the Mississippi River at a point 15 miles above the mouth of the Arkansas, into which a part of its waters are discharged. It is navigable by large steamboats to Batesville, Ark., 380 miles.

White River, in Indiana, rises by two forks. The E. or Driftwood fork (called also Blue River), flowing from Henry co., is 250 miles long, and is navigated to Rockford. The W. fork, the longer arm, rises in Randolph co., and crosses the State. It is 300 miles long, and is navigable at high water 150 miles to Martinsville. The main stream is 50 miles long, and flows into the Wabash opposite Mount Carmel, Ill.

White River, in Michigan, rises in Newaygo co., and after a S. W. course reaches White Lake, which extends eastward from Lake Michigan like an estuary or bay.

White River, in Vermont, rises in Addison co., and after a devious course falls into the Connecticut River at White River Junction. This stream and its branches afford fine water-power.

White River, tp., Benton co., Ark. P. 1315.

White River, tp., Independence co., Ark. P. 1472.

White River, tp., Izard co., Ark. P. 366.

White River, tp., Prairie co., Ark. P. 997.

White River, tp., Washington co., Ark. P. 1545.

White River, tp., White co., Ark. P. 60.

White River, Woodruff co., Ark. P. 944.

White River, p.-v. and tp., Tulare co., Cal. P. 120.

White River, tp., Gibson co., Ind. P. 2174.

White River, tp., Hamilton co., Ind. P. 2047.

White River, tp., Johnson co., Ind. P. 1755.

White River, tp., Randolph co., Ind. P. 4069.

White River, p.-v. and tp., Muskegon co., Mich. P. 1452.

White River, tp., Barry co., Mo. P. 756.

White River Junction, p.-v., Windsor co., Vt.

White Rock, tp., Franklin co., Ark. P. 280.

White Rock, p.-v. and tp., Ogle co., Ill. P. 999.

White Rock, p.-v. and tp., Huron co., Mich. P. 270.

White Rock, tp., McDonald co., Mo. P. 341.

White's, tp., Blount co., Ala. P. 252.

White's, tp., Bertie co., N. C. P. 1025.

Whites'boro', v., Whitestown tp., Oneida co., N. Y. P. 964.

Whites'borough, p.-v., Grayson co., Tex.

Whites'burg, p.-v. and tp., Madison co., Ala. P. 2937.

Whitesburg, p.-v., cap. of Letcher co., Ky.

White's Creek, tp., Bladen co., N. C. P. 1440.

White Sea, a large inlet of the Arctic Ocean, penetrates into European Russia for a distance of 380 miles, with a breadth of from 30 to 150 miles. It is frozen from October to May, and is rich in herring and codfish.

White Shoals, p.-v. and tp., Lee co., Va. P. 2750.

White'side (James), LL.D., b. at Delagny, county Wicklow, Ireland, in 1806; educated at Trinity College, Dublin; was called to the Irish bar 1830; became queen's counsel 1842; was counsel for Daniel O'Connell 1843, and for Smith O'Brien and Thomas F. Meagher 1848; represented Enniskillen in Parliament 1851–59; was subsequently chosen for the University of Dublin 1859–66; was solicitor-general for Ireland in the Derby cabinet, and a bencher of the King's Inns 1852; attorney-general and privy councillor in the second Derby cabinet 1858–59, and also in the third 1865–66, and became lord chief-justice of Ireland 1866. Author of *The Law of Nisi Prius* (1840), *Italy in the Nineteenth Century* (3 vols., 1848), *The Vicissitudes of the Eternal City* (1849), *The Life and Death of the Irish Parliament* (1863), and *Essays and Lectures, Historical and Literary* (1869).

White'sides, county of N. W. Illinois, separated from Iowa by Mississippi River, intersected by Rock River, and traversed by Chicago and North-western and Rockford Rock Island and St. Louis R. Rs. The surface is level, with considerable woodland; soil fertile. There are saw-mills, planing-mills, flour-mills, and manufactures of agricultural implements, carriages, furniture, gloves, and woollen goods. Horses, cattle, and swine are very numerous. Staples, Indian corn, oats, wheat, hay, wool, and dairy products. Cap. Morrison. Area, 730 sq. m. P. 27,503.

White's School'house, tp., Lee co., Ala. P. 120.

White's Store, p.-v. and tp., Anson co., N. C. P. 1358.

White'stone, p.-v., Queens co., N. Y., on the N. end of Long Island, 14 miles N. E. of New York City, has 4 churches, 4 good schools, savings bank, several tinware manufactories, hotels, an excellent harbor, and in its immediate vicinity are the U. S. fortifications at Willett's Point and (Fort Schuyler) on Throgg's Point, commanding the eastern entrance to New York harbor. P. 1907.

Chas. W. Smith, Ed. "Herald."

Whitestone, tp., Lancaster co., Va. P. 2078.

Whites'town, p.-v., Boone co., Ind.

Whitestown, p.-v. and tp., Oneida co., N. Y. P. 4339.

Whitestown, tp., Vernon co., Wis. P. 637.

White Sul'phur, tp., Greenbrier co., W. Va. P. 976.

White Sulphur Springs, p.-v., Greenbrier co., West Va., on Howard's Creek and on Chesapeake and Ohio R. R., 227 miles W. of Richmond, is a celebrated summer resort on account of a mineral spring, the waters having been employed medicinally since 1778. There are hotels capable of accommodating 1500 guests, and the place is conveniently located for access to the Red, Salt, and Blue Sulphur Springs, which are distant from 20 to 40 miles.

Whites'ville, p.-v., Daviess co., Ky. P. 257.

White Swell'ing, the popular name for a chronic inflammation of the joints (for which see Scrofula).

White'throat, the *Sylvia undata*, or *Curruca cinerea*, a very abundant European warbler whose song is rather sweet and very energetic. It is a favorite cage-bird, five and a half inches in length, colored reddish and whitish-brown, with a throat of pure white. There are several other warblers called whitethroat in England.

White'ville, tp., Jefferson co., Ark. P. 613.

Whiteville, tp., Marion co., Ark. P. 314.

Whiteville, v., Union tp., Montgomery co., Ind. P. 129.

Whiteville, p.-v. and tp., cap. of Columbus co., N. C. P. of v. 101; of tp. 2026.

Whiteville, v., Hardeman co., Tenn. P. 80.

White'wash, a preparation of slaked lime, thinned to a milky consistence, and used for whitening walls. Skimmed milk, glue, zinc-sulphate, tallow, and various pigments are sometimes added. Some of them form insoluble compounds with lime, and thus add to the permanency of the wash.

White'water, tp., Franklin co., Ind. P. 1467.

White Water, p.-v., Franklin tp., Wayne co., Ind. P. 141.

Whitewater, tp., Dubuque co., Ia. P. 1160.

Whitewater, tp., Grand Traverse co., Mich. P. 510.

Whitewater, tp., Winona co., Minn. P. 435.

Whitewater, tp., Cape Girardeau co., Mo. P. 1226.

Whitewater, tp., Hamilton co., O. P. 1609.

Whitewater, tp., Oconee co., S. C. P. 526.

Whitewater, p.-v. and tp., Walworth co., Wis., on Whitewater River and Chicago Milwaukee and St. Paul R. R., 51 miles S. W. of Milwaukee, contains 11 churches, the State normal school, 1 bank, 9 cheese-factories, a reaper manufactory, 1 paper-mill, a wagon-factory, 1 newspaper, furniture and sash and door factories. Principal business, wheat- and stock-raising. P. 4285.

E. D. Coe, Ed. "Register."

Whitewater River, in Indiana, is formed by two forks (the E. and W.), which unite at Brookville. The stream enters Ohio, and joins the Great Miami 6 miles from its mouth. Length to remotest source, 100 miles.

Whitewater River, in the S. E. of Missouri and the N. E. of Arkansas, originates in Cape Girardeau co., Mo., flows southward and joins the complicated lake and river system of the S. E. of that State, and after a course of 250 miles its waters are for the most part discharged into St. Francis River in Arkansas.

White Whale, the popular English designation for the Delphinidæ of the genus *Delphinapterus*, which is itself the type of a peculiar sub-family, represented by itself and the quite dissimilar genus *Monodon*. It is doubtful whether there is more than one species (*Delphinapterus beluga*), although some authors (*e. g.* Cope) have differentiated several. The type, whether generic or specific, is common to all the northern seas, and on the eastern coast of North America extends southward at least as far as the Gulf of St. Lawrence, where it is tolerably abundant. The form is essentially similar to that of the common porpoise, but the head is rounded forward and the cervical region has somewhat of a contraction; the teeth in the adult are generally about 22 in the upper and 8 in the lower jaw ($\frac{11}{8} \times 2$); no dorsal fin is developed, and hence the name *Delphinapterus*—*i. e.* "porpoise without a fin;" the color is a spotless white, and to this peculiarity the popular name alludes. Specimens sometimes attain a length of twenty feet, or even more, but the average is perhaps about thirteen feet. The animals frequently ascend a considerable distance up large rivers (*e. g.* the St. Lawrence). They often associate together in troops, but are also observed "in lines of seldom more than two or three abreast, or more frequently in single file, spouting irregularly," and showing little of the form above water. "When undulating along in this manner" they often make "a noise at the moment of coming to the surface to respire which may be likened to the faint lowing of an ox, but the strain is not so prolonged." (*Scammon.*) They are captured with harpoons and lances, as in ordinary whaling, as well as in nets. On the north-western coast of America "large numbers are captured by the natives of those coasts, and the oil obtained is to them a valuable article of commerce. In winter the fat of the white whale is considered a luxurious dish for the table, and the lean flesh supplies ample food for the sledge-dogs." (*Scammon.*)

Theodore Gill.

White'wood, a name given in the U. S. to the wood of the Tulip Tree (which see). The bark of *Canella alba* (see Canella Alba) is called whitewood bark. Other whitewoods are *Pittosporum bicolor*, of Australia, etc., *Oreodaphne leucoxylon*, *Lagunaria Pattersoni*, *Tecoma leucoxylon*, and many other trees, mostly tropical.

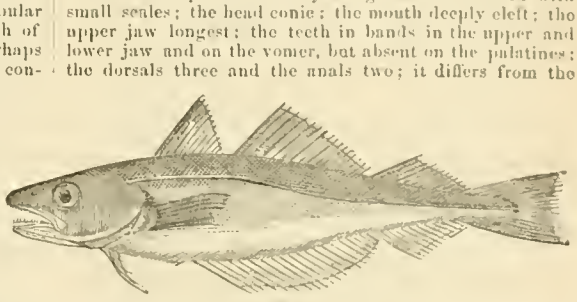
Whit'field, county of N. W. Georgia, bordering on Tennessee, bounded E. by Conasauga River, and traversed by Selma Rome and Dalton, Western and Atlantic, and East Tennessee Virginia and Georgia R. Rs.: surface hilly, but with some fertile valleys. Staples, Indian corn, wheat, and wool. Cap. Dalton. Area, 286 sq. m. P. 10,117.

Whitfield (Henry), b. in England in 1597; son of an eminent lawyer, received a university education, and studied law at one of the inns of court; took orders in the Church of England; was minister of Ockley, Surrey, where he sheltered a number of Puritan ministers during the persecution by Archbishop Laud, from which he ultimately suffered himself, in consequence of his refusal to read in church the *Book of Sports*; came to New Haven 1637; was one of the founders of Guilford, Conn. (1639), where his house, one of the oldest in the U. S., is still standing (1876); made a liberal use of a handsome fortune, and was esteemed one of the chief founders of New Haven colony; returned to England 1650, and became minister at Winchester, where he d. soon afterward. Author of *Helps to Stir up to Christian Duties* (1631), *The Light Appearing more and more towards the Perfect Day, or A Further Discovery of the Present State of the Indians in New England, etc.* (1651; new ed., New York, 1865), and *Strength out of Weakness, or A Glorious Manifestation of the Further Progresse of the Gospel among the Indians in New England* (1652; new ed., New York, 1865).

Whit'gift (John), D. D., b. at Great Grimsby, Lincolnshire, England, about 1530; educated at Queen's College and at Pembroke Hall, Cambridge, under Ridley and Bradford; was chosen a fellow of Peterhouse 1555; favored the Reformation unobtrusively; took orders in the Church of England; became chaplain to Cox, bishop of Ely, and rector of Feversham, Cambridgeshire, 1560; was appointed Lady Margaret professor of divinity 1563, regius professor of divinity, master of Pembroke Hall and of Trinity College, Cambridge, all in 1567; became chaplain to Queen Elizabeth, prebendary of Ely 1568, vice-chancellor of Cambridge 1570, dean of Lincoln 1571, prebendary of Lincoln 1572, bishop of Worcester and vice-president of the Marches of Wales 1577; succeeded Edmund Grindall as archbishop of Canterbury 1583; showed himself intolerant both of Roman Catholicism and of Puritanism, insisting on new articles of subscription, suspending the clergy who refused them, and managing the Star-Chamber prosecutions with great rigor; obtained a decree against liberty of printing June, 1585; became privy councillor 1586; founded a magnificent hospital and grammar school at Croydon 1595, and took part in the conferences at Hampton Court Jan., 1604. D. at Lambeth Palace Feb. 29, 1604. His theological *Works* were edited for the Parker Society (Cambridge, 3 vols., 1851–54) by Rev. John Ayre. His *Life* was written by Sir George Paule (1612) and by John Strypo (1718).

Whit'ing, or **Prepared Chalk,** chalk freed from impurities by elutriation, or pulverization and suspension of the finer and purer particles in water, from which they separate on standing; used as a water-color pigment and for coating paper, also as a polishing-powder for soft metals, like silver and brass.

Whiting, a European fish of the family Gadidæ and genus *Merlangus*, related to the true codfishes. As in them, the body is moderately elongated and covered with small scales; the head conic; the mouth deeply cleft; the upper jaw longest; the teeth in bands in the upper and lower jaw and on the vomer, but absent on the palatines; the dorsals three and the anals two; it differs from the true codfishes especially in that no barbel is developed at the chin; the color above is very dark and almost black, and below grayish; a black spot is developed in the axil of the pectoral fin. The species is esteemed for the excellence of its flesh, which is said to surpass in delicacy that of any other representative of the family. "The pearly whiteness of its flaky muscles, added to its extreme lightness as an article of food, recommends it particularly to invalids who are unable to digest more solid nutriment." (*Yarrell.*) It is quite common in the seas of Northern Europe, and is fished for throughout almost the entire year, but is more abundant in winter, when it approaches the shore—it is believed, to spawn. Its average size is about twelve or sixteen inches, with a weight of a pound and a half, although it sometimes attains a weight of three or four pounds. It is a voracious fish, and "seizes indiscriminately any of the Mollusca, worms, small Crustaceæ, and young fishes." "It appears to prefer sandy banks, but shifts its ground frequently in the pursuit of the various fry of other fishes, upon which it principally subsists." (*Yarrell.*) Although repeatedly claimed to be an inhabitant of the American coast, it has not yet been found thereon, the hake (*Merlucius bilinearis*) having been mistaken for it. On some parts of the coast the name "whiting" is also applied to the *Menticirrus nebulosus*, more generally known as the Kingfish (which see).



The Whiting.

Theodore Gill.

Whiting, p.-v. and tp., Washington co., Me. P. 414.

Whiting, p.-v. and tp., Addison co., Vt. P. 430.

Whiting (Henry), b. at Lancaster, Mass., about 1790; entered the U. S. army as cornet of dragoons 1808; was chief quartermaster of Gen. Taylor's army in Northern Mexico, and was brevetted brigadier-general for services at Buena Vista Feb. 23, 1847. D. at St. Louis, Mo., Sept. 16, 1851. Author of poems, *Ontway, the Son of the Forest* (1822), and *Sannillac* (1831); co-author of *Historical and Scientific Sketches of Michigan* (Detroit, 1834), and wrote the *Life of Z. M. Pike* for Sparks's series of American biography.

Whiting (James R.), b. at Brooklyn, N. Y., Apr. 20, 1803; was admitted to the New York bar 1824; soon became distinguished in his profession, and also in politics; was early elected alderman; was district attorney for the county of New York several years from 1836; displayed great ability in the celebrated trials of John C. Colt and Monroe Edwards; served a few months as a judge of the supreme court of New York; returned to the practice of law as counsellor, seldom appearing in court; was defeated as an independent candidate for mayor, and accumulated a fortune of $2,000,000, gained in great part from a street-cleaning contract. D. at Spuyten Duyvil Mar. 16, 1872.

Whiting (John), b. at Naylsey, England, in 1655; became a Quaker leader; resided many years at Wrington, Somersetshire, and subsequently at London, where he d. in 1722. Author of many books in defence of Quakerism, including vigorous replies to George Keith (1701) and Cotton Mather (1702), and of *A Catalogue of Friends' Books* (1708), republished and enlarged by Joseph Smith (1867).

Whiting (Samuel), b. in Boston, England, Nov. 20, 1597, son of John Whiting, mayor of that town; educated at Cambridge University; became a Puritan minister; emigrated to New England, arriving at Boston, Mass., May 26, 1636, and was ordained first minister of Lynn, Nov. 8 of that year, remaining there 43 years until his death, Dec. 11, 1679. Author of a Latin oration pronounced at Harvard College 1649, a *Treatise on the Last Judgment* (1664), etc.

Whiting (W. H.), U. S. N., b. July 8, 1843, in New York; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served in the Monongahela at the battle of Mobile Bay, and commended for "gallantry." Foxhall A. Parker.

Whiting (William), a descendant of Rev. Samuel, b. at Concord, Mass., Mar. 3, 1813; graduated at Harvard 1833, and at the Cambridge Law School 1838; became an eminent lawyer at Boston; was solicitor of the U. S. war department 1862–65, and five years president of the New England Historico-Genealogical Society. Author of several legal pamphlets, a *Memoir of Rev. Joseph Harrington* (1854), and of a very important and well-written treatise on *The War-Powers of the President and the Legislative Powers of Congress in Relation to Rebellion, Treason, and Slavery* (1862), which soon passed through 27 eds. (revised and augmented 1863), and was credited with having had great influence upon the management of the war department and with some important steps taken by Pres. Lincoln. He was elected to Congress 1872. D. at Boston June 29, 1873.

Whiting (William D.), U. S. N., b. May 1, 1823, in Massachusetts; entered the navy as midshipman Mar. 1, 1841; became a lieutenant in 1855, commander in 1866, captain in 1872; served as executive officer of the Vandalia in the battle of Port Royal; in Sept., 1861, and in 1863 commanded the Ottawa in many of the fights with the forts defending the harbor of Charleston. Commended for "skill, fine bearing, and superior judgment." Became chief of Bureau of Navigation June 11, 1878. Foxhall A. Parker.

Whiting (William H. C.), b. in Mississippi 1825; graduated at the U. S. Military Academy at the head of his class July 1, 1845, when appointed second lieutenant in the corps of engineers. Until 1853 he was engaged as assistant in the construction of the defences of Pensacola harbor, Fla., and in the improvement of rivers and harbors in Texas, of the defences of San Francisco 1853–55; was in charge of the construction and repair of fortifications on the South Atlantic coast, and the improvement of various rivers and harbors in that section, including Cape Fear and Savannah rivers, 1856–61. He resigned his commission of captain of engineers Feb. 20, 1861, to join the Southern Confederacy, in whose service he became a major-general, and commanded a division in Jackson's corps in 1863. Fort Fisher, at the mouth of Cape Fear River, was planned and constructed by him, and in defence of that work (Jan., 1865) he was severely wounded and taken prisoner. Removed to Governor's Island, New York harbor, where his death occurred Mar. 10, 1865.

Whi'tinghum, p.-v. and tp., Windham co., Vt. P. 1263.

Whiting Pont. See Bir.

Whi'tinsville, p.-v., Worcester co., Mass.

Whit'ley, county of N. E. Indiana, intersected by Eel River, and traversed by Pittsburg Fort Wayne and Chicago R. R.; surface generally undulating, soil fertile. There are many saw-mills and carriage-factories. Cattle and sheep are the chief live-stock. Staples, wheat, Indian corn, wool, and dairy products. Cap. Columbia City. Area, 324 sq. m. P. 14,399.

Whitley, county of S. E. Kentucky, bordering on Tennessee, and intersected by Cumberland River, the falls of which are in this county. The surface is hilly and broken, and there is an abundance of bituminous coal and iron ore. Swine, cattle, and sheep are the chief live-stock. Staples, Indian corn, oats, tobacco, and wool. Cap. Whitley Court-house. Area, 450 sq. m. P. 8278.

Whitley Court-house, p.-v., cap. of Whitley co., Ky.

Whitley's, tp., Moultrie co., Ill. P. 1280.

Whit'low, better known as **Felon,** a painful inflammation of the fingers and toes, more often affecting the last joint of the fingers. The felon may arise from a local bruise; more often it is the result of disturbed and deteriorated states of the blood. From the latter causes a number of felons may develop successively. A point of local tenderness and hardness is observed; swelling and induration increase, with persistent, deep-seated pain, at first dull, later more severe, with sense of tension, and ultimately lancinating and throbbing. The felon involves the periosteum, or fibrous sheath of the bone, and the unusual pain attending this condition is due to the dense and unyielding structure of the part and the degeneration of the inflammatory exudation into pus. The periosteum is usually separated from the bone by the burrowing pus, giving rise to the sense of tension; the bone, so deprived of its sheath and nutritive vessels, is liable to die, dead bone being a frequent sequel of felon. The constitutional disturbance is marked, the result of great suffering, the local injury, and the absorption of pent-up pus into the blood. When detected early, a felon may sometimes be dissipated by an ice-pack or by a small blister; more often it will progress. An early and efficient incision of the point of induration may avert further suffering and prevent the formation of much pus. Poulticing is a slower and painful means of bringing the pus to the surface; it should be evacuated with the knife as soon as detected. Dead bone and stiff joints need never follow felon if opened early. In severe cases anodynes may be needed to secure sleep and allay pain; quinine to sustain the strength; and sulphites to correct the blood in recurring felon.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Whit'man, county of Washington Territory, bordering on Idaho. It has been formed since the census of 1870. Cap. Colfax. Area, about 3000 sq. m.

Whitman (Bernard), b. at East Bridgewater, Mass., in 1796; educated at Harvard, and became pastor of the Second (Unitarian) church at Waltham, Mass., 1826. D. at Waltham in 1834. He took an active part in the "Unitarian controversy," publishing *Two Letters on Religious Liberty* (1830), *Village Sermons* (1832), *Friendly Letters to a Universalist on Divine Rewards and Punishments* (1833), and many single sermons and addresses.

Whitman (Ezekiel), b. at East Bridgewater, Mass., Mar. 9, 1776; graduated at Brown University 1795; settled in Maine as a lawyer 1799, residing at Portland from 1807; was a member of Congress 1809–11, 1817–21, and 1821–23, of the executive council 1815–16, and of the constitutional convention 1819; chief-justice of common pleas 1822–41, and of the superior court 1841–48. D. at East Bridgewater, Mass., Aug. 1, 1866. Author of *A Genealogy of the Descendants of John Whitman* (1832).

Whitman (Jason), brother of Bernard, b. at Bridgewater, Mass., in 1799; graduated at Harvard 1825; studied theology; was pastor of Unitarian churches at Saco, Me., 1830–34, at Portland 1835–45, and at Lexington, Mass., 1845–48, and was general secretary of the American Unitarian Association 1834–45. D. at Lexington Jan. 25, 1848. Author of a *Memoir* of his brother Bernard (1837) and of their father, Deacon John Whitman (1843), and of several devotional, moral, and religious treatises, chiefly for the young.

Whitman (Sarah Helen **Power**), b. at Providence, R. I., in 1803; married in 1828 John Winslow Whitman, a lawyer at Boston, who died in 1833, since which time she has resided at Providence. Author of *Hours of Life, and other Poems* (1853), *Edgar Allan Poe and his Critics* (1860), and, with her sister, Anna Marsh Power, of a volume of *Fairy Ballads* (revised ed. 1867–68). D. June 27, 1878.

Whitman (Walt), b. at West Hills, Long Island, N. Y., May 31, 1819; educated in the public schools of Brooklyn and New York City; learned the printing and

subsequently the carpenter's trade; taught school; made extended pedestrian tours through the U. S. and Canada 1847–48; edited for brief periods newspapers at New Orleans and at Huntington, L. I.; was a volunteer nurse in the hospitals at Washington and in Virginia 1862–65; held clerkships in the government offices at Washington most of the time from 1865 to 1874; since which time, being partially disabled by paralysis, he has resided at Camden, N. J. Author of *Leaves of Grass* (1855), *Drum-Taps* (1865), and *Two Rivulets* (1873).

Whit'marsh (Caroline Snowden), b. at Boston, Mass., in 1827; is authoress of many works for the young of a religious, moral, or educational character; has contributed to the *Christian Examiner* and other magazines; was joint editor (with Mrs. Anne E. Guild) of an interesting and valuable collection, *Hymns of the Ages* (3 series, 1859–64), and sole editor of *Prayers of the Ages* (1867).

Whit'more, tp., Macon co., Ill. P. 1111.

Whitmore (William Henry), b. at Dorchester, Mass., Sept. 6, 1836; educated in the Boston public schools; was associated with Mr. John Ward Dean in founding the *Historical Magazine*; has been editor of the *New England Genealogical Register* and of the *Heraldic Journal*, a contributor to several magazines, chiefly on genealogical and historical subjects, and is a prominent officer of the New England Historico-Genealogical Society. Author of *A Register of Families settled at the Town of Medford, Mass.* (1855), *A Hand Book of American Genealogy* (1862), *The Cavalier Dismounted, an Essay on the Origin of the Founders of the Thirteen Colonies* (Salem, 1865), *A Brief Genealogy of the Descendants of William Hutchinson and Thomas Oliver* (1865), *The Elements of Heraldry* (1866), *The American Genealogist, being a Catalogue of Family Histories and Publications containing Genealogical Information issued in the U. S., arranged chronologically* (Albany, 1868; new ed. 1871), and many brief genealogies issued separately, among which are those of the families Hall, Whitmore, Temple, Bowdoin, Lane, Reyner, Whipple, Quincy, Norton, Winthrop, and Ayres. He has edited for the Prince Society *The Hutchinson Papers* (2 vols., 1865) and *The Massachusetts Civil List 1636–1774* (1871), and supervised an edition of the *Poems* of W. M. Praed (1860).

Whit'ney (Adeline D. **Train**), b. at Boston, Mass., in 1824; married Seth D. Whitney of Milton, Mass.; has long been a favorite contributor to magazines, especially those for the young. Author of *Footsteps on the Sea, a Poem* (1857), *Mother Goose for Grown Folks* (1860), *The Boys at Chequasset* (1862), *Faith Gartney's Girlhood* (1863), *The Gayworthys, a Story of Threads and Thrums* (1865), *A Summer in Leslie Goldthwaite's Life* (1866), *Patience Strong's Outings* (1868), *Hitherto, a Story of Yesterday* (1869), *Real Folks* (1872), and other works.

Whitney (Asa), b. in Townsend, Mass., Dec. 1, 1791. His early advantages of education were limited, and at fourteen years of age he sought employment in Boston; after some months returned home, and after attending school for a time entered his father's blacksmith-shop, and, having learned the trade, worked in Swansea, N. H., on cotton-mill machinery for two years or more; in 1813 removed to Brattleboro', Vt., and engaged in the same business, but was burned out and lost all his savings; removed to Brownsville, Jefferson co., N. Y., and for the next twelve years, in company with Mr. U. Walton, manufactured cotton machinery, nails, etc.; in 1826–30 made the machinery for a cotton-mill and engaged in the manufacture of cotton goods, but was unsuccessful; in 1830 was appointed master-machinist in the Mohawk and Hudson R. R. shops, and from 1833 to 1836 was superintendent of the road; in 1836 took charge of a foundry for making cast steel in Orange co., but was recalled the next year to the superintendency of the railroad; in 1839 resigned from impaired health; was appointed a canal commissioner of the State of New York the same year, and served two years, having charge of the Champlain Canal and the eastern division of the Erie Canal; his reputation as a railroad engineer was at this time so high that he was consulted on the question of the gauge of the Erie Railway, then building; gave an elaborate opinion in favor of the 4 foot 8½-inch gauge, which, had it been adopted then (it has been recently), would have saved the railway many millions of dollars; in 1842 removed to Philadelphia, and became a partner with Matthew Baldwin in the manufacture of locomotives; four years later devoted his energies to the work of perfecting of car-wheels by a new process; was delayed for a year or two by his duties as president of the Morris Canal Co., and it was not until 1848 that he commenced the manufacture of car-wheels on a large scale. Using only the best qualities of iron, testing the wheels at every stage, and annealing them thoroughly by a process of his own invention, it was soon found that these car-wheels were not liable to breakage, and were practically indestructible. The manufacture constantly increased, and for some years previous to his death about 75,000 wheels were produced annually. D. in Philadelphia June 4, 1874. Mr. Whitney was a man of great benevolence, giving liberally through life, and at his death left $50,000 to found a chair of dynamical engineering in the University of Pennsylvania, and about $10,000 to other charitable purposes.

L. P. Brockett.

Whitney (Asa), b. about 1797; became a merchant in New York City, and was the first person who suggested a railroad to the Pacific, a project which he urged for many years upon Congress and upon the public by means of personal influence, speeches, newspaper articles, and pamphlets, and was instrumental in securing the survey of several routes. D. at Washington, D. C., in Aug., 1872. Among his publications were *A Project for a Railroad to the Pacific* (New York, 1849) and *A Plan for a Direct Communication between the Great Centres of the Populations of Europe and Asia* (London, 1851).

Whitney (Eli), b. in Westborough, Mass., Dec. 8, 1765; graduated at Yale College 1792; went to Georgia; studied law while residing in the family of the widow of Gen. Nathanael Greene, by whom he was stimulated to devise a machine for cleaning seed-cotton, in which he succeeded, having invented the cotton-gin; suffered much from violence and fraud, the idea of his invention having been stolen by others, but formed a partnership with a Mr. Miller and commenced the manufacture of the machines near the town of Washington, Ga., in 1795; was voted by the legislature of South Carolina a sum of $50,000 for his invention, which he succeeded in collecting only after many years of litigation; received a percentage for five years upon the use of his gins from the State of North Carolina, and was promised the same by Tennessee, but without results; turned his attention to the manufacture of firearms, entering into a contract with the U. S. government 1798, and reaped a fortune from his various improvements in their manufacture, which rapidly increased and became the origin of the flourishing village of Whitneyville, Conn. D. at New Haven Jan. 8, 1825.

Whitney (Frederick Augustus), b. at Quincy, Mass., Sept. 13, 1812; graduated at Harvard 1833, and at the Cambridge Divinity School 1838; was pastor of the Unitarian church at Brighton, Mass., 1843–58. Author of *An Historical Sketch of the Old Church at Quincy, Mass.* (1864), *A Biography of James Holton, Founder of the Holton Library, Brighton, Mass.* (1865), and of various published sermons, orations, hymns, Sunday-school reports, and articles in periodicals.

Whitney (Geffrey), b. at Nantwich, Cheshire, England, about 1550; educated at Oxford University; resided several years at Leyden, Holland, where he published a curious and exceedingly rare volume, *A Choice of Emblemes, and other Devises, for the moste parte gathered out of Sundrie Writers, Englished and Moralized and Divers Newly Devised, etc.* (2d ed. 1586), and settled soon afterward at Ryle's Green, Cheshire, where he d. 1602 or 1603. A photo-lithographic reprint of his *Emblemes* (1866) was edited by Rev. Henry Green of Knutsford, Cheshire.

Whitney (George), b. at Quincy, Mass., in 1804; graduated at Harvard 1824, and at Cambridge Theological School 1829, and was pastor successively of the Second and Third churches at Roxbury, Mass., where he d. in 1842. Author of several published sermons and addresses, and of *Some Account of the Early History and Present State of the Town of Quincy, Mass.* (1827).

Whitney (Henry Austin), b. at Boston, Mass., about 1835; is a banker in that city, but a resident of Hingham, and is a member of the Massachusetts Historical Society. He has privately printed *A Brief Account of the Descendants of John and Elinor Whitney* (1857) and *Incidents in the Life of Samuel Whitney* (1860), and has reproduced in fac-simile Cushing's *Account of the First Settlers of Hingham, Mass.*

Whitney (James Amaziah), M. A., LL.B., b. June 30, 1839, at Rochester, N. Y.; was in youth a farmer in the township of Maryland, Otsego co., N. Y., and received a common-school education; from 1860 to 1865 devoted himself without assistance to the study of chemistry, mechanics, and engineering; acquired by practice the trades of pattern and model maker, machinist, and draftsman; in 1865 came to New York City, and entered the office of a firm of patent solicitors as a writer of specifications; in 1868 became editor of the *American Artisan*, a weekly technical journal; in the same year took a leading part in organizing the New York Society of Practical Engineering, and was elected its president, which position he still holds; in 1869 became prominent in the New York Farmers' Club,

and was elected professor of agricultural chemistry of the American Institute; in 1872 established himself as a solicitor of U. S. and foreign patents, and in 1876 was admitted to practice as attorney and counsellor at law in the circuit courts of the U. S. He is the author of numerous essays on the law of patents, etc., on agricultural chemistry, applied mechanics, and engineering. He is now writing a textbook on the law of patents for inventions, and another work, involving long and laborious research, on the relations of the law of patents to industrial, social, and intellectual progress, from the inception of the system in the early part of the seventeenth century to the present time.

Whitney (Josiah Dwight), brother of Prof. Wm. D., LL.D., b. at Northampton, Mass., Nov. 23, 1819; graduated at Yale College 1839; was for many years employed on State and national geological surveys, including Ohio, the Lake Superior region, Mississippi, and California, where he has been for many years State geologist; has been since 1865 Sturgis-Hooper professor of geology in Harvard University, and is a prominent member of the American Association and of the National Academy of Science. Author of *The Metallic Wealth of the U. S.* (Philadelphia, 1854), *A Report on the Upper Mississippi Lead Region* (1862), *The Geological Survey of California* (vol. i., 1864), and *The Yosemite Guide-Book* (1864); translated *Berzelius on the Blowpipe* (1845); was joint author with Prof. John W. Foster of a *Report on the Geology of the Lake Superior Land District* (1851–52), and with Prof. James Hall of a *Geological Report on Ohio* (1858).

Whitney (Peter), b. at Petersham, Mass., in 1744; graduated at Harvard 1762, and was pastor of the church at Northborough from 1767 until his death, in 1815. Author of several occasional addresses and scientific papers, and of a *History of the County of Worcester* (1793).

Whitney (Thomas R.), b. in New York City in 1804; became editor of the *Republic* and the New York *Sunday Times*, and wrote for other periodicals; served two years in the New York assembly, and was member of Congress 1855–57. D. Apr. 12, 1858. Author of *The Ambuscade, an Historical Poem* (1845), and of *A Defence of the American Policy as opposed to the Encroachments of Foreign Influence, etc.* (1856).

Whitney (William Collins), b. at Conway, Mass., July 5, 1841, son of Gen. James S. Whitney, a distinguished Democratic leader; was prepared for college at the Williston Seminary, Easthampton, Mass.; graduated at Yale College 1863; studied law at the Harvard Law School, Cambridge, Mass.; commenced practice in New York City in 1865; soon obtained an extensive business, and became prominent in city politics, and was appointed in 1875 to the post of corporation counsel.

Whitney (William Dwight), b. at Northampton, Mass., Feb. 9, 1827; graduated at Williams College 1845; was several years clerk in a bank; in 1849–50 studied Sanskrit at New Haven; 1850–53 studied in Germany at Berlin and Tübingen, especially with Profs. Weber and Roth; planned with the latter an edition of the *Atharva-Veda*, and copied and collated all the MSS. then in Europe, visiting Paris, Oxford, and London on the way home for that purpose in the summer of 1853. A volume of the text appeared in 1856–57 (only one yet published); notes, translation, indexes, etc., are now in preparation. He became a member of the American Oriental Society in 1849, librarian from 1855–73, corresponding secretary since 1857, much occupied with labors for it and contributions to its journal; vols. v.–ix. were more than half written by him; principal contributions, translation with notes, etc. of *Sûrya-Siddhânta*, astronomical treatise (1860); text, notes, etc., of *Atharva-Veda-Prâtiçâkhya* (1862), and text, native comment, version, and notes of *Tâittirîya-Prâtiçâkhya* (1871); these two being Hindoo grammatical treatises. The *Tâittirîya-Prâtiçâkhya* received the Bopp prize from the Berlin Academy as the most important Sanskrit publication of the three years then ending. Prof. Whitney at this time was engaged in other discussions of Asiatic astronomy, relating especially to the "lunar zodiac," or division of the ecliptic into twenty-seven or twenty-eight lunar stations, of which he shows the origin to be undetermined, as against the arguments of Biot and others; also discussions of Lepsius's standard alphabet and other phonetic works. He was made professor of Sanskrit in Yale College in 1854, and of comparative philology in 1870; was first president of the American Philological Association; delivered in 1864 a series of lectures on the study of languages at the Smithsonian Institution, Washington; repeated, in extended form, the same at Lowell Institute, Boston; published these lectures in New York and London (1867). They were translated into German by Dr. J. Jolly in 1874. A volume on the *Life and Growth of Language* in "International Scientific Series" was issued in 1875, which was also translated into German and French in the following year. His views of language, taken and defended, may be gathered from his articles on Language in this work. Mr. Whitney has made numerous contributions to journals and reviews, mostly in America, also in England and Germany. From these, 2 vols. of *Oriental and Linguistic Studies* were collected and published in 1872–74. He contributed aid to the editors of the great Sanskrit lexicon of St. Petersburg (1852–75). In addition to these literary labors, Prof. Whitney has been now for many years an instructor in modern languages in Yale College, and in 1869 he published a *Compendious German Grammar*, and in 1873 a *Reader*, with notes and a vocabulary, on a somewhat new plan, with a view to derivations and English-German correspondences. He has in preparation a fuller dictionary, and a series of annotated German dramas. He has also in preparation an English school grammar and Sanskrit grammar for a German publisher. Prof. Whitney's reputation as a scholar is due to labor in several fields. He has established his position as one of the leading Sanskritists of the day by his above-mentioned editions of Sanskrit works. His grammatical textbooks for the study of German, aside from their practical merits, deserve high recognition for their scientific statements of general grammatical doctrine. His most conspicuous services, however, have probably been in his contributions to the science of language, of which, in the judgment of many, he is the most successful systematizer and expositor. His original and suggestive characterization of language as an *institution* has put the real character of language in a new light. In contrast with some, he regards language not as inseparable from thought or spontaneously generated in the mind, but as conventional signs agreed upon among men; giving great efficacy in the beginnings of speech to the principle of onomatopœia. He thus views language as a development of human forces in a highly-endowed nature. His latest work, entitled *Life and Growth of Language*, is perhaps the most complete and consistent exhibition of the leading principles of linguistic science that is anywhere to be found. James M. Hoppin.

Whitney Ridge, tp., Penobscot co., Me. P. 18.

Whit'ney's Point, p.-v., Triangle tp., Broome co., N. Y. P. 480.

Whit'neyville, tp., Washington co., Me. P. 569.

Whi'ton (James Monris), b. at Boston, Mass., in 1833; graduated at Yale College 1853; was for some years rector of the Hopkins Grammar School at New Haven, Conn. Author of *A Handbook of Exercises and Reading Lessons for beginners in Latin* (1860; new ed. 1864), *First Lessons in Greek* (1861), and *Exercises in Latin Prose Composition* (1863).

Whiton (John Milton), D. D., b. at Winchendon, Mass., Aug. 1, 1785; graduated at Yale College 1805, and was pastor of the Presbyterian church at Antrim, N. H., 1808–53. D. at Antrim Sept. 28, 1856. Author of *Brief Notices of the Town of Antrim* in the *Collections* of the New Hampshire Historical Society (vol. iv., 1852), of a statistical account of the Congregational and Presbyterian ministers of Hillsborough county in the *New Hampshire Repository* (1846), and of *Sketches of the History of New Hampshire 1623–1833* (Concord, 1834). He left incomplete a *History of Presbyterianism in New Hampshire*.

Whit'paine, tp., Montgomery co., Pa. P. 1330.

Whitsunday, or **Whitsuntide.** See Pentecost.

Whit'taker (John William), D. D., b. at Manchester, England, in 1790; educated at, and became fellow of, St. John's College, Oxford; took orders in the Church of England; was vicar of St. Mary's, Blackburn, and honorary canon of Manchester. D. Aug. 3, 1854. Author of *An Historical and Critical Enquiry into the Interpretation of the Hebrew Scriptures* (1819) and a *Supplement* (1820), of several volumes of sermons and religious treatises, and contributed to various periodicals.

Whit'taker's, p.-v., Edgecombe co., N. C.

Whit'telsey (Chauncy), son of Rev. Samuel, b. at Wallingford, Conn., Oct. 28, 1717; graduated at Yale College 1738; was a distinguished tutor there 1739–45; was a merchant at New Haven 1745–55; preached occasionally, having been licensed in 1740; was ordained pastor of a church in New Haven, as colleague with Rev. Joseph Noyes, Mar. 1, 1758, and became sole pastor 1761. D. at New Haven July 24, 1787. Five of his *Sermons* were printed.

Whittelsey (Samuel), b. at Saybrook, Conn., in 1686; graduated at the college, then established at Saybrook, afterward known as Yale, 1705; commenced preaching at Wallingford, Conn., 1709; was ordained colleague to Rev. Samuel Street, pastor at that place, May, 1710; married

Sarah Chauncy, granddaughter of Pres. Chauncy, July, 1712, and was a fellow of Yale College from 1732 until his death, at Wallingford Aug. 15, 1752. Four of his *Sermons* were printed.—His eldest son, SAMUEL, b. Nov., 1711, graduated at Yale College 1729; was tutor there 1732–38, and was pastor of Milford, Conn., from 1738 until his death, Oct. 22, 1768.

Whitte'more, tp., Darlington co., S. C. P. 1986.

Whittemore (AMOS), b. at Cambridge, Mass., Apr. 19, 1759; was brought up as a farmer; worked some years as a gunsmith; became a manufacturer of cotton and wool cards, and invented a machine for puncturing the leather and setting the wires, patented 1797. This invention was afterward sold for $150,000, though he was unsuccessful in an effort to secure a patent in England. One of its leading features occurred to the inventor in a dream. He was employed during his later years in devising an orrery in which each planet should describe its own orbit, but never completed it. D. at West Cambridge Mar. 27, 1828.

Whittemore (THOMAS), D. D., b. at Boston Jan. 1, 1800; was successively apprenticed to a morocco-dresser, a brass-founder, and a boot-maker; studied theology under Rev. Hosea Ballou; preached to Universalist churches in Milford 1821, and Cambridgeport 1822–31; settled at Cambridge; was joint editor of the *Universalist Magazine*, sole editor and proprietor for nearly thirty years from 1828 of its successor, *The Trumpet*; sat repeatedly in the Massachusetts legislature, and was president of the Vermont and Massachusetts R. R. D. at Cambridge Mar. 21, 1861. Author of *The Modern History of Universalism* (1830; enlarged ed. 1860), *Notes and Illustrations of the Parables of the New Testament* (1832), *Songs of Zion* (1836), *A Commentary on the Revelation of St. John* (1838), *A Main Guide to Universalism* (1839), *The Gospel Harmonist* (1841), *Conference Hymns* (1842), *Sunday-school Chair* (1844), *Life of Walter Balfour* (1853), *Life of Rev. Hosea Ballou* (1 vols., 1854–55), and an *Autobiography* (1859); wrote a number of tracts in favor of Universalism, and edited Dr. Southwood Smith's *Illustrations of the Divine Government* (1831), with an *Appendix*.

Whit'ten's, tp., Lee co., Ala. P. 2019.

Whit'tier (JOHN GREENLEAF), b. at Haverhill, Mass., Dec. 17, 1807, of Quaker parentage; received a common-school education; spent his boyhood on a farm, learning also the trade of a shoemaker; began when eighteen years of age to write verses for the Haverhill *Gazette*; spent two years thereafter at the Haverhill Academy; became in 1829 editor of the *American Manufacturer*, a newspaper at Boston; succeeded George D. Prentice (who in 1830 went South to write the life of Henry Clay) as editor of the *New England Weekly Review*, which had been founded by J. G. C. Brainerd, at Hartford, Conn.; returned to Haverhill 1831, and engaged in farming for several years; edited, however, the *Gazette* 1832 and 1836; was a member of the legislature 1835–36; became secretary of the American Anti-Slavery Society at Philadelphia 1836; edited the *Pennsylvania Freeman* 1838–39, his office being sacked and burned by a mob; settled at Amesbury, Mass., 1840; became corresponding editor of the *National Era*, an anti-slavery paper published at Washington, D. C., by Dr. Gamaliel Bailey, 1847; contributed to its columns many of his anti-slavery and other favorite lyrics, and has lived in literary retirement of Quaker simplicity for many years, publishing frequent volumes of poetry, which have procured him a prominent place among American authors and the love and admiration of his countrymen. He has never married. In 1876 he took up his residence at Peabody (formerly South Danvers), Mass. Several collective editions of his poems have appeared, the best being the "Centennial edition" of 1876. His prose writings are *Legends of New England* (Hartford, 1831), *Justice and Expediency, or Slavery considered with a View to its Abolition* (1833), *The Stranger in Lowell* (1845), *Supernaturalism in New England* (1847), *Leaves from Margaret Smith's Journal* (1849), *Old Portraits and Modern Sketches* (1850), and *Literary Sketches* (1854). He has published no extended poem. (For the characteristics of his poetry see ENGLISH LANGUAGE AND LITERATURE, by RICHARD GRANT WHITE.) PORTER C. BLISS.

Whit'tingham (Sir SAMUEL FOOD), b. in England about 1782; entered the army as lieutenant 1803; served in the Peninsular war as deputy assistant quartermaster-general 1809–10; became major Mar., 1810; was aide-de-camp to Gen. Castaños and to the duke of Albuquerque; took part in the battles of Baylen, Talavera, and Barossa; raised and disciplined a large corps of Spanish troops; took command of them with the rank of major-general; was commander of a division under Sir John Murray, and subsequently under Lord William Bentinck; was appointed aide-de-camp to the prince regent 1814; knighted May 3, 1815; became governor of Dominica 1819; quartermaster-general in India 1822; took part in the famous siege of Bhurtpoor 1825–26, and was appointed major-general; was commander-in-chief in the Windward and Leeward islands 1835–39, and at Madras as lieutenant general from 1840 until his death, Jan. 19, 1841. His son, Major Gen. Ferdinand Whittingham, has published his biography.

Whittingham (WILLIAM), b. at Chester, England, in 1524; educated at Brasenose College, Oxford; subsequently studied divinity at Orleans, France, where he married a sister of John Calvin; settled at Geneva, where he was ordained pastor of the church of English exiles (1556) as the successor of John Knox in the ministry, and took part, with others, in the translation of the Bible called by his name, which was published by C. Badius at Geneva (1557). He also made metrical translations of the Ten Commandments and of some of the Psalms. In 1563 he became dean of Durham, England, where he d. in 1589. His widow and children emigrated to New England, and a son graduated at Harvard College and married a daughter of Rev. William Hubbard, the historian. A granddaughter by this marriage became the wife of Gov. Gurdon Saltonstall of Connecticut.

Whittingham (WILLIAM ROLLINSON), D. D., LL.D., D. C. L., b. of devout English parents in N. Y. City Dec. 2, 1805. His father, while actively engaged in business, found time for the pursuits of a scholar. His mother, a woman of strong mind, with a view to educating her son, made herself, under the instruction of her husband, proficient in the learned languages; such were her attainments that she at one time gave lessons in Hebrew to theological students. Young Whittingham, who at a very early age showed that aptitude for learning and devotion to study which characterized him, had no other instructor until he became a student at the General Theological Seminary. Whatever the benefits of such home-training, it may yet be doubted whether it be the best for one who is to be the guide and ruler of other men. He was graduated a year in advance of the canonical age for ordination. When made deacon by Bishop Hobart, he was sent as a missionary to Orange, N. J., and the adjoining villages, and within the year was advanced to the priesthood. His zeal for parochial work was as intense as had been his application as a student. In 1835 he was nominated to the professorship of ecclesiastical history in the General Theological Seminary by Mr. Stuyvesant, who had lately endowed the chair. While engaged in labors so congenial he was (in 1840) chosen bishop of Maryland. His success as a professor had been so marked, and his influence over the future teachers of the Church so great, that many regretted his abandoning this work even for that to which he was called. He was elected after warm and long-continued party contests. It cannot be pretended that party spirit ceased on his becoming bishop, but yet from his access the diocese rapidly advanced in all that belongs to Church improvement, and his personal influence with both clergy and laity could be rightly described only in terms of seeming exaggeration. This popularity he with pain sacrificed, to a great extent, during the troubles which followed secession, for his sense of duty separated him from the sympathies of the larger number of his people; but by this very cause for regret he was the better enabled, after the close of the war, to prevent obstacles to the return to unity in the Church. By the request of the House of Bishops, and as their representative, he attended the Bonn conference of the Old Catholics in Sept., 1872. While yet a student he, jointly with Dr. Turner, translated and prepared for the press Jahn's *Introduction*, and he has from time to time edited various Church works, but he has given to the world but little of his own. When seeking to influence men for their good, it seems not to have occurred to him that he could best do this by drawing on his own stores; to "esteem others better than himself" belonged to his nature. The esteem in which he was held by others cannot be better shown than by words spoken in convocation of the province of Canterbury during the current year by the bishop of Lichfield (Selwyn): "At the forthcoming meeting of bishops of the Anglican communion, if it be said that the whole of the Anglican bishops of the world could add very little to the learning that is to be found among the English bishops, I quite admit it; but there is one man in the American Church who, I believe, could take his part with credit, and that is Bishop Whittingham of Maryland." (*Guardian*, Feb., 1876.) D. at Orange, N. J., Oct. 17, 1879. W. F. BRAND.

Whit'tington (Sir RICHARD), b. at Pauntley, Gloucestershire, England, about 1350, younger son of Sir William de Whityngdon, lord of the manor of Pauntley, who d. 1360; was obliged to seek his living, and, according to a well-known legend, walked to London; was apprenticed there to a merchant, from whom at one time he started to

run away, but while seated at the foot of Highgate Hill seemed to hear in the chime of Bow Bells—

"Turn again, Whittington,
Thrice lord mayor of London;"

obeyed the summons; married Alice Fitzwarren, daughter of his employer; became a wealthy merchant, his first capital having been derived from the consignment of a cat to an Eastern market; was lord mayor of London 1397, 1406, and 1419; carried on the business of a mercer; made loans to Henry IV. and Henry V.; bought on the Continent the wedding trousseaux for the princesses Blanche and Philippa, of which the invoices are still in existence, and d. in 1423. Having no children, he left his large estate to public or charitable objects, among which were the rebuilding of Newgate prison, the founding of a college and of the libraries at Guildhall and of the Grey Friars, the repair of St. Bartholomew's Hospital, etc. He shared with Richard Harweden the expense of rebuilding the nave of Westminster Abbey, and during his magistracy ordered the compilation of a sort of directory of the city of London, containing curious and valuable accounts of its mediæval customs and privileges. This work, called the *Liber Albus* (or "White Book"), was written in 1419, in Latin and Anglo-Norman, by John Carpenter, common clerk of the city, and was first translated by Henry T. Riley for the rolls commission 1862. Interesting particulars respecting Whittington are given by Mr. Riley in the preface to the above work, and his memory as an historical character has been vindicated by Rev. Samuel Lysons in his entertaining book, *The Model Merchant of the Middle Ages, exemplified in the Story of Whittington and his Cat, being an Attempt to rescue that interesting story from the region of Fable, and to place it in its proper position in the Legitimate History of this Country* (London, 1860).

PORTER C. BLISS.

Whittington, or **Whitynton** (ROBERT), b. at Lichfield, England, about 1480; began to teach a grammar school about 1501; was a secular priest; became famous as a Greek and Latin scholar and as a Latin poet; was honored with the last rhetorical degree conferred at Oxford 1512, and was author of very numerous grammatical treatises published by Wynkin de Worde. D. about 1535.

Whit'tlesey (ABIGAIL **Goodrich**), sister of Samuel G. and Charles A. Goodrich, b. at Ridgefield, Conn., about 1795; founded and conducted the well-known and useful periodicals *The Mother's Magazine* (1833 *seq.*) and *The Mother's and Daughter's Magazine.* (See Mrs. S. J. Hale's *Woman's Record.*)

Whittlesey (CHARLES), b. at Southington, Conn., Oct. 5, 1808; removed to Ohio in 1813 with his parents; graduated at the U. S. Military Academy July, 1831, when appointed brevet second lieutenant of infantry. After a year's service, he resigned to study law, upon the practice of which profession he entered in 1835 at Cleveland, O., but became editor of the Cleveland *Herald* in 1836, which paper he conducted for a year; turning his attention now to engineering pursuits, he was employed upon the geological surveys of Ohio and Wisconsin; conducted mineralological surveys in Michigan, Minnesota, and Wisconsin, and engaged as mining engineer in the Lake Superior region. In the civil war he served as chief engineer of Ohio troops in the West Virginia campaign July–Aug., 1861, when appointed colonel 20th Ohio Vols., but employed as chief engineer of the department of the Ohio until December of that year. In Feb., 1862, he was engaged at Fort Donelson, and at Shiloh in April, on the 19th of which month ill-health compelled his resignation. Among his writings are the *Life of John Fitch* in Sparks's *American Biography, Ancient Mining on Lake Superior, Early History of Cleveland,* and, as a Smithsonian contribution, a paper on the *Glacial Drift of the North-western States.*

Whittlesey (ELISHA), b. at Washington, Conn., Oct. 19, 1783; received an academical education; studied law; settled in the Western Reserve of Ohio 1806; served in the war of 1812–15 as aide-de-camp to Gen. Wadsworth; was for sixteen years prosecuting attorney of his district; sat in the Ohio legislature 1820–21; was a member of Congress 1823–39; was one of the founders of the Whig party; was appointed by Pres. Harrison auditor for the post-office department, and by Pres. Taylor first comptroller of the treasury—a post which he held until 1857, and again under Pres. Lincoln from 1861 until his death, at Washington Jan. 7, 1863. He was a conspicuous example of ability and integrity in long and arduous public service.

Whittlesey (FREDERICK), b. at Washington, Conn., June 12, 1799; graduated at Yale College 1818; studied law; was admitted to the bar at Utica, N. Y., 1821; settled at Rochester 1822; conducted an anti-Masonic political newspaper in the campaign of 1828; was a member of Congress 1831–35; vice-chancellor of the eighth judicial district 1839–47; judge of the supreme court of New York 1847–48, and professor of law in Geneva College 1850–51. D. at Rochester Sept. 19, 1851. He published an *Address* delivered at Rochester July 4, 1842.

Whittlesey (SARAH J. C.), b. at Williamston, Martin co., N. C., about 1832; has written serial tales and verses for several periodicals, and published a volume of miscellaneous poems, *Heart-Drops from Memory's Urn* (1852), and 2 vols. of novelettes (1860 and 1867).

Whit'tredge (WORTHINGTON), b. in Ohio in 1820; became a painter of portraits and of landscapes at Cincinnati; resided in Europe 1849–59; settled in New York City 1860; became prominent among the artists of that city, and in 1876 was president of the National Academy of Design. Among his most admired productions are—*Twilight on the Shawangunk Mountains, The Ruins of Tusculum, The Roman Campagna, The Old Kentucky Home,* and *The Coast of Rhode Island.*

Whit'worth (CHARLES), BARON, b. at Aldboston, Staffordshire, England, about 1670; entered the diplomatic service as attaché to Mr. Stepney, whom he attended at several courts; was secretary of legation at Vienna; became resident to the German Diet at Ratisbon 1702, envoy to Russia 1704, and again 1710, plenipotentiary to the Diets of Augsburg and Ratisbon 1714, envoy to Prussia 1716 and 1719, to the States-General of Holland 1717, and plenipotentiary at the Congress of Cambray 1722, having in the preceding year been made Baron Whitworth of Galway. D. in London in 1725. His papers fell into the hands of the Walpole family, and Horace Walpole printed at Strawberry Hill his *Account of Russia as it was in 1710* (1758).

Whitworth (CHARLES), EARL **Whitworth,** b. at Laybourne Grange, Kent, England, in 1754; educated at Tunbridge School; became an officer in the Guards; was British minister to Poland 1786–88, to Russia 1788–1800, to Denmark 1800–02, and to France after the Treaty of Amiens (1802–03), the signal for the renewal of the war having been given by Napoleon in a celebrated interview (Mar. 13, 1803) with the British minister, who comported himself with dignity on the occasion. He had been made an Irish peer in 1800; was made a viscount June 14, 1813, and an earl Nov. 25, 1815, and served as viceroy of Ireland 1813–17. D. at Knowle May 13, 1825.

Whitworth (Sir JOSEPH), BART., F. R. S., b. at Stockport, England, in 1803; was trained to mechanical and manufacturing pursuits at Manchester, where he established an important manufacturing business; invented some improvements in planing-machines and other tools which attracted attention at the Great Exhibition of 1851; was a commissioner to the Exhibition at New York 1853, and began in 1854 the manufacture of the breech-loading rifles, cannons, and other firearms by which his name is widely known. (See ARTILLERY.) He founded in 1868 the "Whitworth scholarships" in mechanical science, thirty in number, of the annual value of £100; was made a baronet Oct., 1869, and has written several treatises on mechanics.

Whitworth Guns. See ARTILLERY, by MAJOR-GEN. W. F. BARRY.

Whoop'ing Cough, a disease generally occurring but once in the life of an individual, and usually during infancy or childhood, is characterized by paroxysms of convulsive coughing, followed by a long ringing inspiration, whence the name. It is the chin-cough of early English physicians, the *pertussis* of Sydenham, and the *coqueluche* of French authorities, and was formerly confounded with the catarrhal affections, which it much resembles in its symptoms and earlier diagnosis. The simple disease is rarely if ever fatal, but when complicated with pulmonary or cerebral disease it is extremely dangerous.

Whor'tleberry, Hurtleberry, or **Huckleberry,** a well-known American edible berry, being the fruit of the genera *Gaylussacia* and *Vaccinium,* constituting a sub-order of the ERICACEÆ, or heath family (which see).

Whyd'ah, town of Western Africa, in a district of the same name, on the Slave Coast of Guinea, on the Atlantic, in lat. 6° 18′ N. It was quite a considerable place, exporting palm oil, ivory, gold-dust, and salt, and the chief seat of the slave-trade. But it was almost entirely destroyed by fire in 1852, and has not yet recovered.

Whydah-Bird. See WIDOW-BIRD.

Whym'per (EDWARD), b. in London, England, Apr. 27, 1840; educated at Clarendon House School; became a draftsman on wood; made a series of journeys on the Continent, in one of which, in 1861, he ascended Mont Pelvoux, reputed the highest mountain in France; discovered from its summit another peak, the Pointe des

Écrins, 500 feet higher, which was subsequently ascended (1861); was chosen a member of the Alpine Club 1861; made for several years a series of bold ascents of Alpine summits before considered inaccessible, culminating in that of the Matterhorn July 14, 1865, when four of his companions lost their lives; travelled in N. W. Greenland, collecting fossiliferous deposits for the British Museum, and made a second visit to Greenland for a similar purpose in 1872. Author of *Swiss Pictures, drawn with Pen and Pencil* (1866), and *Scrambles among the Alps 1860–69* (1869).—His relative, FREDERICK WHYMPER, is author of *Travel and Adventure in Alaska* (1868) and *The Heroes of the Arctic and their Adventures* (1875).

Whyte (WILLIAM PINCKNEY), b. at Baltimore, Md., in 1824, is grandson of William Pinckney, a signer of the Declaration of Independence; received a classical education; became a merchant; studied law at Cambridge, Mass.; was admitted to the bar at Baltimore 1846; was elected to the Maryland house of deputies 1847, and State comptroller 1853; was appointed U. S. Senator for an unexpired term 1868, and has twice been elected to the same post.

Whytt (ROBERT), M. D., F. R. S., b. at Edinburgh, Scotland, in 1714; studied medicine at Edinburgh, London, Paris, and Leyden, besides taking a medical degree at Rheims and at St. Andrew's 1736; became a fellow of the Edinburgh Royal College of Physicians 1738, professor of the institutes of medicine at Edinburgh 1746, first physician to the king in Scotland 1761, and president of the Royal College of Physicians 1761. D. at Edinburgh Apr. 15, 1766. Author of *An Essay on the Vital and other Involuntary Motions of Animals* (1751), *Physiological Essays* (1755), *Observations on Nervous Disorders* (1765), and other professional treatises, which were collectively published as his *Works* (1768).

Wich'ern (JOHANN HEINRICH), b. in Hamburg Apr. 21, 1808; studied theology at Göttingen and Berlin, and opened in 1833 at Hort, near Hamburg, the *Rauhes Haus*, a reformatory for vagrant children, the beneficent effects of which institution were so great that it was soon imitated not only in various places in Germany, but also in France, Holland, and England. In 1848 the Protestant Ecclesiastical Assembly at Wittenberg combined, for the purpose of united action, all the inner missions under one central committee, at the head of which Wichern was placed, and finally in 1858 the Prussian government appointed him superintendent of all penal and correctional institutions of the country. Since 1844 he has issued the monthly *Fliegende Blätter des Rauhen Hauses*, and in 1849 he published *Die Innere Mission der deutsch-evangelischen Kirche*.

Wichi'ta, unorganized county of W. Kansas. Area, about 720 sq. m.

Wichita, unorganized county of N. W. Texas, bounded N. by Red River, and drained by the Wichita and other streams. Area, about 650 sq. m.

Wichita, p.-v. and tp., cap. of Sedgwick co., Kan., the terminus of Atchison Topeka and Santa Fé R. R., has 4 churches, good schools, 3 banks, 2 weekly and 2 monthly newspapers, 6 hotels, and 1 sash and 1 wagon manufactory. P. 689. R. P. MURDOCK, MAN. "EAGLE."

Wick [Ang.-Sax. *wecce*], the central porous material which by its capillary attraction affords a passage for the oil of lamps and candles to ascend to the flame. The pith of rushes is used by the peasantry in parts of Europe, moss and lichens are employed in Arctic regions, and in most civilized regions cotton, usually plaited or braided, is employed. In candles of the best quality many ingenious devices are used to obviate the necessity of snuffing. (See *Wicks* in STEARIC ACID.)

Wick, town of Scotland, capital of the county of Caithness, at the mouth of the Wick, consists of Wick proper, on the northern bank of the river, and Pulteney, on the southern. Herring fishing, shipbuilding, and trade in wool and cattle are carried on with great energy. P. 8132.

Wickacance', tp., Northampton co., N. C. P. 1641.

Wick'er's, tp., Clay co., Ala. P. 770.

Wick'ersham (JAMES PYLE), LL.D., b. in Chester co., Pa., in 1825; educated at Unionville Academy; taught school several years; became principal of an academy at Marietta, O., 1846, and of the Pennsylvania State Normal School at Millersville 1855–66, and in the latter year became State superintendent of public schools. Author of *School Economy* (1864), *Methods of Instruction* (1865), *Methods of Culture*, and a *History of Education*.

Wick'ford, p.-v., Washington co., R. I.

Wick'ham, tp., Limestone co., Ala. P. 882.

Wick'liffe (CHARLES A.), b. at Bardstown, Ky., June 8, 1788; educated at the Bardstown grammar school; was admitted to the bar 1811; became a prominent lawyer; was aide to Gen. Caldwell at the battle of the Thames, Oct. 5, 1813; was a member of the legislature 1812–25, of Congress 1823–33, Speaker of the legislature 1831; was elected lieutenant governor 1836; became acting governor 1839; was postmaster general in the administration of Pres. Tyler 1841–45; was sent by Pres. Polk on a secret mission to Texas 1845; was a member of the State constitutional convention 1849, of the Peace Congress of Feb., 1861, of the U. S. Congress 1861–63, and delegate to the Chicago convention of 1864; was blind during his later years, but continued to practise at the bar. D. in Howard co., Md., Oct. 31, 1869.

Wickliffe (JOHN). See WYCLIFFE.

Wick'low, county of Ireland, bordering E. on the Irish Sea, comprises an area of 782 sq. m., with 78,509 inhabitants, of whom over 28,500 are unable to read or write. The surface rises in the middle in a group of mountains 3000 feet high, sometimes well wooded and picturesque, sometimes barren and wild. On the slopes of these mountains are good pastures and tracts of fertile soil. Crops of oats, potatoes, and some wheat are gathered; dairy farming much attended to, and copper and lead mines worked. Chief town, Wicklow. Since 1851, 17,925 persons have emigrated from this county.

Wicom'ico, county of S. E. Maryland, bordering on Delaware, drained by the Pocomoke, Nanticoke, Wicomico, and other streams, and traversed by Eastern Shore and Wicomico and Pocomoke R. Rs.; surface generally low and level, soil tolerably fertile. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn and wool. Cap. Salisbury. Area, 350 sq. m. P. 15,802.

Wicomico, p.-v. and tp., Northumberland co., Va. P. 1415.

Wicomico River rises by several head-streams in Sussex co., Del., and flows south-westward into Maryland, and its waters at least reach Ellis and Monie bays, arms of Chesapeake Bay. It is navigable to Salisbury, Md., and is an important channel of trade.

Wiconis'co, p.-v. and tp., Dauphin co., Pa. P. 2993.

Wic'opy, the popular name of *Dirca palustris*, a shrub of the mezereum family or Thymelaceæ, found in the eastern forests of the U. S. from Maine to Florida. The name is of Algonkin Indian origin, and the plant is better known under the names of "leatherwood" and "moosewood," being remarkable for the toughness of its bark, which is employed for thongs, and also for baskets.

Wid'der Station (THEDFORD P. O.), v., Lambton co., Ont., Canada, on Grand Trunk Railway, 32 miles N. E. of Sarnia, has a woollen-factory and a weekly newspaper. P. about 500.

Wid'din, town of European Turkey, in Bulgaria, near the Servian frontier, on the Danube, is wretchedly built, dirty, and filthy, but strongly fortified, surrounded by morasses, and defended by walls and citadels. At high tide large ships from the Black Sea can ascend to its harbor, and the trade which it carries on in corn, wine, and rock-salt is very important; leather and arms are manufactured. P. about 25,000.

Widg'eon [Fr. *vingeon*], the vernacular English name for the ducks of the genus *Mareca*. These are characterized by the bill being shorter than the head (about equal to the claw of the inner toe), rather high, with its sides parallel nearly to its end, the end somewhat obtusely pointed, and the nail at the tip a third as broad as the bill itself; "the upper lateral angle at the base not prominent, nor extending as far back as the lower edge;" the tail is pointed, and less than half the length of the wings. Four species are known, two of which are inhabitants of the northern hemisphere, and two of the southern one. The northern species are closely related, both, according to Baird, agreeing in having "the upper parts finely waved transversely with black and gray or reddish-brown, the under parts, with the usual exceptions, snowy white. The top of the head is uniform white or cream-color, the neck more or less spotted. The middle and greater coverts are white, the latter tipped with black. The speculum is green, encircled by black. The tertials are black on the outer web, edged with hoary white; the entire outer web of one of them hoary." The related species are, on the whole, representatives of each other in their respective colonies, but both wander sometimes beyond their natural limits. The European widgeon (*M. penelope*) has the head and neck reddish-brown or cinnamon, with the feathers of the former slightly spotted with dusky, and those of the latter nearly uniform: the head is further diversified by cream-color on the top, and by green in a band around the eye and in a few spots behind it. The American widgeon (*M. americana*) is distin-

guished by the head and neck being in the main grayish, with the feathers of the former thickly spotted, and of the latter banded with black: the head is also relieved by white on the top, and by green in a broad and continuous patch around and behind the eye. The species remain farther to the southward than many of their kindred: the American form, for example, breeding "in abundance in Northern Dakota and Montana, and along the banks of the streams and pools," according to Dr. Coues, who found a young widgeon "still unable to fly even as late as the middle of September, at a time when all the other ducks observed were well on the wing." The species are moderately good as food-birds. THEODORE GILL.

Wid'ner, tp., Knox co., Ind. P. 1704.

Widow. See DOWER, by PROF. T. W. DWIGHT, LL.D., and MARRIAGE, by J. N. POMEROY, LL.D.

Wid'ow-Bird [a corruption of *whidah-* or *whydah-bird*, the latter name having reference to its habitat in Whydah, on the western coast of Africa], a name given to species of *Vidua* and related genera, and placed by most modern ornithologists in a "family," Plocidæ or "weavers;" the scientific name is a translation of the vernacular one first given—*i. e.* widow-bird. The species have the bill conic, but with the culmen more or less arched and advancing on the forehead in a point, while the sides are compressed toward the tip; the lateral margins are sinuate and straight, and the gonys lengthened and ascending; the wings are moderate, "with the first quill spurious; the second nearly as long as the third; the third, fourth, and fifth nearly equally long;" the tail is variable, but in the males some of the coverts and tail-feathers are usually greatly developed; the tarsi are slender, shorter than the middle toe, and covered in front with large plates; the toes are rather slender, and the hind one especially so, being as long as the inner; the claws are all long and moderately curved, and the hindermost developed. The species are peculiar to Africa. They chiefly feed upon grains. Their nest is generally complex and elaborately woven. The excessive development of the plumage, and especially the tail-feathers, of the males is peculiar to the breeding season. About sixteen or seventeen species are known, the most familiar of which is the *Vidua principalis*. THEO. GILL.

Wie'land (CHRISTOPH MARTIN), b. at Oberholzheim, Würtemberg, Sept. 5, 1733; received a careful education from his father, in the school of Klosterbergen, near Magdeburg, under a private tutor at Erfurt, and finally at the University of Tübingen, where he studied law, modern languages, and belles-lettres. His literary instinct, with its appetites and its talents, awakened very early. He devoured all kinds of books, and wrote Latin and German verses when he was only twelve years old, and before he had finished his law-studies he went to Switzerland, where he resided from 1752 to 1760, partly in Zurich, in the house of Bodmer, as his guest and as his literary assistant; partly in Berne, as a private tutor, deeply engaged all the while in various kinds of literary production, though without any remarkable result. From 1760 to 1769 he lived at Biberach, a free imperial city not far from his birthplace, where he held an office in the civil service, and here, or rather at the residence of Count von Stadion in the neighboring Warthausen, he came in contact with the German nobility, whose life, half sentimental and half frivolous, agreed very well with his own nature, and whose education, half English and half French, corresponded exactly with his taste. In this period he produced *Don Sylvio de Rosalva* (1764), *Komische Erzählungen* (1766), *Agathon* (1767), all of a very captivating but rather doubtful character; the didactic poem *Musarion* (1768), very elegant in its form, and in those days very startling in its ideas; and a prose translation of Shakspeare in 8 vols. (1762–66), which was the first introduction of the English poet to the German public. In 1767 he received a chair of philosophy in Erfurt, and held it to 1772, in which year he published, among other things, *Combabus*, a disgusting tale, and *Der neue Amadis*, a comic poem in 18 songs. In 1772 he was called to Weimar as tutor to the young duke, and he remained there till his death, Jan. 20, 1813, residing partly in the city itself, partly at his estate in the neighborhood, Osmannstedt, where he was buried in the garden. With Goethe, Schiller, and Herder he lived very intimately and very friendly, though the enormous literary activity which he developed followed other courses and sometimes occasioned collisions. He edited *Deutscher Mercur* (1773–95), *Attisches Museum* (1796–1804), and *Neues Attisches Museum* (1805–09); translated and annotated the epistles and satires of Horace (1788–89), all the works of Lucian, and Cicero's letters (5 vols., 1808–12); wrote *Oberon* (1780), his best and most celebrated work, a romantic epic, translated into English by W. Sotheby (London, 1826), *Neuen Göttergespräche* and *Geheime Geschichte des Philosophen Peregrinus Proteus* (1791), imitations after Lucian; *Geschichte der Abderiten* (1774; translated into English by H. Christmas under the title *The Republic of Fools, being the History of the State and People of Abdera in Thrace*, 2 vols., London, 1861); *Aristipp und einige seiner Zeitgenossen* (1800–01), his last romance. The first collected edition of his works was published by himself in 42 vols. (1794–1802), the second by Gruber in 50 vols. (1818–28); subsequently several other more or less complete editions have appeared. Of his letters there exist three collections—*Ausgewählte Briefe* (4 vols., 1815), *Auswahl denkwürdiger Briefe* (2 vols., 1815), and *Briefe an Sophie La-Roche* (1820). His biography was written by Gruber (4 vols., 1827) and Löbell (Brunswick, 1858). Considered by themselves, simply as productions of art, Wieland's works have lost somewhat of their interest. The frivolity of his humor, the sensuality of his imagination, are covered, but not always redeemed, by the sprightliness of his wit and by the quickness and compass of his sensibility. His style and manner of composition have become somewhat old-fashioned. But considered in their connection with the development of German literature as historical influences they will always be of the highest interest. After Luther, Wieland is the first poet in the German literature to whom verse was a natural form of speech—natural as the song to the lark—and beneath the elegance and refinement of form, which he learned partly from the French and partly from the Greek literature, there moves in all his works a native grace, a genuine spirit of sweetness and cheerfulness, which will never become stale. By these qualities he made German fiction respected and attractive to the upper classes of German society, which had hitherto scorned and neglected it, and became a most important element, the model of naturalness, in the education of Goethe. Many important issues in modern literature in Germany—the worship of Shakspeare, the enthusiasm for the Middle Ages, etc.—can be traced back to him as their source, or found in him one of their most effective supporters. His statue by Gasser was raised in Weimar Sept. 4, 1857.

CLEMENS PETERSEN.

Wieliczka, town of Austria, in Galicia, contains the largest and richest salt-mines in the world. They were accidentally discovered in 1233 by a shepherd, Wielicz, and have been worked uninterruptedly since that time. They now extend under the town—9590 feet in one direction, 3600 feet in the other, and 1780 feet in depth. They employ about 1500 men, and yield annually 55,000 tons of salt. They seem to be inexhaustible, and contain many curious features, as, for instance, the lake, the Gothic chapel hewn out in the salt, etc.

Wien. See VIENNA.

Wien, tp., Marathon co., Wis. P. 109.

Wieniaws'ki (HENRI), b. at Lublin, Poland, July 10, 1835; entered the Conservatory of Paris as a pupil in 1843, and received instruction on the violin by Clavel and Massart, and in harmony by Colet; gave his first concert in 1852; visited most of the great cities of Europe and the U. S. in 1872, and was appointed professor at the Conservatory of Brussels in 1876.

Wiertz (ANTOINE JOSEPH), b. at Dinant, Belgium, Feb. 22, 1806, in humble circumstances; was admitted as a pupil in the art school of Antwerp in 1820; won the great prize in 1834; studied for some years in Rome, and settled after his return at Brussels, where he d. June 18, 1865. The first period of his artistic career (1834–48) is characterized by colossal representations of mythological or biblical subjects—*Contending for the Body of Patroclus* (1835), 20 by 30 feet; the *Revolt of the Angels*, the *Flight from Egypt*, the *Triumph of Christ* (1848), 50 by 30 feet—and by very fierce polemics against certain features of modern art-life. He refused to sell any of his pictures; exhibited a *Carotte peinte au patientiotype;* offered his *Patroclus* as a prize to him who could show thoroughly the mischievous influence of journalism on art; forged his name on a picture by Rubens, sent it to the committee of the Paris Exhibition, and made the unfortunate judges the laughing-stock of Europe when they rejected it. In 1847 the Belgian government built him a large studio after his own designs, and between 1848 and 1853 he succeeded in perfecting the discovery of a new method of painting, which he called *peinture mate*, and which combines the qualities of fresco and oil painting. In the later period of his life (1853–65) his polemical temper developed into an exquisite though often somewhat grotesque humor, and his pictures became less pretentious in size and richer both in conception and execution: *The Last Cannon, A Second after Death, Napoleon in Hell, Precipitate Inhumation, Visions of a Head cut off*, etc. He bequeathed all his pictures to the state, and they are now exhibited in the so-called Wiertz Museum, his former studio. He also wrote *Eloge de Rubens* (1840) and *L'École*

flamande de Peinture (1863), both of which were crowned by the Belgian Academy. (See Labarre, *Antoine Wiertz*, Brussels, 1866.)

Wies'baden, town of Prussia, province of Nassau, is beautifully situated at the foot of Mount Taunus, on the Salzbach, an affluent of the Rhine, neatly built, and one of the most popular watering places of Germany. It contains fourteen hot saline springs, of which the principal has a temperature of 156° and is very copious. These springs, which are considered very efficacious in cases of gout and rheumatism, were known to the Romans (*Aquæ Mattiacæ*), and they are now generally used by over 20,000 persons each season. P. 35,463.

Wife. See MARRIAGE, by J. N. POMEROY, LL.D.

Wif'fen (BENJAMIN BARRON), b. at Woburn, Bedfordshire, England, in 1794, of a Quaker family; wrote for several periodicals, and devoted himself to the study of Spanish literature, and especially of the Spanish Reformers of the sixteenth century, whose numerous writings he rescued from long neglect by the publication, with the assistance of Don Luis de Usoz i Rios, of a series of volumes entitled *Reformistas Antiguos Españoles, or the Works of Spanish Reformers republished and edited* (29 vols., 1848–69), with biographical and bibliographical notices. He rediscovered and published the *Alfabeto Christiano* of Juan de Valdés. D. at Woburn Mar. 18, 1867.

Wiffen (JEREMIAH HOLME), brother of Benjamin, b. near Woburn, England, in 1792; was for some years a schoolmaster, and subsequently librarian to the duke of Bedford at Woburn Abbey, retaining that position until his death, May 2, 1836. Author of esteemed poetical translations of Garcilaso de la Vega (1823), of Tasso's *Jerusalem Delivered* (2 vols., 1824–25), and of *Historical Memoirs of the House of Russell from the Norman Conquest* (2 vols., 1833), besides several volumes of original verse. He contributed poems to the annuals, and made some translations from the Welsh *Triads*.

Wig [shortened from *periwig*; Fr. *perruque*], a covering of hair for the head used to conceal baldness; it has been also, at some periods, fashionable as a means of decoration only. Horse-hair wigs are a part of the paraphernalia of British judges and barristers. Wigs also sometimes appear in the livery of servants for great occasions, and are of great value on the stage. The wearing of wigs is of great antiquity, and prevails among some savage races.

Wig'an, town of England, county of Lancaster, on the Douglas, is rather indifferently built, but is in the centre of a rich coal-field, and carries on an extensive manufacturing industry. It has iron and brass foundries, paper-mills, cotton-spinning factories, and manufactures of cotton goods, nails, edge tools, and chemicals. P. 39,160.

Wigeon. See WIDGEON.

Wig'fall (LEWIS T.), b. in South Carolina about 1824; settled in Texas as a lawyer; represented that State in the U. S. Senate from 1859 until its secession in 1861, when he was expelled for disloyalty, and became a brigadier-general of the Confederate army. D. at Galveston Feb. 21, 1871.

Wig'glesworth (EDWARD), D. D., b. at Malden, Mass., in 1693; graduated at Harvard 1710, and was the first Hollis professor of divinity in that institution, from Oct. 21, 1722, until his death, Jan. 16, 1765. Author of various published lectures, sermons, and controversial essays.

Wigglesworth (EDWARD), D. D., son of the preceding, b. at Cambridge, Mass., Feb. 7, 1732; graduated at Harvard with the first honors 1719; became tutor there 1764; succeeded his father as Hollis professor of divinity 1765, and was emeritus professor from 1791 to his death, at Cambridge June 17, 1794. Author of *Calculations on American Population* (1775), *The Authority of Tradition considered, etc.* (1777), being the Dudleian lecture for that year, and a discourse on *The Hope of Immortality* (1779).

Wigglesworth (EDWARD), grandson of Rev. Michael, b. at Ipswich, Mass., Jan. 3, 1742; graduated at Harvard 1761; was commissioned colonel by the Massachusetts provincial congress June 24, 1776; third in command of Arnold's flotilla on Lake Champlain Sept. 5, 1776, and colonel of the 13th Massachusetts regiment Nov. 6, 1776; resigned Mar. 10, 1779, and was appointed by Pres. Washington collector of Newburyport, where he d. Dec. 8, 1826.

Wigglesworth (EDWARD), a descendant of Rev. Edward, b. at Boston, Mass., about 1800; was associate editor (with Dr. Francis Lieber) of the *Encyclopædia Americana* (Philadelphia, 13 vols., 1828–32), and contributed to the *North American Review* and other literary periodicals. D. at Boston Oct. 16, 1876.

Wigglesworth (MICHAEL), b. in England Oct. 18, 1631; was brought to New Haven, Conn., and thence to Charlestown, Mass., by his father 1638; graduated at Harvard 1651; became tutor and fellow there; studied divinity; was ordained minister of the church at Malden 1656; had some skill as a physician, and was offered the presidency of Harvard 1684, but declined on account of ill-health, being "a little feeble shadow of a man." He preached the election sermon 1688, and the artillery election sermon 1696. D. at Malden June 10, 1705. Author of *The Day of Doom, or a Poetical Description of the Great and Last Judgment, with a short Discourse about Eternity* (1662), which went through 9 eds. in America and 2 in England, and was long one of the most popular books in New England. In it occurs the famous passage assigning to infants "the easiest room in hell." Another small volume, "intended for poetry" (*Allibone*), was entitled *Meat out of the Eater, or Meditations concerning the Necessity, End, and Usefulness of Afflictions unto God's Children, all tending to Prepare them for and Comfort them under the Cross* (1669; 5th ed. 1717). He left in MS. a poem entitled *God's Controversy with New England*, printed in the *Proceedings* of the Massachusetts Historical Society 1871. An edition of his *Day of Doom*, with the addition of other poems and a *Memoir*, has been issued by William H. Burr (New York, 1867), and Mr. John Ward Dean published a *Sketch of his Life, with a Fragment of his Autobiography, some of his Letters, and a Catalogue of his Library* (Albany, 1863; new ed. 1871).

Wight (MOSES), b. at Boston, Mass., Apr. 2, 1827; began to paint portraits at the age of eighteen; studied in Italy three years, after which he practised his art in Boston until 1860, when he spent some time in Paris studying *genre* painting under Couture, and made another visit to Europe 1865–67. He has executed portraits of Humboldt, Quincy, Everett, Agassiz, Sumner, and other eminent men, two large ideals, *The Sleeping Beauty* and *Eve at the Fountain*, and a number of cabinet, figure, and interior subjects, among which are *Le Seizième Siècle, Les Confidants, The Old Cuirassier*, and *John Alden and Priscilla*.

Wight (ORLANDO WILLIAMS), b. at Centreville, N. Y., Feb. 19, 1824; educated at Westfield Academy and at Rochester Collegiate Institute; travelled in Europe, and settled as a literary man at Brooklyn, N. Y. Author of *Lives and Letters of Abelard and Heloise* (1853; new ed. 1861); edited *The Philosophy of Sir William Hamilton* (1853), 12 vols. of *Standard French Classics* (1859 *seq.*), and *The Household Library* (1859 *seq.*); translated Victor Cousin's *Course of the History of Modern Philosophy* (2 vols., 1852) and *Lectures on the True, the Beautiful, and the Good* (1854); aided Miss Mary L. Booth in her translation of Henri Martin's *History of France*, and is understood to have in preparation a *Dictionary of Philosophical Science*.

Wight (PETER BONNETT), b. in New York City Aug. 1, 1838; studied architecture under Thomas R. Jackson; drew up the plans for the New York Academy of Design 1862, and has since built the Yale School of Fine Arts at New Haven, Conn., the Mercantile Library building in Brooklyn, and several important public edifices in Chicago, Ill., where he now (1876) resides.

Wight, Isle of, an island in the English Channel, belonging to the county of Hampshire, England, from which it is separated by the famous *roadstead* of Spithead, comprises an area of 136 sq. m., with 55,182 inhabitants. It is traversed from E. to W. by a range of chalk downs rising between 600 and 700 feet, which presents a great variety of fine scenery. The soil is very fertile, and the climate remarkably mild and equable; on the southern side the myrtle and fuchsia grow without any protection. Wheat, vegetables, and fruits are extensively cultivated, and a fine breed of sheep is reared on the downs. The island is much resorted to as a bathing-place, and by people who suffer from consumption. Cap. Newport. Near the town of Cowes is Osborne House, where Charles I. was imprisoned for a short time, and which is a favorite residence of Queen Victoria.

Wight'man (WILLIAM MAY), D. D., LL.D., b. in Charleston, S. C., Jan. 8, 1808; in 1827 graduated at Charleston College, and in 1828 joined the South Carolina conference of the M. E. Church; he filled important appointments in the pastoral work till 1834, when he was made agent for Randolph-Macon College in Virginia, in which capacity he served for three years, when he took the chair of English literature in that institution; in 1839 became presiding elder of the Cokesbury district, S. C., conference, and at the General Conference of 1840, of which he was a member, he was made editor of the *Southern Christian Advocate*, published in Charleston; was a member of the General Conference of 1844, which took measures for the division of the Church, and of the Louisville convention of 1845, which organized the M. E. Church, South, and of the General Conferences of 1846, 1850, 1854, 1858 (1862 not held), and 1866. In 1854 he became president of Wofford College, Spartanburg, S. C., where he remained

till he was made chancellor of the Southern University, Greensboro', Ala., 1859, when he also joined the Alabama conference. In all these positions he displayed eminent ability. His learning is extensive, his eloquence fervid and ornate, and he is abundant in labors. He has written much for the periodical press, and is the author of the *Life of Bishop Capers* (1858), his devoted friend, and of various published sermons and addresses. He was elected bishop at the General Conference of 1866, since which time he has resided in Charleston, S. C. T. O. SUMMERS.

Wigram (GEORGE VICESIMUS), b. at Walthamstow, England, about 1805, son of Sir Robert Wigram, Bart.; educated at Trinity College, Cambridge, and became a distinguished member of the sect of Plymouth Brethren. Author of *The Englishman's Greek Concordance to the New Testament* (1839) and *The Englishman's Hebrew and Chaldee Concordance of the Old Testament* (2 vols., 1843).

Wigram (Sir JAMES), brother of George V., b. at Walthamstow, England, in 1793; educated at Trinity College, Cambridge, where he became a fellow; was called to the bar at Lincoln's Inn 1819; entered Parliament for Leominster 1841, and was second vice-chancellor from Oct., 1841, until 1850, when he retired on a pension of £3500. D. July 29, 1866. Author of *An Examination of the Rules of Law respecting the Admission of Extrinsic Evidence in Aid of the Interpretation of Wills* (2d ed. 1835), of which the 2d American edition was annotated by Theodore W. Dwight, LL.D., and of *Points in the Law of Discovery* (2d ed. 1840).

Wigram (JOSEPH COTTON), D. D., brother of George V. and Sir James, b. in England Dec. 26, 1798; graduated at Trinity College, Cambridge, 1819; took orders in the Church of England 1823; became assistant preacher at St. James's, Westminster, 1827; was secretary of the National Society for Promoting the Education of the Poor in the Principles of the Established Church 1827–39; rector of East Tisted, Hampshire, 1839–50; became archdeacon of Winchester 1845, rector of St. Mary's, Southampton, and canon of Winchester, 1850, and bishop of Rochester 1860, and was notable for his "evangelical" views and his reproval of his clergy for wearing beards and for playing cricket. Author of *Practical Hints on Sunday-Schools* (1833), *The Geography of the Holy Land* (2d ed. 1836), and of many published sermons, charges, and pamphlets.

Wig'ton, or Wigtown, county of Scotland, occupying the south-western corner of the country, and bordering S. on the Irish Sea and W. on the North Channel, comprises an area of 481 sq. m., with 38,830 inhabitants. The surface is undulating, and gradually rises toward the N. to a height of 1500 feet. It consists to a great extent of moorland, interspersed with small lakes, but it contains some fine pastures where an excellent breed of cattle is reared, and some tracts of good soil where agriculture is carried on to a high degree of perfection.

Wil'berforce (EDWARD), son of Archdeacon Robert Isaac, b. in England about 1832; served some years in the British navy; conducted for a short time in 1856 a periodical entitled *The Idler;* has travelled extensively, given much attention to music and the fine arts, and married in 1860 an American lady. Author of *Brazil viewed through a Naval Glass, with Notes on Slavery and the Slave-Trade* (1855), *Social Life in Munich* (1863), *One with Another, a Novel* (1865), *Franz Schubert, a Musical Biography* (1866), *The Duke's Honor* (3 vols., 1870), a volume of *Poems* (1857), and other publications.

Wilberforce (HENRY WILLIAM), youngest son of William, b. at Clapham, England, in 1809; graduated with high honors at Oriel College, Oxford, 1830; took orders in the Church of England; was for some time curate of Bransgore, Hampshire; became vicar of East Farleigh, Kent, 1843; became a Roman Catholic 1850; was proprietor and editor of the *Weekly Register* and a magistrate for the county of Galway. D. Apr. 23, 1873. Author of *The Parochial System, an Appeal to English Churchmen* (1838), which gained a prize of £200 offered by the Christian Influence Society.

Wilberforce (ROBERT ISAAC), son of William, b. at Broomfield House, near Clapham Common, England, Dec. 19, 1802; graduated at Oriel College, Oxford, 1823; became fellow, tutor, and examiner there; took orders in the Church of England; was for some years vicar of East Farleigh, Kent, and of Burton Agnes, 1840; became archdeacon of the East Riding of Yorkshire Jan. 11, 1841, and prebendary of York Feb. 8 of the same year; resigned these preferments 1854 on being received into the Roman Catholic Church at Paris, and entered an ecclesiastical academy at Rome with a view to the priesthood. D. at Albano, near Rome, Feb. 3, 1857, being attended in his last illness by Dr. (now Cardinal) Manning. He was a joint author of his father's *Life*, and author of *The Five Empires, an Outline of Ancient History* (1840), *Rutilius and Lucius, or Stories of the Third Age* (1842), *Church Courts and Church Discipline* (1843), *The Doctrine of the Incarnation* (1848), *The Doctrine of Holy Baptism* (1849), *A Sketch of the History of Erastianism* (1851), *The Doctrine of the Holy Eucharist* (1853), 2 vols. of *Sermons* (1850–51), and *An Inquiry into the Principles of Church Authority, or Reasons for Recalling my Subscription to the Royal Supremacy* (1854).

Wilberforce (SAMUEL), D. D., son of William, b. at Clapham, England, Sept. 7, 1805; graduated with honors at Oriel College, Oxford, 1826; took orders in the Church of England; became curate of Chickendon, Oxfordshire, 1828, rector of Brixton (Brightstone), Isle of Wight, 1830, select preacher before the University of Oxford 1837, and again 1845, rector of Alverstoke, Hampshire, archdeacon of Surrey and chaplain to Prince Albert 1839, canon of Winchester cathedral 1840, sub-almoner to the queen 1844, dean of Westminster 1845, bishop of Oxford and *ex-officio* chancellor of the order of the Garter Nov., 1845, lord high almoner to the queen Nov., 1847, and bishop of Winchester Oct., 1869. He was a leader of the High-Church party, but an opponent of ritualism; was distinguished for skill as a debater in convocation and in the House of Lords, and for his versatility of opinions received the sobriquet of "Slippery Sam," by which he was popularly known; was a great favorite in the highest society, and was an influential advocate of free trade. He was killed by a fall from his horse, while riding with Earl Granville, near Dorking, Surrey, England, July 19, 1873. Author of *Note-Book of a Country Clergyman* (1833), *Eucharistica* (1839), *Sermons preached before the University of Oxford* (2 series, 1839–62), of several other volumes of sermons, *A History of the Protestant Episcopal Church in America* (1844), and many miscellaneous publications.

Wilberforce (WILLIAM), the third of four children and only son of Robert and Elisabeth Wilberforce, b. at Hull, England, Aug. 24, 1759. On the death of his father, in 1768, he went to live with an uncle in Wimbledon, near London, but at the age of twelve returned to his mother's house in Hull. During these early years he is spoken of as a boy whose activity and spirit made up for deficiency in bodily strength, with a love of letters and eloquence already developed, with a strong memory, warm affections, and a marked hatred of injustice and oppression. When not much more than seven years old, he was sent to the grammar-school of Hull, then under the charge of Joseph and Isaac Milner, and "even then," says the younger Milner, "his elocution was so remarkable that we used to set him upon a table and make him read aloud as an example to the other boys." In Oct., 1776, he entered St. John's College, Cambridge, and being the master of an independent fortune, of a genial temper, self-indulgent, playful, and witty, and thrown without restraint into the society of "as licentious a set of men as could well be conceived" (to use his own words), the risk to his health, his morals, and his general welfare was extreme. Happily, he was not long in becoming aware of his peril, and after the first year contrived to shake off these men, and for the last two years of college life was the centre of a higher circle. With his ample means and his free social nature it is not surprising that he was a universal favorite. Notwithstanding his temptations to idleness, he became a good classic and creditably passed the college examinations. Mathematical studies he was tempted to neglect, and in later life never ceased to regret the lack of this early discipline, to which he ascribed a certain want of mental regularity of which he was conscious. At Cambridge he formed an acquaintance with William Pitt, which afterward ripened into intimacy. Having determined to enter public life, he offered himself for Hull (in 1780), and after a sharp contest was elected to Parliament at a personal expense of between £8000 and £9000. He had just come of age, and was at once brought into the gayest and most seductive society of London, was chosen member of the leading clubs, became immersed in politics and fashion, and entered eagerly into play. From this dangerous amusement, however, he broke away, like Pitt, on seeing the hazard not only to himself, but to others who could ill afford to lose. In 1781 he was elected to represent the great county of York, a success which seemed to open before him the most gratifying prospects. The years 1785–86 witnessed a change in his religious convictions which modified the whole course of his future life. This change was consequent, mainly, upon a careful reading of the New Testament, to which he was led, during a tour upon the Continent, by his travelling companion, Rev. Isaac Milner. The result of this was that he began in 1787 a series of efforts for the reformation of manners, and especially for abolishing the African slave-trade. The latter subject was brought into Parliament, and

after overcoming many obstacles he opened the debate against the traffic on May 12, 1789, in a speech of great beauty and power. In this philanthropic effort he was supported by Burke, Pitt, and Fox. Although defeated, he renewed the effort whenever there seemed a chance of success, and finally, in 1807, after a struggle of nearly twenty years, had the joy of seeing the bill passed by both houses. It received the royal assent on Mar. 25, and became the law of the land. In 1797, Mr. Wilberforce published his book entitled *A Practical View of the Prevailing Religious System of Professed Christians in the Higher and Middle Classes, contrasted with Real Christianity.* The publisher thought that, since the author's name was given, 500 copies might be disposed of. Within six months 7500 were sold, and it was subsequently translated into the leading languages of Europe. In fact, few religious books have been read more widely or more generally approved. During the same year (1797) he married Barbara Ann, eldest daughter of Isaac Spooner of Elmdon Hall, Warwickshire. Four sons and two daughters were the result of this union. In 1825, Mr. Wilberforce retired from Parliament after a continuous service of nearly forty-six years, during which his labors had been conspicuous and unceasing for every measure, public or private, tending to ameliorate suffering, to relieve the oppressed, and to elevate the moral and religious condition of the kingdom. Among the most important of these were his efforts in behalf of the Bible and missionary societies, for Roman Catholic emancipation, against the war with America, for christianizing India, and for abolishing the slave-trade and slavery. In consequence of these philanthropic labors, and the spirit with which he conducted them, his name became known throughout the civilized world, and no one in the kingdom was more highly venerated and beloved.

Mr. Wilberforce was remarkable for many personal qualities. Madame de Staël spoke of him as the best converser she had met with in England. Pitt pronounced him to possess, of all men he had known, the greatest natural eloquence. Of a slight frame, his voice was uncommonly sweet and musical, and capable of great variety and richness of modulation. Sir Samuel Romilly declared him to be the most efficient speaker in the House of Commons. Lord Brougham speaks of his power of rebuke and invective as of the highest order. On one occasion, when a member sneeringly referred to him as "the honorable and religious gentleman," he turned upon him with a severity of dignified rebuke which was overwhelming, so that his friends hardly knew which most to admire, his remarkable power of sarcasm or the restraint under which he so generally held it. Sir James Mackintosh speaks of him as "the very model of a reformer—ardent without turbulence, mild without timidity or coldness, . . . patient and meek, yet intrepid, . . . just and charitable even to his most malignant enemies, unwearied in every experiment to disarm the prejudices of his more rational and disinterested opponents, and supporting the zeal without dangerously exciting the passions of his adherents."

After leaving Parliament, he retired almost altogether from public life, and went to live upon a small estate which he had purchased at Highwood near London. This, however, on account of a loss of property, he was obliged to relinquish in 1831, after which he lived with his sons in Kent and the Isle of Wight. His health gradually failed from about this time to the end. Three days before his death he had the intense pleasure of learning that the House of Commons had passed to its second reading the bill for the abolition of slavery. "Thank God," he exclaimed, "that I should have lived to witness a day in which England is willing to give twenty millions sterling for the abolition of slavery!" Held in great honor during all his later years, he died in Cadogan Place, London, July 29, 1833, and, in accordance with the wishes of the nation, was buried in Westminster Abbey, "side by side with Canning, at the feet of Pitt, and within two steps of Fox and Grattan." His daughters died before their father; four sons survived him, three of whom attained ecclesiastical or literary distinction.—The *Life of William Wilberforce*, 5 vols. 8vo, was written by his sons, Robert Isaac and Samuel. S. G. Brown.

Wil'braham, p.-v. and tp., Hampden co., Mass. P. 2330.

Wil'brord, or **Willibrod** (Saint), called "the apostle of the Frisians," b. in the Saxon kingdom of Northumbria about 657, his father's name being Wigils; was placed in childhood in the monastery of Ripon, then governed by (Saint) Wilfrid; embraced the monastic profession while very young; spent twelve years in Ireland, studying under the care of (Saint) Egbert and the monk Wybert or Wigbert, who had preached in Friesland; was ordained a priest about 689; went to Friesland in 690 or 691, landing near Utrecht, and was joined there by (Saint) Swidbert and ten or eleven other English monks; was well received by Pepin the Big, the Franconian ruler of Friesland; is said to have visited Denmark; made a visit to Rome 692; obtained ecclesiastical authority from Pope Sergius, and during a second visit (695) was ordained bishop of the Frisians under the name of Clemens; converted large numbers of the natives by his preaching, enjoying the patronage of Charles Martel; is claimed as the founder of the see of Utrecht, where he built the church of Saint Saviour, and spent his last years at a monastery he had established (698) at Echternach, near Treves, where he d. in 738. His festival is celebrated Nov. 7. Considerable uncertainty exists respecting the events of his career.

Wil'bur (Hervey), D. D., b. at Wendell, Mass., in 1787; was minister of his native place 1817–23, and subsequently presided over several female seminaries. D. at Newburyport in 1852. He published a *Reference Bible* (1828), *Elements of Astronomy* (1829), *A Lexicon of Useful Knowledge* (1830), and a *Reference Testament for Bible Classes* (1831).

Wilbur (Hervey Backus), M. D., son of Rev. Dr. Hervey, b. at Wendell, Mass., Aug. 18, 1820; graduated at Amherst College 1838; taught school some months; studied engineering, and afterward medicine, which he practised at Lowell and at Barre, Mass.; was so impressed by the perusal of an account of Dr. Seguin's school for idiots at Paris that he received several idiot pupils into his own house at Barre July, 1848; prevailed upon the legislature of New York to establish in 1851 an experimental school at Albany, which under his direction was so successful as to be fully organized in 1854 as the State asylum for idiots at Syracuse. Dr. Wilbur has continued in charge of this philanthropic institution, and has published various *Reports* and other papers on idiocy.

Wilbur (John), b. at Hopkinton, R. I., in 1774; became a minister of the Society of Friends; opposed the introduction of religious views at variance with the original doctrines of that society; was accused in 1838 by several members of Rhode Island yearly meeting of circulating in his conversation and writings opinions and statements derogatory to the character of the celebrated Joseph John Gurney, then (1837–40) visiting the U. S.; was sustained by a large majority in his own monthly meeting (that of South Kingston), but that body having been dissolved and its members added to the Greenwich meeting, he was formally disowned by the latter body Jan., 1843, and its action was confirmed by the quarterly meeting and the Rhode Island yearly meeting. His supporters were, however, sufficiently numerous in Rhode Island and other parts of New England to form an independent yearly meeting, the members of which were known as "Wilburites." D. in 1856. He published some polemical pamphlets, and his *Journal and Correspondence* (Providence, 1859) have appeared since his death.

Wil'burger, county of Texas, returned in the census of 1870 as having no population.

Wil'burton, tp., Fayette co., Ill. P. 1509.

Wil'bye (John), a famous composer of music who flourished in England at the close of the seventeenth century, of whom all that is positively known, his works excepted, is that in 1598 he was a teacher of music in Austin Friars, London. In that year he published *The First Set of English Madrigals to 3, 4, 5, and 6 Voices*, and a second book of the same in 1609. Both have been reprinted for the Musical Antiquarian Society, the former edited by James Turle (1841), the latter by G. W. Budd (1846). They are said to include "some of the most lovely and, at the same time, the most scientific compositions that, in this department, the art ever produced."

Wil'cocks (Alexander), M. D., b. at Philadelphia, Pa., in 1817; graduated at Jefferson Medical College 1844; contributed papers to the *Medical Examiner* and to the *American Journal of Medical Science*, and is author of *An Essay on the Tides* (1855), *Reflections upon the Nature of the Temporary Star of the Year 1572, an Application of the Nebular Hypothesis* (1860), *Thoughts on the Influence of Ether in the Solar System* (1861), and other scientific essays.

Wil'cox, county of S. W. Alabama, intersected by Alabama River, and traversed in the E. part by Selma and Gulf R. R.; surface undulating, soil generally fertile. Swine, cattle, and mules are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Camden. Area, about 900 sq. m. P. 28,377.

Wilcox, county of Central Georgia, lying upon Ocmulgee River; surface undulating, soil productive. Cattle, sheep, and swine are the chief live-stock. Staples, cotton, Indian corn, and wool. Cap. Abbeville. Area, about 500 sq. m. P. 2439.

Wilcox, tp., Hancock co., Ill. P. 4058.

Wilcox, p.-v., Elk co., Pa.

Wilcox (Cadmus M.), b. in North Carolina about 1825; graduated at the U. S. Military Academy, and commissioned brevet second lieutenant of infantry July, 1846; served in the war with Mexico from Vera Cruz to the City of Mexico, for the greater part of the time on the staff of Gen. Quitman, and brevetted first lieutenant for gallantry at Chapultepec; subsequently on frontier until June 8, 1861, when he resigned his commission of captain. In July he was commissioned colonel of the 9th Alabama regiment, and in October appointed a brigadier-general in the Confederate army. In Virginia he commanded a brigade in Longstreet's corps, as at the second battle of Bull Run, Fredericksburg, Chancellorsville, Salem Heights, Gettysburg, etc.; promoted to major-general Aug., 1863, and commanded a division in the Mine Run campaign and throughout the campaign of 1864–65, ending with the surrender at Appomattox Court-house. Author of *Rifles and Rifle Practice* and a translation of *Austrian Infantry Evolutions of the Line.*

Wilcox (Carlos), b. at Newport, N. H., Oct. 22, 1794; removed to Orwell, Vt., in childhood; graduated with valedictory honors at Middlebury College 1813, and at Andover Seminary 1817; was ordained to the Congregational ministry, and began to preach at Hartford, Conn., in 1818, but was soon obliged by ill-health to desist; travelled through New England; resided at Salisbury, Conn., where he published a poem, *The Age of Benevolence* (1822); delivered before the Phi Beta Kappa Society of Yale College his poem *The Religion of Taste* (1824); was pastor of the North church, Hartford, 1824–26; travelled in Europe 1826, and on his return accepted the pastorate of a church at Danbury, Conn., where he d. May 29, 1827. His *Remains*, consisting of poems and sermons, were published in 1828. Some of the descriptions of scenery have been highly commended.

Wild (Henry), known as the "learned tailor," b. at Norwich, England, about 1684; acquired some knowledge of Greek and Latin at the grammar school of that town, after which he served a seven years' apprenticeship to a tailor; worked seven years more as a journeyman, and had nearly forgotten his early classical acquisitions when, during a long period of sickness, he amused himself by reading some volumes of controversial theology abounding in quotations from the Bible in the original Hebrew; devoted his spare time for several years to the study, first, of Hebrew, and afterward of Chaldee, Syriac, Arabic, and Persian. His proficiency accidentally became known in 1614 to the celebrated Dean Prideaux and to Rev. Dr. Turner of Norwich, who were instrumental in raising a subscription in his behalf, and procured him a situation in the Bodleian Library at Oxford, where he was employed in classifying and indexing Oriental MSS., from which he made some translations. About 1720 he left Oxford and settled in London, where he was patronized by Dr. Richard Mead, and is supposed to have died before 1734, in which year his only publication appeared, a translation from the Koran of *Mahomet's Journey to Heaven.*

Wild-Cat. See Cat.

Wild Cat, tp., Tipton co., Ind. P. 1547.

Wild Cherry (*Cerasus serotina*, De Cand.). The wild cherry is a very common tree throughout America, growing in all parts of the U. S. In the Western States it may attain a height of from 80 to 100 feet, but in the Atlantic States it is usually much smaller. The fruit is small, about the size of a large pea, and when ripe is of a shining blackish-purple color. The wood of the wild cherry is much prized by cabinetmakers for its fine grain, handsome tint, and susceptibility to high polish. The inner bark, taken from all parts of the tree, furnishes the drug known as "wild cherry." By a mistake, the Latin officinal designation of this drug is *Prunus virginiana*, which is properly the botanical name of the choke-cherry, a different tree. Wild cherry bark is in pieces of various sizes, without epidermis, and of a light cinnamon color. It has the odor of peach-leaves and an agreeable aromatic taste, with a flavor of bitter almonds. The important ingredients of the bark are tannin and the peculiar principles *amygdaline* and *emulsine*, which by mutual reaction in the presence of water develop a volatile oil containing a small percentage of hydrocyanic acid. Preparations of wild cherry bark were formerly supposed to possess remarkable medicinal virtues, but they are now regarded as feeble, and are principally employed for the purposes of a mild and agreeable stomachic tonic, a gentle calmative in bronchial affections with an irritative cough, and to impart the pleasant flavor of the bark to compound medicinal preparations. E. Curtis.

Wilde (James Plaisted), **Baron Penzance**, brother of Baron Truro, late lord chancellor, b. in London, England, in 1816; studied at Winchester School; graduated at Trinity College, Cambridge, 1838; was called to the bar at the Inner Temple 1839; was appointed junior counsel to the excise and customs 1840, queen's counsel 1855, counsel to the duchy of Lancaster 1859, and a baron of the exchequer Apr., 1860, on which occasion he was knighted; was judge of the court of probate and divorce 1863–72; was sworn of the privy council 1864, and created a peer by the title of Baron Penzance Apr. 6, 1869.

Wilde (Richard Henry), b. in Dublin, Ireland, Sept. 24, 1789. His parents migrated to the U. S., and settled in Baltimore while he was an infant. His father soon died, and during his childhood he was dependent mainly upon his mother for the rudiments of an English education. In his eleventh year he was placed as a clerk in a store, and when he was thirteen his mother moved to Augusta, Ga., where they obtained a living by merchandising in a small way, the boy devoting all his leisure to books. Under many difficulties he studied law; was admitted to the bar, and soon rose to high distinction in his profession. He became attorney-general of the State; in 1815 was elected to Congress. This position he held for a number of years, and took rank among the ablest and most accomplished orators of that body. On retiring from Congress in 1835 he visited Europe, and spent several years in literary pursuits. Several productions of great merit came from his pen; several of these appeared before he went abroad, and several after. Those which will live longest, perhaps, are, first, his famous lyric entitled "My life is like a summer rose," and the second his *Life of Tasso.* After his return from Europe in 1843, he moved to New Orleans, when he renewed the practice of law with unusual success, and was elected professor of constitutional law in the University of Louisiana. D. of yellow fever in New Orleans Sept. 10, 1847. Alexander H. Stephens.

Wilde (Samuel Sumner), LL.D., b. at Taunton, Mass., Feb. 5, 1771; graduated at Dartmouth College 1789; was admitted to the bar 1792; practised successively at Waldoborough, Warren, and Hallowell, Me.; was a member of the legislature and of the executive council; was a delegate to the Hartford Convention 1814, and judge of the Massachusetts supreme court 1815–50; removed to Newburyport, Mass., 1820, and to Boston 1831; sat in the Massachusetts constitutional convention 1820; was a member of the American Academy of Arts and Sciences, and was noted for learning and integrity as a judge, being especially an authority in *nisi prius* cases. D. at Boston June 22, 1855.

Wilde (Sir William Robert Wills), M. D., b. at Castlerea, county Roscommon, Ireland, about 1810; became a distinguished surgeon; was director of St. Mark's Ophthalmic and Aural Hospital, Dublin, was surgeon oculist to the queen for Ireland, and vice-president of the Royal Irish Academy; was distinguished as a traveller, antiquary, and statistician, having twice superintended the Irish census, for which services he was knighted 1864. Author of *A Voyage along the Shores of the Mediterranean* (2 vols., 1840), *Austria, its Literary, Scientific and Medical Institutions, etc.* (1843), *Irish Popular Superstitions* (1852), *Aural Surgery* (1853), *Catalogue of the Antiquities in the Museum of the Royal Irish Academy* (1857–62), *Malformations and Diseases of the Organs of Sight* (1862), etc. D. Apr. 19, 1876.

Wildebeest. See Gnu.

Wil'der (Alexander), M. D., b. at Verona, Oneida co., N. Y., May 13, 1823; is self-educated; was for some years a teacher; edited the Syracuse *Star* 1852, and the *Journal* 1853; was employed in the State department of public instruction 1854–55; became editor of the *New York Teacher* 1855, and of the *College Review* 1856; was a staff contributor to the *Anglo-American*, the *New Church Repository*, the New York *Evening Post* 1858–71; also to the *Medical Review* and the *Medical Eclectic*; practised in New York City as an eclectic physician; was president of the Eclectic Medical Society of New York 1869–70, and is secretary of the National Eclectic Medical Association; edited 2 vols. of *Transactions* (1869–70) of the former and a volume of *Proceedings* of the latter society, and has been since 1867 president of the Eclectic Medical College of the City of New York, and lecturer on physiology and physiological medicine. Author of an English grammar, of *The Secret of Immortality Revealed*, of a *City Directory*, of treatises on *The Eclectics of Alexandria* (1869), *The Intermarriage of Kindred* (1870), *The Medical Education of Women* (1874), *A Protest against Vaccination* (1876), and *The Worship of the Serpent* (1877); has edited Westropp's *Ancient Symbol-Worship* (1873), Taylor's *Eleusinian and Bacchic Mysteries* (1875), and R. Payne Knight's *Symbolical Language of Ancient Art and Mythology* (1876), and has prepared a translation of Iamblichus *On the Mysteries.*

Wilder (Marshall Pinckney), b. at Rindge, N. H., Sept. 22, 1798; educated at common schools and at the

Ipswich Academy; worked on his father's farm; afterward engaged in commercial pursuits, and in 1825 established himself as a merchant at Boston; was prominent in the organization of the State board of agriculture and the establishment of the State Agricultural College; was president of the Massachusetts Horticultural Society 1840–48, of the American Pomological Society from 1848, of the U. S. Agricultural Society 1852–58, and of the New England Historico-Genealogical Society from 1869; has sat in both houses of the legislature and in the executive council, and was president of the senate 1850, besides having held many other important trusts. Author of numerous speeches, addresses, and essays in horticultural journals.

Wil'derness, tp., Nicholas co., West Va. P. 821.

Wilderness, Battles of the, fought between the United States and Confederate States armies. The general character of the section of the country in which this battle was fought is that of a wilderness, by which name it is locally known. Though containing but moderate hills, the underlying rocks are quartzite, and in places gold bearing, and to aid in reducing the gold the primitive forests had been cut down for fuel, leaving the site to be again covered by the thick and tangled growth that succeeds such an operation. Thickets of pine and other trees occupied a soil composed of sand and clay, unfavorable to agriculture and very swampy when wet. Two good roads pass through this region from Orange Court-house to Fredericksburg, uniting at the place called Chancellorsville; but on both sides of them the country is a very difficult one in which to control the movements of a large army. During the winter of 1863–64 the U. S. forces, under command of Gen. Meade, were encamped along the line of the Orange and Alexandria R. R., extending from Bull Run to the Rapidan. The opposing army, under Gen. Lee, occupied a strong line, partly intrenched, on the S. bank of the Rapidan, extending from Mine Run westward to Orange Court house and Gordonsville, covering Richmond, and threatening Washington if the Union army uncovered it by a flank movement. In Mar., 1864, Gen. Grant, then commander of all the Union armies, took up his headquarters with Gen. Meade's army. Gen. Meade broke camp at midnight May 3–4, and commenced moving toward the Rapidan, the right, consisting of the 5th corps (Warren's) and the 6th corps (Sedgwick's), to cross at Germanna Ford; the left, comprising the cavalry (Sheridan's) and the 2d corps (Hancock's), to cross at Ely's Ford, 6 miles below. Before sunset Meade's army was established with but slight opposition in the Wilderness, with the 5th corps and a division of cavalry on the right, next the enemy. Gen. Grant, at 6 P. M. on the 4th, ordered an advance toward Lee next morning. Lee, however, had determined to give battle in the Wilderness, which, familiar to his soldiers, was but partially known to their opponents, and had also set his army in motion to meet his adversary. Accordingly, on the morning of May 5, the 5th corps and the advance of Lee's army met, a fierce encounter between some 25,000 men opening this bloody campaign. At intervals during the day others of the opposing columns met, and engaged with much valor and loss of life on both sides. The evening of May 5 found both armies face to face, and an inevitable and momentous conflict impending on the morrow. The 9th corps (Burnside's) and that of Longstreet on the other side had not yet reached the field, toward which they marched that night. At dawn of day on May 6 the battle was renewed along all the opposing lines, and continued with unceasing movements and attacks, with much loss of life, until dark. The day closed with the two armies holding substantially the positions of the night before. On the morning of May 7 both armies were behind intrenched lines, each too much exhausted to renew the fight. Gen. Grant then determined to move to his left, thus securing a short base of operations by way of Fredericksburg and the Potomac River, and threatening Lee's communications with Richmond. This was begun after dark on the 7th, the 5th corps having the advance toward Spottsylvania Court-house. Gen. Lee, however, anticipated this, and having a shorter road, his main force reached there first, and the battles of Spottsylvania followed, which for convenience to the reader are herewith described, although the "Wilderness" battles proper are considered by the army to have ended with the movement of May 7:

Spottsylvania, Battles of, May 8–21.—The advance cavalry of the Union army occupied this place early in the morning of May 8, but were compelled to withdraw before their enemy's advancing infantry. The 5th corps forced the enemy back until it found itself confronting the corps of Longstreet, and severe fighting followed. During the day the 6th corps joined the 5th, and a combined attack was made by them at dark, but without result. The other corps of both armies continued to arrive and take up positions, attended with constant fighting and severe loss of life. The 9th, 10th, and 11th of May were passed in movements and bloody conflicts, without being decisive. These actions include the fights at Laurel Hill—a name borne upon the records of many regiments—and near this Gen. Sedgwick was killed, and the command of the 6th corps was assigned to Gen. Wright. Early on the morning of the 12th a general assault was made by Gen. Grant upon Lee's position. The 2d corps (Hancock's) carried a salient, capturing nearly a division and twenty cannon, but the subsequent resistance was so obstinate that no decisive result was obtained. The 13th to the 18th was spent in demonstrations, conflicts, and reorganization while awaiting reinforcements. Unable to force the position at Spottsylvania, Gen. Grant issued orders for a movement toward North Anna River, around the right of Gen. Lee. The latter delayed this movement until the 21st by moving out a heavy force on the afternoon of the 19th, which attacked Gen. Grant's right, but after a sharp conflict it was driven back. Lee began to move as soon as his adversary did, and established his forces on the S. bank of the North Anna, where the battles were again renewed.

North Anna, Battles of.—The 5th corps reached the North Anna on the afternoon of the 23d, closely followed by the 6th corps, the 2d and 9th coming up about the same time. Gen. Warren effected a crossing the same afternoon without much opposition. Soon after getting into position he was violently attacked, but repulsed the enemy with great loss. Hancock on the left effected a crossing after some fighting. On the 24th the 6th corps crossed, taking position on Warren's right. The attempt of Burnside, on the centre, was repulsed. Finding the enemy's position on the North Anna stronger than either of his previous ones, Gen. Grant withdrew on the night of the 26th to the N. bank, and moved to turn the enemy's position by his right. The battle of Cold Harbor (which see) was the next serious engagement between the two armies. The official report of Gen. Meade states his losses May 5–31 at 41,398, of which 33,948 were killed and wounded, not including Burnside's loss, whose corps was not formally united to Meade's command until May 21. The Confederate loss is not officially reported, but, though large, was much less than that sustained by Gen. Meade.

Wild'ers, tp., Johnston co., N. C. P. 1203.

Wild'erspin (Samuel), b. in England about 1792; was founder and master of the London Central Infant School, the first institution of its kind, and was prominent in the Pestalozzian movement for the reform of the methods of instruction. D. in London Mar. 10, 1866. Author of the *Infant System of Education* (1823), *Early Discipline illustrated* (3d ed. 1840), *A System of Education for the Young* (1840), and, with T. J. Terrington, of *A Manual of Instruction for Young Children* (1845).

Wil'dey (Thomas), b. in England Jan. 15, 1783; came to the U. S. 1817; settled at Baltimore as a coach-spring maker, and there instituted in 1819 the first lodge of Odd Fellows in America. He was grand sire of that order from 1825 to 1833. D. at Baltimore Oct. 19, 1861. His funeral (Oct. 22) was attended by delegations of Odd Fellows from the principal Eastern cities, and a monument to his memory has been erected by that order. (See Odd Fellows.)

Wild-Goose. See Canada Goose.

Wild'man (Richard), b. at Chilham Castle, Kent, England, in 1802; was called to the bar 1829; became a sergeant-at-law; is recorder of Nottingham and a circuit judge, and a high authority upon the law of nations. Author of *Institutes of International Law in Time of Peace or War* (2 vols., 1849–50; republished at Philadelphia 1850), *Directions for Naval Officers regarding the Law of Prizes* (1854), and *Considerations on the Chinese Coalition* (1857).

Wild Service. See Sorb Tree.

Wild'wood, tp., Craven co., N. C. P. 2241.

Wi'ley (Calvin Henderson), b. in Guilford co., N. C., Feb. 3, 1819; studied at Caldwell Institute, Greensboro'; graduated at the University of North Carolina 1840; studied law, and was admitted to the bar 1841; was a member of the North Carolina legislature 1850 and 1852; became State superintendent of common schools Dec., 1852; was six times re-elected for terms of two years by an almost unanimous vote; rendered great services to the cause of education, and kept in regular operation the schools of North Carolina during the civil war; was licensed to preach by the Orange presbytery 1856, and regularly ordained to the ministry 1866; contributed to *Sartain's* and other magazines; founded and edited the *Southern Weekly Post* at Raleigh; was editor and proprietor of the *Oxford Messenger*; was instrumental in founding a State educational association, and was one of the editors of its journal; preached

during the civil war the establishment at Greensboro', N. C., of a publishing-house to supply the State with textbooks, and took a prominent part in organizing at Columbia, S. C., the Educational Association of the C. S. A., and has been since 1869 agent of the American Bible Society in Tennessee. Author of many addresses, of some religious, political, and educational pamphlets, of two historical novels upon North Carolina subjects—*Alamance, or the Great and Final Experiment* (1847), and *Roanoke, or Where is Utopia?* (1850; new ed. 1866); *Life in the South, a Companion to Uncle Tom's Cabin* (1852), *The North Carolina Reader* (1863), embodying a popular history of North Carolina, *Elocution and Oratory, a Treatise on the Arts of Reading and Speaking* (1869), and other works.

Wiley (Isaac William), D. D., b. in Pennsylvania Mar. 29, 1825; graduated in medicine, afterward studied theology, and joined the Philadelphia Methodist Episcopal conference in 1849; the next year he was sent as missionary to China, where he continued four years. On his return he spent four years in the pastorate, and then became principal of the Pennington Seminary in New Jersey. In 1864 he was appointed editor of the *Ladies' Repository*, a monthly publication of his Church at Cincinnati, which he conducted till 1872, when he was elected bishop. He is author of *Fallen Heroes in Foo-Chow* and *Religion in the Family*.

Wi'ley's Cove, p.-v. and tp., Searcy co., Ark. P. 663.

Wil'ford (Francis), b. in Hanover about 1760; went to India in the military service of the East India Company 1781; devoted himself to Sanskrit studies, and wrote numerous memoirs in the *Asiatic Researches*, which at the time attracted great attention in Europe, as proving from Hindoo records the accounts of the Creation and the early history of mankind found in the book of Genesis. For some years the name of Lieut. Wilford figured largely in the writings of biblical commentators, but it subsequently appeared that he had been imposed upon by a Hindoo pundit, who had palmed upon him a series of forgeries. He attained the rank of lieutenant-colonel, and d. at Benares Sept. 4, 1822.

Wil'frid, or **Wilfred** (Saint), b. in the Saxon kingdom of Bernicia (Northumberland) about 634, of a noble family; studied at Lindisfarne Abbey, where he became a monk; travelled in France and Italy, residing some time at Rome; built a monastery at Ripon 663; was commissioned by King Alefrid to regulate the usages of the Northumbrian Church upon the time of celebrating Easter, on which subject a famous council was held at Whitby (664) in the royal presence; was appointed by the king bishop of York, and consecrated as such at Paris, but was opposed by Ceadda (St. Chad), who had taken possession of the see in his absence; retired to his monastery for three years; was put in possession of the bishopric 669; was ejected by King Egfrid, who divided the diocese into three bishoprics; visited Rome for redress, and obtained the papal decision in his favor, but was imprisoned nine months on his return, and never recovered possession of his see. D. at the monastery of Oundle Apr. 24, 709.

Wil'helm (Karl), b. at Smaleald, Prussian province of Hesse; lived for many years as a teacher of music in Crefeld, and d. there Aug. 26, 1873. In 1854 he composed the music to *Die Wacht am Rhein*, and when this song became so immensely popular during the Franco-German war the Prussian government gave him a pension, and a monument was erected at Smaleald.

Wilhelmshaven. See Jade.

Wilhelmshöhe. See Cassel.

Wilk. See Whelk.

Wilkes, county of N. E. Georgia, drained by Broad River and Little River, and partially traversed by a branch of Georgia R. R., which terminates at the county-seat. Surface undulating, with considerable iron ore; soil generally unproductive. Staples, cotton and Indian corn. Cap. Washington. Area, 550 sq. m. P. 11,796.

Wilkes, county of N. W. North Carolina, intersected by Yadkin River, and having the Blue Ridge along the N. W. border; surface alternating hills and valleys; soil in the valleys fertile, in the mountains well adapted to pasturage. Swine and cattle are the chief live-stock. Staples, Indian corn and tobacco. Cap. Wilkesborough. Area, 864 sq. m. P. 15,539.

Wilkes (Charles), b. at New York in 1801; entered the naval service of the U. S. as midshipman Jan. 1, 1818; became lieutenant 1826, commander 1843, captain 1855, commodore 1862. He conducted the U. S. expedition (1838–42) to explore the Southern and Pacific oceans, a narrative of which he published, and of the detailed report of the expedition, giving the scientific results obtained, he contributed the volume on meteorology. In 1861 he was ordered to the West Indies in command of the frigate San Jacinto to search for the Confederate cruiser Sumter. Learning that the Confederate commissioners Slidell and Mason were on their way to Europe in the British mail-steamer Trent, he intercepted that vessel and took from her those men, whom he conveyed to Boston. This act met the approval of his department and of Congress, and the commissioners were for a time held as prisoners in Fort Warren, but subsequently surrendered by our government to Great Britain. In 1862 he was placed in command of the Potomac flotilla to co-operate with the Army of the Potomac, but on the withdrawal of that army from the Virginia peninsula, was ordered to command the flying squadron organized for the purpose of breaking up the blockade-running between the Southern States and the West Indies. Many captures were made. In July, 1866, he was promoted rear-admiral, and shortly after placed on the retired list. Among his published works, other than those above mentioned, are *Western America, including California and Oregon* (1849), *The Theory of the Wind*, with maps and charts (1856), etc. The London Geographical Society awarded him the gold medal in 1848. D. at Washington, D. C., Feb. 8, 1877.

Wilkes (George), b. in New York about 1820; became a journalist; wrote a *History of California* (1845) and *Europe in a Hurry* (1852); became in 1858 co-editor, with William T. Porter, of the *Spirit of the Times*, and subsequently proprietor of that paper; is well known as a politician, and has repeatedly travelled in Europe.

Wilkes (John), b. at Clerkenwell, London, England, Oct. 17, 1727, son of a wealthy distiller; educated at Hertford and Aylesbury schools and at the University of Leyden, where he acquired a taste for classical literature which he retained through life; travelled on the Continent; married in 1749 Miss Mead, a lady of fortune ten years his senior, from whom he was separated after the birth of one daughter; settled in Buckinghamshire; became colonel of the militia and high sheriff of that county; was elected to Parliament from Aylesbury 1757; commenced in June, 1762, the publication of a weekly paper, *The North Briton*, in opposition to the administration of Lord Bute; printed in his No. 45 (Apr. 23, 1763) a violent attack upon the king, which led to the issue of a "general warrant" for his arrest and the seizure of his papers; was committed to the Tower Apr. 30, but was soon released by order of Chief-Justice Pratt of the common pleas, who decided that general warrants were "unconstitutional, illegal, and also absolutely void." The House of Commons, however, declared No. 45 of the *North Briton* to be a "seditious libel," caused it to be burned by the hangman Nov., 1763, notwithstanding a popular commotion, and passed a special law for the prosecution of its author. Wilkes meanwhile won a suit against the under-secretary of state for seizure of his papers, being awarded £1000 damages, but was expelled from the House of Commons Jan. 19, 1764; was prosecuted at the instance of the House of Peers before Lord Mansfield on the charge of republishing No. 45, and also for printing and publishing an obscene poem called *An Essay on Woman*, and was found guilty of both charges by the court of king's bench Feb. 21, 1764, when, having previously fled to France, he was outlawed; returned to England in 1768; was chosen to Parliament for the county of Middlesex (including the city of London); surrendered himself to the court of king's bench; was rearrested, rescued by the mob, but went voluntarily into confinement; was the occasion, on the meeting of Parliament, of a riot in St. George's Fields May 10, 1768, in which several lives were lost, and was sentenced for his former offence to pay £1000 fine and to imprisonment for twenty-two months. His outlawry was reversed by Lord Mansfield, but he was expelled from the House of Commons for the new offence of libelling Lord Weymouth, but was returned without opposition at the new election. Though declared by Parliament incapable of a seat, he was three times chosen by his constituency, until, on the ground of illegality of votes cast for him, an opponent who had received but few votes was declared elected. These events caused great commotion in England: Wilkes became the idol of the people at large, being considered a martyr to the cause of liberty, received costly presents, extricated himself from bankruptcy by the aid of a subscription of £20,000, and was awarded £4000 damages from Lord Hardwick for false imprisonment (Nov., 1769). In Apr., 1770, he was set at liberty, was chosen alderman of London, and took his seat in Parliament, where a vain attempt was made to force him to appear at the bar in the capacity of alderman. He was elected sheriff of London 1771, lord mayor 1774, in which year he was re-elected to Parliament; had the resolutions of the House on the elections expunged May, 1782, and was chamberlain of London from 1779 to his death, in that city Dec. 27, 1797. He published many

political speeches and pamphlets, including a correspondence with "Junius," edited *Catullus* (1788) and *Theophrastus* (1790), and left a large *Correspondence*, which was edited by Almon, with a *Memoir* (5 vols., 1805). Among his numerous biographies, the latest and best are those of J. S. Watson (1870) and W. F. Rae (1870).

PORTER C. BLISS.

Wilkes'barre, city and tp., cap. of Luzerne co., Pa., in the beautiful valley of Wyoming, on the E. bank of the N. branch of Susquehanna River, near the 41st parallel. It is connected with the W. bank of the river by a fine double track bridge. The township was surveyed under a Connecticut claim in 1770, and named after John Wilkes and Col. Isaac Barré for their efforts as members of the British Parliament in the cause of liberty. The town in 1772 contained four white women; incorporated a borough under Pennsylvania in 1806; has 13 banks, 3 national, 4 savings, with others incorporated or private for deposits and discount under State laws; 23 churches and chapels, some of them very fine buildings; 3 large iron foundries and machine-shops, engaged in supplying the mining operations of the Wyoming coal-field, of which it is the centre; 3 large school buildings of creditable architecture, and an historical and geological society having a fine collection of coins and natural curiosities. The last appraisement shows 260 mercantile establishments. Incorporated by act of assembly as a city May 1, 1871, it is lighted with gas and is supplied with pure mountain water by two companies. Kingston and Plymouth on the W. side of the river are populous boroughs, and several boroughs on the E. side, all properly suburbs of the city, swelling the population of which it is the centre by many thousands. Twelve million tons of coal are taken to market annually from the county. Lehigh and Susquehanna and Lehigh Valley R. Rs. afford direct facilities for communication N. and S. by connection with Philadelphia and New York at Allentown, Bethlehem, and Easton on the Lehigh, and N. to the lakes and St. Lawrence by Erie, Albany and Susquehanna, and other roads. North Branch Canal affords water-communication S., and Lackawanna and Bloomsburg R. R. runs through Kingston and Plymouth N. and S. on the W. side from Scranton to Northumberland, where it connects with Northern Central road. Two horse railroads connect it with neighboring towns. A paid fire department has two steam-engines with hose-carriages and other engines. One daily paper and 2 English and 2 German weekly papers are published here. A driving-park with half-mile track has regular races. P. of city, 10,174; of tp., exclusive of city, 7090. The population of the city is now (1876) over 20,000.

W. P. MINER, ED. "RECORD OF THE TIMES."

Wilkes'boro', p.-v. and tp., cap. of Wilkes co., N. C. P. 1300.

Wilkes'ville, p.-v. and tp., Vinton co., O. P. 1472.

Wil'kie (Sir DAVID), b. at Cults, Fifeshire, Scotland, Nov. 18, 1785; studied painting in the Trustees' Academy, Edinburgh, and at the Royal Academy, London, where in 1806 he exhibited his celebrated *Village Politicians*, quickly followed by *The Blind Fiddler* (1807), *The Card-Players* (1808), *Rent Day* (1809), and *Village Festival* (1811), which obtained him great popularity; was chosen an associate of the Royal Academy 1809, and an academician 1811; visited Paris with Haydon 1814; produced during the ensuing twelve years many notable pictures, including a group of *Sir Walter Scott and his Family* (1817), the *Chelsea Pensioners reading the Gazette of the Battle of Waterloo* (1822), executed for the duke of Wellington; spent three years (1825–28) on the Continent on account of ill-health, visiting Italy and Spain; was made painter in ordinary to George IV. Jan., 1830; was knighted by William IV. 1836; made portraits of those sovereigns and of Queen Victoria; executed a fine painting of the *First Council of Queen Victoria;* went to Constantinople for the express purpose of painting a portrait of the sultan 1840; visited Palestine and Egypt. D. at sea near Gibraltar on his homeward voyage, June 1, 1841. Several volumes of engravings of his best works have been issued, including *Oriental Sketches* (1843), *The Wilkie Gallery* (1850), and *The Great Works of Sir David Wilkie* (1867), with a *Memoir* by Mrs. C. Heaton. His *Life, Journals, and Correspondence* (3 vols., 1843) were published by his friend, Allan Cunningham.

Wilkie (WILLIAM), D. D., b. at Dalmeny, West Lothian, Scotland, Oct. 5, 1721; educated at the University of Edinburgh; became a successful farmer; was ordained minister of the Scottish Kirk at Ratho 1753, and became professor of natural philosophy in the University of St. Andrew's 1759. D. Oct. 10, 1772. Author of *The Epigoniad, a Poem in Nine Books* (1757; 2d ed. 1759), an epic upon the taking of Thebes, which procured for its author the title of the "Scottish Homer," and a volume of *Fables* (1768) after the manner of Gay.

Wil'kin, county of W. Minnesota, separated from Dakota by Bois de Sioux and Red rivers, and traversed by St. Paul and Pacific R. R.; surface uneven, soil generally fertile. Cap. Breckenridge. Area, 900 sq. m. P. 295.

Wil'kins, tp., Allegheny co., Pa. P. 3455.

Wilkins (Sir CHARLES), D. C. L., F. R. S., b. at Frome, Somersetshire, England, in 1749; went to Bengal in the civil service 1770; resided in India sixteen years, during which time he acquired a knowledge not only of Bengali, Arabic, and Persian, but also of Sanskrit, which language he was the first to make known to European scholars; made with his own hands the matrices of the first Bengali and Persian types employed in Bengal, with which he printed at Hoogly, N. B. Halhed's *Grammar of the Bengal Language* (1778); founded, in conjunction with Sir William Jones, the Literary Society of Calcutta, which subsequently became the Royal Asiatic Society of Calcutta; published a translation from the Sanskrit of *The Bhagvat Geta, or Dialogues of Kreeshna and Arjoon* (London, 1785; reprinted New York, 1867), to which Warren Hastings prefixed *Introductory Observations;* returned to England 1785, but continued his Oriental studies; became librarian of the East India Company 1801, and visitor of the company's colleges at Haileybury and Addiscombe; was made a knight of the Guelphic order 1823; chosen a member of the French Institute, and honored as the "father of Sanskrit literature." D. in London May 13, 1836. He edited Richardson's *Arabic and Persian Dictionary* (2 vols., 1806–10), published translations of the *Hitopadesa* (Bath, 1787), *The Story of Dooshwanta and Sakoontala* (1795), and was author of a *Grammar of the Sanskrita Language* (1808) and a treatise on *The Radicals of the Sanskrita Language* (1815).

Wilkins (DAVID), D. D., b. in Switzerland in 1685; studied theology; became keeper of the archiepiscopal library at Lambeth Palace 1715; drew up a catalogue of all the MSS. and printed books in that collection; became rector of Mongham Parva, Kent, 1716, of Great Chart, Kent, and Hadleigh, Essex, 1719, subsequently of Monks-Ely and of Bocking; prebendary of Canterbury 1720, and archdeacon of Suffolk 1724. D. Sept. 6, 1745. He published editions of the Pentateuch (1731) and of the New Testament in Coptic (1716); edited the *Leges Anglo-Saxonicæ* (1721), the *Works* of Selden (1726), and the *Concilia Magnæ Britanniæ et Hiberniæ* (4 vols. folio, 1736–37). He is also considered the author of a work published in the name of "J. Chamberlayne," *Oratio Dominica in diversas omnium fere Gentium Linguas versa, etc.* (Amsterdam, 1715), being the first attempt to present the *Pater-Noster* in many languages for philological purposes.

Wilkins (HENRY MUSGRAVE), b. in England about 1822; graduated at, and became fellow of, Merton College, Oxford, and took orders in the Church of England. Author of *Notes for Latin Lyrics* (1851), *Progressive Greek Delectus* (1859), *Progressive Latin Delectus* (1867), *Progressive Greek Anthology* (1861), *Progressive Latin Anthology* (1864), *Scriptores Attici* (1866), *Speeches from Thucydides* (1870), and other valuable classical textbooks.

Wilkins (JOHN), D. D., b. in 1614 at Fawsley, Northamptonshire, England, at the house of his maternal grandfather, the Puritan divine John Dod, "the Decalogist;" educated at New Inn and Magdalen halls, Oxford, graduating at the latter about 1632; took orders in the Church of England 1635; was successively chaplain to Lord Say and Sele, Lord Berkeley, and Charles, count-palatine of the Rhine; was a zealous adherent of Parliament during the great rebellion, and took the Solemn League and Covenant; was chiefly instrumental in forming at London in 1645 the club of scientists which became the nucleus of the Royal Society; became warden of Wadham College Apr. 13, 1648; married the widow of Dr. French, a sister of the Protector, Oliver Cromwell, 1656; was appointed by Richard Cromwell master of Trinity College, Cambridge, 1659; was ejected at the Restoration 1660; became prebendary of York 1660; obtained the favor of Charles II., who made him rector of St. Lawrence, Jewry, London, 1662; became preacher to Gray's Inn; was one of the charter members and councillors of the Royal Society 1663, and became bishop of Chester 1668. He was the inventor of the perambulator or measuring-wheel; was an excellent mathematician and physicist, a skilful mechanician, untiring in his experiments, a philologist of great erudition, and a noted theologian and pulpit-orator. D. in London Nov. 19, 1672. Author of *Discovery of a New World* (1638), treating of the habitableness of the moon and the possibility of a passage thither; *Mercury, or the Secret and Swift Messenger, showing how a Man may with Privacy and Speed communicate his Thoughts to a Friend at any*

Distance (1641); *Mathematical Magick, or the Wonders that may be performed by Mechanical Geometry* (1641); *An Essay towards a Real Character and a Philosophical Language, with an Alphabetical Dictionary* (folio, 1668), an ambitious and ingenious attempt to form a universal language; *Ecclesiastes, or a Discourse concerning the Gift of Preaching as it falls under the Rules of Art* (1646), and of various other religious treatises. His *Mathematical and Philosophical Works* were published collectively (1708; new ed., 2 vols., 1802), with a *Life of the Author and an Account of his Works;* and Archbishop Tillotson, his literary executor, who married his step-daughter, edited a posthumous volume of *Sermons* (1675) and a treatise on *The Principles and Duties of Natural Religion* (1675), which was many times reprinted. PORTER C. BLISS.

Wilkins (Ross), b. in Pennsylvania about 1805; became a lawyer; was appointed by Pres. Jackson a Federal judge for the Territory of Michigan; became in 1837 a regent of the State university; presided over the first war-meeting held in Detroit in 1861, and was many years a circuit judge, resigning that post in 1870.

Wilkins (WILLIAM), R. A., F. S. A., b. at Norwich, England, Aug. 31, 1778; graduated at Caius and Gonville College, Cambridge, 1800; became a fellow there 1805; devoted himself to the study of classic architecture; became architect to the East India Company and professor of architecture at the Royal Academy 1837. He designed the University Club House, St. George's Hospital, the London University 1827, the National Gallery, London, 1832–38, Corpus Christi and Downing colleges, Cambridge, the Nelson pillars at Dublin and Great Yarmouth, the additions to Trinity and King's colleges, Cambridge, and several other important public buildings; contributed to the *Archæologia;* translated *The Civil Architecture of Vitruvius* (2 parts, 1812–17); edited several works for the Dilettanti Society, and restored the mutilated Greek inscriptions on public edifices at Athens with great learning and ingenuity. D. at Cambridge Aug. 31, 1839. Among his works were—*The Antiquities of Magna Græcia* (1807), *Atheniensia, or Remarks on the Topography and Buildings of Athens* (1816), and *Prolusiones Architectonicæ, or Essays on Greek and Roman Architecture* (part i., 1837).

Wilkins (WILLIAM), b. in Eastern Pennsylvania in 1779, son of Gen. John (1762–1814), a Revolutionary officer and early settler at Pittsburg; received a good education; became in 1810 president of the Pittsburg Manufacturing Company, subsequently transformed into the Bank of Pittsburg; was elected in 1819 to the legislature, where he became noted for knowledge of business details and for skill in debate; was U. S. Senator 1831–34, minister to Russia 1834–36, member of Congress 1843–44, secretary of war under Pres. Tyler 1844–45; was co-founder (with Thomas Bakewell and John Harper) of the Western Pennsylvania Hospital 1847, and was subsequently judge of the U. S. district court for Western Pennsylvania. D. at Homewood, near Pittsburg, June 23, 1865.

Wil'kinsburg, p.-v., Allegheny co., Pa.

Wil'kinson, county of Central Georgia, lying on Oconee River, drained by its affluents, and traversed by Georgia Central and Milledgeville and Eatonton R. Rs.; surface undulating, partially wooded, with chalybeate and sulphur springs; soil moderately fertile. Swine and cattle are the chief live-stock. Staples, cotton and Indian corn. Cap. Irwinton. Area, 430 sq. m. P. 9383.

Wilkinson, county of S. W. Mississippi, bordering on Louisiana, bounded W. by Mississippi River and intersected by West Feliciana R. R. Cattle and swine are the chief live-stock. Staples, cotton and Indian corn. Cap. Woodville. Area, 580 sq. m. P. 12,705.

Wilkinson, tp., Desha co., Ark. P. 569.

Wilkinson (JAMES), b. in Maryland in 1757; studied medicine in Philadelphia, but after the battle of Bunker Hill repaired to Cambridge, and was soon appointed a captain in Reed's New Hampshire regiment, serving as such with Arnold in the Northern army; promoted brigade-major July, 1776, and lieutenant-colonel Jan. 12, 1777; bearer of despatches to Gen. Washington from Gen. Gates Dec., 1776, he participated in the battles of Trenton and Princeton. Upon Gates's accession to command of the Northern army, Wilkinson was made his adjutant-general May, 1777, and upon the surrender of Burgoyne he conveyed the official despatches to Congress. Brevetted brigadier-general in November, he was in Jan., 1778, appointed secretary of the board of war, of which Gates was president. A quarrel arising with the latter at the time of the Conway cabal, Wilkinson resigned his secretaryship, and in July, 1779, was appointed clothier-general of the army. Settled in Kentucky after the peace, and engaged in mercantile affairs. Appointed lieutenant-colonel 2d Infantry Nov., 1791, and conducted an expedition against the Wabash Indians 1791–92; promoted to be brigadier-general Mar., 1792, and commanded right wing of Wayne's army at Maumee Rapids, and in Dec., 1796, became general-in-chief of the army, serving on the Western frontier; one of the commissioners to receive Louisiana from the French in 1803, he was governor of that Territory 1805–06; ordered to command on the Mississippi Dec., 1808, he was recalled to Washington in 1810, and tried by court-martial in 1811 on charges of corruptly receiving money from Spain and being in complicity with Aaron Burr. The court acquitted him with credit, and he returned to the Southern department. In 1813 he was appointed major-general, and transferred to the Northern frontier. Owing to the failure of Hampton to co-operate with him, his plans for the occupation of Canada totally failed. He was superseded in command, and a court of inquiry ordered in 1815, which acquitted him of all blame. On the reorganization of the army in 1815, he was discharged, and passed the later years of his life upon his estates in Mexico. In 1816 he published *Memoirs of My Own Times* (3 vols. 8vo, 1800). D. near City of Mexico Dec. 28, 1825.

Wilkinson (JEMIMA), b. at Cumberland, R. I., about 1753; educated as a Quaker; recovered from a severe fever, attended by an apparent suspension of life, 1773, after which she asserted that she had been raised from the dead to instruct mankind, professed to work miracles, and made a few proselytes, with whom she settled on a tract of land in the present town of Torrey, Yates co., N. Y., where a village named Jerusalem was built, and resided there until her death, July 1, 1819. At her death the sect was entirely broken up.

Wilkinson (Sir JOHN GARDNER), D. C. L., F. R. S., b. at Haxendale, Westmoreland, England, Oct. 5, 1797, son of Rev. John Wilkinson by a daughter of Rev. Richard Gardner; educated at Harrow School and at Exeter College, Oxford; resided twelve years in Egypt, engaged in a careful study of the ancient history, geography, ethnography, and architectural remains of that country, making by his publications important additions to the existing knowledge, for which he was knighted 1839; travelled extensively in Europe; revisited Egypt 1855–56; presented his collections of Egyptian, Greek, and other antiquities to Harrow School for the purpose of forming a museum, to which he added in 1874 his valuable collection of coins and medals, and was an influential member and officer of the leading British scientific associations. D. Oct. 29, 1875. Author of *Materia Hieroglyphica* (Malta, 1828), *The Topography of Thebes and General View of Egypt* (1835), *The Manners and Customs of the Ancient Egyptians* (2 series, 6 vols., 1837–41; 3d ed., 5 vols., 1847), *Modern Egypt and Thebes* (2 vols., 1843), republished as Murray's *Handbook for Travellers in Egypt* (1847; new ed. 1857), *Dalmatia and Montenegro* (2 vols., 1848), *The Architecture of Ancient Egypt* (1850), *The Fragments of the Hieratic Papyrus at Turin* (1851), *The Egyptians in the Time of the Pharaohs* (1857), a treatise *On Colour* (1857); prepared an abridgment of his chief work as *A Popular Account of the Ancient Egyptians* (2 vols., 1853), and contributed a dissertation on Egypt to Prof. George Rawlinson's translation of *Herodotus* (4 vols., 1858–60; 3d ed., revised, 1876). A new edition of his *Manners and Customs* was prepared by Dr. Samuel Birch (1876), and a *Memoir* (1876) has been written by his widow.

PORTER C. BLISS.

Wilkinson (JOHN JAMES GARTH), M. D., b. in London in 1812; became a homœopathic physician, and has published *Swedenborg, a Biography* (1849), *The Human Body, and its Connection with Man* (1851), *The Ministry of Health* (1857), *Improvisations from the Spirit* (1857), and *Methods of Human Science and of Divine Revelation* (1876), and translated from the Latin several of the scientific works of Swedenborg.

Wilkinson (MORTON S.), b. at Skaneateles, N.Y., Jan. 22, 1819; received an academical education; settled in Illinois 1837; returned to Skaneateles to study law 1839; settled at Eaton Rapids, Mich.; went to Minnesota Territory 1847; was elected to the legislature 1849, and drew up the code of laws then enacted; was a Republican U. S. Senator 1859–65, a delegate to the Baltimore convention of 1864, and to the Loyalists' convention of 1866, and a member of Congress 1869–71, serving on the committees on foreign affairs and on the census.

Wilks (MARK), b. in England about 1765; was appointed a cadet in the East India service 1782; rose to the rank of lieutenant-colonel 1808, and brevet colonel 1811; was political resident at Mysore 1803–08; was governor of St. Helena 1812–16, embracing the first year of Napoleon's captivity in that island, and was placed on the retired list 1818. D. in England Sept. 19, 1831. Author of *A Report on the Interior Administration of the Government*

of Mysoor (1805) and *Historical Sketches of the South of India in an Attempt to Trace the History of Mysoor, etc.* (London, 3 vols. 4to, 1810–17).

Wilks (Washington), grandson of Mark, b. in England in 1826; became a Liberal journalist and politician in London; was co-editor of the *Morning Star*; published *The Half Century, its History, Political and Social* (1852), *Turk, Greek, and Russian—their Past, Present, and Probable Future* (1853), *Edward Irving, a Biography* (1851), and *The Three Archbishops of Canterbury, Lanfranc, Anselm, A Becket* (1858). D. suddenly of apoplexy while addressing a meeting on parliamentary reform at London June 27, 1861.

Will is one of the three forms under which the human mind becomes conscious of itself, thought and feeling being the two others. From its lowest phase, as an entirely unconscious correlation between action and reaction—as, for instance, when the hand is involuntarily moved back when touching something very hot—to its highest phase as the pursuit of an aim exclusively for its moral worth and regardless of its relations to the natural individual, the will runs through a great number of stages, appearing first as instinct, impulse, appetite, passion, etc., before it submits to the government of the moral ideas, and thereby enters into the sphere of freedom; and its definition varies according to the stages in which it is considered. In modern times Schopenhauer has made it the fundamental element of all existence, and his observations, though sometimes mystical and sometimes materialistic in their tendencies, have thrown much new light on all questions relating to the will.

Will (in law). The testament of the Roman law consisted essentially in the naming of an heir or heirs, who succeeded, as representatives of the defunct, to his entire inheritance, including not only his property, but his liabilities; while the legacies, if any, were in the nature of charges upon the succession, to be paid by the heir. It was a fundamental principle of that jurisprudence that no person (except a military man in active service, in whose favor many rules were relaxed) could die partly testate and partly intestate. This doctrine was first modified by Justinian in one of the *Novels* issued after the great codification which bears his name. (See Testament.) The will of the American and English law is radically different in its conception, form, and effect from the Roman testament. The recipients of the testator's bounty under it are not thereby his heirs: they do not succeed to his entire inheritance as such, but to such specific gifts or separate amounts as he bestows upon them individually; they do not become liable for his debts, but the personal estate devolves primarily upon the executor, who by its means discharges all the outstanding claims, and if it is not sufficient, recourse is had to the real estate; the legatees of personal property derive their title not directly from the deceased, but from the executor, while the devisees of lands take immediately under the will; finally, the will need not embrace all of the testator's estate, but he may die partly testate and partly intestate. Anciently, in England, "testament" was sometimes said to be a gift of personal property alone, and to require the appointment of an executor, while "will" was properly confined to a devise of lands; these distinctions, however, have long disappeared, and even statutes have enacted that the two words should be synonymous. A will may therefore be defined as the disposition in whole or in part of the testator's estate, real and personal, executed in the manner and form required by the law during his lifetime, but taking effect only at his death. Every will is "ambulatory" as long as the testator lives; that is, it is an inchoate act, remaining under his complete control; he may change or annul it at any time if he retains a disposing faculty of mind. Strictly speaking, "devise" refers to land, "legacy" to personal property, while "give," "bequeath," and "bequest" are applied indiscriminately to both. But the accurate use of these words is not necessary, and the will will be perfectly valid if the intent of the testator can be ascertained from his language. For example, a "devise of $1000" or "a legacy of" a certain farm, though improper expressions, could leave no doubt as to the meaning.

What may be given by Will.—From the most remote periods of the English law, personal property could be bequeathed. The customs and doctrines of feudalism long prevented lands from being devisable. After the introduction of uses, those peculiar estates could be bequeathed (see Use); at length the statute of wills (32 Hen. VIII. ch. 1, and 34 and 35 Hen. VIII. ch. 5) removed nearly all the existing restrictions, and rendered lands devisable as a general rule. By virtue of the existing legislation all property, real and personal, with a few special exceptions, may be disposed of by will to whatever persons or recipients of his bounty the testator chooses. The most important of these exceptions are those created by the statutes of mortmain, which prohibit a gift of lands to corporations unless they are expressly empowered by statute to receive devises—those created by statute in England and in many of the American States, which in various forms and with much diversity of detail limit the power of testators in respect to the time and amount of their testamentary gifts to religious or charitable institutions and for distinctly religious or charitable purposes; and that—by far the most important one in the U. S.—which prevents a husband from depriving his widow of her dower or its equivalent.

In whose favor Wills may be made.—Beyond the excepted classes last enumerated, the law places no limitation upon the capacity to receive testamentary gifts. Wills may be made in favor of, and property real and personal may be bequeathed to, all persons, whatever may be their disabilities to perform any positive act which shall be legally binding, including married women, infants, lunatics, idiots, persons of unsound mind, and the like, as well as all those in the full possession of their mental faculties and in the enjoyment of all the legal rights belonging to manhood.

By whom Wills may be made.—As a general proposition, all persons are empowered to make a valid will except those disqualified through lack of the requisite age, through coverture, or through mental incapacity. (1) *Age.*—The statutory rule is almost universal that a person must have attained the age of twenty-one years before he or she can make a will of lands, and the same age is frequently, and perhaps generally, required for a will solely of personal property. In New York males of eighteen and females of sixteen are competent to bequeath personal estate. In Connecticut, California, and Nevada both males and females, and in Vermont, Maryland, and Illinois the females, acquire the full testamentary capacity in respect of lands as well as chattels at the age of eighteen. (For the peculiar rule of the law concerning the precise time when a person actually reaches any given age, as twenty-one, eighteen, or sixteen, consult the article Year and a Day.) (2) *Married Women.*—The ancient law denied to married women any testamentary power over lands, and admitted only a partial authority in the bequest of personal estate. The recent legislation in the U. S. has to a very great extent removed these restrictions, and has clothed married women with the same power to devise and bequeath their separate property as that held by single women. (See Marriage and Married Women.) (3) *Mental Incapacity.*—It is a fundamental doctrine that a sufficient mental capacity in the testator—that is, sound and disposing mind and memory—is essential to the validity of any will. This rule excludes idiots, lunatics—unless the instrument is executed during a lucid interval—persons completely intoxicated at the time of the execution, and persons of unsound or weak mind to such a degree that they are unable without assistance to call up to their memory the property which they possess or the individuals who would naturally be the recipients of their bounty, or to comprehend without prompting the nature of the act in which they are engaged while making a testamentary disposition. It is almost impossible to form an accurate and comprehensive definition which shall embrace all the instances of mere mental unsoundness, and each case must to a considerable extent depend upon its own circumstances. A will is also invalid when procured by fraud, or by undue influence exerted upon a testator of enfeebled mind and memory, even though he might possess a sufficient testamentary capacity if left to exercise his own judgment unforced by the external pressure.

The Form and Execution of Wills.—The existing legislation, both in the U. S. and in England, concerning the form and execution of wills is constructed upon the same model, applies alike to those of real and of personal property, and differs only in minor points of detail. All wills, except in the single case to be mentioned hereafter, must be in writing. The following formalities must be observed in order that the execution—the *factum*—may be complete: (1) The instrument must be subscribed or signed at the end by the testator, or by some one in his presence and by his direction. In some of the States the statutory language still remains "signed," and this, it has been decided, is complied with wherever in the instrument the signature appears, even at the commencement. (2) The signature must either be affixed, or must be acknowledged by the testator to be his own, in the presence of each of the witnesses. (3) The testator must declare the instrument to be his last will in the presence of each of the witnesses. This step, which is technically termed the "publication," is of the utmost importance, and was borrowed directly from the Roman mode of execution. (4) There must be a certain number of witnesses, who act as such in all that they do at the request of the testator, which request may

be made by him personally or by some one in his presence. In most of the States the required number is two, but in some it is three. (5) These witnesses must all sign the will at the end thereof in the presence of the testator; some of the statutes add that this signing must also be in the presence of each other. If the testator's name is written by an amanuensis, it is often required that he should be one of the attesting witnesses. While all these five steps are necessary to the validity of a will, a substantial compliance is sufficient. A *codicil* is an appendix annexed to the main will after its execution, whereby the testator makes some change in or addition to his former dispositions, and it must be signed, published, and attested in the same manner as the original. Verbal or *nuncupative* wills are, by the existing legislation in England and in a great majority of the American States, permitted to be made only by soldiers in active service during war and by sailors while at sea; in a very few States, however, the privilege is extended to all persons *in extremis* in respect to a limited amount of property. The statutes authorizing nuncupative wills contain various provisions intended to prevent imposition or mistake, by requiring a certain number of witnesses, and frequently that the testator's declaration should be reduced to writing and attested within a short time after his death —generally thirty days—and that the will itself must be offered for probate before the expiration of a limited period from its execution, often fixed at six months.

Revocation.—The revocation of a will may be express or implied. (1) *Express.*—As the statutory law requires that the intent of the testator in the execution shall be manifested by a compliance with certain fixed formalities, so it demands that the contrary act shall be done in a manner which leaves no doubt as to his real purpose. An express revocation may be effected by a subsequent will, which in plain and absolute terms annuls any and all former ones, or which, without such formal clause, disposes of all the estate in manner inconsistent with the prior bequests. It may also be made by the destruction or cancellation of the instrument, if done by the testator himself or under his direction with the intent thereby to revoke—*animo revocandi.* The statutes often enumerate the modes, as burning, tearing, obliterating, cancelling, and destroying. (2) *Implied.*—An implied revocation is wrought by the subsequent marriage of the testator and the birth of children, or by either. A will made by a single woman is annulled by her marriage. In the greater number of the American States the will of a man is revoked by his subsequent marriage and the birth of children for whom it makes no provision. In England and in a portion of the States the same effect is produced by the marriage alone. In a very few States the implied revocation results from the subsequent birth of a child or children who are left unprovided for by the testator. As a general rule, however, such children receive the portions to which they would have been entitled had their father died intestate, and the will stands, subject to the necessary deduction from its bequests. (For the rules concerning the construction and interpretation of wills, see the article on INTERPRETATION. In connection with the general subject of wills the reader may also consult the articles on PROBATE, SUCCESSION, EXECUTOR, LEGACY.) JOHN NORTON POMEROY.

Will, county of N. E. Illinois, bordering on Indiana, intersected by Des Plaines and Kankakee rivers, which unite near the S. W. border and form the Illinois, and traversed by Illinois and Michigan Canal, Illinois Central, Chicago and Alton, Chicago Rock Island and Pacific, and Chicago Danville and Vincennes R. Rs.; surface mostly level prairie-land, soil generally productive. There are flour-mills, planing-mills, tanneries, breweries, and manufactories of agricultural implements, carriages, saddlery, iron castings, machinery, bricks, and woollen goods. Livestock, especially horses and cattle, very numerous. Staples, Indian corn, oats, hay, wool, and dairy products. Cap. Joliet. Area, 828 sq. m. P. 43,013.

Will, tp., Will co., Ill. P. 911.

Willa'mette River, a branch of the Columbia, rises in the Cascade Mountains in Oregon, and flows first N. W. and then N. through a beautiful region, extremely fertile and now well settled. It is navigable for ships to Portland, 15 miles. Twenty-five miles from its mouth are the Willamette Falls, at Oregon City. The river here falls 40 feet perpendicularly, but a canal and locks have been constructed at a cost of over $500,000, so that small steamboats for two-thirds of the year can pass from the mouth of the river to Eugene City, more than 130 miles. At Oregon City the river furnishes a noble water-power.

Wil'lan (ROBERT), M. D., F. S. A., b. at Hill, near Sedburgh, Yorkshire, England, Nov. 12, 1757; graduated in medicine at Edinburgh 1780; settled at Darlington, Yorkshire, 1781, and soon afterward at London, where he was physician of the Corey street Dispensary 1783–1803, and also physician of the Finsbury Dispensary, and was eminent as a specialist upon cutaneous diseases. D. at Madeira Apr. 7, 1812. Author of *The History of the Ministry of Jesus Christ, combined from the Narrative of it in the Four Evangelists* (1782), entitled in the 3d ed. *The United Gospel* (1806), and *The Description and Treatment of Cutaneous Diseases* (3 orders, 4 parts, 1798–1808), a work which was left unfinished, but was completed by his eminent pupil and successor, Dr. Thomas Bateman. Dr. Willan contributed to several medical journals, read several papers before the Antiquarian Society, and left valuable MSS., from which, and from his printed monographs, was prepared a volume of his *Miscellaneous Works* (1821), edited by Dr. Ashby Smith. A *Memoir* by Dr. Bateman was published in the Edinburgh *Surgical Journal.*

Wil'lard (CHARLES W.), b. at Lyndon, Vt., June 18, 1827; graduated at Dartmouth College 1851; was admitted to the bar at Montpelier 1853; was elected secretary of state 1855, and declined a re-election; was chosen State senator 1860; became editor of the *Green Mountain Freeman* 1861, and was a member of Congress 1869–73, serving on the committee of foreign affairs and as chairman of that on Revolutionary pensions.

Willard (EMMA C. **Hart**), b. in Worthington parish, Berlin, Conn., Feb. 23, 1787, descended on the paternal side from Rev. Thomas Hooker, the first minister of Hartford, and from Stephen Hart, the deacon of his church, was the youngest but one of a family of seventeen children; educated at the village academy; became a district schoolteacher at the age of sixteen; taught a select school the following year; was at different times preceptress in academies at Berlin, Westfield, Mass., and Middlebury, Vt.; married Dr. John Willard at Middlebury, Vt., Aug., 1809; opened at that place a boarding-school for girls 1814; introduced several new studies and many improvements upon the ordinary methods of instruction; wrote *A Plan for improving Female Education* (1819), which was submitted in MS. to Gov. De Witt Clinton of New York; obtained his encouragement for her project, and by a special act a portion of the State fund for academies; opened a school under his patronage at Waterford, N. Y., 1819; removed the school to Troy, May, 1821, that town having tendered her a building; lost her husband 1825; wrote several school histories and other educational books; superintended the seminary with great success until 1838, when she resigned it to her son and his wife; visited Europe 1830; published on her return her *Journal and Letters from France and Great Britain* (1833), devoting the profits (about $1100) to the assistance of a school for women in Athens, Greece, which owed its origin to her; settled at Hartford, Conn., 1838; directed her energies for several years to the revision of her numerous school-books and to public labors in the cause of higher education, visiting the Western and Southern States and addressing teachers' conventions, being received by many of her former pupils with the utmost affection. D. at Troy Apr. 15, 1870. Among her numerous publications were—*A History of the U. S.* (1828), *Universal History* (1835), *Ancient Geography*, a volume of *Poems* (1830), *The Motive Powers which produce the Circulation of the Blood* (1846), *Respiration and its Effects* (1842), *Last Leaves of American History* (1849), and *Morals for the Young* (1857). A biography by John Lord, LL.D., was published in 1874. PORTER C. BLISS.

Willard (ERASTUS), b. at Lancaster, Mass., July 4, 1800; graduated at Waterville College, Me., about 1824; was for some years a teacher; studied theology at the Newton Seminary; was ordained pastor of a Baptist church at Grafton, Vt., Oct., 1833; went to France as a missionary teacher Aug., 1835; was eminently successful as an instructor of French candidates for the Protestant ministry; returned from France 1856; was missionary to the Ottawa Indians 1856–59, pastor of a church at Salem, N. Y., 1859–65, and subsequently settled at Newport, R. I., where he d. Dec. 30, 1871. He was an excellent Hebrew scholar, and familiar with the modern languages and literature of Europe.

Willard (FRANCES E.), b. near Rochester, N. Y., Sept. 28, 1839; graduated at the North-western Female College 1858; was a successful teacher in several Western towns; became directress of the Genesee Wesleyan Seminary at Lima, N. Y., 1867, and was chosen (Feb. 14, 1871) president of the Evanston College for ladies, established in connection with the North-western University. In 1869–71 she travelled in Europe, Egypt, and Palestine, and on her return delivered lectures at Chicago. Author of a biographical sketch of a deceased sister which appeared in a volume (1861), and has contributed to various periodicals.

Willard (GEORGE), b. at Bolton, Vt., Mar. 20, 1821; received a liberal education; removed to Michigan in early manhood; was two years professor in Kalamazoo College;

member of the board of education 1857–63; became regent of the university 1863; was a member of the State constitutional convention; a delegate to the national Republican convention of 1872; was for several years editor and proprietor of the Battle Creek *Journal*, and a member of Congress 1873–77.

Willard (John), b. in New York in 1792; became a prominent Democratic lawyer; was appointed by Gov. Marcy in 1836 judge and vice-chancellor of the 1th circuit court of New York, which post he filled until the adoption of the constitution of 1846; was a justice of the supreme court of New York 1847–55; was elected to the State senate by a unanimous vote 1861; served on the judiciary committee and prepared the act of 1862 restoring the death penalty and repealing all former statutes on that subject. D. at Saratoga Sept. 1, 1862.

Willard (John Dwight), LL.D., b. at Lancaster, Mass., Nov. 1, 1799; graduated at Dartmouth College 1819; was admitted to the New York bar about 1823; began practice at Troy, N. Y., 1826; was for some years editor of the Troy *Sentinel*; member of the State senate and judge of the circuit court of New York. D. at Troy Oct. 16, 1861. He left a legacy of $10,000 to Dartmouth College. Author of *A Treatise on Equity Jurisprudence* (Albany, 1855), *A Treatise on the Law of Executors, Administrators, and Guardians* (1859), and *A Treatise on the Law of Real Estate, and the Mode of Alienation thereof* (1861).

Willard (Joseph), D. D., LL.D., great-grandson of Pres. Samuel, b. at Biddeford, Me., Dec. 28, 1738; went to sea at an early age, and made several coasting-voyages; graduated at Harvard 1765; was tutor there 1766–72; became colleague pastor of the Congregational church at Beverly, Mass., Nov. 25, 1772, and was president of Harvard College from Dec. 19, 1781, until his death, at New Bedford, Mass., Sept. 25, 1804. He published several sermons, a Latin address on the death of Washington, prefixed to Rev. Dr. David Tappan's *Discourse* (1800); contributed mathematical and astronomical papers to the *Memoirs* of the American Academy and to the *Philosophical Transactions*; was a good Greek scholar, and left in MS. a Greek grammar.

Willard (Joseph), son of Pres. Joseph, b. at Cambridge, Mass., Mar. 11, 1798; studied at Phillips Academy; graduated at Harvard 1816; studied law at Amherst, N. H.; practised for some years at Waltham, and afterward at Lancaster, Mass.; settled at Boston about 1829; was corresponding secretary of the Massachusetts Historical Society 1829–64; became a master in chancery 1838; was appointed joint clerk of the courts of Suffolk co. (supreme and common pleas), which post he held until 1856, when, those offices becoming elective, he was chosen clerk of the superior court for five years; was re-elected for a like term 1861, and was for some years a trustee of the old Boston Library. Author of *Topographical and Historical Sketches of the Town of Lancaster* (Worcester, 1826), *The Willard Memoir, or Life and Times of Major Simon Willard, etc.* (1858), *An Address in Commemoration of the 200th Anniversary of the Incorporation of Lancaster* (1853), and of other addresses and pamphlets; edited Mrs. Rowlandson's *Narrative of Captivity, etc.* (5th ed., Lancaster, 1828); contributed to numerous historical and literary periodicals, and left incomplete a *Life* of Gen. Henry Knox.—His son, Sidney, b. at Lancaster Feb. 3, 1831, graduated at Harvard 1852; was noted at college as an oarsman, and subsequently for skill in athletic sports, on which subject he wrote for the *Atlantic Monthly*; became a lawyer at Boston; served in the civil war as major of the 35th Massachusetts regiment, and was killed at Fredericksburg, Va., Dec. 13, 1862.

Willard (Samuel), son of Major Simon, b. at Concord, Mass., Jan. 31, 1640; graduated at Harvard 1659; studied divinity; was minister of Groton from 1663 until driven away during King Philip's war, 1676; became colleague pastor with Rev. Thomas Thacher over the Old South church, Boston, Apr. 10, 1678; succeeded to the pastorate in the same year; opposed the witchcraft delusion of 1692, and was vice-president (exercising full powers as president) of Harvard College, as successor to Pres. Mather, from 1701 until his death, at Boston Sept. 12, 1707. He was twice married and had twenty children; author of *A Complete Body of Divinity* (1726), posthumously published in a folio volume under the editorship of Joseph Sewall and Thomas Prince, and of various minor religious treatises.

Willard (Samuel), D. D., nephew of Pres. Joseph, b. at Petersham, Mass., Apr. 19, 1776; graduated at Harvard 1803; was tutor in Bowdoin College 1804–05, and pastor of the Congregational church at Deerfield, Mass., from Sept. 3, 1807, to Sept., 1829, when he resigned on account of total loss of sight. D. at Deerfield Oct. 8, 1859. Author of *The Deerfield Collection of Sacred Music* (1808), *Original Hymns* (1823), *An Index to the Bible* (1826), *An Improved Reader* (1827), *The General Class-Book* (1828), *Sacred Poetry and Music Reconciled, a Collection of Hymns* (1830), *An Introduction to the Latin Language* (1835), and other works, some being anonymous schoolbooks, and left other works in MS.

Willard (Sidney), son of Pres. Joseph, b. at Beverly, Mass., Sept. 19, 1780; graduated at Harvard 1798; was librarian there 1800–05; studied theology, and sometimes preached, though he never held a pastoral charge; was a member of the famous Anthology Club; was Hancock professor of Hebrew and Oriental languages at Harvard 1807–31, filling also the chair of English literature, and for some years that of Latin; was frequently a member of the Massachusetts legislature, and once of the executive council, and was mayor of Cambridge 1848–50. Author of a *Hebrew Grammar* (1817), *Memories of Youth and Manhood* (2 vols., 1855); was one of the founders of and a contributor to the *Literary Miscellany*; also founder and editor of the *American Monthly Review* (4 vols., 1832–33); wrote largely for the *Monthly Anthology*, the *North American Review* (18 papers, 1816 *seq.*), the *General Repository*, and the *Christian Examiner*.

Willard (Simon), b. in Kent, England, in Apr., 1605; came to Massachusetts in 1634; was one of the chief founders of Concord; afterward lived in Lancaster, Groton, and Salem; held various civil offices; was major of militia during King Philip's war; became a magistrate, and d. at Charlestown, where he was holding a court, Apr. 24, 1676. He was ancestor of most of the name in the U. S. (See the *Willard Memoir* (1858), by his descendant, Joseph Willard.)

Willard (Simon), b. at Roxbury, Mass., Jan. 9, 1795; graduated at the U. S. Military Academy Mar. 2, 1815; promoted to the army as third lieutenant of ordnance, and ordered to the Pittsburg arsenal, crossing the Alleghany Mountains on foot; resigned May 1, 1816. After an unsuccessful business career of seven years, he entered his father's clockmaking establishment, but at the end of two years apprenticed himself to Mr. D. Eggert, an ingenious mechanician in New York, to learn the watchmaking and chronometer business. He soon became expert, and in 1828 returned to Boston, where he embarked in business for himself, and for forty-two years occupied the premises where he commenced business, during which time he attained a very distinguished reputation in his profession and acquired a handsome fortune. At the outset of his later venture in Boston he constructed an astronomical clock that was for forty years the standard of time for that section. D. at Boston Aug. 24, 1874.

Willard (Sylvester D.), M. D., b. at Wilton, Conn., in 1825; graduated at the Albany Medical College 1848; became a distinguished physician at Albany, an active member and officer of the State and county medical societies, and contributed to medical periodicals. Author of *Biographical Memoirs of Physicians of Albany Co.* (1857), *Annals of the Medical Society of Albany 1800–51* (1864), and other works.

Willcox (Orlando Bolivar), b. at Detroit, Mich., Apr. 16, 1823; graduated at the U. S. Military Academy, and appointed second lieutenant of artillery July, 1847; served in garrison and on frontier duty until 1857, when he resigned and commenced the practice of law at Detroit. On the outbreak of war in 1861 he took command of the 1st Michigan Vols., which he led at Bull Run, where wounded, taken prisoner, and not released until Aug., 1862. His commission of brigadier-general of volunteers was dated from the day of his capture, and at South Mountain and Antietam he commanded a division of the 9th corps, and at Fredericksburg was in command of that corps. During the riots arising from the enforcement of the draft in Indiana in 1863, Gen. Willcox was placed in command there; was engaged in East Tennessee from Sept., 1863, until Mar., 1864, when transferred to the Army of the Potomac, and in the Richmond campaign of that year commanded a division of the 9th corps, through the Wilderness battles to Petersburg, participating in the capture of that city; subsequently commanded various military districts until Jan., 1866, when mustered out. Resuming his profession at Detroit, he was also U. S. assessor of internal revenue until July, 1866, when reappointed into the army as colonel of the 29th Infantry; transferred to the 12th Infantry in 1869. Brevet brigadier and major general for gallantry at Spottsylvania and capture of Petersburg.

Willehad, or **Wilhead** (Saint), b. in Northumbria, England, early in the eighth century; was educated at York; became a priest; went as a missionary to the pagans of Friesland shortly after the martyrdom of (Saint) Boni-

face: was supported by Pope Adrian I. and by Charlemagne: became bishop of "Wigmodia" (afterward Bremen) 787; built there a noble cathedral, and had great success in the conversion of both Frieslanders and Saxons. D. in 789. He was canonized in the Roman Catholic Church, his festival being Nov. 8. Author of a *Commentary on the Epistles of Paul* and of several works still in MSS.

Wil'lement (THOMAS), b. in England about 1790; became heraldic artist to George IV.; executed many fine works in stained glass, and was author of *Royal Heraldry, the Armorial Insignia of the Kings and Queens of England, from Coeval Authorities* (1821), *Heraldic Notices of Canterbury Cathedral* (1827), *Rolls of Arms of the Peers* (2 vols., 1829–33), *An Account of the Restoration of the Collegiate Chapel of St. George's, Windsor* (1844), *Insignia of the Orders of Knighthood of the United Kingdom*, and other works.

Wil'lemite, or **Wilhelmite** [named after Wilhelm I., king of the Netherlands, by the mineralogist Levy: also called *troostite* (the New Jersey ore)], a native silicate of zinc, of composition O_4SiZn_2; rhombohedral in crystallization: generally yellowish, greenish, or salmon-colored; generally opaque, but sometimes translucent, or even transparent; hardness somewhat below feldspar. Willemite, which in European localities is not common, occurs at some American localities in New Jersey—about Franklin and Stirling—almost in rock-masses, constituting a very valuable and important zinc ore. It contains (in New Jersey) about 60 per cent. of zinc oxide, equal to 48 per cent. of metallic zinc. The molecular structure of willemite is—

$$O_{4\cdot 23}\cdot\left(\frac{Zn}{22}\,\frac{Zn}{21}\right) = 4.203 \begin{cases} \text{Levy, from Moresnet, Belgium, 4.18.} \\ \text{Monheim, from Stolberg, 4.18.} \end{cases}$$

HENRY WURTZ.

Wil'lems (FLORENT), b. at Liege, Belgium, about 1812; studied at the Academy of Mechlin; settled in 1839 in Paris, and acquired a great reputation as a genre painter. Among his most celebrated works are—*L'Après-diner sous Louis XV.*, *Une Partie du Music* (1844), *Visite de Marie de Médicis à Rubens*, *Les Adieux* (1847), *Au Roi!* (1861), *La Sortie* (1864), etc.

Willems (JAN FRANZ), b. at Bouchout, near Antwerp, Belgium, Mar. 11, 1793; was educated at Lierre, where he was trained in music and singing, and afterward at Antwerp, where he studied in the office of a notary; won in 1811 a prize by his poem on the battle of Friedland, and published in 1818 *Den de Belgen*, an ode which became immensely popular, and in 1819 *De Nederduytsche Taal en Letterkunde*, which placed him at the head of the Flemish movement. Alternately coaxed or slighted by the Dutch and the Belgian governments, according as the anti-Dutch or the anti-French tendency of the Flemish movement could be used, he died as keeper of the archives of Ghent June 24, 1846, but by his quarterly review, *Belgisch Museum*, and by his poems and editions of old Flemish poems, he gave the whole movement scientific interest and literary importance.

Willes (Sir JAMES SHAW), LL.D., b. at Cork, Ireland, in 1814; graduated at Trinity College, Dublin, 1836; was called to the bar at the Inner Temple 1840; was appointed a commissioner of common-law procedure 1850; was the chief author of the acts on that subject passed in 1852, 1854, and 1860, and was knighted and appointed a judge of common pleas 1855. D. by his own hand, during a paroxysm of insanity, at Otterspool, Hertfordshire, Oct. 2, 1872. With Sir Henry S. Keating he edited Smith's *Leading Cases* (2 vols., 1849).

Willes (Sir JOHN), b. in England in 1685: educated at Trinity College, Oxford; was called to the bar 1707; was a commissioner for the prosecution of the Scottish rebels 1715; entered Parliament 1722; was appointed attorney-general and chief-justice of Chester 1733; chief-justice of the common pleas 1737, and missed the chancellorship only by "holding out for the promise of a peerage in addition." D. Dec. 16, 1761. Author of *The Present Constitution and the Protestant Succession vindicated* (1714) and of *Reports of Adjudged Cases in the Common Pleas* (1799).

Wil'let, or **Stone Curlew**, the *Symphemia semipalmata*, a bird of the snipe family, found in North and South America. It is a fine game-bird, and its eggs and flesh are prized as food. It is named from its note, "pilt-will-willet."

Willet (ANDREW), D. D., b. at Ely, England, in 1562; educated at Peterhouse and at Christ's College, Cambridge, where he became a fellow; took orders in the Church of England; was appointed rector of Childerley, prebendary of Ely 1584, and rector in 1597 of Little Grantesden, which he exchanged for the living of Barley. D. in 1621. Author of *Synopsis Papismi* (1593), *Tetrastylon Papisticum* (1593), *A Catholicon, that is, a Generall Preservative or Remedie against the Pseudo-Catholyke Religion* (1602), of *Hexapla, or "Sixfold Commentaries"* on Genesis (1605), Exodus (1608), Leviticus (1631), Daniel (1610), and Romans (1611), of *Harmonies* of the First (1607) and Second Books of Samuel (1614), and numerous other works. His *Life and Death*, by his son-in-law, Peter Smith, D. D., was prefixed to the 5th ed. of the *Synopsis* (1634).

Willet (THOMAS), b. in England in 1610: was a distinguished merchant in Plymouth Colony; settled at New York at the time of its capture from the Dutch; was the first mayor of that city, and subsequently resided in Seekonk, Mass., where he d. "August ye 4th, 1674," as attested by the rude inscription on his dilapidated headstone, still visible "on a lonely and barren heath at a place seldom visited by the footsteps of man."

Wil'lett, p.-v. and tp., Cortland co., N. Y. P. of v. 120; of tp. 889.

Willett (MARINUS), b. at Jamaica, L. I., July 31, 1740; was a lieutenant in Delancey's regiment during the French war, and was distinguished at the unsuccessful assault upon Fort Ticonderoga; served in Col. Bradstreet's expedition against Fort Frontenac; was a captain under Montgomery in the Canada campaign of 1775–76; became lieutenant-colonel of the 3d New York regiment 1776; defended Fort Stanwix against the regulars, Tories, and Indians commanded by St. Leger Aug., 1777; made a successful sally as a diversion in favor of Gen. Herkimer; held the fort until its relief by Arnold; joined the army in New Jersey June, 1778; was present at Monmouth; accompanied Sullivan in his campaign against the Six Nations; was sheriff of New York 1784–92; declined the post of brigadier-general in the expedition sent against the Western Indians 1792, and was mayor of New York 1807. D. in New York Aug. 22, 1830. He left an autobiography, from which *A Narrative of the Military Actions of Col. Marinus Willett, etc.* (New York, 1831), was prepared and edited by his son, William M. Willett.

Willett (RALPH), F. S. A., b. in England in 1720; purchased in 1751 the property of Merly, Dorsetshire, where he built a fine country-seat and gathered a library famous for bibliographical rarities and for their luxurious red morocco bindings. D. at Merly in 1795. He printed *A Description of the Library at Merly House* (1776; new ed., in English and French, folio, with plates, 1785), *A Catalogue of the Books in the Library at Merly* (1790), and contributed to the *Archæologia* (vol. xi.) *A Memoir on the Origin of Printing* (1818), and to vol. viii. *Observations on the Origin of Printing* (1819). The sale of the 2906 lots comprising this celebrated library (in 1813) was a great event in the bibliographical world, giving rise to many spirited contests and realizing the sum of £13,508 4s. His collections of prints were sold in 1813 and 1814. (See Dr. T. F. Dibdin's *Bibliographical Decameron*.)

Wil'ley, tp., Lewis co., West Va. P. 2515.

Willey (HENRY), b. in Geneseo, N. Y., July 19, 1824; educated at the academy in that town and the Bridgewater (Mass.) Normal School; was for several years a teacher, and since 1856 has been editor of the *Daily Evening Standard* of New Bedford, Mass. As a botanist has occupied himself especially with North American lichens, and has published the following: *List of North American Lichens* (New Bedford, 1873); *Statistics and Distribution of North American Lichens*, in *Bulletin* of Buffalo (N. Y.) Natural History Society (1873); *Lichens of the Yellowstone*, in *U. S. Geological Survey of the Territories* (Washington, 1873); *Lichens of Colorado*, in *Synopsis of the Flora of Colorado* (Washington, 1874); *American Lichenography*, in *Proceedings* of the Essex Institute (Salem, Mass., 1867); *Lichens under the Microscope*, in *American Naturalist* (1871); and the article on LICHENS in the present work.

Wil'liam, the name of three kings of the Netherlands, not descending from William the Silent of Orange-Nassau, but from his brother, Count Johann of Dillenburg, through his youngest son, Ernst Casimir of Nassau-Dietz. William III. of England, the last of the house of Orange-Nassau, bequeathed the Orange estates and the stadtholdership of Holland to Johann Wilhelm Friso of Nassau-Dietz, stadtholder of Friesland. Johann Wilhelm Friso's son, William IV., was stadtholder of Holland, Friesland, Groningen, Geldern, Zutphen, etc. WILLIAM I. (1815–40), b. at the Hague Aug. 24, 1772, the eldest son of William V., prince of Orange-Nassau and stadtholder of the Dutch republic, and married Oct. 1, 1791, Friederike Luise Wilhelmine, a daughter of Friederich Wilhelm II. of Prussia. When the National Convention of France declared war against the republic (Feb. 1, 1793), William assumed the command of the Dutch army, but on Jan. 18, 1795, he embarked with his father and the rest of the family at Scheveningen, and went to England. Aug. 29, 1802, he received the principality of Fulda, together with Corvey, Dortmund, and Weingarten, which had been given to his

father in compensation for the Netherlands, and he now resided for several years at Fulda. On his father's death (Apr. 9, 1806), he also came into possession of the hereditary estates of the family, Nassau Dietz, but having allied himself with Prussia and accepted a command in the Prussian army, he was taken prisoner at Jena by the French, and all his possessions were confiscated by Napoleon. He was soon released from his captivity, and fought against the French at Wagram, but lived subsequently in retirement at Berlin until after the battle of Leipsic. The Hollanders now rose against the French, and on Nov. 29, 1813, William landed at Scheveningen, and was hailed by the people as their sovereign. By the Congress of Vienna the kingdom of the Netherlands, consisting of Holland and Belgium, was formed, and on Mar. 16, 1815, William I. was proclaimed king at the Hague. In compensation for his hereditary possessions, which were given partly to Prussia, partly to Nassau, he received the grand duchy of Luxemburg. The combination of Holland and Belgium proved a blunder. By the revolution of 1830, Belgium seceded, and was recognized as an independent kingdom by the grand powers at the conference in London Dec. 20, 1830. William I., however, would not submit to this decision, but continued his protest and resistance up to 1839 in a foolish and very expensive manner. This and other circumstances also spoiled his relation to his Dutch subjects, and on Oct. 7, 1840, he found it advisable to abdicate in favor of his son. He went to Berlin with an almost fabulous fortune, and d. there Dec. 12, 1843.—WILLIAM II. (1840–49), b. at the Hague Dec. 6, 1792, the eldest son of William I., was educated in the military academy of Berlin and the University of Oxford; served in the Spanish and English armies against the French, and distinguished himself at Quatre-Bras and Waterloo, where he was wounded. On Feb. 21, 1816, he married the grand duchess Anna Paulowna, a sister of Alexander I. of Russia. As king, he restored order to the finances, which had fallen into utter confusion during the reign of his father, but showed himself very unwilling to enter on any political reforms. Nevertheless, when, in 1848, the fermentation became dangerous in the country, he consented to a thorough reorganization of the government, but d. before the new constitution could be established, Mar. 17, 1849.—WILLIAM III., b. at the Hague Feb. 19, 1817, the eldest son of William II.; married June 18, 1839, Sophie, a daughter of King William of Würtemberg, and succeeded to the throne on the death of his father, Mar. 17, 1849. When the German union was dissolved in 1866, he succeeded in separating Limburg and Luxemburg from all connection with Germany, and annexed the former completely to the Netherlands. Concerning the latter, negotiations were opened by Napoleon III., who wanted to buy it, but these negotiations were frustrated by Bismarck, and Luxemburg was declared neutral under the sovereignty of the house of Orange-Nassau by the treaty of May 11, 1867. In the interior his government has proved very successful.

William, the name of four kings of England. (1) WILLIAM I., THE CONQUEROR, king of England (1066–87), b. at Falaise, Normandy, in 1027, the bastard son of Robert the Devil, duke of Normandy, by the beautiful Arletta, a tanner's daughter of Falaise; was educated at the court of King Henry I. of France; succeeded by his aid to the ducal throne of Normandy on the death of his father in 1035, and married, in 1053, Mathilde, a daughter of Count Baldwin V. of Flanders. In his numberless feuds with his vassals and neighbors, and with the king of France, he showed himself a man of superior talents, and his ambition was fully on a par with his power. As the English king, Edward the Confessor, had no children, William laid claims to the succession, his grandmother, Emma, being a sister to Edward; and it is said that the king himself acknowledged the claim. Nevertheless, when Edward died (Jan. 5, 1066), Harold was elected king by the Anglo-Saxon nobles, and William now gathered an immense armament—700 vessels and 60,000 men—in the harbor of St. Valéry, at the mouth of the Somme, crossed the Channel, and landed at Hastings Sept. 29. Here, Oct. 14, the battle was fought between him and Harold; the Anglo-Saxons were completely routed, Harold fell, and, Dec. 25, William was crowned king of England at Westminster. His government was at first mild and conciliatory, but as one insurrection followed another, and found support both from the Scots and the Danes, it soon changed its character and became a most formidable tyranny. The Danes, who landed under Asbjörn at the mouth of the Humber and perpetrated fearful depredations, were bought off; Scotland was successfully invaded, and Malcolm III. was compelled to declare himself a vassal of William; the whole country between the Tees and the Humber was laid waste, and every Saxon was expelled from his position in the administration, the courts, and the Church, and supplanted with a Norman. The estates of the fallen or banished Saxon nobles were partitioned out to the Norman lords, and a network of military stations was spread over the whole country—strongly fortified castles, from which the feudal Norman kept the Saxon population in absolute submission. In 1068 the curfew bell was introduced, at the sound of which every light and fire in the country should be extinguished, and between 1080 and 1086 a survey was taken of the Conquest and the division of the spoil—the so-called Doomsday Book. Besides the establishment and consolidation of his power in England, William also carried on a series of wars on the Continent, with his son, with Brittany, with the king of France, etc., which, however, were of less importance. In a campaign against Paris he was thrown from his horse at Mantes sur Seine, and hurt severely. He was brought to Rouen, and d. there Sept. 9, 1087. He was buried in the church of St. Stephen at Caen. (See Thierry, *Histoire de la Conquête de l'Angleterre par les Normands* (1825); Freeman, *History of the Norman Conquest of England* (1867).)—(2) WILLIAM II., RUFUS ("the red-haired"), king of England (1087–1100), b. in Normandy in 1056, the second son of William the Conqueror, was educated in England by Lanfranc, and succeeded to the throne of England on the death of his father, while his elder brother, Robert, took possession of Normandy. He carried on a long series of wars with his brother, with Scotland, etc., and came finally into possession of Normandy when, in 1096, Robert went to the Holy Land and sold the country to him for £10,000. He made a similar bargain in 1100 with the count of Poitiers; but before he could take possession of this new dominion he was shot by Walter Tyrrel while hunting in the New Forest, Aug. 2, 1100. He built London Bridge and completed London Tower and Westminster Hall.—(3) WILLIAM III., king of Great Britain and Ireland (1689–1702) and stadtholder of the Netherlands (1672–1702), a son of William II., prince of Orange and stadtholder of the Netherlands, and Mary, the eldest daughter of Charles I., king of England, b. at the Hague Nov. 4, 1650, ten days after the death of his father, and grew up under rather gloomy circumstances. His mother died in 1661; Louis XIV. took possession of the family estate of Orange; Oliver Cromwell persecuted him as a Stuart; and in the Netherlands, where his father had exerted himself to make the stadtholdership hereditary in the family of Orange, Jan de Witt carried through a law which prevented any one person from being at the same time stadtholder and commander-in-chief of the military forces of the republic. Nevertheless, in 1672, when France and England attacked the Netherlands, and Jan de Witt had been murdered, William was made stadtholder and commander-in-chief, and by his military and diplomatic talents he freed the country from the grasp of Louis XIV, much in the same way as his ancestor had wrenched it from the grip of Philip II. He succeeded in detaching England from France, and the Peace of Nymwegen (1678) was at least honorable to the republic. In 1677 he married his cousin Mary, eldest daughter of James, duke of York and heir presumptive to the English crown, and in the contest between the king and the people, which became almost desperate as soon as James ascended the throne, he naturally became the centre of the opposition. In 1688 he was invited by a large number of the most prominent men in England to interfere, and on Nov. 5 of the same year he landed at Torbay with an army of 15,000 men. James fled to France, deserted by all, and on Feb. 13, 1689, was deposed by Parliament, and William and Mary were established on the throne. James afterward went to Ireland, where the Roman Catholic population rose in favor of him, but he was completely defeated in the battle of the Boyne, and in Ireland, as well as in Scotland, all Jacobite movements were successfully suppressed. England now joined the great coalition against France which William had formed between Austria, Spain, and the Netherlands, and war was declared May 7, 1689. From 1691, William himself commanded the allied army in the Netherlands, and although he was defeated at Steenkerke (Aug. 3, 1692) and at Neerwinden (July 29, 1693), he nevertheless prevented France from making any progress. At La Hogue the French fleet was nearly annihilated in 1692, and by the Peace of Ryswick (1697) England and the Netherlands lost nothing and France was utterly exhausted. Louis XIV., however, had by no means given up his ambitious plans, and England had just determined and publicly announced that it would take part in the Spanish war of succession when William d. Mar. 8, 1702, in consequence of a violent fall from his horse. In England he was not loved, and his position was often very difficult, especially after the death of Mary (Dec. 28, 1694). He was entirely destitute of all those small arts by which a man in a superior position so easily wins the confidence,

good-will, and enthusiasm of his inferiors; but the soundness and elevation of his political views, and the sagacity and self-sacrificing energy with which he carried them out, have probably never been doubted. His great task was to resist Louis XIV., and in him political absolutism and religious intolerance: and he fulfilled it. (See Trevor, *Life and Times of William III.* (1835); Vernon, *Court and Times of William III.* (1841); and Macaulay's *History of England.*)—(4) WILLIAM IV., king of Great Britain, Ireland, and Hanover (1830–37), b. in London Aug. 21, 1765, the third son of George III.; was educated for the navy; became a lieutenant in 1785, an admiral in 1801, and lord high admiral in 1827; was created duke of Clarence in 1789, with an income of £12,000, and became heir presumptive to the crown in 1827, with an income of £40,000; entered in 1790 into a connection with an actress, Dora Jordans, with whom he lived twenty years and had ten children, but in the belief that he could get his appanage increased by a legitimate marriage, he left Dora Jordans in 1811, and she died in poverty and misery in 1815. In 1818 he married a German princess, but he was succeeded in Hanover by his brother, and in England by his niece. (What took place during his reign is related in the articles on his ministers, LORD GREY, LORD MELBOURNE, and SIR ROBERT PEEL.)

William I., emperor of Germany, b. Mar. 22, 1797, the second son of King Frederick William III. and Queen Luise, a princess of Mecklenburg. He grew up with the humiliating impressions of the defeat of Jena, and under the melancholy consequences of this disaster, but distinguished himself, though as yet very young, in the campaigns of 1813–14, which terminated with the overthrow of Napoleon and the restoration of Prussia. All his life through he has been an enthusiastic soldier, indefatigable in the military service, even in its minutest details. When his father died (in 1840), and his elder brother, Frederick William IV., became king, he received the title of prince of Prussia as heir presumptive, but many years passed away before his name acquired any prominence in political affairs. He was considered an absolutist, and for this reason, as well as on account of his military inclinations, he was very unpopular. On the outbreak of the revolution in 1848 he was compelled to leave the country and go to England. In the spring of 1849 he took command of the military force sent against the South German insurgents, and suppressed the revolution in the Palatinate and Baden. Later, when the supremacy of the Austrian policy in German affairs was felt with much regret in Prussia, public opinion underwent a change concerning the prince, and people began to look at the strength and firmness of his character as a support of the greatness of Prussia. He was, nevertheless, by no means popular, and frequent collisions arose between him and the people when he came to the head of the government as regent Oct. 9, 1858, and as king Jan. 2, 1861. It was especially the reorganization of the army which perpetually irritated the people. The king considered this measure as the most effective means of elevating the Prussian state, and was consequently most anxious to carry it; while the people looked at it as an instrument of oppression. On Oct. 18, 1861, he was crowned at Königsberg, and his peculiar taste for ceremonious magnificence became very apparent on that occasion, as did also his high pride in his royal dignity and in his family—qualities which, however, with him are connected with the greatest personal simplicity, with temperance, perfect conscientiousness, and great industry. The relation between the king and the people remained cold, and it became even difficult after the appointment of Bismarck as president of the cabinet. But suddenly a complete change took place in this respect. In the war with Denmark (1864) the army proved able and effective. The people felt elated, and the king began to be popular. Still more apparent became this change in 1866, when, under the personal leadership of the king, brilliant victories were won over Austria and her German allies. At the opening of the war the liberal party condemned unanimously the policy of the government, but when the result of this policy became an accomplished fact, a storm of enthusiasm arose for the king and his most intimate councillors, Bismarck, Von Moltke, and Roon. After the war the king hesitated long before he decided to annex Hanover, Hesse, and Nassau, and thereby give the principle of legitimacy its death-blow; but finally the conviction of the statesman superseded the hesitation of the king. By the *publicandum* issued from Ems July 26, 1867, he placed himself at the head of the newly-formed North German union, and assumed for himself and his successors to the Prussian crown the rights and duties connected with this new dignity. But the greatest glory was gained by the king for his crown in the war with France (1870–71). By a peculiar combination of circumstances the final decision of the question of war or peace came to depend solely on him and his personal character, and in the crisis which preceded the war—the negotiations with the French ambassador, Benedetti, in Ems July, 1870—his presence of mind, his firm courage, and his proud consciousness of his dignity showed themselves in an imposing manner. From this moment he became the admired representative of the whole German people, and the enthusiasm for him increased every day as the German army under his leadership pushed farther and farther into France and gained one victory after another. It was simply just, however, that this should be so, for it must be remembered that the principal part of the success was actually due to the king. He created the army; he selected the leaders; he gave the undebatable decision in cases in which opinions differed; and in the bloodiest battles he exposed himself with the greatest valor and bravery to the bullets of the enemy. Moved partly by the brilliancy of the victory, partly by the personality of the victor, the German princes, so long divided, finally agreed in offering the imperial crown of Germany to King William, and he accepted it at Versailles Jan. 18, 1871. On Mar. 15, 1871, he returned to Berlin under an indescribable enthusiasm of the people. Here, however, a new contest awaited him—a contest which probably proved much more difficult to him than the war, as by nature he is a man of piety, leaning toward conservative views. The interior state of Germany, especially on the ecclesiastical field, needed a development in a liberal direction, and the policy of Bismarck soon brought about a conflict which must principally be fought out with the Roman curia, but which will necessarily also engage the Evangelical Church and the conservative party. In this conflict the emperor assumed a firm and decided position, guarding the rights of the State and the Crown against the encroachments not only of the Church, but also of that party which was generally considered the main support of the Prussian throne—a position which could not fail to surprise any one who knew the past life of the prince and the traditions of the Prussian state. But it is evident from this, as from many other important events of the emperor's life, that he is a man of sound and elevated understanding, steady, calm, energetic, always prepared for great decisions, willingly listening to the counsels of wise men, without jealousy of the fame of his servants and friends, and endowed with a happy faculty of recognizing such characters and talents as might be useful to his plans. In personal appearance he is tall and dignified, with a kind expression and a winning address.

AUGUST NIEMANN.

William I. and II., electors of Hesse-Cassel. See HESSE.

William of Champeaux (GUILLIELMUS CAMPELLENSIS), b. at Champeaux, a village in the present department of Seine-et-Marne, France, in the latter half of the eleventh century; studied at Paris under Anselm of Laon; became archdeacon of Notre Dame, and taught philosophy in the school of the cathedral. Among his pupils was Abelard, and one day the disciple outwitted the master in a philosophical debate. William retired to one of the suburbs of Paris, and founded in 1113 the abbey of St. Victor, where he opened a new school and taught in opposition to Abelard, until he became bishop of Châlons-sur-Marne. D. in 1121. His *Moralia Abbreviata* and *De Origine Animæ* are in Martenne's *Thesaurus*, vol. v.

William of Malmesbury. See MALMESBURY, WILLIAM OF.

William of Nassau. See WILLIAM THE SILENT on page 1429.

William of Orange. See WILLIAM III. of England.

William of Wykeham. See WYKEHAM, WILLIAM OF.

William and Mary College. This college is, next to Harvard, the oldest in the U. S. It was chartered by King William and Queen Mary in 1693. Its germ was planted at a much earlier period—in 1619, before the Pilgrims saw Plymouth Rock. This was destroyed in the Indian massacre of 1622. In 1660 grants were again made to establish a college in the colony of Virginia. Nothing important was effected till 1693, when the commissary of the bishop of London, the Rev. Dr. James Blair, sought and obtained from the sovereigns, William and Mary, a charter and a valuable endowment. This and Columbia College in N. Y. City alone in the U. S. received royal charters. The college was made surveyor-general of the territory of Virginia, and was entitled by its charter to a duty of a penny a pound on tobacco exported from Virginia and Maryland. In 1776 these fees and duties were worth upward of $5000 per annum, and were steadily increasing. The Revolution of 1776 and the adoption of our Constitution deprived the institution of these sources of wealth. For these losses it has received no compensation, from State or national gov-

ernment. It received, with Harvard, until 1776, the annual proceeds of a fund left for educational and other purposes by the distinguished Christian and philosopher, the Hon. Robert Boyle. The services of William and Mary College to the country are well known. "As an offspring of the revolution of 1688, its sons were the warm and enthusiastic advocates of that of 1776." George Washington, after an attendance and examination in its halls, was made one of its deputy surveyors. Benjamin Harrison, Carter Braxton, Thomas Nelson, and George Wythe, signers of the Declaration; Peyton Randolph, president of the first American Congress; Edmund Randolph, secretary of state; John Marshall, chief-justice; Thomas Jefferson and James Monroe, Presidents of the U. S.; Gov. John Tyler, John Taylor of Caroline, the Nelsons, the Blands, the Pages, the Carters, the Harrisons, the Nicholases, the Braxtons, the Grymeses, the Burwells, the Lewises, the Lyonses, the Mercers, the Cockes, the Bollings, the Nicholsons, the Carringtons, and many others known to fame were among those educated at William and Mary before 1776. In 1775 the Phi Beta Kappa Society was founded at this college. Since 1776 it has educated John Tyler, President of the U. S.; Tazewell, Giles, Randolph of Roanoke, the Roanes, Bushrod Washington, the Breckenridges, the Stewarts, the Prestons, the Bibbs, the Barrys, the Fitzhughs, the Barbours, the Johnsons, the Leighs, the Cabells, the Joneses, the Nelsons, the Lennoxes, William S. Archer, Crittenden, Winfield Scott, William C. Rives, the Harrisons, the Randolphs, the Carters, the Pages, and a host besides. Besides its losses by war, that of 1776 and the late civil war, it has lost its buildings by fire three times—in 1705, in 1859, and in 1862. It is endeavoring to maintain itself in spite of obstacles, with an abiding faith in the future. B. S. EWELL.

Williams, county of N. W. Dakota, bounded N. E. by Missouri River, and intersected by Big Knife and Little Missouri rivers. Formed since the census of 1870. Area, about 2500 sq. m.

Williams, county of N. W. Ohio, bordering on Indiana and Michigan, intersected by St. Joseph's and Tiffin rivers, and traversed by Lake Shore and Michigan Southern R. R.; surface generally undulating, soil productive. There are saw-mills, tanneries, and manufactories of agricultural implements, carriages, and woollen goods. Live-stock, especially cattle and sheep, numerous. Staples, wool, hay, wheat, Indian corn, oats, and dairy products. Cap. Bryan. Area, about 600 sq. m. P. 20,991.

Williams, tp., Sangamon co., Ill. P. 1279.

Williams, tp., Bay co., Mich. P. 145.

Williams, tp., Benton co., Mo. P. 2277.

Williams, tp., Stone co., Mo. P. 332.

Williams, tp., Columbus co., N. C. P. 905.

Williams, tp., Dauphin co., Pa. P. 1451.

Williams, tp., Northampton co., Pa. P. 2248.

Williams, tp., Wood co., West Va. P. 1186.

Williams (ALPHEUS STARKEY), b. at Saybrook, Conn., Sept. 20, 1810; graduated at Yale College 1831, but continued his studies in the law school there two years longer; in 1836 removed to Michigan, and took up his residence in Detroit, where he began to practise law; was chosen alderman of that city in 1843, city recorder in 1844, and from 1840 to 1841 was judge of probate of Wayne co. In 1843 he became proprietor of the Detroit *Daily Advertiser*, of which he was also editor until 1848. In the war with Mexico he served as lieutenant-colonel of the 1st Michigan Vols., and was postmaster of Detroit 1849–53. On the outbreak of civil war he was early (May 17, 1861) appointed a brigadier-general of volunteers, and afterward commanded a division in the Shenandoah; succeeded to the temporary command of the 12th corps in 1862, which he led at South Mountain, at Antietam (after the fall of Mansfield), and until Apr., 1863; in temporary command of corps at Gettysburg; transferred with his corps to Tennessee in October, and engaged at Lookout Mountain. In Sherman's Atlanta campaign of 1864 he commanded a division of the 20th corps, succeeding to the command of that corps Nov. 11, which he held during the march to the sea and subsequent campaign in the Carolinas. Mustered out of service in Jan., 1866, he served in August of that year in the adjustment of the military claims of Missouri; was U. S. minister to Salvador 1866–69; member 44th and 45th Congress 1875–79. D. at Washington, D. C., Dec. 21, 1878.

Williams (Mrs. CATHARINE R.), b. at Providence, R. I., in 1790; author of *Original Poems* (1828), *Tales, National and Revolutionary* (2 series, 1830–35), *Fall River, an Authentic Narrative* (1833), *Lives of Gen. William Barton and Capt. Stephen Olney* (1839), *The Neutral French, or the Exiles of Nova Scotia* (2 vols., 1841), and other works.

Williams (CHARLES KILBOURNE), LL.D., son of Prof. Samuel, b. at Cambridge, Mass., Jan. 24, 1782; removed to Rutland, Vt., in childhood; graduated at Williams College 1809; practised law at Rutland; was a member of the legislature, State attorney 1814–15, collector of customs for the district of Vermont 1825–29, judge of the supreme court 1822–24 and 1829–42, chief-justice and *ex-officio* chancellor 1842–46, president of the council of censors 1847, and governor 1850–52. D. at Rutland Mar. 9, 1853. A brief *Memoir* was published by Hon. Isaac F. Redfield.

Williams (DAVID), b. near Cardigan, Wales, in 1738; was a dissenting minister successively at Frome, Somersetshire, at Exeter, and at Highgate; opened in 1776, at Margaret street, Cavendish Square, London, a chapel for public worship on a purely theistic basis; abandoned the experiment for lack of success 1780; became a private tutor; published a splendid edition of Hume's *History of England*; translated works of Voltaire; wrote several theological treatises, and *Letters on Political Liberty* (1782), which procured him an invitation from the leaders of the French revolution to assist in the formation of a constitution, and was the founder of the Royal Literary Fund (1802), by which he was supported during his later years. D. in London June 29, 1816.

Williams (EDWARD), better known by his bardic name of IOLO MORGANWG, b. in the parish of Llancarvan, Glamorganshire, Wales, in 1745; was associated with Owen Jones and William Owen Pughe in the editorship of the great collection of ancient Welsh literature known as the *Myvyrian Archaiology* (3 vols., 1801–07); published *The Fair Pilgrim, a Poem translated from the Welsh* (1792), and *Poems, Lyrical and Pastoral* (2 vols., 1794), in the former of which appeared *An Ode on the Mythology of the Ancient British Bards, in the manner of Taliesin*, accompanied by notes and specimens of "Triads" containing the metaphysical and religious doctrines of the old Druidical bards, alleged to have been copied from the MS. of a Welsh poet of the sixteenth century. This publication gave rise to a controversy as to the genuineness of these "Triads," and the alleged MS. was never produced. Williams was a friend of Southey, and was recognized as the best Welsh writer of his time. D. at Flemingstone, Wales, Dec. 17, 1826. His posthumous Welsh work, *Secrets of the Bards of the Isle of Britain* (1829), was edited by his son, Taliesin Williams. An amusing volume, *Recollections and Anecdotes of Edward Williams* (1850), was published by Elijah Waring.

Williams (EDWARD), D. D., b. at Glanelwyd, Wales, in 1750; became a dissenting minister at Ross, Hertfordshire, 1776, at Oswestry 1777, and at Birmingham 1792, and was superintendent of the Independent academy at Rotherham from 1792 until his death in 1813. Author of several theological treatises and of *The Christian Preacher* (1800; 5th ed. 1843), which has been extensively used as a manual for the choice of evangelical books. His *Life* (1825) was written by Rev. Joseph Gilbert.

Williams (EDWIN), b. at Norwich, Conn., in 1797, son of Gen. Joseph, a Revolutionary officer; resided many years in New York City, where he was a constant contributor to periodicals; was many years secretary to the American Institute, an active member of the Historical and Geographical societies and of the Mechanics' Institute, and was noted for the extent of his statistical researches, and was one of the editors of the *New York Herald*. D. in New York Oct. 21, 1854. Author of the *New York Annual Register* (10 vols., 1830–45), *The Politician's Manual* (1832), *The New Universal Gazetteer* (4th ed. 1833), *The Book of the Constitution* (1833), *New York as it is in 1833, et seq.*, *The Political Manual* (1834), *The Statesman's Manual* (1838), *The Political History of Ireland* (1843), *The Statistical Companion* (1846), *The Presidents of the U. S.* (1849), and various other works; was joint author, with C. Edwards Lester, of *The Napoleon Dynasty, etc.* (1852), under the pseudonym of "the Berkeley Men," and furnished historical and statistical data to Benson J. Lossing's *National History of the U. S.* (2 vols., 1855). The latter gentleman has edited the *Statesman's Manual* (4 vols., 1851; new ed. 1859) since the author's death.

Williams (ELEAZAR), b. at Caughnawaga, N. Y., about 1787, son of Thomas Williams, a chief of the Caughnawaga or St. Regis Indians, who was a grandson of Eunice, daughter of Rev. John Williams of Deerfield, Mass., known as "the redeemed captive." He was educated at Longmeadow, Mass.; served in the American army in the war of 1812–15, being wounded at Plattsburg; became a missionary of the Protestant Episcopal Church among the Oneida and St. Regis Indians, and subsequently among the tribes at Green Bay, Wis. About 1842 the claim was made that he was the dauphin of France, son of Louis XVI. and Marie Antoinette, and a narrative of his having

been rescued from prison at Paris and brought to the U. S. gradually gathered form, and was embellished with all necessary details, including the total loss of memory by the young prince in consequence of his sufferings in prison. The story was brought before the public by Rev. J. H. Hanson in a famous article in *Putnam's Magazine—Have we a Bourbon among us?* in 1853, expanded the following year into a volume entitled *The Lost Prince*. Belief in this story was much aided by a remarkable personal resemblance to the Bourbon type. Williams d. at Hogansburg, N. Y., Aug. 28, 1858. Author of an *Iroquois Spelling-Book* (1813), a translation of the *Book of Common Prayer* into Mohawk (1853), a political tract against the British (1815), and a *Life of Thomas Williams* (1859).

Williams (Elisha), b. at Hatfield, Mass., Aug. 26, 1694; graduated at Harvard 1711; became minister of Newington, Conn., 1722, and subsequently of Wethersfield; was "rector" or president of Yale College 1726–39; resigned on account of ill-health; returned to Wethersfield; was elected to the legislature; served as judge of the superior court; was chaplain of the Connecticut regiment sent against Cape Breton 1745; was appointed colonel of a regiment destined for an expedition against Canada, but never sent, and went to England to collect the pay due his regiment, remaining there until 1752. D. at Wethersfield July 25, 1755.

Williams (Ephraim), b. at Newton, Mass., Feb. 24, 1715; was bred to the sea, and made several voyages to Europe; served in Canada against the French in the war of 1740–48, attaining the rank of captain; received from the Massachusetts legislature a grant of 200 acres of land in the present townships of Adams and Williamstown, upon which he erected Fort Massachusetts, 1751, and was made commander of the whole line of frontier posts W. of the Connecticut River, and on the renewal of war with the French in 1755 led a regiment of Massachusetts troops to join Sir William Johnson in his projected invasion of Canada; made his will while on the march, leaving his property to found a free school at Williamstown (see Williams College); fell in an ambuscade of French and Indians near the head of Fort George, N. Y., and was killed at the first fire, Sept. 8, 1755. He was never married. On the spot where he fell a monument was erected in 1854 by the alumni of Williams College.

Williams (Frederick Dickinson), b. at Boston, Mass., Aug. 27, 1828; studied at the Boston Latin School; graduated at Harvard 1850; was teacher of drawing at the Boston Latin and High schools 1850–57; afterward devoted himself successfully to landscape-painting, especially of New England scenery.

Williams (George), b. in Wales in 1814; educated at Eton; graduated at King's College, Cambridge, where he became a fellow 1836; took orders in the Church of England 1837; was chaplain to Bishop Alexander at Jerusalem 1841–45; was warden of St. Columba's College 1850–55, and vice-provost of King's College 1854–56, where he has been for some years senior fellow. Author of *The Holy City, or Historical and Topographical Notices of Jerusalem, etc.* (1845), of which a second edition (2 vols., 1845) contained *An Architectural History of the Church of the Holy Sepulchre*, by Prof. Robert Willis; *An Historical and Descriptive Memoir of Jerusalem, with Plan* (1849); *Dr. Pierotti and his Assailants, or a Defence of Jerusalem Explored, etc.* (1864); *The Orthodox Church of the East in the Eighteenth Century, etc.* (1868), and contributed articles on Oriental geography to Dr. William Smith's *Dictionaries*. In them, as well as in his larger works, Mr. Williams defends the genuineness of the traditional sacred sites in Palestine against the objections of Dr. Robinson and other recent geographers.

Williams (George H.), b. in Columbia co., N. Y., Mar. 23, 1823; educated at an academy in Onondaga co.; was admitted to the bar 1844; settled in Iowa; was elected judge of the first judicial district 1847; was chief-justice of Oregon Territory 1853–57; was a member of the Oregon constitutional convention 1857; was a Republican U. S. Senator 1865–71; was a member of the commission which signed the Treaty of Washington for settling the "Alabama claims" 1871; appointed attorney-general in Pres. Grant's cabinet 1872; was nominated chief-justice of the U. S. Supreme Court 1873, but not confirmed by the Senate; resigned his seat in the cabinet May, 1875.

Williams (Helen Maria), b. near Berwick, England, in 1762. After publishing several volumes of verse which obtained her some literary fame, she became a resident of Paris shortly before the Revolution; was imprisoned in the Temple on account of her writings in favor of the Girondins; was released on the fall of Robespierre; returned to Paris 1796; was again temporarily imprisoned after the Peace of Amiens on suspicion of being a spy; subsequently wrote in favor of the Bourbons and against the Revolution. D. at Paris in Dec., 1827. Among her writings were several volumes of *Letters from France* (1790–94), which contain graphic accounts of the scenes of the Revolution; *A Tour in Switzerland* (2 vols., 1798); *Sketches of the State of Manners and Opinions in the French Republic toward the Close of the Eighteenth Century* (2 vols., 1801); *Narrative of Events in France* (1815); *Letters on Events in France since the Restoration* (1819), and the portions of the *Annual Register* relating to France during several years. She translated St. Pierre's *Paul and Virginia* (1796) and Humboldt's *Personal Narrative* (7 vols., 1814–29), and wrote the hymn "While thee I seek, protecting Power."

Williams (Hugh W.), b. in Wales about 1790; became an eminent landscape painter; travelled some years in Italy and Greece, and settled at Edinburgh 1819. He published *Travels in Italy, Greece, and the Ionian Islands* (2 vols., 1820) and *Views in Greece* (2 vols. imp. 8vo, 1825–29), a series of 64 exquisitely beautiful line engravings by Horsburgh, Miller, and other distinguished artists, after drawings by Mr. Williams and Mr. Charles R. Cockerell.

Williams (Isaac), b. in Wales in 1802; graduated at Trinity College, Oxford, 1826; took orders in the Church of England 1831; became a fellow of Trinity 1832; was curate successively of Windrush, St. Mary the Virgin's, Oxford, and Bisley; was associated with Keble, Newman, and Pusey in the "Tractarian" movement, having written the tracts Nos. 80, 86, and 87, and was a successful imitator of Keble as a sacred poet; was defeated by Mr. Garbett in his candidacy for the professorship of poetry at Oxford 1842; was a contributor to the *Lyra Apostolica*; wrote numerous theological treatises imbued with a vein of mysticism and symbolism, and spent his later years in complete retirement at Stinchcombe, Gloucestershire, where he d. May 1, 1865. Author of *The Cathedral* (1838), *Hymns* (1839), *Thoughts in Past Years* (1842), *Harmony and Commentary on the Whole Gospel Narrative* (8 vols., 1842–45), *The Baptistery* (4 parts, 1842–44), *The Christian Scholar* (1849), *The Altar* (1849), *The Seven Days, or the Old and the New Creation* (1850), *The Apocalypse* (1852), *The Beginning of the Book of Genesis* (1861), *The Psalms interpreted of Christ* (3 vols., 1864–65), and other works.

Williams (Isaiah Thornton), b. at New Ipswich, N. H., Feb. 12, 1819; educated mainly under private tutelage, but received the degree of A. M. from Williams College; studied law under the tuition of the late Pres. Fillmore at Buffalo, where he practised his profession till 1854, when he removed to the city of New York, and at once entered upon an extensive practice, being for a time the partner of the late B. F. Cutting, and engaged as counsel for the late Mr. Greeley in his most important libel suits. Excessive labor broke down his health, and in 1867 he accepted the office of register in bankruptcy, which office he still holds.

Williams (James), b. in Granville co., N. C., about 1730; emigrated to Little River, Laurens district, S. C., 1773; was a member of the provincial congress of South Carolina Jan., 1775; became colonel of militia Apr., 1779; commanded a detachment at the battle of Stono, June 20, 1779; defeated the British and Tories at Musgrove's Mills Aug. 18, 1780, and led one of the attacking columns at the battle of King's Mountain, where he was killed, Oct. 8, 1780.

Williams (James D.), b. in Pickaway co., O., Jan. 8, 1808; settled in Knox co., Ind., in childhood; received a common-school education; became a farmer and stock-raiser; was frequently elected as a Democrat to the lower house of the legislature; was State senator 1859–67 and 1871–75; chosen member of Congress 1874, serving as chairman of the committee on accounts; was a member of the State board of agriculture seventeen years, and its president four years, and was chosen governor of Indiana over Gen. Benjamin Harrison at the election of Oct., 1876, after one of the most exciting contests in the political history of the U. S. He is widely known by the sobriquet of "Blue Jeans," given him by his supporters on account of the farmer's costume which he ordinarily wore.

Williams (Jesse L.), b. in Stokes co., N. C., May 6, 1807. His parents removed to Cincinnati, O., during his childhood; the impaired means of his father compelled him to avail himself of the aid of his son upon the farm, the latter being thus denied the privileges of obtaining an education other than such as the limited advantages of the town afforded during the brief intervals of time he was able to devote even to these. Following the inclination of his mind, however, at the age of seventeen he accepted the position of rodman in the surveying-party for the proposed Miami and Erie Canal. He was, however, soon advanced as assistant engineer, and during a portion of the time was called upon to direct the progress of the whole

work. In 1832 he accepted the position of chief engineer of the contemplated Wabash and Erie Canal; in 1835 was placed in charge of other new works, and a year later was appointed chief engineer of the entire system of canals throughout Indiana; in 1837 the railroads and turnpikes then in progress were added to his charge, and continued under his supervision as State engineer until 1841, during which time he was *ex officio* a member of the board of internal improvement; after a suspension of five years upon the public works in Indiana, Mr. Williams was in 1847 reappointed chief engineer of the Wabash and Erie Canal. He was chief engineer of the Fort Wayne and Chicago R. R. 1851-56; a government director of the Union Pacific R. R. during its construction 1864-69; receiver of the Grand Rapids and Indiana R. R. 1869-71, during which time he completed 200 miles of that road; chief engineer of the Cincinnati Richmond and Fort Wayne R. R. 1871-72; has been a director of the Pittsburg Fort Wayne and Chicago R. R. since 1856.

Williams (John), D. D., b. at Aber-Conway, Carnarvonshire, Wales, Mar. 25, 1582; educated at Ruthin School; graduated at St. John's College, Cambridge, 1603; became a fellow there, distinguishing himself for the vast range of his studies; took orders in the Church of England 1609; was appointed chaplain to Lord Chancellor Egerton, Baron Ellesmere, 1611, and soon afterward to King James I.; was favored by that monarch on account of his learning and his absolutist opinions; became prebendary of Hereford 1612, of Lincoln 1613, and of Peterborough 1616; was made dean of Salisbury 1619, and of Westminster July 12, 1620; was successor to Bacon as lord keeper of the great seal July 10, 1621, to Oct. 25, 1626; was consecrated bishop of Lincoln Nov. 11, 1621; had a large share in the negotiation of the Spanish marriages 1622-23, thereby making a bitter enemy of Buckingham; used his court influence against monopolies and illegal exactions, and displayed moderation in the management of the Star-Chamber tribunal; preached the funeral sermon of James I. 1625; offended the new sovereign, by whom he was dismissed from the keepership the following year; supported the Petition of Right 1628; was three times prosecuted by Archbishop Laud before the Star Chamber on a charge of betraying the king's secrets; was condemned, after eight years' legal proceedings, to imprisonment, suspension from his bishopric, and successive fines of £10,000 and £8000; was confined four years in the Tower 1636-40, until released by the Long Parliament and restored to his diocese; caused the withdrawal of the bishops from the House of Lords on the occasion of the impeachment of Strafford; advised the king to assent to the execution of that minister; became archbishop of York Dec. 4, 1641; was soon afterward sent to the Tower with eleven other bishops for protesting against the validity of acts passed during their enforced absence from the House of Lords; was released 1643; was a firm supporter of the king during the great rebellion, and fortified and held Conway Castle. D. at Aber Conway Mar. 25, 1650. He wrote a treatise in opposition to Laud's innovations in church ceremonies. His *Life* (1693) was written by Bishop John Hacket.

Williams (John), D. D., b. in Northamptonshire, England, in 1634; educated at Magdalen Hall, Oxford; took orders in the Church of England; became rector of St. Mildred's, London, 1673, prebendary of St. Paul's, London, 1683, of Canterbury 1692, and bishop of Chichester 1696. D. in 1709. He was one of the commissioners on the liturgy and canons in 1689; kept a curious diary of their proceedings, which was printed by order of the House of Commons in 1854; was author of a *History of the Gunpowder Treason* (1679), *A Brief Exposition of the Church Catechism* (1690), of a volume of Boyle lectures, preached in 1695-96, and of many pamphlets against Roman Catholics and dissenters.

Williams (John), b. at Roxbury, Mass., Dec. 10, 1644; graduated at Harvard 1683; became pastor of the church at Deerfield, Mass., 1686; was carried away captive to Montreal with his family by the Indians 1704; was returned to Boston 1706, and in 1710 was a commissioner in Col. Stoddard's expedition to Canada. D. at Deerfield June 12, 1729. His personal narrative, *The Redeemed Captive returning to Zion* (Boston, 1707), passed through many editions.—His daughter, EUNICE, b. at Deerfield Sept. 17, 1696, was detained by her Indian captors, with whom she lived thirty-eight years; married John de Rogers, and was grandmother of Rev. Eleazar, the so-called "Bourbon prince."—His eldest son, ELEAZAR, b. at Deerfield July 1, 1688, graduated at Harvard 1708, and was minister of Mansfield, Conn., from 1710 until his death, Sept. 21, 1742. He published several sermons.

Williams (John), LL.D., b. at Lampeter, Cardiganshire, Wales, in 1726; became an Independent minister of Socinian views; was noted for classical scholarship, and was pastor of a dissenting congregation at Sydenham, Kent, from 1758 to his death, at Islington in 1798. Author of *A Concordance to the Greek Testament, etc.* (1767), *A Free Inquiry into the Authenticity of the First and Second Chapters of St. Matthew's Gospel* (1771), *An Enquiry into the Truth of the Tradition concerning the Discovery of America by Prince Madog ab Owen Gwynedd about the Year 1170* (1791), *A Further Observation, etc., with an Account of a Welsh Tribe of Indians* (1792), and other works, chiefly theological.

Williams (John), b. in Surry co., N. C., Jan. 29, 1778; settled at Knoxville, Tenn., as a lawyer 1803; raised a regiment of volunteers 1812, and marched against Florida; was appointed colonel of the 39th U. S. Infantry June 18, 1813; served at the battle of Horseshoe Bend; was U. S. Senator 1815-23, being chairman of the military committee; was minister to Central America 1825-27, and subsequently a member of the State senate. D. near Knoxville Aug. 10, 1837.

Williams (John), b. at Ystradmeirig, Cardiganshire, Wales, in 1792; educated at Baliol College, Oxford; took orders in the Church of England; was classical instructor at Winchester College and at Hyde Abbey School; was incumbent of Lampeter, Wales, several years; was appointed, by the influence of Sir Walter Scott, rector of the New Edinburgh Academy; preached the funeral sermon of Scott; was on intimate terms with the celebrated authors then residing at Edinburgh, and became archdeacon of Cardigan 1833. D. at Bushey Heath, Hertfordshire, Dec. 27, 1858. Author of *The Life and Actions of Alexander the Great* (1829; 3d ed. 1860), *Two Essays on the Geography of Ancient Asia* (1829), *Homerus* (1842), *Claudia and Pudens, an Attempt to show that Claudia, mentioned in St. Paul's Second Epistle to Timothy, was a British Princess* (Llandovery, 1848), *Gomer, or a Brief Analysis of the Language and Knowledge of the Ancient Cymry* (2 parts, 1851), *A Life of Julius Cæsar* (1854), and *Essays on Various Subjects, etc., connected with the Pre-historical Records of the Civilized Nations of Ancient Europe, especially of that Race which first occupied Great Britain* (1858).

Williams (John), b. at Tottenham, near London, England, June 29, 1796; was apprenticed to an ironmonger, and acquired great skill in mechanical arts; was ordained a minister 1816, and sent by the London Missionary Society to the South Pacific islands; labored several years in the Society Islands with great success, acquiring the native languages; visited the Hervey Islands, and founded a mission at Raratonga 1823; built with his own hands a vessel 60 feet long, with which for four years he explored the neighboring groups of islands, including the Samoan; returned to England 1834; superintended the publication of the New Testament in the Raratongan language; raised £4000 for the purchase and outfit of a missionary ship, with which, accompanied by other missionaries, he returned to Polynesia 1838; renewed his explorations, and reached the New Hebrides, where he was about to plant a mission when he was killed and eaten by the cannibals of Erromanga Nov. 20, 1839. Author of *A Narrative of Missionary Enterprises in the South Sea Islands* (London and New York, 1837). Several memoirs were published, the most complete being that by Rev. E. Prout (1843).

Williams (John), called AP ITHEL, b. at Llangyhafel, Denbighshire, North Wales, in 1811; graduated at Jesus College, Oxford, 1834; took orders in the Church of England, and was successively incumbent of Llantor, Nerquis, Llanymowddwy, and Llaneuddwyn, Merionethshire, where he d. Aug. 27, 1861. He was editor of the *Cambrian Journal*, a quarterly commenced in 1854; edited for the Welsh MSS. Society an *Ancient Welsh Grammar* (1856), *The Medical Practice of Rhiwallon* (1856), and *Barddas, or Bardism, a Collection of Original Documents, etc.* (1862), and for the Rolls Series *The Chronicle of the Princes* (1860) and the *Annales Cambriæ*; translated Aneurin's celebrated poem, *The Gododin* (1858), and was author of *The Ecclesiastical Antiquities of the Cymry* (1844) and other works.

Williams (John), D. D., b. at Deerfield, Mass., Aug. 30, 1817; graduated at Trinity College 1835; studied divinity, and was ordained in the Protestant Episcopal Church 1838; was rector of St. George's, Schenectady, N. Y., 1842-48; president of Trinity College 1848-53; became assistant bishop of Connecticut 1861, and sole bishop Jan., 1865. Author of *Ancient Hymns of the Holy Church*, *Tracts on the Gospel Miracles*, and other religious publications.

Williams (John Mason), LL.D., b. at Taunton, Mass., in June, 1780; graduated at Brown University 1801, was admitted to the bar at New Bedford 1803; was associate justice of the court of common pleas 1821-39, chief justice of the same 1839-41, and commissioner of insolvency

1844–56. D. at New Bedford Dec. 28, 1868. Author of numerous addresses and legal and political arguments, and contributor to literary and educational periodicals.

Williams (Jonathan), b. at Boston, Mass., 1750, received a good education; was employed in the office of a commercial house in Boston; made frequent business-voyages to the West Indies and to England. On various occasions during his visits to England he was entrusted by his grand-uncle, Benjamin Franklin, with important political despatches and documents to his party in America. During Dr. Franklin's residence in France as U. S. ambassador, Williams was employed by him as secretary, performing also during a portion of the same time the duties of U. S. commercial agent. While here he studied the military sciences, and made himself acquainted with the standard works on fortification. Returning with his relative in 1785, he resided near Philadelphia, where he was for several years a judge of the court of common pleas. On Feb. 6, 1801, he accepted an appointment in the army as major of the 2d regiment of artillerists and engineers. In December he was appointed inspector of fortifications, and on the 4th of that month took command of the post of West Point and the duties of instruction of the artillerists and engineers. The act of Mar. 16, 1802, fixing the military peace establishment, separated the two corps and provided for the present Military Academy, of which the "principal engineer" should have the superintendency. Under this act Williams was retained as major of engineers (Apr. 15, 1802), and at once assumed the duties of superintendent at West Point, where he continued until June 20, 1803, when on a question of rank Major Williams resigned from the army. An adjustment of the point at issue was arranged, however, and Apr. 19, 1805, Williams, at the request of Pres. Jefferson, returned to the army as chief engineer, with the rank of lieutenant-colonel, resuming also the superintendency of the Military Academy. While exercising the latter duty he devoted himself personally to the fortifications of New York harbor and most of the forts which constitute its inner line of defence. Fort Columbus, Castles Williams and Clinton (Castle Garden), and a work similar to the last named (Fort Gansevoort) located 2 or 3 miles higher up the river were planned by him and built under his immediate supervision. Castle Williams was the first "casemated" battery erected in this country (built 1807–10), and was planned after the system of Montalembert, with which Col. Williams had made himself acquainted in France. Upon the declaration of war with Great Britain in 1812 he was at Castle Williams, and being the senior officer present claimed command of that work. The authorities at Washington, however, assigned the command to another, whereupon Col. Williams resigned July 31, 1812. Returning to Philadelphia, he was chosen to Congress in 1814, devoting his leisure to literary pursuits; was vice-president American Philosophical Society; author of a *Memoir on the Use of the Thermometer in Navigation* (1799), *Elements of Fortification* (translation, 1801), *Kosciusko's Movements for Horse Artillery* (1808), of numerous military and philosophical works, and translator of several works on military science. He was an officer of decided merit, and justly styled the "father of the corps of engineers." D. at Philadelphia, Pa., May 20, 1815.

Williams (Lewis), b. in Surry co., N. C., about 1783; graduated at the University of North Carolina 1808; was a member of the State legislature 1813–15, and a member of Congress for twenty-nine years, from 1815 until his death, at Washington, D. C., Feb. 23, 1842. He was for fifteen years chairman of the committee on claims, and was known as the "father of the House," from his term of service being the longest on record.

Williams (Marmaduke), b. in Caswell co., N. C., Apr. 6, 1772; became a lawyer; was a member of Congress from North Carolina 1803–09; settled in Madison co., Ala., 1810, and in Tuscaloosa co. 1818; was a member of the convention that framed the State constitution 1819, and was an unsuccessful candidate for governor against William W. Bibb at the first State election; was eleven times chosen to the legislature between 1821 and 1840; was a commissioner to adjust the unsettled accounts between Alabama and Mississippi 1826, and judge of the county court from 1832 until 1842, when he retired on account of having reached the age of seventy years. D. at Tuscaloosa Oct. 29, 1850.

Williams (Mary **Bushnell**), b. at Baton Rouge, La., in 1826; educated under the care of Prof. Alexander Dimitry; became proficient in modern languages and literature; married Mr. Josiah P. Williams of the parish of Rapides, La.; lost her husband during the civil war; has since resided in New Orleans, and has written much for the press, both in prose and verse. Her poem, *The Serfs of Châteney*, has received high praise from cautious critics.

Williams (Monier), b. at Bombay, India, in 1819; studied at King's College, London, and at the East India Company's College at Haileybury; graduated at Baliol College, Oxford, 1844; became Boden Sanskrit scholar 1843; professor of Sanskrit at Haileybury 1844–58, and at Cheltenham College 1858–60; was chosen Boden professor of Sanskrit at Oxford Dec., 1860, and visited India 1875–76. Author of a *Sanskrit Grammar* (1846; 2d ed. 1857), an *English-Sanskrit Dictionary* (1851), textbooks in Persian (1858) and Hindostani (1859), *Original Papers illustrating the History of the Application of the Roman Alphabet to the Languages of India* (1859), *Indian Epic Poetry* (1863), *A Sanskrit and English Dictionary* (1872), and *Indian Wisdom* (1875).

Williams (Otho Holland), b. in Prince George's co., Md., in Mar., 1749; entered the Revolutionary army before Boston 1775 as lieutenant of a rifle company under Col. Michael Cresap; became major of a rifle regiment 1776, and was distinguished at Fort Washington, N. Y., where he was wounded and taken prisoner, but soon exchanged; became colonel of the 6th Maryland regiment, with which he accompanied Gen. De Kalb to South Carolina; was adjutant-general of the Southern army under Gens. Gates and Greene from 1780 until the end of the war; rendered efficient service at the battle of Camden and during Greene's retreat, when he commanded a light corps which acted as a rear-guard; took an active part, commanding the Maryland brigade, at the battles of Guilford and Hobkirk Hill; decided the victory by a brilliant charge at Eutaw Springs; was made brigadier-general May, 1782, and was collector of customs for the State of Maryland from 1783 to his death, July 16, 1794. He wrote a *Narrative of the Campaigns of 1780*, and a *Sketch* of his life was published by Osmond Tiffany (Baltimore, 1851).

Williams (Reuel), LL.D., b. at Hallowell (now Augusta), Me., June 2, 1783; received an academic education; studied law; was admitted to the bar 1802; took a high rank in his profession; was a member of the legislature 1822–26, and again 1829–32; of the State senate 1827–28; was a Presidential elector 1836, U. S. Senator 1837–43, a trustee of Bowdoin College, and a promoter, and for twelve years manager, of the railroad uniting Augusta with Boston. D. at Augusta July 25, 1862.

Williams (Robert), brother of Marmaduke, b. in Caswell co., N. C., about 1765; received a good education; became a lawyer, and adjutant-general of North Carolina; represented that State in Congress from 1795 until 1803, when he was appointed commissioner of land-titles for Mississippi Territory; was governor of that Territory 1805–09; settled in Tennessee some years later, and d. in Louisiana.

Williams (Robert), b. in Wales about 1800; was educated at Christ Church, Oxford; became a curate in Denbighshire, and a distinguished authority on Welsh history and literature. Author of *A Biographical Sketch of the most Eminent Welshmen* (1836), *Enwogion Cymru, a Dictionary of Eminent Welshmen from the Earliest Times* (Llandovery, in Nos., 1843–52), and *Lexicon Cornu-Britannicum, a Dictionary of the Ancient Celtic Language of Cornwall, etc.* (1865), a work containing also the synonyms in the cognate dialects, Welsh, Armoric, Irish, Gaelic, and Manx.

Williams (Robert Folkestone), b. in England about 1805; was for many years professor of ancient and modern history at the Cavalry College, Richmond, and was editor of Colburn's *New Monthly Magazine*. Author, among other works, of *Rhymes and Rhapsodies* (1833), *The Youth of Shakespeare* (3 vols., 1838), *Shakespeare and his Friends* (3 vols., 1838), *The Secret Passion* (3 vols., 1844), *Lives of the Princes of Wales* (1843), *Memoirs of Sophia Dorothea, Consort of George I.* (2d ed., 2 vols., 1848), *Strawberry Hill, an Historical Novel* (3 vols., 1847), *Domestic Memoirs of the Royal Family and of the Court of England, chiefly at Shene and Richmond* (3 vols., 1860), *Lives of the English Cardinals* (2 vols., 1868), and *Memoirs and Correspondence of Francis Atterbury, D. D., Bishop of Rochester* (2 vols., 1868), edited from the MS. collections of Dr. Thomas Birch in the British Museum; *The Court and Times of James I.* (2 vols., 1848) and *The Court and Times of Charles I.* (2 vols., 1848), and completed Capt. Marryat's *The Little Savage* (2 vols., 1848) and Theodore Hook's *Fathers and Sons* (3 vols., 1841), left unfinished at the death of their respective authors.

Williams (Roger), b. in Wales about 1599; resided in London during his youth; was apparently destined for the law; made reports in shorthand of the proceedings before the court of Star Chamber, which gained him the patronage of Sir Edward Coke, through whose influence he was elected a scholar of Sutton's Hospital (now the Charter-house) July 5, 1621; obtained an "exhibition" there July 19, 1624; was admitted to Pembroke College, Cambridge, Feb.

8, 1623; was matriculated a pensioner July 17, 1625; graduated there as B. A. Jan., 1627; took orders in the Church of England; obtained a benefice in Lincolnshire; became a nonconformist or "Separatist," holding very decided views; embarked for New England at Bristol Dec. 11, 1630, with his wife Mary, on board the ship Lyon; arrived off Nantasket, Mass., Feb. 15, 1631; was immediately chosen "teacher," and invited to supply the place of John Wilson, minister of Boston, during the contemplated visit of the latter to England, but declined on the ground that the members of that church were "an unseparated people;" made known some "novel opinions" denying the right of magistrates to punish a breach of the Sabbath or other offences against God, coming thereby into collision with the authorities of the infant colony; was invited to Salem as assistant pastor to Mr. Skelton Apr. 22, but in consequence of the remonstrance of the Massachusetts court soon went to Plymouth; labored there as assistant pastor to Rev. Ralph Smith, whose opinions were also "leavened with the humors of the Rigid Separation;" supported himself by manual labor, engaging also in trade in a very limited way; made a vigorous effort to acquire the Indian language, in which he ultimately succeeded; left Plymouth with a number of adherents in 1633, on account of the church having refused to sanction "divers of his singular opinions;" proceeded anew to Salem, where he assisted Mr. Skelton in the care of the church, though without any formal ordination; wrote a treatise attacking the validity of the title of the Massachusetts Company to its lands, as derived from the royal patent, which he sent to Gov. Winthrop at the latter's request, and which was submitted to the examination of the governor and assistants Jan. 6, 1634, resulting in a vote of censure; was nevertheless settled as pastor of Salem church on the death of Mr. Skelton, Aug., 1634; preached against the custom of women appearing in public without veils; influenced Mr. Endecott, the assistant governor at Salem, to cut out from the flag of England the red cross, as being "a superstitious thing and a relique of Anti-Christ" (Oct., 1634), for which act Endecott was disabled for a year from bearing office; refused to take either the freeman's or the resident's oath, preaching against the latter, which was instituted Apr. 10, 1635; was cited before the general court, held July 18, to answer complaints made against him, when he maintained his opinions in a protracted debate; drew up letters of admonition to the churches of Massachusetts, charging all the magistrates with "heinous sin" in postponing action upon a petition of the Salem settlers for the assignment to them of lands at Marblehead, and demanding that the magistrates should be subjected to "the discipline of admonition therefor;" withdrew his communion from the churches of Massachusetts by letter of Aug. 25, 1635, and from his own church in consequence of its declining to follow his guidance in the matter; held a separate Sunday service in his own house for his few adherents; appeared upon summons before the general court at Newtown (Cambridge), Oct. 18, 1635, on which occasion the pastors of nearly all the fifteen churches of Massachusetts were present by special invitation; was called upon to meet the charge of teaching various doctrines considered as subversive of authority; maintained his opinions in formal debate with Rev. Thomas Hooker, who represented the general court; was ordered by vote of the court of the following day (Oct. 19) to depart out of the jurisdiction of Massachusetts within six weeks, on account of having "broached and divulged divers new and dangerous opinions against the authority of magistrates, as also writ letters of defamation both of the magistrates and churches;" was allowed by the authorities to remain at Salem until spring, on condition that he should not "go about to draw others to his opinions;" was charged with having broken this condition in Jan., 1636, when it was determined by the general court to send him to England; left Salem with four companions about the middle of January; proceeded to the residence of his friend, the Indian "king," Massasoit, at Sowams (now Warren, R. I.); purchased of the chieftain Ousamequin a tract of land on the eastern shore of Seekonk River, where he commenced a clearing in April; soon removed to the other side of the river, in order to be beyond the jurisdiction of Plymouth Colony; founded with a few associates the town of Providence about May 29, designing it as "a shelter for persons distressed for conscience;" made a "covenant of peaceful neighborhood" with the surrounding Indian sachems; drew up articles of agreement signed by all the settlers at Providence to subject themselves to the will of the majority "only in civil things;" embraced the principles of the Baptists; was baptized with some ten associates, and formed a church Mar., 1639, but withdrew from it four months later, and was never again connected with any church; visited England in 1643, having sailed from New Amsterdam (now New York); obtained a charter for his plantation through the influence of Sir Henry Vane; printed in London his *Key into the Language of America, or an Help to the Language of the Natives in that Part of America called New England; together with Brief Observations of the Customs, Manners, and Worships, etc., of the Aforesaid Natives in Peace and Warre, in Life and Death, etc.* (1643; new ed. by John Pickering, Providence, 1827), and two controversial treatises, *Mr. Cotton's Letter, lately printed, Examined and Answered* (1644), and *The Bloudy Tenent of Persecution for Cause of Conscience discussed, in a Conference betweene Truth and Peace, etc.* (1644), which elicited replies from Cotton and others; returned to Providence 1644, landing at Boston in September; refused to act as governor of the colony; again visited England to secure a confirmation of the charter 1651; remained in London nearly three years; was for some time a teacher of the Hebrew, Greek, Latin, French, and Dutch languages, employing the conversational method of instruction; became acquainted with Cromwell and Milton; was intimate with Sir Henry Vane, and had a curious correspondence with Mrs. Anne Sadleir, daughter of his early patron, Sir Edward Coke; published *The Bloody Tenent yet more Bloody, by Cotton's Endeavour to Wash it White in the Blood of the Lamb, etc.* (1652), *The Hireling Ministry none of Christ's, or a Discourse touching the Propagating the Gospel of Jesus Christ, etc.* (1652), and *Experiments of Spiritual Life and Health, and their Preservatives* (1652); returned to Providence early in 1654; was president of the colony 1654–57; rendered important services to the colonies by his influence with the Indians and by giving warning of impending hostilities; refused to sanction in 1672 the proposed exclusion of Quakers from Rhode Island, but engaged in public debate, both at Newport and at Providence, with three Quaker preachers (Stubbs, Burnet, and Edmundson), and published *George Fox digg'd out of his Burrowes, or an Offer of Disputation on Fourteen Propositions made this Last Summer 1652 unto G. Fox, then present on Rode Island in New England* (Boston, 1676), which elicited Fox's violent rejoinder, *A New England Fire-Brand Quenched, etc.* (1679). D. at Providence in Apr., 1683. He was buried on his own estate, where a monument has been erected by his descendants, and a statue has been placed by Rhode Island in the Capitol at Washington, D. C. His *Letters* to the two Govs. Winthrop (65 in number) were printed by the Massachusetts Historical Society (1863), and the Narragansett Club has published a careful edition of his works (6 vols., 1866–75), under the supervision of Reuben Aldridge Guild. There are biographies by J. D. Knowles (1833), Prof. William Gammell (1846), and Romeo Elton (London, 1852). (See also Samuel G. Arnold's *History of Rhode Island* (vol. i., 1860), and Rev. Henry M. Dexter's *As to Roger Williams and his Banishment from the Massachusetts Plantation* (Boston, 1876).)

PORTER C. BLISS.

Williams (ROWLAND), D. D., b. at Halkyn, Flintshire, Wales, Aug. 16, 1817; educated at Eton; graduated at King's College, Cambridge, 1841; became fellow and tutor there; took orders in the Church of England, identifying himself with the "Broad-Church" movement headed by Arnold and Maurice; was prominent in connection with university reform; became chaplain to the bishop of Llandaff; vice-principal and professor of Hebrew at St. David's College, Lampeter, 1850; was select preacher to the University of Cambridge 1854; became vicar of Broad Chalk, Wiltshire, 1859; was prosecuted before the court of arches for having contributed to the famous volume of *Essays and Reviews*, and was condemned Dec., 1862, but obtained a reversal of judgment from the privy council Feb., 1864; resigned his professorship 1862, and resided thenceforth at his vicarage of Broad Chalk, near Salisbury, where he d. Jan. 18, 1870. Author of *Rational Godliness* (1855), *Christianity and Hinduism* (1856), *A Letter to the Lord Bishop of St. David's* (1860), *The Hebrew Prophets, a New Translation* (2 vols., 1868–71), *Broad Chalk Sermons* (1867), *Owen Glendower* (1870), and *Psalms and Litanies* (1872). His *Life and Letters* (2 vols., 1874) have been published by his widow.

Williams (SAMUEL), LL.D., b. at Waltham, Mass., Apr. 23, 1743, son of Rev. Warham and grandson of Rev. John of Deerfield; graduated at Harvard 1761; was distinguished in mathematical and philosophical studies; accompanied Prof. John Winthrop to Newfoundland to observe the transit of Venus of June 6, 1761; taught a school at Bradford while pursuing theological studies 1761–63; was licensed to preach Oct. 11, 1763; was ordained minister of Bradford Nov. 20, 1765; instructed several young men in theology; gave lessons in natural philosophy to the celebrated Benjamin Thompson, who was for a time an inmate of his family, and maintained a scientific correspondence with him in later years; was Hollis professor of mathematics and natural philosophy in Harvard College 1780–88; lec-

tured on astronomy to the senior class 1785–88; surveyed the western boundary of Massachusetts at the request of the colonial government 1786; visited Penobscot Bay with Prof. Stephen Sewall in the galley Lincoln, in behalf of the American Academy of Arts and Sciences and the corporation of Harvard College, to observe the total eclipse of the sun of Oct. 20, 1786; resigned his professorship and removed to Rutland, Vt., 1788; preached there 1789–95; subsequently preached two years at Burlington, Vt.; was for some years editor and proprietor of the Rutland *Herald;* surveyed the western boundary of Vermont 1805, by appointment of Gov. Tichenor, and delivered a course of lectures on astronomy and natural philosophy in the University of Vermont shortly after its establishment. D. at Rutland Jan. 2, 1817. Author of various printed sermons and scientific memoirs, and of many more left in MS., and of *The Natural and Civil History of Vermont* (Walpole, N. H., 1794; 2d ed., Burlington, Vt., 2 vols., 1809).

Williams (Samuel), b. at Colchester, England, Feb. 23, 1788; was apprenticed to a printer in his native town; applied his spare time in learning and practising the art of designing and engraving on wood; subsequently started in business as an engraver, first at Colchester and afterward at London; became known by his 300 excellent illustrations to Crosby's *Natural History;* was employed to illustrate Whittingham's *Robinson Crusoe*, Hone's *Every-Day Book*, Wiffen's *Tasso*, Thomson's *Seasons*, Britton's *Cathedral Antiquities*, Howett's *Rural Life*, Scrope's *Salmon-Fishing* and *Deer-Stalking*, *The Boy's Treasury of Sports*, and other works; contributed much by the spirit and vigor of his style to the improvement of wood-engraving in England, and made some successful essays as a painter in oil-colors. D. Sept. 19, 1853.

Williams (Samuel Wells), LL.D, b. at Utica, N. Y., Sept. 22, 1812; graduated at the Rensselaer Polytechnic Institute at Troy, N. Y., 1832; went to Canton, China, as printer to the American mission 1833; assisted in editing the *Chinese Repository;* completed at Macao the printing of Medhurst's *Dictionary;* visited Japan to return some shipwrecked sailors 1837; learned the Japanese language, into which he translated the books of Genesis and Matthew; aided Dr. Bridgman in preparing his *Chinese Chrestomathy;* published *Easy Lessons in Chinese* (Macao, 1842), *The Chinese Commercial Guide* (1844), and *An English and Chinese Vocabulary in the Court Dialect* (1844); visited the U. S. 1845, delivering lectures on China, and procuring from Berlin a new font of Chinese type; published *The Middle Kingdom, a Survey of the Geography, Government, Education, Social Life, Arts, Religion, etc., of the Chinese Empire and its Inhabitants* (2 vols., 1848; 3d ed. 1857), which is still considered the best work of the kind on that country; returned to China 1848; edited the *Chinese Repository* until 1851, when it was discontinued; accompanied Commodore Perry as interpreter on his expedition to Japan 1853–54; was appointed secretary and interpreter of the U. S. legation in Japan, of which he had charge until the arrival of the first minister; published a *Tonic Dictionary of the Chinese Language in the Canton Dialect* (1856), of which most of the copies were burned in December of same year, along with the mission-press at Macao; aided Hon. William B. Reed in the negotiation of the Treaty of Tientsin 1858; accompanied Mr. Ward to Peking to exchange the ratifications of 1859; revisited the U. S. 1860–61; went to reside at Peking as secretary of the U. S. legation 1862, then first established in the capital of China; published a 5th ed. of the *Commercial Guide* (1863), nearly rewritten; completed and brought out the great work of his life, *The Syllabic Dictionary of the Chinese Language* (4to, Shanghai, 1874); returned to the U. S. in 1875, and settled at New Haven, Conn., where he has been appointed lecturer on Chinese at Yale College. A new edition of his *Tonic Dictionary*, revised by Dr. Eitel, has been published by the English authorities (Hong-Kong, 1876).

Williams (Seth), b. at Augusta, Me., Mar. 22, 1822; graduated at West Point 1842; served as lieutenant of artillery and aide-de-camp to Gen. Patterson in the Mexican war; was brevetted captain for gallantry at Cerro Gordo; was adjutant of the Military Academy 1850–53; was appointed brigadier-general of volunteers Sept. 23, 1861; was adjutant-general to Gen. McClellan in Western Virginia and in the Army of the Potomac; was brevetted colonel U. S. A. for gallantry at Gettysburg, became acting inspector-general on the staff of Gen. Grant May 10, 1864, became major-general of volunteers Aug. 1, 1864, and subsequently brigadier and major general U. S. A., and rendered very valuable services in the organization of the army. D. at Boston Mar. 23, 1866.

Williams (Solomon), D. D., son of Rev. William of Hatfield, and grandson of Rev. Solomon Stoddard of Northampton, b. at Hatfield, Mass., June 4, 1700; graduated at Harvard 1719, and was minister of Lebanon, Conn., from Dec. 5, 1722, until his death, Feb. 29, 1776. He held a prominent place among the New England clergy; maintained polemics with Rev. Andrew Croswell "on the nature of justifying faith" (1746), and with his cousin, Jonathan Edwards, "on the qualifications necessary to lawful communion in the Christian sacraments" (1751). He published many funeral and anniversary sermons, of which one of the most notable was that preached at Mansfield, Conn., in 1741, on the occasion of the visit of his relative, the celebrated Eunice Williams, the Deerfield captive.

Williams (Stephen), D. D., son of Rev. John, the "redeemed captive," b. at Deerfield, Mass., May 14, 1693; was carried captive with his family to Canada by the Indians Mar., 1704 (see Williams, Rev. John); was bought of the Indians by the French governor of Canada, and sent to Boston before the rest of his family, arriving there Nov. 21, 1705; not long afterward wrote a minute narrative of his experiences in captivity; graduated at Harvard 1713; taught school at Hadley 1713–14; was ordained minister of Longmeadow, Mass., Oct. 17, 1716; was chaplain to a regiment in Sir William Pepperell's expedition against Louisburg 1745, to Col. Ephraim Williams's regiment in the expedition to Lake George 1755, and to Col. Thomas Williams's regiment in the campaign of 1756; visited the Housatonic Indians at Stockbridge, Mass., 1734, and was instrumental in the establishment of a mission among them. D. at Longmeadow June 10, 1782, in the sixty-sixth year of his ministry. Three of his sons, Stephen, Warham, and Nathan, were respectively ministers of Woodstock, Northford, and Tolland, Conn.

Williams (Stephen West), M. D., b. at Deerfield, Mass., Mar. 27, 1790, son of Dr. W. S. Williams of Deerfield, and descended from Rev. John, the "redeemed captive;" became a distinguished physician and contributor to medical periodicals, and settled in 1852 in Laona, Ill., where he d. July 6, 1855. Author of *A Catechism of Medical Jurisprudence* (Northampton, 1835), *A Biographical Memoir of the Rev. John Williams, etc., with an Appendix containing the Journal of the Rev. Dr. Stephen Williams of Longmeadow during his Captivity* (Greenfield, 1837; 3d ed., Northampton, 1853), *American Medical Biography* (Greenfield, 1845), and *The Genealogy and History of the Family of Williams in America, more particularly of the Descendants of Robert Williams of Roxbury* (1847).

Williams (Taliesin), called Ab Iolo, son of Edward, known as Iolo Morganwg (1745–1826), b. in Glamorganshire, Wales, about 1775; was his father's associate in his labors upon the Welsh literature and antiquities; edited his posthumous *Iolo Manuscripts* (Llandovery, 1848), and was author of a *Prize Essay on the Bardic Alphabet* (1840), in Welsh, and other writings. D. at Merthyr Tydvil in 1847.

Williams (Thomas), b. in New York in 1815; graduated at the U. S. Military Academy July, 1837, when appointed second lieutenant of artillery. After a two years' campaign in Florida, he was chiefly in garrison and on frontier duty until 1844, in which year he was attached to the staff of Gen. Scott as aide-de-camp, in which capacity he served throughout the Mexican war, gaining the brevet of captain for gallantry at Contreras and Churubusco, and of major for Chapultepec, and retained as A. D. C. until 1850, when again on frontier duty and in garrison until 1861, in May of which year he attained a majority in the 5th Artillery. During the early days of the civil war he was inspector-general of the department of Virginia; appointed brigadier-general of volunteers Sept. 28, 1861, he was in command of Fort Hatteras, N. C., until Mar., 1862, when placed in command of a brigade in the Ship Island expedition and capture of New Orleans. In the first unsuccessful attempt to capture Vicksburg (June–July, 1862) he was in command of the land forces. Upon the abandonment of the attempt he was entrusted with the defence of Baton Rouge, La., which post he gallantly defended against the attack of the Confederates under Gen. Breckenridge, and where, at the moment of victory, placing himself at the head of an Indiana regiment whose field officers had fallen, he was instantly killed, Aug. 5, 1862.

Williams (Thomas Scott), LL.D., b. at Wethersfield, Conn., June 26, 1777; graduated at Yale College 1794; studied law at Litchfield, Conn., under Judge Tapping Reeve; was admitted to the bar Feb., 1799; commenced practice at Mansfield; removed to Hartford 1803; became attorney of the board of managers of the school fund 1809; represented Hartford in the general assembly seven years, between 1813 and 1829; was a member of Congress 1817–19; associate judge of the supreme court of errors 1829–34, chief-justice of the same 1834–47; mayor of Hartford 1831–35; president of the deaf and dumb asylum at Hart-

ford twenty years; vice-president of the insane retreat and of the American Board of Foreign Missions, and subsequently president of the American Tract Society. D. at Hartford Dec. 15, 1861. He bequeathed $28,000 to charitable institutions.

Williams (William), b. at Newtown, Mass., Feb. 2, 1665, son of Deacon Isaac, and grandson of Robert Williams of Roxbury; graduated at Harvard 1683, in the same class (consisting of only three persons) with his cousin John, afterward celebrated as the "redeemed captive," and was minister at Hatfield, Mass., from 1685 until his death, Aug. 29, 1711, in the fifty-sixth year of his ministry. His first wife was Eliza, daughter of Rev. Seaborn Cotton of Hampton, N. H., and his second was a daughter of Rev. Solomon Stoddard of Northampton, Mass. He published a number of sermons. He preached a half-century sermon from his ordination, as did his son, Dr. Solomon, of Lebanon, Conn., his grandson, Dr. Eliphalet, at East Hartford (b. at Lebanon Feb. 21, 1727; graduated at Yale College 1713; d. at East Hartford, Conn., June 29, 1803), and his great-grandson, Solomon, of Northampton, Mass., who was b. at East Hartford, Conn., in 1752; graduated at Yale College 1770; was tutor there 1773–75; and d. at Northampton, Mass., Nov. 9, 1834, in the fifty-fifth year of his ministry. He published a considerable number of sermons.

Williams (William), son of Rev. Solomon, b. at Lebanon, Conn., Apr. 18, 1731; graduated at Harvard 1751; served on the staff of his relative, Col. Ephraim Williams, in the expedition to Lake George 1755; became a merchant at Windham; was long the town-clerk and justice of the peace; many times elected to the provincial assembly, serving often as clerk of that body; was a member of the Connecticut committee of correspondence 1773, Speaker of the house of representatives 1775, afterward a member of the council, of the committee of safety, and of the Continental Congress 1776–77 and 1783–84; was a signer of the Declaration of Independence, and contributed by his pen and his estate to the cause of independence, lending his "last mite" to the Continental treasury in 1779. He married a daughter of Gov. Trumbull.

Williams (William), b. at Norwich, Conn., in 1788; became an eminent shipping merchant and a general of Connecticut militia; was one of the founders of the Norwich Free Academy, to which he liberally contributed, and served many years as president of its board of trustees; maintained for seventeen years by his personal efforts a Sabbath service among the Mohegan Indians, acting as a Sunday-school teacher; was very active as an officer of the American Seamen's Friend Society and a benefactor of missionary and Bible societies. D. at Norwich Oct. 28, 1870.

Williams (Sir William Fenwick), b. in Nova Scotia Dec. 4, 1800; entered the royal artillery in 1825, and in 1868 attained the rank of general in the British army. Having been much employed in Turkey prior to 1848, he was in June of that year appointed English commissioner for the settlement of the Turco-Persian boundary, and in 1854 was made British commissioner with the Turkish army in the East, with the local rank of brigadier-general. His gallant defence of Kars in 1855 won him the promotion to major-general, and he was created a baronet and knight of the Bath. The order of the Medjidie and the grand cross of the Legion of Honor of France were also bestowed on him. Was a member of Parliament for Calne 1856–59; from 1859 to 1865 was in command of the troops in Canada, and in 1870 was appointed governor and commander-in-chief of Gibraltar.

Williams (William R.), D. D., b. in New York City Oct. 14, 1804, son of Rev. John Williams (1767–1825), pastor of the Fayette street Baptist church; graduated with the highest honors at Columbia College 1822; studied law with Peter Jay, and practised that profession one year; entered the Baptist ministry 1831, and became in that year pastor of the Amity street Baptist church at its formation, and still retains (1876) that post; made three visits to Europe, and collected a theological library of unusual extent and excellence. Author of *Miscellanies* (1850; 3d ed. 1860), *Religious Progress, Discourses on the Development of Christian Character* (1850), *Lectures on the Lord's Prayer* (1851); has published many single sermons and addresses; has edited several religious works, and has announced for publication a *History of the Baptists*.

Wil'liamsboro', tp., Rockingham co., N. C. P. 2340.

Wil'liam's Bridge, v., West Farms tp., Westchester co., N. Y. P. 144.

Wil'liamsburg, county of E. South Carolina, lying on Great Pedee and Santee rivers, drained by Black River, and traversed by North-eastern R. R.; surface level, with numerous pine forests; soil moderately productive. Swine and cattle are the principal live stock. Staples, cotton, tar, pitch and turpentine, rice, and Indian corn. Cap. Kingstree. Area, about 1200 sq. m. P. 15,489.

Williamsburg, p.-v., Jefferson co., Fla. P. 253.

Williamsburg, p.-v., Green tp., Wayne co., Ind. P. 248.

Williamsburg, v., Whitley co., Ky. P. 139.

Williamsburg, tp., Piscataquis co., Me. P. 176.

Williamsburg, p.-v. and tp., Dorchester co., Md. P. 1247.

Williamsburg, p.-v. and tp., Hampshire co., Mass. P. 2159.

Williamsburg, p.-v., cap. of Covington co., Miss.

Williamsburg, p. v., Kings co., N. Y. Since 1874 forming a part of the city of Brooklyn (which see).

Williamsburg, p.-v. and tp., Clermont co., O. P. of v. 773; of tp. 2383.

Williamsburg, v., Beaver tp., Noble co., O. P. 213.

Williamsburg, p.-v., Woodbury tp., Blair co., Pa. P. 821.

Williamsburg, p.-v. and tp., cap. of James City co., Va., on an elevated plateau between James and York rivers, about equidistant from either stream. The town was first settled in 1632, is the oldest incorporated town in the State, and abounds in historic interest. Prior to the Revolution it was the seat of the royal government, and subsequently, until 1799, the capital of the State. The capitol was destroyed by fire in 1748, and rebuilt; the latter building was also burned about 1830. The Eastern lunatic asylum, located here, authorized in 1769 and opened in 1773, is the oldest institution of the kind in this country. It is also the seat of William and Mary College (which see), the oldest educational institution, except Harvard University, in the U. S., having been incorporated in 1692. There are public schools for both white and colored youth in the town; also Methodist, Baptist, and Episcopal churches, the latter building having stood since 1678, and is still in good condition. P. in 1870, 1392.

The immediate vicinity of this town was the scene of the first serious engagement in the Peninsular campaign of 1862. The siege of Yorktown was so far advanced that the Union batteries would have been ready to open on that city by May 6, when on the morning of the 4th it was found that the enemy had evacuated that city and abandoned their lines. All the available cavalry force, with four batteries of artillery, under Gen. Stoneman, was ordered in immediate pursuit. The infantry divisions of Hooker and Smith were ordered to proceed in support of Stoneman, and these were followed by the divisions of Couch, Kearny, and Casey. The immediate charge of these operations was given to Gen. Sumner. Stoneman, moving promptly, met with but little opposition until arriving in front of the enemy's works about 2 miles E. of Williamsburg, where he took up a defensive position to await the arrival of the infantry. The division of Smith arrived during the afternoon, and Hooker during the night; but an order for the former body to attack that evening was abandoned, and a heavy rain setting in, the roads became almost impassable by the morning of the 5th. The Confederate commander, Johnston, perceiving the pursuit to be serious, hastily recalled his troops to the works previously prepared in front of Williamsburg. Hooker began the attack at 7½ on the morning of the 5th, and for a while silenced the guns of Fort Magruder and cleared the ground in his front; but the enemy, being constantly reinforced, made attack after attack upon his left, which were gallantly resisted until about 4½ P. M., when, just as his ammunition was about exhausted, Kearny, who had succeeded by great exertion in pushing to the front through the mud, arrived, and at once gallantly attacked, driving the enemy back and allowing Hooker to withdraw his wearied troops. Peck's brigade (Couch's division), which had arrived about 1 P. M., was posted on Hooker's right, and the attacks of the enemy at that point were repulsed. Meanwhile, about 11 o'clock, Gen. Sumner ordered Hancock's brigade (Smith's division) to take possession of an unoccupied work on the enemy's left, which was successfully accomplished, and finding a second one vacated, he occupied that also, and sent back for reinforcements to enable him to advance farther and take the next redoubt, which commanded the plain between him and Fort Magruder. The enemy's attention being now attracted to his position on their flank, they soon showed in force in Hancock's front, threatening his rear right flank. To his repeated calls for reinforcements, Hancock was ordered back to his first position. Delaying as long as possible giving up the advantage he had gained, but being confronted with a superior force, he feigned to retreat slowly, awaiting their onset, until they were close upon him, when, after some

terrific volleys of musketry, he ordered a bayonet charge, which routed and dispersed their whole force. This brilliant engagement was not surpassed during the war, and put an end to the battle that day, for Hancock was now reinforced in his position, and during the night the enemy withdrew. The loss on the Union side was 2228, all told, of which Hooker lost 1575. The Confederate loss was probably about equal in numbers.

Williamsburg, p.-v. and tp., Greenbrier co., West Va. P. 1012.

Williams College is beautifully located in Williamstown, Berkshire co., Mass. It owes its origin and name to Col. Ephraim Williams, who fell in 1755 near Lake George in the French and Indian war. On his way to the field of battle, at the city of Albany, he made his will, devoting the bulk of his property to the founding of an institution of learning, which in 1793 was chartered as Williams College. Rev. Ebenezer Fitch, D. D., who had been the principal of the school up to the time of its incorporation as a college, became its first president, and continued such till 1815. The catalogue published in 1795 contained 77 names; the largest number of students under Pres. Fitch was 144. Rev. Zephaniah Swift Moore succeeded him, resigning in 1821. Rev. Edward Dorr Griffin, D. D., followed, and held the office with distinguished success till 1836. During his administration a society of alumni was formed "for the promotion," as they state it, "of literature and good-fellowship among ourselves, and the better to advance the reputation and interests of our alma mater." What is now known as Griffin Hall was then built, and funds were raised for the library, for the aid of indigent students, and other general purposes of the college. After him came Rev. Mark Hopkins, D. D., LL.D., who after a remarkably long and successful presidency of thirty-six years resigned in 1872. During this period the college grounds were greatly extended, most of its present buildings erected, its corps of instructors enlarged, and its main endowment secured. The present head of the college is Hon. Paul A. Chadbourne, LL.D., formerly president of the State University of Wisconsin. Though the resources of the institution have always been small, and its position in former years isolated, yet in all the great interests of humanity, whether religious or scientific, it has always wrought in the front rank. Here originated in 1808 the whole series of American missions in connection with Samuel J. Mills and his associates. Here, under Prof. Hopkins, was erected the first astronomical observatory on this continent. Here also, under Profs. Emmons and Hopkins, originated the first of those college scientific expeditions now so common, followed in later years by others to Labrador, Greenland, Florida, South America, and Central America. The number of its graduates is 2500. The condition of the college at present is highly prosperous; its libraries contain 25,000 vols. Its cabinet, recitation-room, appliances, and apparatus are of the best order; it has 13 professors; its funds and securities amount to $300,000; a college hall has been erected where board is furnished at cost or even less. This, with the scholarships already founded and an ample charitable fund, has enabled the trustees to assume the ground that no young man of merit shall be obliged to intermit his studies in this institution on account of inability to pay his college fees. N. H. Griffin.

Wil'liamsfield, p.-v. and tp., Ashtabula co., O. P. 892.

Wil'liamson, county of S. Illinois, drained by Big Muddy River, and traversed by Carbondale and Shawneetown R. R., which terminates at the county-seat; surface alternate prairie and woodland, with much bituminous coal; soil fertile. Live-stock numerous. Staples, Indian corn, tobacco, wheat, and wool. Cap. Marion. Area, 432 sq. m. P. 17,329.

Williamson, county of Central Tennessee, drained by the head-streams of Harpeth River, and traversed by Louisville Nashville and Great Southern R. R.; surface generally hilly, soil fertile. There are saw-mills, flour-mills, and carriage-factories. Horses, mules, cattle, sheep, and swine are numerous. Staples, Indian corn, cotton, and wheat. Cap. Franklin. Area, 476 sq. m. P. 25,328.

Williamson, county of Central Texas, drained by San Gabriel River and its affluents; surface level, with alternate prairie and woodland; soil fertile. Cattle, horses, and sheep are numerous. Staples, Indian corn, cotton, and wool. Cap. Georgetown. Area, 1100 sq. m. P. 6368.

Williamson, p.-v. and tp., Wayne co., N. Y. P. 2430.

Williamson, tp., Richmond co., N. C. P. 2044.

Williamson (Hugh), M. D., LL.D., b. at West Nottingham, Pa., Dec. 5, 1735; graduated at the University of Pennsylvania 1757; studied theology and occasionally preached; was professor of mathematics in the University of Pennsylvania 1760–63; studied medicine at Edinburgh and Utrecht, where he took his degree; practised at Philadelphia; observed the transits of Venus and of Mercury for the Philosophical Society 1769; visited the West Indies 1772; was in London 1774, and was examined before the privy council on the subject of the destruction of tea; spent two years on the Continent 1774–76; engaged in mercantile business at Charleston, S. C., 1777; subsequently settled and practised medicine at Edenton, N. C.; was a surgeon in the Continental service 1781–82; was a member of the North Carolina legislature, a delegate to the Continental Congress 1782–85 and 1787–88, and to the Federal constitutional convention 1787, and a member of Congress 1790–93; removed afterward to New York, and was one of the founders of the Literary and Philosophical Society in 1814. D. at New York May 22, 1819. Author of various medical and scientific treatises, and of a very defective *History of North Carolina* (2 vols., 1812).

Williamson (Isaac Dowd), D. D., b. Apr. 4, 1807, in Pomfret, Vt. Beginning to preach as a Universalist in Oct., 1828, was pastor at Albany, N. Y., from 1830 to 1837; since then in Baltimore, Md., New York City, Philadelphia, Pa., Mobile, Ala., Lowell, Mass., Louisville, Ky., and Cincinnati, O. (1873). He has been a voluminous author of works upon Universalism, besides contributing largely to the press of his denomination. He has also labored earnestly in the spread of Odd Fellowship in the U. S.

Williamson (Isaac H.), LL.D., b. at Elizabethtown, N. J., in 1769; was admitted to the bar 1791; soon became prosecuting attorney for Morris county, and rose to the head of the New Jersey bar; was chosen to the assembly 1817; was governor and chancellor of the State 1817–29, and president of the State constitutional convention of 1844. D. at Elizabethtown July 10, 1844.

Williamson (Robert S.), b. in New York about 1825; graduated at the U. S. Military Academy July, 1848, and appointed a brevet second lieutenant in the corps of topographical engineers, serving on the Pacific coast in surveying railroad routes in California and Oregon until 1856; thence, until 1861, on the staff of the general commanding the department of the Pacific, and conducting (1858–61) meteorological observations and barometric experiments. In the civil war he served as chief topographical engineer at the capture of Newberne and Fort Macon, N. C. (Mar.–Apr., 1862), gaining the brevet of lieutenant-colonel for gallantry at the siege of Fort Macon; subsequently engaged in fortifying Newberne until August, when transferred to the Army of the Potomac. Ordered to the Pacific coast in 1863 (in May of which year he attained a majority in the corps of engineers), he was for a short time chief topographical engineer of the department, and retained on the staff of the general commanding until Dec., 1865. Since Feb., 1863, he has performed the duties of lighthouse engineer, besides having charge at times of the improvement of rivers and harbors on the Pacific coast and of surveys in California and Oregon. In 1868 he published a valuable work *On the Use of the Barometer in Surveys and Reconnoissances.*

Williamson (Thomas), b. in Maryland Aug. 1, 1791; received his degree in medicine from the University of Pennsylvania; commissioned surgeon's mate May, 1813, and passed through all the grades up to the highest; was conspicuously noted for his fearlessness, disregarding even yellow fever; Napoleon III. presented him a gold medal for services rendered to a French steamer having this disease on board. D. at Norfolk, Va., Jan. 12, 1859.
Paul F. Eve.

Williamson (William Durkee), b. at Canterbury, Conn., July 31, 1779; graduated at Brown University 1804; settled as a lawyer at Bangor, Me., 1807; was attorney for Hancock county 1808–16; State senator 1816–20; president of the first senate of the new State of Maine and acting governor 1821; member of Congress 1821–23, and judge of probate 1824–40. D. at Bangor May 27, 1846. Author of *A History of the State of Maine* (Hallowell, 2 vols., 1832; new ed. 1839), and contributor to the collections of the Massachusetts Historical Society.

Wil'liamsport, p.-v., cap. of Warren co., Ind., on the W. bank of Wabash River, and on Toledo Wabash and Western R. R., equidistant from Lafayette and Danville, Ill., contains 3 churches, a fine school building, 1 newspaper, 1 woollen-factory, handsome court-house, 2 hotels, jail, and an extensive grist-mill and warehouse. P. 988.
J. Gregory, Ed. "Republican."

Williamsport, tp., Shawnee co., Kan. P. 566.

Williamsport, p.-v. and tp., Washington co., Md., on Potomac River and on Western Maryland and Cumberland Valley R. Rs., has an extensive coal and grain trade, good schools, several flouring mills, 2 sash and door

factories, 1 newspaper, and a fine hotel. The village was founded in 1787. Gen. Lee's army crossed into Maryland at this point during the late war. P. of v. 1283; of tp. 3123. ALPHEUS A. TOWNSEND, ED. "PILOT."

Williamsport, p.-v., Deer Creek tp., Pickaway co., O. P. 514.

Williamsport, city, cap. of Lycoming co., Pa., on the left (N.) bank of the W. branch of Susquehanna River, 202 miles N. W. of Philadelphia; lat. 41° 14′, lon. 77° 2′ W. It is the northern terminus of Philadelphia and Reading R. R., and a station on Philadelphia and Erie and Northern Central R. Rs., and on Pennsylvania Canal. Selected as county-seat in 1795, when the county was organized, and chartered as a city in 1861. Built on a plain along the river at the base of hills, regularly laid out, supplied with abundance of excellent water from two mountain springs conducted in pipes under Susquehanna River; lighted with gas; has excellent markets. Williamsport contains 32 churches, 1 savings and 6 national banks, 10 public school houses and Dickinson Seminary, 1 gas and 2 water companies, and 12 incorporated companies. It has a paid fire department with 3 steamers, 2 daily and 6 weekly newspapers, and 1 monthly magazine; Y. M. C. A. and library, and Woman's Christian Home, 2 Masonic lodges, a chapter, commandery, and a council, 5 Odd Fellows' lodges, 1 lodge Good Templars, 2 of I. O. Red Men, 3 of Knights of Pythias, 3 of United Order American Mechanics, 4 camps of P. O. S. of A., and 1 post of G. A. R. It has 1 horse railroad, 28 saw and 2 grist mills, 8 sash, door, and blind factories, an extensive rubber manufactory, 1 iron-furnace, 2 furniture-factories, 1 paint, 2 soap, and 1 glue works, 3 public parks, 2 race-courses, and agricultural society grounds, a number of manufactories of wood-working machinery, several extensive foundries and boiler-works, and 1 factories of carriages and wagons. It derives its prosperity and importance from its lumber manufacture. The Susquehanna boom, costing upward of $1,000,000, is here located, catching all logs cut from the vast forests of pine and hemlock on the W. Branch and its tributaries. From 1862 to 1875 there were rafted out of the boom 11,938,815 logs, which when sawed made 2,302,685,182 feet of lumber, at an average value of $18 per M. The manufacture of pickets, lath, and shingles is very extensive. Streets paved with Nicholson and stone, and a large number of elegant residences. P. 16,030.

C. E. FRITCHER, MAN. "GAZETTE AND BULLETIN."

Williamston, p.-v., Ingham co., Mich., on Detroit Lansing and Lake Michigan R. R., 71 miles W. of Detroit, has 3 churches, 1 bank, excellent schools, 1 newspaper, 3 hotels, 2 foundries, 2 flouring and 2 saw mills, fine water-power, a coal-mine, and a stave-factory. P. 1237.

EBER S. ANDREWS, ED. "ENTERPRISE."

Williamston, p.-v. and tp., cap. of Martin co., N. C. P. of v. 520; of tp. 3160.

Williamston, p.-v. and tp., Anderson co., S. C. P. 1126.

Williamstown, v., Posey tp., Clay co., Ind. P. 65.

Williamstown, p.-v., cap. of Grant co., Ky., on Cincinnati Southern R. R., 36 miles S. of Cincinnati, O., has 2 churches, 1 academy and 1 school building, 1 newspaper, Odd Fellows' lodge, 2 hotels, and 2 flouring-mills. Principal business, corn and tobacco-raising. P. 281.

E. H. EYER, ED. "SENTINEL."

Williamstown, p.-v. and tp., Berkshire co., Mass., on Troy and Boston R. R., 42 miles E. of Troy, contains Williams College and Greylock Institute, the latter located at South Williamstown, 1 woollen manufactories, 1 newspaper, fine water-power from Hoosac River, several saw-mills, and 2 large hotels. It is a summer resort for tourists. P. 3559.

FRANK TERRIS, ED. "WILLIAMS ATHENÆUM."

Williamstown, p.-v. and tp., Lewis co., Mo. P. 180.

Williamstown, p.-v. and tp., Oswego co., N. Y. P. 1833.

Williamstown, p.-v., Dauphin co., Pa.

Williamstown, p.-v. and tp., Orange co., Vt. P. 1236.

Williamstown, p.-v., Williams tp., Wood co., West Va. P. 282.

Williamstown, tp., Dodge co., Wis. P. 2305.

Williams Valley, v., Porter tp., Schuylkill co., Pa. P. 425.

Williamsville, p.-v., Sangamon co., Ill.

Williamsville, p.-v., Amherst tp., Erie co., N. Y. P. 912.

Williamsville, p.-v. and tp., Bath co., Va. P. 998.

William the Silent, b. at Dillenburg, Nassau, Apr. 16, 1533, was the eldest son of Count William of Nassau-Dillenburg and his second wife, Juliane von Stolberg, both of whom were Protestants. In 1544 he inherited from his cousin, Renatus of Nassau, the principality of Orange in Provence, whence he derived the title of prince of Orange, and extensive estates in the Low Countries, and he was now sent to Brussels, where he was educated at the court of the queen regent, Mary of Hungary, in the Roman Catholic faith. When he was fifteen years old he became a page to Charles V., and the emperor showed him from the very first a most extraordinary attention. He employed him, while still a young man of twenty years, in the highest military and diplomatic positions, and on his abdication (1555) recommended him in the strongest terms to his son and successor. In the beginning, Philip II. also seemed inclined, if not to put confidence in him, at least to use him. He held high offices in the provinces; he negotiated the Peace of Cateau-Cambrésis, Apr. 3, 1559; and he was one of the four hostages—the duke of Alva was another—which Spain sent to France as a guaranty for the fulfilment of the treaty. While here the French king, Henry II., one day told him that there existed a secret treaty between him and Philip II. for the purpose of exterminating by fire and sword all Protestants within their dominions; but although this communication must have affected him like a flash of lightning, revealing in hideous nakedness the mainsprings of the policy of his royal master, and changing with dreadful suddenness all his own plans and aspirations, yet such was his self-possession and presence of mind that the news was received as carelessly as it was given. Afterward, when people began to realize what must have taken place in the young man's mind in that moment, they called him "the Silent," and there was something in his character and bearing which soon made the surname popular. He was too early and too intensely engaged in business to have any time either for the frivolous gossip of the camp and the court or for the long-winded eloquence of his time, and he hated from the very bottom of his heart those duplicities and lies which in the sixteenth century formed the principal characteristic of the great invention of Ferdinand of Aragon—the diplomatists. Thus, it was quite natural that he should make an impression of taciturnity, though in every-day life his talk was pleasant and cordial, and though in the council-chamber he gave his advice more freely and more forcibly than any one else, and never left the least doubt as to how he would act. As a young man he was even gay, kept a magnificent household, and exercised a most generous hospitality. Soon, however, after his conversation with Henry II., he found other use for his money, for he rose immediately in opposition to Philip II., and never, as long as he lived, gave up his resistance for one moment. As governor of Holland and Zealand he refused in 1564 to allow the establishment of the Spanish Inquisition in these provinces; and although he had not signed the compromise which the *Gueux* presented to the regent, Margaret of Parma, in 1566, yet he supported their demands at the court. When, finally, Philip II. decided to send the duke of Alva as governor-general to the Netherlands with a large Spanish army, William resigned all his offices and retired with his family to Germany. As soon as Alva arrived, the most arbitrary measures for the religious and political suppression of the provinces were carried out, often with incredible atrocity. William was summoned to appear before the council which had condemned Egmont and Horn, and his eldest son, a boy of thirteen years, who studied at the University of Louvain, was seized and carried to Spain, where he was held in captivity for twenty-eight years. He now raised an army by his own funds, and invaded the country in 1569, but although he gained some advantages, he was unable either to rouse the population to a general revolt or to bring Alva to a decisive battle; and he was soon compelled by lack of money to disband his army. In 1572 he made a new attempt, and with greater effect. In 1570 he had issued letters of marque to privateers, and these *Gueux of the Sea* inflicted great damages on Spanish commerce, especially since they early in 1572 had come into possession of Briel and Flushing, which formed a solid basis for their operations and commanded the navigation of the Scheldt and the Meuse. Thus, war with Spain appeared to be a remunerative trade, while obedience had proved to be utter desolation and ruin, and, consequently, on the approach of William with a new army, the province of Holland rose in open rebellion, and its states chose William stadtholder in July, 1572. Gelders, Overyssel, Zealand, and Utrecht immediately joined, and although William again was compelled to disband his army from lack of money, war, nevertheless, now began to be carried on in a regular manner against the Spaniards. The military successes which the Hollanders achieved under the leadership of William were not very remarkable, though many events—such as the defence of Leyden—show a circumspection in the formation of the

plan and a heroism in its execution which are most admirable. But it soon became apparent that the provinces under Spanish rule were impoverished and fallen to ruin, while the provinces under William's administration prospered and gathered wealth. By degrees, the hatred to the Spaniards became universal also throughout the southern provinces, even among the Roman Catholics, and in Oct., 1576, William brought about the so-called "Pacification of Ghent," by which all the provinces united for the purpose of driving the foreign soldiers out of the country and establishing religious toleration. The southern provinces, however, soon separated from the league, and returned under the rule of Alexander Farnese. They were Roman Catholics, and the prince of Orange had now openly joined the Calvinists. Religious liberty and toleration were ideas which the people of that age seemed incapable of comprehending fully and practising sincerely. Meanwhile, on Jan. 23, 1579, the "Union of Utrecht" was signed, by which Philip II. was formally deposed, and it was agreed to confer the sovereignty on some other prince—Archduke Mathias, the duke of Anjou, the queen of England, etc.—who might be able to vindicate himself against the Spaniards. On Mar. 15, 1580, Philip II. put a price of 25,000 crowns on William's head, and after several attempts which failed, one Balthazar Gerard finally succeeded in shooting him, at Delft, July 10, 1584. He had been four times married, and left twelve children, of whom the two sons, Maurice and Frederick Henry, became very celebrated. (See Klose, *Wilhelm I. von Oranien* (1864); Herrmann, *Wilhelm von Oranien* (1873); Motley, *The Rise of the Dutch Republic* (3 vols., 1856).) CLEMENS PETERSEN.

Willibrod. See WILBROND (SAINT).

Wil'limansett, p.-v., Hampden co., Mass.

Williman'tic, p.-b., Windham co., Conn., about 30 miles E. of Hartford, contains 4 churches, 2 savings banks, 2 trust companies, 100 stores, markets, etc., and 3 hotels. It has 1 weekly newspaper and 1 monthly, and is the business centre for miles around. Willimantic is the most extensive railroad centre in Eastern Connecticut, being the junction of Hartford Providence and Fishkill, New London Northern, New Haven Middletown and Willimantic, and New York and New England R. Rs.; 52 trains arrive and depart from the station daily. The principal industries of the place are the manufacture of silk, cotton thread, print cloths, cotton warps, and machinery. The factories of the Willimantic Linen Co., whose thread has a world-wide reputation, are located here and give employment to a large number of people. It has fine schools, broad streets, concrete sidewalks, gasworks, a fire department, and a portion of the streets supplied with water-pipes. For the last few years its growth has been rapid, and for business thrift and enterprise it stands at the head of the list in this section of the State. Its unequalled railroad facilities, convenience to tide-water, light taxes, and other advantages enumerated above combine to make it one of the most attractive and best points in New England for manufacturing or other business purposes.

H. L. HALL, ED. "JOURNAL."

Wil'ling, tp., Allegany co., N. Y. P. 1199.

Willing (THOMAS), b. at Philadelphia, Pa., Dec. 19, 1731; studied law at the Temple, London; became the head of the mercantile house of Willing & Morris at Philadelphia, one of the most important commercial establishments in the country, who were agents of Congress during the Revolution for the supply of naval and military stores; became mayor of Philadelphia, judge of the supreme court, and representative in the general assembly; was chairman of one of the earliest popular meetings in behalf of resistance to Great Britain, June, 1774; president of the provincial congress of Pennsylvania; delegate to the Continental Congress 1775–76; president of the first chartered bank in America, and of the first Bank of the United States. D. at Philadelphia Jan. 19, 1821.

Wil'lingborough, tp., Burlington co., N. J. P. 750.

Wil'lington, p.-v. and tp., Tolland co., Conn. P. 942.

Wil'link, p.-v., Erie co., N. Y.

Wil'lis (BENJAMIN A.), b. at Roslyn, L. I., in 1840; graduated at Union College 1861; was admitted to the bar the same year; entered the army as captain of a company raised at his own expense 1862; was at Chancellorsville, Gettysburg, and Lookout Mountain, and was twice promoted; commenced the practice of law in New York City 1864; was one of the leaders of the Reform Democrats in overthrowing the leadership of Tammany Hall; was elected to Congress 1874, and re-elected 1876.

Willis (BROWNE), LL.D., F. S. A., grandson of Dr. Thomas, b. at Blandford, Dorsetshire, England, in 1682; educated at Westminster School and Christ Church, Oxford; entered Parliament for Buckinghamshire 1705; possessed an ample estate, and devoted his life to philanthropy and antiquarian pursuits. D. at his seat, Whaddon Hall, Bucks, Feb. 5, 1760. He was one of the leading members of the Society of Antiquaries at its revival in 1707; presented his valuable cabinet of coins to the University of Oxford, and gave many MSS. to the Bodleian Library. Author of *Notitia Parliamentaria, or A History of the Counties, Cities, and Boroughs in England and Wales* (vol. i. 1715; ii. 1716; and iii. 1750), *Surveys of the Welsh Cathedrals* (4 parts, 1717–21), *History of the Mitred Parliamentary Abbeys and Conventual Churches* (2 vols., 1718–19), *Survey of the (Fourteen Northern English) Cathedrals* (3 vols., 1727–30), *Parochiale Anglicanum* (1733), *Table of the Gold Coins of the Kings of England* (1733), and *The History and Antiquities of the Town, Hundred, and Deanery of Buckingham* (1755); contributed to S. Gale's *Winchester Cathedral*, to Leland's *Itinerary*, and to the *Archæologia*.

Willis (FRANCIS), M. D., b. at Greatford, Lincolnshire, England, about 1718; graduated at, and became a fellow of, Brasenose College, Oxford; took orders in the Church of England 1740; was presented by his college with the living of St. John's, Wapping; paid much attention to mental diseases, as his grandfather had done before him; conducted at Greatford a private lunatic asylum, which fact brought upon him the enmity of the medical faculty, to obviate which he took his degree in medicine; was consulted with other physicians, on the occasion of the first attack of insanity experienced by George III. in 1786; was the only one who predicted his recovery; was in consequence entrusted with the principal care of that monarch for many years; received a parliamentary reward of £1500 for twenty-one years, and was summoned to attend the queen of Portugal in a similar case, but without much success, though he gained a fee of £20,000. D. at Greatford Dec. 5, 1807.—His son, DR. ROBERT DARLING WILLIS, succeeded him as attendant physician to George III.

Willis (NATHANIEL), b. at Boston June 6, 1780, his father and grandfather being printers; established at Portland, Me., the *Eastern Argus* 1803, and at Boston in 1816 the *Boston Recorder*, the first religious newspaper in America, which he conducted until 1843, and founded in 1827 the *Youth's Companion*, the first American juvenile paper, of which he was editor and proprietor until 1857. D. at Boston May 26, 1870.

Willis (NATHANIEL PARKER), son of Nathaniel, b. at Portland, Me., Jan. 20, 1807; studied at the Boston Latin School and at Phillips Academy, Andover; graduated at Yale College 1827; gained while an undergraduate a prize of $50, offered by the *Album* for the best poem, and wrote for his father's paper, the *Boston Recorder*, some religious poems which were (and still are) much admired, and were reprinted by S. G. Goodrich under the title *Sketches* (Boston, 1827); edited for Mr. Goodrich ("Peter Parley") two annuals, *The Legendary* (1828) and *The Token* (1829); founded and conducted *The American Monthly Magazine* (1829–31) until it was merged in the New York *Mirror* (1823–42), of which he became associate editor with George P. Morris; travelled in Europe and Asia Minor 1831–37, seeing much of the best literary society, which he described with abundance of personal details in letters to the *Mirror*, collected under the title *Pencillings by the Way* (3 vols., 1835); married in England in 1835 Miss Mary Leighton Stace, daughter of Commissary-General William Stace of the royal arsenal, Woolwich; wrote for numerous English magazines; returned to the U. S. 1837; settled on a beautiful estate on the Susquehanna, near Owego, N. Y., which he called "Glen Mary;" founded, with Dr. T. A. Porter in 1839, a short-lived weekly literary paper, *The Corsair*; revisited Europe in 1839; discontinued the *Mirror* Dec. 31, 1842; conducted, with Gen. Morris, two daily papers, *The New Mirror* (Apr. 8, 1843, to Sept. 28, 1844) and *The Evening Mirror* (Oct. 7, 1844, to end of 1845); lost his wife, and went to Europe for his health 1844–46; published numerous volumes of European correspondence; married Miss Grinnell of New Bedford 1846, and established a new home at "Idlewild," near Newburg, on the Hudson; published in that place a complete edition of his writings in a large volume, and joined his friend Morris in the editorship of a new weekly paper, the *Home Journal*, upon which he continued to be occupied until his death, at Idlewild Jan. 21, 1867. Among his numerous works were—*Inklings of Adventure* (3 vols., 1836), *Loiterings of Travel* (3 vols., 1840), *Letters from under a Bridge* (1840), *People I have Met* (1850), *Hurry-Graphs* (1851), *A Health-Trip to the Tropics* (1853), *Famous Persons and Places* (1854), *The Convalescent, his Rambles and Adventures* (1859), and a volume of *Poems*, which appeared in many editions, some of them richly illustrated. PORTER C. BLISS.

Willis (RICHARD STORRS), son of Nathaniel, b. at Boston Feb. 10, 1819; graduated at Yale College 1841; con-

tributed to various periodicals; edited the New York *Musical World* and *Once a Week*, and is author of *Church Chorals and Choir Studies, Our Church Music, a Book for Pastors and People* (1855), and *Carols and Music Poems* (15 Nos., 1860–61).

Willis (Robert), F. R. S., b. in London, England, in 1800; graduated at Caius College, Cambridge, 1826; became a fellow there; took orders in the Church of England; was early distinguished for his attainments in several departments of natural science, and especially for his acoustical researches upon the mechanism of the larynx; invented the lyophone, the odontograph, and a tabulo scriptive engine to facilitate the graphical representation of the results of the application of analysis to physics; was one of the original members of the British Association; made an architectural tour in France, Germany, and Italy 1832–33; became widely known as the most profound architectural historian of England; was a member of many scientific societies, before which he delivered many addresses; was on the foundation of the London School of Mines, appointed lecturer on applied mechanics, and was Jacksonian professor of natural and experimental philosophy at Cambridge from 1837 until his death, at that place Feb. 28, 1875. As a lecturer on mechanics, statics, and dynamics, with their practical application to manufactures and the steam-engine, he was unrivalled; "the power, the clearness, the vividness with which he brought forward every point left absolutely nothing to be wished for." Author, among other works, of *Remarks on the Architecture of the Middle Ages, especially of Italy* (Cambridge, 1835), *Principles of Mechanism for Students* (1841), *Architectural History of Canterbury Cathedral* (1845), of similar works upon the cathedrals of Winchester (1845), York (1846), Chichester (1862), the church of the Holy Sepulchre at Jerusalem (1849), and Glastonbury Abbey (1866), and contributed many learned papers to archæological and other scientific journals.

Willis (Robert), M. D., b. in England about 1810; received a careful classical and medical education, and has been for many years physician to the Royal Infirmary for Children at London. Author of *Benedict de Spinoza, his Ethics, Life, Letters, and Influence on Modern Religious Thought* (1870), and of many professional treatises.

Willis (Thomas), M. D., F. R. S., b. at Great Bedwin, Wiltshire, England, Jan. 27, 1621; graduated at Christ Church, Oxford, 1639, and in medicine 1642; served in the royalist ranks during the great rebellion; practised his profession at Oxford; became Sedleian professor of natural philosophy in the university at the Restoration; afterward settled in London; was one of the founders of the Royal Society; became physician to Charles II. 1666, and was considered for many years "the most famous physician of his time." He published several medical works, written in good Latin, of which the most important were—*Cerebri Anatome, cui accessit Nervorum Descriptio et Usus* (1664), *Pathologiæ Cerebri et Nervosi Generis Specimina* (1667), and *De Anima Brutorum* (1672). His complete works were posthumously collected in Latin (2 vols., 1676) and in English, translated by Roger l'Estrange (folio, 1679). They also appeared under other titles, such as *Dr. Willis's Practice of Physic, being the Whole Works of that Renowned Physician* (1681; translated by Samuel Pordage), and *The London Practice of Physic, etc.* (1685).

Willis (William), b. Haverhill, Mass., Aug. 31, 1794; graduated at Harvard University 1813; studied law, and admitted to the bar in Boston 1817; removed to Portland in 1819, and for twenty years was the law-partner of William P. Fessenden; was chosen to the State senate in 1855, and mayor of Portland 1857; was for many years president of the Maine Historical Society and vice-president of the New England Genealogical Society; was the author of a *History of Portland* (2 vols., 1831–33; new ed. 1865), *McKinstry Genealogy* (1866), *Books and Pamphlets relating to Maine* (1859), *History of the Law, the Courts, and the Lawyers of Maine* (1863), and edited the *Journals of Smith and Deane, Maine Historical Collections*, Dr. Kohl's *Discovery of Maine*, etc. etc. D. at Portland Feb. 17, 1870.

Willis River, in Virginia, rises in Buckingham co., and near Cartersville flows into the river James. It is navigable for bateaux 30 miles to Curdsville.

Wil'liston, tp., Barnwell co., S. C. P. 1379.

Williston, p.-v. and tp., Chittenden co., Vt. P. 1441.

Williston (Payson), D. D., b. at West Haven, Conn., in 1763, son of Rev. Noah, minister of that parish (b. at Springfield, Mass., July, 1733; graduated at Yale College 1757; d. Nov. 10, 1811); graduated at Yale College 1783; studied divinity at New Haven; was ordained pastor of the Congregational church at Easthampton, Mass., 1789, and occupied the pulpit until 1833. D. at Easthampton Jan. 30, 1856. He published some occasional *Sermons*, and contributed some interesting personal reminiscences of Connecticut ministers of the eighteenth century to Rev. Dr. W. B. Sprague's *Annals of the American Pulpit* (vols. i. and ii., 1857).

Williston (Samuel), son of Rev. Dr. Payson, b. at Easthampton, Mass., June 17, 1795; began classical studies at Phillips Academy, Andover, with a view to the ministry, but discontinued it from weakness of the eyes; gained a large fortune by the manufacture of buttons; established at Easthampton in 1840 the Williston Seminary, to which at different times he gave $250,000; endowed professorships in Amherst College by gifts of $125,000, 1858–59; gave liberally to the Mount Holyoke Female Seminary, and three times erected a church at Easthampton, which was twice burned. His entire gifts and bequests amounted to above $1,500,000. D. in July, 1871.

Wil'listown, tp., Chester co., Pa. P. 1552.

Will'mar, p.-v. and tp., cap. of Kandiyohi co., Minn. P. 149.

Will'more (James Tibbits), b. at Handsworth, Staffordshire, England, Sept. 15, 1800; became one of the most eminent of the landscape engravers who distinguished themselves by their beautiful reproductions of the masterpieces of Turner, and was chosen an associate of the Royal Academy 1843. D. Mar. 12, 1863. Among his prints of Turner are *Mercury and Argus, The Fighting Téméraire*, and *Ancient Italy*. He also engraved several notable pictures by Eastlake, Landseer, Stanfield, and Creswick.

Will'mott (Robert Aris), b. at Great Bradford, Wiltshire, England, in 1809; educated at Merchant Taylors' and Harrow schools, and at Trinity College, Cambridge; was for several years a private tutor in Suffolk; took orders in the Church of England 1842; was curate of St. James's church, Ratcliffe, 1842–44, and rector of St. Catharine's church, Bear Wood, Hampshire, from 1846 to 1862, when he retired on account of ill-health, receiving a pension from his generous patron, Mr. John Walter of the London *Times*, and d. at Nettlebed, Oxfordshire, May 27, 1863. Author of a biography of Jeremy Taylor (1846); edited the works of Herbert (1854), Gray (1851), Cowper (1854), Burns (1858), Wordsworth, Goldsmith, and Montgomery (1859); compiled *The Poets of the Nineteenth Century* (1856), and published a volume of original poems (1849).

Wil'loughby, p.-v. and tp., Lake co., O. P. of v. 867; of tp. 2516.

Willoughby (Sir Hugh), supposed to have been born at Risby, Derbyshire, England, about 1500; acquired military experience in the continental wars; was chosen commander of an expedition fitted out by the Merchants Adventurers at the instance of Sebastian Cabot, and received from Edward VI. a "license to discover strange countries;" fitted out three vessels, one of them under the command of Richard Chancellor; sailed from Deptford May 10, 1553; proceeded to the Arctic regions by the coasts of Norway, and his vessel, having become separated from the others, was detained in the ice somewhere upon the northern coast of Lapland, and its whole company perished, but the circumstances are unknown. By a journal, supposed to be his, which was recovered from the Russians, it appeared that his company was living in Jan., 1554, but when his vessel, the Bona Speranza, was discovered in the spring of 1554, all the inmates were dead. Richard Chancellor, with his vessel, the Edward Bonaventura, discovered the port of Archangel, and thus gave rise to direct commerce with Russia, which did not then extend to the Baltic. A journal of Sir Hugh's voyage to Sept., 1553, is printed in Hakluyt, from a MS. in the handwriting of Michael Lok.

Willoughby Lake, v. on the lake of the same name in the town of Westmore, Orleans co., Vt. The lake is some 7 miles long, and is very deep. It is an attractive place of summer resort. On either side is a high peak. Willoughby Mountain, the taller of these peaks, is a famous resort for botanists, many rare species of plants being found upon it. The view from this mountain is very fine.

Wil'low [Ang.-Sax. *wilig*], the trees and shrubs of the *Salix*, of which there are over 160 well-recognized species, besides innumerable varieties. Many of the long-leaved, shrubby sorts are used in basket-making (see Osier), and the larger kinds, short-leaved, and called *sallows*, are in Europe raised in copses for hoop-poles; for charcoal, to be used in gunpowder-making; for fence-poles, which when peeled and dried are very durable; for vine-props, hoe-handles, and the like. Willow-wood is also used for steamboat paddles, cricket-bats, and surgeons' splints. It is light, tough, and stands exposure in water very well. Salicine, an active principle from willow-bark, is very useful in medicine. The *S. babylonica*, or weeping willow, has

long been an emblem of grief. It is much planted as an ornamental tree. The U. S. have about 60 willows, and Europe nearly as many more.

Willow, tp., Cherokee co., Ia. P. 278.

Willow, tp., Richland co., Wis. P. 667.

Willow Branch, tp., Piatt co., Ill. P. 1438.

Willow Creek, tp., Lee co., Ill. P. 1019.

Willow Fork, tp., Moniteau co., Mo. P. 2242.

Willow Grouse, or **Ptarmigan,** a name of the *Lagopus albus*, a species found in the northern regions of the Old and New Worlds. (See PTARMIGAN.)

Willow Hill, p.-v. and tp., Jasper co., Ill. P. 1552.

Willow Springs, p.-v. and tp., Douglas co., Kan. P. 1163.

Willow Springs, p.-v. and tp., Howell co., Mo. P. 608.

Willow Springs, v., Erath co., Tex. P. 238.

Willow Springs, tp., Lafayette co., Wis. P. 1117.

Wills, tp., Saline co., Ark. P. 351.

Wills, tp., La Porte co., Ind. P. 884.

Wills, tp., Guernsey co., O. P. 1670.

Wills (DAVID), D. D., b. in South Carolina in 1825; graduated at the State college in Columbia in 1847, and at the theological seminary at the same place in 1850; in 1851 was called to the pastorate of a church in Laurens district; in 1860 to the Presbyterian church in Macon, Ga.; in 1870 elected president of Oglethorpe University at Atlanta, Ga.; in 1875 received and accepted a call to the pastorate of a Presbyterian church in Washington City, which position he still holds (Oct., 1876). Dr. Wills is distinguished not only for his high scholarly attainments, but for the peculiar and rare power of his eloquence.

A. H. STEPHENS.

Wills (WILLIAM GORHAM), b. in county Kilkenny, Ireland, in 1828; educated at Trinity College, Dublin; studied art at the Royal Irish Academy; became a portrait-painter at Dublin and in London; is author of *Notice to Quit* (3 vols., 1861) and *The Wife's Evidence* (3 vols., 1863), both republished in the U. S., and of several successful dramas, among which are *Charles the First* (1872), which had a run of 200 nights at the Lyceum, *Eugene Aram* (1873), and *Marie Stuart* (1874).

Wills (WILLIAM HENRY), b. at Plymouth, England, Jan. 13, 1810; devoted himself to literary pursuits at London in connection with the Messrs. Chambers, whose sister he married; contributed to the *Penny* and *Saturday Magazines*; was one of the original editors of *Punch*; became working editor and part proprietor of *Household Words* (1850) and *All the Year Round* (1859–69), in connection with Charles Dickens, and has also been an editor of *Chambers's Journal* and the *Daily News*. He published *Old Leaves gathered from Household Words* (1860), and edited *Sir Roger de Coverley* (1850) and *Poets' Wit and Humor, Selected* (1860).

Wills (WILLIAM JOHN), b. at Totnes, Devonshire, England, Jan. 5, 1834; educated at the Ashburton grammar school; was apprenticed to his father, Dr. William Wills; pursued his medical studies also in London; emigrated to Australia Oct., 1852; was joined there in the following year by his father, with whom he practised medicine at Ballarat; became a surveyor; was appointed assistant in the magnetic observatory at Melbourne Nov., 1858; joined the expedition headed by O'Hara Burke for the exploration of the interior of the continent, leaving Melbourne Aug. 20, 1860; crossed the entire continent northward through the deserts, reaching the Gulf of Carpentaria in Jan., 1861, but on their return both Burke and Wills died of starvation near Cooper's Creek about July 1, 1861. The journal kept by the latter was recovered and published by his father, *A Successful Exploration from Melbourne to the Gulf of Carpentaria, from the Journals and Letters of William John Wills* (1863), with portrait and map.

Wills'borough, p.-v. and tp., Essex co., N. Y. P. 1719.

Will'shire, p.-v. and tp., Van Wert co., O. P. of v. 268; of tp. 1641.

Willshire (Sir THOMAS), BART., b. at Halifax, Nova Scotia, Aug. 24, 1789, son of a paymaster; was appointed a lieutenant in the British army when six years of age; educated at Lynn and at Kensington; served in the West Indies, in Whitelock's expedition against Buenos Ayres July, 1807, in the Peninsular war 1808–09, in the Walcheren expedition 1809; returned to Spain 1812; was wounded at Salamanca; distinguished himself at the assault upon San Sebastian; had actual command of a regiment, with which he saw four years' hard service on the frontiers of Kaffraria, South Africa, 1818–22; annexed the territory on Great Fish River; served in India against the Mahrattas 1822; was appointed lieutenant-colonel 1827; distinguished himself in the Afghan war, especially at the siege of Ghuznee and the capture of Khelat 1839, for which exploits he was first knighted, and soon afterward made a baronet, receiving the thanks of Parliament; returned to England 1840; was commander of Chatham 1842–47, and became major-general 1847. D. at Hillhouse, near Windsor, May 31, 1862.

Will'son (JAMES M.), D. D., b. in Pennsylvania in 1809; received a good education; became a minister of the Reformed Presbyterian Church; was an eminent scholar, preacher, and professor in the Covenanters' theological seminary at Allegheny City, Pa., where he d. Aug. 31, 1866.

Willson (JAMES RENWICK), D. D., b. near Pittsburg, Pa., in 1780; graduated at Jefferson College 1805, and was licensed as a preacher of the Reformed Presbyterian Church 1807. D. in 1853. Author of *An Historical Sketch of Opinions on the Atonement* (1817), *Alphabetical Writing and Printing* (1826), *Prince Messiah's Claim to Dominion, etc.* (1832), *The Written Law* (1840), and of several single sermons and addresses.

Willson (MARCIUS), b. at West Stockbridge, Mass., in 1813; graduated at Union College 1836; became a teacher in New York City and Brooklyn; prepared a very successful series of readers and histories published by the Harpers, and is author of *Civil and Political Economy* (1838), *An Atlas of Perspective, Architectural, and Landscape Drawing* (1839), *Theoretical Arithmetic* (1842), *Object Lessons* (1862), and (with N. A. Calkins) of *School and Family Charts* (22 Nos., 1862).

Willson (ROBERT), D. D., b. in Lincolnshire, England, in 1795; educated at the Roman Catholic seminary at Oreott; was ordained priest by Bishop Milner 1825; was stationed several years at Nottingham, where he became noted for his services during the cholera epidemic of 1832, and for his labors for ameliorating the treatment of the insane, and procured the erection, after designs by Pugin, of the church of St. Barnabas, commenced in 1840, one of the finest as well as earliest architectural monuments of the new Gothic revival; was appointed by Pope Gregory XVI. bishop of Tasmania 1842; returned to England 1847, and communicated to the government facts proving the barbarous treatment of convicts in Tasmania and on Norfolk Island, which through his efforts was speedily remedied; returned to Tasmania 1848; resigned his bishopric from ill-health 1865; was seized with paralysis on the voyage to England, and d. at Nottingham June 30, 1866.

Wil'lughby (FRANCIS), b. at Wollaton Hall, Nottinghamshire, England, in 1635; graduated at Trinity College, Cambridge, about 1656; became a pupil of John Ray in natural history; resided some time at Oxford; travelled extensively on the Continent with Ray, making valuable collections for a work on natural history, and contemplated a voyage to America. D. July 3, 1672. He left many Latin MSS. upon natural history, which were translated, digested, and extended by Ray, who made them the basis of his own extensive labors. (See RAY, JOHN.) It is claimed for Willughby that he was the most accomplished zoologist of his time, and that he was the author of the system of classification in zoology which was adopted by Linnæus.

Wil'mer (WILLIAM HOLLAND), D. D., b. in Kent co., Md., in 1782; graduated at Washington College; was for some time engaged in mercantile pursuits; took orders in the Protestant Episcopal Church 1808; was minister of Chester parish 1808–12, rector of St. Paul's, Alexandria, 1812–16, first rector of St. John's, Washington, D. C., 1816, and editor of the Washington *Theological Repertory* 1819–26; became professor of theology in Alexandria seminary 1823, and president of William and Mary College and rector of the church at Williamsburg, Va., 1826. D. at Williamsburg July 21, 1827. Author of *The Episcopal Manual* (1815), of which an enlarged edition was prepared by John Coleman, D. D. (1841), of a controversial pamphlet against Father Baxter, a Jesuit priest (1818), and of several printed sermons and addresses.

Wil'mington, p.-v. and b., Union co., Ark. P. 320.

Wilmington, p.-v. and tp., Los Angeles co., Cal. P. 942.

Wilmington, city of New Castle co., Del., on the Delaware River, and at the junction of its affluents, Brandywine and Christiana creeks, 28 miles S. W. of Philadelphia and 70 miles N. E. of Baltimore, on Philadelphia Wilmington and Baltimore R. R., is the terminus of several other lines of railway, and has communication by steamers with Philadelphia and New York. It is built mainly upon elevated ground between the two creeks, about 1½ miles from Delaware River. The houses are generally of brick; the prin-

cipal streets are paved with stone, lighted with gas, and traversed by horse-cars. Brandywine Creek has within a distance of four miles a fall of 120 feet, furnishing immense water-power, which is largely utilized for manufacturing purposes. In 1873 the total capital invested in manufactures was $12,725,000, and the product for the year was more than $21,000,000. The principal manufactures were —machine-work, $2,200,000; morocco and other leather, $2,050,000; foundry-work and car-wheels, $2,000,000; railroad cars, $2,000,000; carriages and wagons, $1,400,000; iron, $1,300,000; iron ship-building, $1,200,000; paper, $1,200,000; powder and chemicals, $1,200,000; flour and meal, $1,200,000; cotton goods, $1,100,000. Besides these, there are large manufactures of tobacco, fertilizers, brick, sashes and blinds, and boots and shoes. There are about 50 churches, among which are 15 Methodist, 8 Episcopal, 7 Presbyterian, 5 Baptist, 5 Roman Catholic, and 2 Friends. Within the limits of the city is the old Swedes' church, built of stone in 1698, and still in a good state of preservation. The principal public buildings are the city hall, almshouse, custom-house, post-office, opera-house, public library, and the Wilmington Institute. There are several charitable institutions, numerous public and private schools, a mechanics' institute, 5 daily and 8 weekly newspapers, 4 national banks, 1 State bank, 2 savings banks, 3 fire insurance companies, and more than 20 building and loan associations. P. in 1870, 30,841; in 1876, including the suburbs, about 43,000.

Wilmington, p.-v. and tp., Will co., Ill. P. of v. 1828; of tp. 2766.

Wilmington, p.-v., Hogan tp., Dearborn co., Ind. P. 301.

Wilmington, tp., De Kalb co., Ind. P. 2296.

Wilmington, tp., Wabaunsee co., Kan. P. 662.

Wilmington, p.-v. and tp., Middlesex co., Mass. P. 866.

Wilmington, p.-v. and tp., Houston co., Minn. P. 1200.

Wilmington, p.-v. and tp., Essex co., N. Y. P. 791.

Wilmington, city, cap. of New Hanover co., N. C., the principal seaport and largest city in the State, on the E. bank of Cape Fear River, 30 miles from the ocean. It is the terminus of Wilmington and Weldon and Wilmington Columbia and Augusta R. Rs., which connect with other railroads running N. and S.; also the terminus of Carolina Central Railway, running through the southern portion of the State to its western border. Lines of steamers ply to Baltimore, Philadelphia, and New York, and there is an extensive commerce by sailing vessels with all parts of the world. At present vessels drawing 16 feet can load here, and when the bar improvements, now in progress, are completed, the depth of water will be materially increased. It has communication with the Sound, a place of summer residence, 7 miles distant by turnpike; has a street railway running through the principal streets to the railroad dépôts and to Oakdale Cemetery; has a city hall, a theatre, court-house, 3 banks, 22 churches, 12 academies and schools, 1 library, 5 newspapers (3 daily), seamen's home, marine hospital, marine railways, 1 cotton-factory, 1 cotton compress company, 5 steam saw and planing mills, 1 steam rice-mill, 4 steam grist and flour mills, 9 turpentine distilleries running 29 stills, 1 iron-foundry, 1 sash and blind factory. The principal exports of the place consist of naval stores, lumber, shingles, and cotton. This has long been the leading naval-store market of the world. Exports for 1875, about $10,000,000, of which about one-half has gone to foreign ports. P. (1870), 13,446. (For the engagement against this place during the civil war see Fort Fisher.) W. H. Bernard, Ed. "Morning Star."

Wilmington, p.-v. and tp., cap. of Clinton co., O., on Cincinnati and Muskingum Valley R. R., 55 miles N. E. of the former city, has 6 churches, Friends' college and excellent public schools, 2 banks, a building and loan association, 2 newspapers, 2 extensive pork-packing establishments, 2 hotels, and several mills. The neighborhood is well adapted for agriculture and grazing. P. 2023.

Frank Browning, Ed. "Clinton Republican."

Wilmington, tp., Lawrence co., Pa. P. 1631.

Wilmington, tp., Mercer co., Pa. P. 548.

Wilmington, p.-v. and tp., Windham co., Vt. P. 1246.

Wilmington (Spencer **Compton**), Earl of, b. in England about 1675; sat in Parliament many years; was Speaker of the House of Commons from Mar., 1714, until 1727, when he resigned; was created Baron Wilmington Jan. 8, 1728, lord president of the council and earl of Wilmington May, 1730, and became prime minister under the title of first lord of the treasury Feb. 17, 1742. D. July 26, 1743. As he left no male issue, his titles became extinct at his death.

Wil'more, p.-v. and b., Cambria co., Pa. P. 393.

Wil'mot, p.-v. and tp., Merrimack co., N. H. P. 1072.

Wilmot, p.-v. and tp., Bradford co., Pa. P. 1365.

Wilmot (David), b. at Bethany, Pa., Jan. 20, 1814; educated at the academies of Bethany and of Aurora (Cayuga co.), N. Y.; studied law, was admitted to the bar, and commenced practice at Wilkesbarre, Pa., 1834; soon removed to Towanda; sat in Congress as a Democrat 1845-51, and moved on Aug. 8, 1846, an amendment to a bill appropriating $2,000,000 for the purchase of Mexican territory, which became celebrated under the name "the Wilmot proviso"—"That, as an express and fundamental condition to the acquisition of any territory from the republic of Mexico by the U. S., . . . neither slavery nor involuntary servitude shall ever exist in any part of the said territory." This proviso was adopted by the House, but rejected by the Senate, and became the starting-point for the "Free-Soil" movement of 1848. Mr. Wilmot was president judge of the 13th district of Pennsylvania 1853-61, was a delegate to the Republican national conventions of 1856 and 1860, acting as the temporary chairman of the latter; an unsuccessful candidate for governor of Pennsylvania 1857; was U. S. Senator to fill a vacancy 1861-63, and was appointed a judge of the U. S. court of claims by Pres. Lincoln 1863. D. at Towanda, Pa., Mar. 16, 1868.

Wilmot (John). See Rochester, Earl of.

Wilmot (Sir John Eardley), b. at Derby, England, Aug. 16, 1709; educated at Lichfield and Westminster schools, and at Trinity College, Cambridge; was called to the bar at the Inner Temple 1732; was a judge of the court of king's bench 1755-66, and chief justice of common pleas 1766-71. D. Feb. 5, 1792. His *Notes of Opinions and Judgments* (1802) were posthumously edited, and a biographical sketch by his son appeared in 1802.

Wilmot (John Eardley), son of the above, b. at Derby, England, in 1748; educated at Westminster School and University College, Oxford; became a fellow of All Souls; studied law; became a master in chancery 1783; was commissioner for settling the claims of American loyalists; long a member of Parliament, and author of several works. D. at Tottenham June 23, 1815.

Wilmot (Sir John Eardley), Bart., b. in England in 1810; graduated at Baliol College, Oxford, 1832; studied and practised law; became recorder of Warwick 1852; was judge of Bristol county court 1854-71; a deputy lieutenant for Warwickshire, and sat in Parliament for South Warwickshire. Author of *An Abridgment of Blackstone's Commentaries* (3d ed. 1855), *Lord Brougham's Acts and Bills* (1857), and several other legal books.

Wilmot (Robert Duncan), b. at Fredericton, New Brunswick, Oct. 16, 1809; educated at St. John's; became a lawyer; was chosen a member of the provincial legislature 1846-64; was surveyor-general, with a seat in the cabinet, 1851-54; provincial secretary 1856-57; member of the cabinet without a portfolio 1865-66, having co-operated as a delegate in effecting the confederation of the various provinces now constituting the Dominion of Canada, and was for some years mayor of St. John's. Author of various treatises on the currency, which have exercised a considerable political influence.

Wilmot Proviso. See Wilmot (David).

Wil'murt, p.-v. and tp., Herkimer co., N. Y. P. 191.

Wilna. See Vilna.

Wil'na, p.-v. and tp., Jefferson co., N. Y. P. 1060.

Wil'son, county of S. E. Kansas, intersected by Fall and Verdigris rivers; surface variegated, with fertile river-bottoms, upland pasturage, and woodland, with beds of coal and salt springs. Cattle and sheep are the chief live-stock. Staples, Indian corn, hay, wheat, oats, and wool. Cap. Fredonia. Area, 576 sq. m. P. 6691.

Wilson, county of N. E. North Carolina, drained by Mackason River, and traversed by Wilmington and Weldon R. R.; surface undulating, soil fertile. Staples, cotton, Indian corn, and sweet potatoes. Cap. Wilson. Area, 550 sq. m. P. 12,258.

Wilson, county of N. Tennessee, lying on Cumberland River and traversed by Tennessee and Pacific R. R., which terminates at the county-seat; surface somewhat hilly, soil fertile. There are saw-mills, flour-mills, and manufactories of carriages, furniture, and woollen goods. Horses, mules, cattle, sheep, and swine are very numerous. Staples, Indian corn, wheat, oats, cotton, tobacco, and wool. Cap. Lebanon. Area, about 500 sq. m. P. 25,881.

Wilson, county of S. Texas, drained by San Antonio River and Cibola Creek; surface hilly, with little timber except along the streams; soil fertile. Cattle and horses are numerous. Cap. Floresville. Area, 670 sq. m. P. 2556.

Wilson, tp., De Witt co., Ill. P. 640.

Wilson, p.-v. and tp., Winona co., Minn. P. 1016.

Wilson, p.-v. and tp., Adair co., Mo. P. of v. 32; of tp. 1119.

Wilson, tp., Audrain co., Mo. P. 1740.

Wilson, tp., Greene co., Mo. P. 1053.

Wilson, p.-v. and tp., Niagara co., N. Y. P. of v. 661; of tp. 2912.

Wilson, p.-v. and tp., cap. of Wilson co., N. C., on Wilmington and Weldon R. R., contains 2 colleges, 1 bank, and 4 newspapers. An extensive business in cotton is carried on. P. of v. 1036; of tp. 3170.

H. G. & J. A. Williams, Eds. "Advance."

Wilson, tp., Clinton co., O. P. 1157.

Wilson, tp., Sheboygan co., Wis. P. 1277.

Wilson (Alexander), b. at Paisley, Scotland, July 6, 1766; was trained as a weaver; engaged in peddling; published a volume of poems in 1790, and was sentenced in 1793 for a lampoon, after which event he emigrated, and landed at New Castle, Del., July 14, 1794. He worked for some time as a weaver, and then as a peddler; taught school in various places—in 1802 at Kingsessing on the Schuylkill—and was afterward employed in Philadelphia as editor of the American edition of Rees's *Cyclopædia*. During his wanderings as a peddler he always took a great interest in observing the life of birds; and this interest was further developed during his residence at Kingsessing by his acquaintance with William Bartram. He determined to make a collection of American birds, and wrote an American ornithology. He learned drawing, coloring, and etching, and began to make excursions for his special purpose—the first in 1804 to the wilderness of Western New York, which he described in a poem, *The Foresters*, published in the *Port Folio*. In 1808 the first volume of his *Ornithology* appeared; the second in 1810; at his death, in Philadelphia Aug. 23, 1813, seven volumes had been published; the eighth and ninth were edited after his death by George Ord, and a continuation of his work was given by Charles Lucien Bonaparte (Philadelphia, 4 vols., 1825–33). He was buried in Old Swedes' churchyard in Philadelphia—in a spot where, as he expressed it, "the birds might sing over his grave." His poems were published at Paisley in 1816, and at Belfast in 1857, and his statue was raised at Paisley in 1874. (See C. Lucy Brightwell, *Difficulties Overcome, Scenes in the Life of Alexander Wilson, the Ornithologist* (London, 1860); Allan Park Patton, *Alexander Wilson the Ornithologist, a New Chapter of his Life* (1863); and a volume of verse, prose sketches, notes, etc., published by A. B. Grosart, Paisley, 1874.)

Wilson (Allen B.), b. in Central New York in 1827; learned the trade of a cabinet-maker. In 1849, at Pittsfield, Mass., he built a shuttle sewing-machine, containing a horizontal table to sustain the material, and a feeding device consisting of two plates, between which the material was held, but not rigidly. One plate was smooth and stationary, the other was roughened and moved forward, carrying the material with it when the needle was out of the material, and back while the needle was through the material, which held it at the point to which the feed had carried it. He never saw or heard of a sewing-machine before his own. A description of this machine was published in the Berkshire *Culturist* Apr. 18, 1849. This was the first machine by which an endless seam could be sewed capable of being turned upon any curve or at any angle at the pleasure of the operator while the seam was being formed. This feed he improved in 1850 by giving the roughened bar four motions, so that it retreated preparatory to feeding the length of the next stitch out of contact with the material, permitting it to remain at rest whether the needle was in or out. This feeding device went into universal use, and became, without substantial modification or change, the feeding device of the world for all kinds of machines except the small class, which fed by the needle. In 1850, Mr. Wilson also invented the rotary hook and stationary bobbin of the "Wheeler & Wilson" sewing-machine, by which was obtained a double-thread machine of the greatest speed, with the least expenditure of power and waste of thread, with the smallest wear of parts, adapted to a range of practical articles and fabrics reaching from the lightest want of a family to the heaviest necessity of stitch manufacture. L. P. Brockett.

Wilson (Sir Archdale), Bart. of Delhi, b. at Didlington, Norfolk, England, in 1803; entered the military service of the East India Company 1819 as an officer of artillery; was distinguished at the siege of Bhurtpore 1825–26; participated in the Sikh war 1848–49; became colonel 1854; was brigadier-general of artillery at Meerut at the outbreak of the Sepoy rebellion May, 1857; was the first British officer to encounter the mutineers in the field, defeating them May 30–31; effected a junction with the Delhi field force under Sir Henry Barnard; succeeded to the command of that force on the death of Barnard in July; maintained his position before Delhi until Sept. 14, when the city was stormed and taken after six days' hard fighting in the streets, for which service he was made a baronet; received the thanks of both houses of Parliament and a pension of £1000 from the East India Company; was promoted to major-general Sept., 1857, and lieutenant-general Mar., 1858, and took part as commander of the Royal Horse Artillery in the siege and capture of Lucknow, 1858, for which he was again thanked by Parliament. D. in London May 9, 1874.

Wilson (Benjamin), b. in England in 1722; became an eminent artist; was appointed master-painter to the board of trade at London 1773, and made valuable researches upon electricity. D. in London June 6, 1788. Author of *An Essay on Electricity* (1746), *Observations upon Lightning, etc.* (1773), *An Account of Experiments on Conductors for Lightning, etc.* (1778), and various papers on the same subject in the *Philosophical Transactions* 1753–72.

Wilson (Bird), D. D., LL.D., son of James (1742–98), b. at Carlisle, Pa., in 1777; graduated at Philadelphia College 1792; studied law; became president judge of the court of common pleas for the 7th circuit 1802; took orders in the Protestant Episcopal Church 1819; was rector of St. John's church, Norristown, Pa., 1819–21; professor of systematic divinity in the General Theological (Episcopal) Seminary, New York, 1821–50, and emeritus professor from 1850 until his death, in New York City Apr. 14, 1859. He edited his father's *Works* (3 vols., 1803–04), Matthew Bacon's *Abridgment of the Law* (7 vols., 1811–13), and wrote *Memoirs of the Life of Bishop William White* (1839; 2d ed. 1856). A *Memorial* (1864) of his life was prepared by W. White Bronson.

Wilson (Byron), U. S. N., b. July 7, 1836, in New York; graduated at the Naval Academy in 1857; became lieutenant in 1861, commander in 1872; served in the Richmond at the passage of the Vicksburg and Grand Gulf batteries, and highly commended in official dispatches.

Foxhall A. Parker.

Wilson (Caroline Fry), b. at Tunbridge Wells, England, in 1787; edited for several years (1823 *seq.*) an educational publication, from the columns of which she issued separately *The Listener* (2 vols., 1832; 13th ed. 1863), which had a wide circulation both in England and America, as well as some later religious works, *Christ our Example* (3d ed. 1834), *Christ our Law* (1842), and *The Scripture Reader's Guide* (16th ed. 1849). D. in 1846. Her *Autobiography, Letters, and Remains* (1848) were edited by her husband.

Wilson (Charles Henry), b. in England in 1756; received a classical education; was called to the bar at the Inner Temple; edited the *Gazette*; was for several years the reporter of the parliamentary debates; published translations from the Icelandic, Danish, and other languages, and was author of several anecdotical works. D. in London in 1808.

Wilson (Daniel), D. D., b. at Spitalfields, England, July 2, 1778; educated at St. Edmund's Hall, Oxford; took orders in the Church of England; became vicar of Chobham 1801, curate of Worton 1803–09, was tutor and vice-principal at St. Edmund's Hall 1807–12, curate of St. John's chapel, Bloomsbury, 1812–24, vicar of St. Mary's, Islington, 1824–32, and lord bishop of Calcutta and metropolitan of India from Mar. 27, 1832, until his death, at Calcutta Jan. 2, 1858. He was a zealous member of the "evangelical school" of theology and opponent of the Tractarian movement, and administered his diocese with great energy and efficiency. Author of several volumes of *Sermons* and *Charges*, of *Lectures on the Evidences of Christianity* (2 vols., 1828–30; 4th ed. 1860), *Lectures on Confirmation* (last ed. 1861), *Lectures on Colossians* (1845; 3d ed. 1853), and various other works. His *Life, with Extracts from his Journals and Correspondence* (2 vols., 1860), was prepared by his son-in-law and chaplain, Rev. Josiah Bateman.

Wilson (Daniel), LL.D., b. at Edinburgh in 1816; educated at the University of Edinburgh; was for some years secretary to the Royal Society of Antiquaries in Scotland; became professor of history and English literature in the University of Toronto, Canada, 1853; was president of the Canadian Institute 1859–60, and edited for several years the *Canadian Journal*. Author of *Memorials of Edinburgh in the Olden Time* (2 vols., 1846–48), *Oliver Cromwell and the Protectorate* (1848), *The Archæology and Pre-historic Annals of Scotland* (1851, with 200 illustrations; enlarged ed., 2 vols., 1863), *Pre-historic Man, Researches into the Origin of Civilization in the Old and the New World* (2 vols., 1862; revised ed. 1865; 3d ed., rewritten, 1876,

with numerous illustrations), *Chatterton, a Biographical Study* (1869), *Caliban, the Missing Link* (1873), and *Spring Wild Flowers* (2d ed. 1875), a volume of poems. Dr. Wilson wrote the elaborate article on "Archæology" in the 8th ed. of the *Encyclopædia Britannica*.

Wilson (Erasmus), F. R. S., b. in England in 1809; studied medicine; became lecturer on anatomy and physiology at the Middlesex Hospital Medical School, consulting surgeon to St. John's Hospital, London, a fellow by election of the Royal College of Surgeons 1843, and a member of its council 1870; gave special attention to diseases of the skin, in which branch he is the leading English authority; founded in 1869 in the College of Surgeons a museum and a professorship of dermatology, and was chosen the first occupant of that chair. Author of *Practical and Surgical Anatomy* (1838), *The Anatomist's Vade-Mecum, a System of Human Anatomy* (1842), *Diseases of the Skin* (1842), *Healthy Skin* (1845), *History of the Middlesex Hospital* (1845), *Ringworm, its Causes, Pathology, and Treatment* (1847), *On Syphilis, Constitutional and Hereditary* (1852), *The Eastern or Turkish Bath* (1861), *On Food as a Means of Prevention of Disease* (1865), and other professional works; contributed largely to medical journals and to cyclopædias, and edited the *Quarterly Journal of Cutaneous Medicine*. Most of his works have been reprinted, and had a large circulation in the U. S.

Wilson (Florence), known only by the Latinized form of his name as Florentius Volusenus, b. near Elgin, Morayshire, Scotland, about 1500; educated at the universities of Aberdeen and Paris; became a member of the households of Cardinals Du Bellay and Sadolet, master of the Latin and Greek school at Carpentras, and an eminent scholar and Roman Catholic theologian. D. at Vienne in 1547. Author of *Commentatio quædam Theologica quæ eadem Precatio est in Aphorismos dissecta* (Lyons, 1539), *De Animi Tranquillitate* (1543; several times reprinted at Edinburgh, the best edition being that of Thomas Ruddiman, 1707), and *Poemata* (London, 1649). His death was commemorated by George Buchanan in sonorous Latin verses, and a *Life* was written by Dr. Lettice.

Wilson (George), M. D., brother of Daniel, b. at Edinburgh, Scotland; educated at the Edinburgh High School; was apprenticed at the age of fifteen in the laboratory of the Royal Infirmary; subsequently pursued chemical researches under Profs. Christison and Graham; graduated at Edinburgh as surgeon 1837, and as physician 1839, but devoted himself entirely to chemistry, in which branch he became lecturer in the extra-academical school of Edinburgh 1840, and in the School of Arts and Veterinary College 1845; was a member of the Maga Club and president of the Physical Society, and was director of the Scottish Industrial Museum and regius professor of technology in the University of Edinburgh from 1855 until his death, Nov. 22, 1859. Amid great physical suffering, protracted through many years, he cherished an ardent love of science and of literature; made valuable experimental discoveries, and for his eminent personal and social qualities was beloved as few men have been by a wide circle of friends. Author of the textbook of *Chemistry* (1850) in Chambers's "Educational Course," of *Lives* of Dalton, Wollaston, and Boyle in the *British Quarterly Review*, *The Life of Henry Cavendish, including Abstracts of his more Important Scientific Papers, and a Critical Inquiry into the Claims of all the Alleged Discoverers of the Composition of Water* (Cavendish Society, iii., London, 1851), *Life of Dr. John Reid* (1852), *Electricity and the Electric Telegraph* and *The Chemistry of the Stars* (1852), *The Grievance of the University Tests* (1852), *Researches on Color-Blindness* (1855), *The Five Gateways of Knowledge* (1856), *The Progress of the Telegraph* (1859), and posthumous works, *Religio Chemici* (1862) and *Counsels of an Invalid* (1862). He left unfinished a *Memoir of Edward Forbes*, which was completed by Archibald Geikie (1861). He contributed to periodicals and scientific journals many articles and papers, including poetical pieces in *Blackwood's* and *Macmillan's Magazines*. His *Memoir*, by his sister, Miss Jessie Aitken Wilson (1860), is a work of unusual interest, of which a condensed edition appeared in 1866.

Wilson (George), b. at Hathersage, Derbyshire, England, in 1808; became a merchant at Manchester; took an active part in the numerous free-trade and other radical and political agitations of that city; became a member of the council of the Anti-Corn Law League Jan., 1839, its chairman in April of the same year, and spent most of his time in its management for the ensuing seven years, until the repeal of the corn laws 1846, when his services were acknowledged by a public testimonial of £10,000. He was afterward president of the National Reform Union, and took an active part in electoral matters and in the direction and management of railways and telegraphs. D. suddenly in a railway train near Liverpool Dec. 29, 1870.

Wilson (Henry), LL.D., b. at Farmington, N. H., Feb. 16, 1812. When but ten years old, in consequence of the extreme poverty of his parents, he was bound an apprentice to a neighboring farmer until twenty-one years of age. After serving out his full time, he received for his eleven years of hard labor, in addition to the privilege of one month's schooling in a year, a sum of about $80. With this he commenced his life as a freeman, taking up his residence in Natick, Mass., where he ever after lived. In 1836 he visited Washington, where his first sight of slavery and the domestic slave trade produced an impression so profound on his mind that he made a solemn resolve to devote his life to the cause of emancipation. In 1840 he was elected a member of the lower branch of the State legislature; in 1844 and 1845 he was a member of the State senate; in 1848 was a member of the national convention of the Whig party. In this body, on the nomination of Gen. Taylor on a platform unpledged against slavery extension, he openly renounced his connection with the Whig party, and gave his support to the Free-Soil organization. In 1850 he was again elected to the State senate, and was made president of that body. He failed of an election as governor of the State in 1853, but two years after he was chosen a Senator of the U. S. in the place of Edward Everett, resigned. To this high position he brought an accurate knowledge of the political history of the country, a sagacity unequalled in estimating the drift of popular sentiment, a vigorous, earnest eloquence, a firm reliance upon justice and truth as the great forces of action in human affairs, and that intense abhorrence of slavery in all its forms which had marked his whole life. When his colleague, Charles Sumner, was stricken down at his desk in the Senate chamber by blows from a bludgeon in the hands of a Representative of South Carolina, he denounced the outrage in terms of fitting indignation, although threatened himself with personal violence. Challenged to mortal combat, he pronounced the duel a survival of barbarous ages, but declared that he was ready to defend himself whenever and wherever assailed. During the war of the rebellion, following the election of Pres. Lincoln, he manifested some of the highest qualities of statesmanship. His name is associated with nearly all the important legislation of the period. As chairman of the committee on military affairs he lifted himself to the level of the great occasions of the national crisis. Measures of the greatest importance relating to the raising and equipment of vast armies were reported from his committee with surprising rapidity, and almost all were passed nearly in the form reported. At the close of the short session of Congress in the summer of 1861, Gen. Scott said: "Senator Wilson has done more work in this short session than all the chairmen of the military committees have done for the last twenty years." At the close of the war he applied himself to the work of union, conciliation, and reconstruction. In 1872 he was elected to the honorable position of Vice-President of the U. S. In the "snatched leisure" of the last years of his life he prepared his great literary work, *The Rise and Fall of the Slave Power*, two volumes of which were published before his death, the third and last being left nearly completed in manuscript. Of his large executive ability, his fidelity to his convictions, his patriotism, moral and physical courage, his hearty sympathy with the poor and wronged, and the purity of his public and private life, there is no divided opinion among his countrymen. Holding for nearly a quarter of a century positions where mercenary inducements abounded, he kept himself spotless, and left the world as poor as he entered it. He died in the Vice-President's apartments in the Capitol at Washington Nov. 22, 1875. John G. Whittier.

Wilson (Henry Bristow), b. in London, England, in 1803; educated at Merchant Taylors' School, of which his father, Rev. Harry B. Wilson, D. D. (1774–1853), was a master and the historian; graduated with high classical honors at St. John's College, Oxford, 1825; became a fellow and tutor there; took orders in the Church of England; was one of the four resident tutors at Oxford who in 1841 issued a joint protest and remonstrance to the editor of *Tracts for the Times* on account of their Romanizing interpretation of the XXXIX Articles; was successively a select preacher, public examiner, professor of Anglo-Saxon, and Bampton lecturer (1850) at Oxford; became vicar of Great Stoughton, Huntingdonshire, 1851, and was one of the seven clergymen of the Church of England who in 1860 published the famous volume of *Essays and Reviews*, to which his contribution was an essay on *The National Church*; was tried for heresy before the court of arches, and sentenced to a year's suspension from his benefice 1862, but obtained a reversal on appeal to the privy council; is

author of *The Communion of Saints, an Attempt to Illustrate the True Principles of Christian Union* (1851); was a contributor to the *Oxford Essays*, and has published a number of sermons and pamphlets on university and theological questions.

Wilson (Horace Hayman), F. R. S., b. in London, England, in 1786; educated for the medical profession; went to India in 1808 as assistant surgeon in the Bengal service of the East India Company; gave his attention to chemistry; obtained an appointment in the Calcutta mint as assistant to Dr. Leyden, the celebrated Orientalist; became assay-master and secretary; applied himself with great diligence to the study of Sanskrit literature; was appointed secretary of the Asiatic Society of Bengal on the death of Dr. William Hunter 1811; became secretary to the public instruction committee at Calcutta, and director of studies of the Hindoo college at Benares 1819; rendered great service in encouraging the progress of education among the natives of Bengal, and in stimulating by his publications the cultivation by Europeans of Oriental philology; was a great favorite in Calcutta society for his musical skill and his talents as an amateur actor; received on several occasions the thanks of the government of India for reforms in the coinage and other public services; was a trusted counsellor upon all questions relating to the history, customs, and welfare of the people of India; returned to England in 1832 to occupy the lucrative Boden professorship of Sanskrit at Oxford University, to which he had been elected over several distinguished competitors; was appointed librarian at the East India House on the death of Sir Charles Wilkins 1836, and retained both offices until his death, in London May 8, 1860. He married in 1832 a granddaughter of the celebrated actress, Mrs. Siddons, and soon afterward became a director of the East India Company. Among his numerous works were a *Sanskrit and English Dictionary* (Calcutta, 1819; 2d ed., enlarged, London, 1832), a *Sanskrit Grammar* (1841; 2d ed., Oxford, 1847), *A Descriptive Catalogue of the Oriental MSS. and other Articles illustrative of the Literature of the South of India, collected by Col. Colin Mackenzie* (Calcutta, 2 vols., 1828), *A History of British India from 1805 to 1835* (3 vols., 1844–48), *Ariana Antiqua, a Descriptive Account of the Antiquities and Coins of Afghanistan* (1841), *A Sketch of the Religious Sects of the Hindus* (Calcutta, 1846), *A Glossary of Judicial and Revenue Terms, etc., in Arabic, Persian, Hindustani, Sanskrit, Bengali, Uriya, Marthi, Guzurathi, Telugu, Karnata, Tamil, Malayalam, and other Languages* (1855), and many translations in verse or prose of classical works from the Sanskrit, including *The Megha-Dûta, or Cloud Messenger* (1813; new ed., with vocabulary, 1869), *Select Specimens of the Theatre of the Hindus* (Calcutta, 3 vols., 1827; 2d ed., 2 vols., 1835), the *Vishnu Purana* (1840; new ed., 6 vols., 1867–70), and *The Rig-Veda Sanhita* (3 vols., 1850–57), comprising about one-half of the hymns of that ancient collection. A collective edition of his miscellaneous *Works*, in 17 vols., has been commenced under the editorship of Dr. Reinhold Rost and Dr. Fitzedward Hall, of which 11 vols. appeared 1864–70.

Porter C. Bliss.

Wilson (James), LL.D., b. near St. Andrew's, Scotland, in 1742; educated at the universities of Glasgow, St. Andrew's, and Edinburgh; emigrated to Pennsylvania 1766; was a tutor in the College and Academy of Philadelphia; studied law in the office of John Dickinson; was admitted to the bar 1768; practised at Reading, Carlisle, and Annapolis, Md.; was a member of the Pennsylvania provincial convention 1774, and of the Continental Congress 1775–77, and again 1782–83 and 1785–87; signed the Declaration of Independence, and wrote several pamphlets on political questions; was commissioned a colonel at the outbreak of hostilities, but did not serve in the field; settled at Philadelphia 1778; was advocate-general of France in the U. S. 1779–83; was a member of the committee which drafted the Federal Constitution 1787, of the Pennsylvania convention which ratified it, and of the convention which amended the State constitution of Pennsylvania in 1790; was appointed in Sept., 1789, one of the first judges of the U. S. Supreme Court, and became in 1790 the first professor of law in the College of Philadelphia. D. at Edenton, N. C., Aug. 28, 1798. His *Works* (3 vols., 1803–04), consisting chiefly of legal lectures, speeches, and orations, were edited by his son, Bird Wilson.

Wilson (James), brother of Prof. John (1785–1854), b. at Paisley, Scotland, in 1795; studied but never practised law; travelled on the Continent in 1816, 1819, and 1820–21; settled at Woodville, near Edinburgh, 1824, and d. there May 18, 1856. Author of *Illustrations of Zoology* (9 parts, 1826–32), *A Treatise on Insects* (1835), *The Natural History of Quadrupeds and Whales* (1838), *The Natural History of Fishes* (1838), *The Natural History of Birds* (1839), *A Voyage round the Coasts of Scotland and the Isles* (2 vols., 1842), and *Illustrations of Scripture, by an Animal Painter*; aided Hugh Murray in his works on Africa, North America, and India, and Patrick Fraser Tytler in his *Progress of Discovery on the Northern Coasts of America* (1832); was joint author with James Duncan of *Entomologia Edinensis* (1834); contributed largely to *Blackwood* and the quarterly reviews, and wrote the articles on natural history in the 7th and 8th eds. of the *Encyclopædia Britannica*, to which he also contributed a biography of Prof. Edward Forbes. His *Memoirs* (1859) were written by James Hamilton, D. D.

Wilson (James), b. at Hawick, Roxburghshire, Scotland, June 3, 1805; was for a time a hatter, and subsequently a tradesman at Hawick, London, and Newcastle, in which business he repeatedly failed; founded at London in 1843 the *Economist* newspaper, of which he was for many years chief editor and sole proprietor; was elected to Parliament 1847, 1852, and 1857; was secretary to the board of control 1848–52, financial secretary to the treasury 1852–56; became vice-president of the board of trade 1859, but in the same year accepted the position of financial member of the council of India; sailed for Calcutta Oct. 20, 1859, and after a brief but eminently successful administration of Indian finances, d. at Calcutta Aug. 11, 1860. His statue has been erected in that city. Author of *The Influence of the Corn Laws* (1839), *The Fluctuations of Currency* (1840), *Capital, Currency, and Banking* (1847), and other works on political economy, of which science he was one of the ablest modern expositors.

Wilson (James F.), b. at Newark, O., Oct. 19, 1828; received a good education, and studied law; settled in Iowa 1853; was elected to the convention for revising the State constitution 1856; sat in both houses of the legislature; was president of the senate 1861; was a member of Congress 1861–69, serving as chairman of the judiciary committee and as one of the managers of the impeachment of Pres. Johnson, and in 1869 was appointed a commissioner for the Pacific R. R.

Wilson (James Grant), b. at Edinburgh, Scotland, 1832; came to America in infancy with his father, William Wilson (1801–60); served in the civil war in the Southwest under Gens. Grant and Banks. Prior to 1861 he had been engaged in the book business with his father in Chicago; removed to New York at the close of the war. Author of *Illinois Officers in the Rebellion* (1863), *Life of Gen. Grant* (1868), *Mr. Secretary Pepys and his Diary* (1869), *Life and Letters of Fitz Greene Halleck* (1869), *Sketches of Illustrious Soldiers, Poets and Poetry of Scotland, History of Chicago*, etc.

Wilson (James Harrison), b. in Illinois about 1838; graduated at West Point 1860; became first lieutenant of topographical engineers Sept. 9, 1861, and captain May 7, 1863; served in the Port Royal expedition and at the capture of Fort Pulaski, Ga., for which he was brevetted major Apr. 11, 1862; was aide-de-camp to Gen. McClellan at South Mountain and Antietam; became staff lieutenant-colonel of volunteers Nov. 8, 1862; was assistant engineer and inspector-general of the Army of the Tennessee in the campaign against Vicksburg; was made brigadier-general of volunteers Oct. 31; brevetted lieutenant-colonel U. S. A. Nov. 24, 1863, for gallantry at Chattanooga; commanded the 3d cavalry division of the Army of the Potomac May to Aug., 1864; was brevetted colonel May 5 for the battle of the Wilderness; took part in the ensuing battles of that campaign, and in the Shenandoah Valley Aug. and Sept., 1864; commanded the cavalry of the division of the Mississippi from Oct., 1864, to July, 1865; took part in Gen. Thomas's campaign in Tennessee, being distinguished at the battles of Franklin and Nashville, and in a cavalry raid into Alabama and Georgia Mar. and Apr., 1865; was brevetted brigadier and major general U. S. A. Mar. 13, 1865, for the battle of Nashville and the capture of Selma, Ala., respectively; took Montgomery, Columbus, and Macon; was made major-general of volunteers Apr. 20; captured Jefferson Davis May 10, 1865; became lieutenant-colonel of 35th Infantry July 28, 1866; left the army Dec. 31, 1870, and has since been engaged upon railroad enterprises in the Western States, having his residence in New York City. Author of many articles in the best periodicals of the day.

Wilson (James Patriot), D. D., b. at Lewes, Sussex co., Del., in 1769; graduated at the University of Pennsylvania 1788; was admitted to the bar 1790; studied theology, and was pastor of the First Presbyterian church in Philadelphia from 1806 until his death, in Bucks co., Pa., Dec. 9, 1830. Author of *Lectures on the Parables* (1810), *An Easy Introduction to Hebrew* (1812), *Common Objections to Christianity* (1829), *The Primitive Government of Christian Churches*, etc. (1833), and other works.

Wilson (John), b. at Windsor, England, in 1588, third son of William Wilson, D. D., prebendary of St. Paul's, of Rochester, and of Windsor, and rector of Cliff, in Kent, who had been chaplain to Edmund Grindall, archbishop of Canterbury, and married one of his nieces, and grandnephew of Sir Thomas Wilson, secretary of state to Queen Elizabeth; educated at Eton School (1598–1602), where he was chosen to make a Latin oration on the occasion of the visit of the French ambassador, the duke of Biron; entered King's College, Cambridge, 1602; graduated about 1606; obtained a fellowship; studied law three years at one of the inns of court; took orders in the Church of England; became conspicuous for his Puritanical leanings, derived from his intimacy with the celebrated Dr. William Ames and Richard Rogers of Wethersfield; was chaplain to Lady Scudamore and in other distinguished families; preached successively at Mortlake, Henley, Bumsted, Stoke, Clare, and Candish; was for some years minister of Sudbury, Essex, where he was several times suspended or silenced by the bishop's court, and was befriended by Robert Rich, earl of Warwick; married Elizabeth (d. 1659), daughter of Sir John Mansfield, surveyor to Queen Elizabeth, and master of the Minories, a relative of Dr. John Dod, the "Decalogist;" took part in the project of the colonization of Massachusetts; embarked at the Isle of Wight Apr. 8, 1630, in the great fleet with Winthrop and his associates of the Massachusetts Company; landed at Salem June 12; removed soon afterward to Charlestown, where he preached under a tree, and instituted (July 30) what was afterward the first church of Boston, consisting of himself, Gov. Winthrop, Isaac Johnson, and Deputy-Gov. Thomas Dudley; was ordained "teacher" of that church Aug. 27 by imposition of hands of the members thereof; sailed for England Apr. 1, 1631, returning May 26, 1632; took the freeman's oath July 3; was ordained "pastor" of the church Nov. 22, 1632; visited England again in the autumn of 1634, returning with his wife Oct. 3, 1635, along with the celebrated Hugh Peters; took a prominent part in the Antinomian controversy as the chief ally of Gov. Winthrop against the party headed by Wheelwright and Mrs. Hutchinson; was chaplain to the Massachusetts forces sent to Connecticut against the Pequots 1636, for which service he afterward received a grant of 1000 acres of land in the present town of Quincy; accompanied the "apostle" John Eliot on his visit to the Indian settlements, and labored for their interests; lost his colleagues Cotton (1652) and Norton (1663); was noted for benevolence, hospitality, and readiness in improvising verses, being esteemed by Mather "the greatest anagrammatist since the days of Adam." D. at Boston Aug. 7, 1667. Biographies were written by Cotton Mather in his *Magnalia* (1702) and by Rev. Dr. A. W. McClure in the *Lives of the Chief Fathers of New England* (6 vols., 1846 *seq.*). Poetical epitaphs on Mr. Wilson were written by Jonathan Mitchell, Cotton Mather, and others. He published in England a theological treatise, *Some Helps to Faith* (1625); a poem, *Famous Deliverances of the English Nation* (1626; new ed., Boston, 1680); a Latin poem to the memory of John Harvard; and a tract, *The Day Breaking, if not the Sun Rising, of the Gospel with the Indians in New England* (1647; new ed., New York, 1865), besides many other occasional productions, the titles of which are unknown.—His son John, b. in Sudbury, England, in July, 1621; graduated in the first class at Harvard 1642; was two years colleague with Richard Mather at Dorchester; married a daughter of Rev. Thomas Hooker, and was pastor of Medfield above forty years, until his death, Aug. 23, 1691.

Porter C. Bliss.

Wilson (John), more generally known by his pseudonym Christopher North, b. at Paisley, Scotland, May 19, 1785; was educated at the universities of Glasgow and Oxford, where he won the Newdegate prize for English poetry in 1803 by a poem on *The Study of Greek and Roman Architecture*, and graduated in 1807. In 1808 he bought the estate of Elleray, on Lake Windermere, in Westmoreland, where he lived in intimate intercourse with Wordsworth, Coleridge, and Southey, and published in 1812 the poem *The Isle of Palms*. In 1815 he sold Elleray, removed to Edinburgh, and was admitted to the bar; published in 1816 the dramatic poem, *The City of the Plague*; became one of the chief contributors to *Blackwood's Magazine*, founded in 1817, and was appointed professor of morals in 1820 at the University of Edinburgh, in preference to Sir William Hamilton. In 1822 he published *Lights and Shadows of Scottish Life*; in 1823, *The Trials of Margaret Lindsay*; in 1824, *The Foresters*; in 1841, *Essay on the Genius and Character of Burns*; but his most popular productions were his contributions to *Blackwood's Magazine* under the pseudonym of "Christopher North:" *Noctes Ambrosianæ* (1822–35), *Dies Boreales, or Christopher under Canvas* (1849–52), etc. In 1851 he resigned his chair at the university, and d. in Edinburgh Apr. 3, 1854. A collected edition of his works has been published in 12 vols. by his son-in-law, Prof. Ferrier; his *Life* has been written by his daughter, Mrs. Gordon, in 2 vols.; and a bronze statue of him has been raised in Edinburgh.

Wilson (John), D. D., b. in Scotland about 1800; was for many years a missionary of the Free Church of Scotland at Bombay, India. Author of *An Exposure of the Hindu Religion* (1832), *The Doctrine of Jehovah, addressed to the Parsis* (1839), *The Parsi Religion Unfolded, Refuted, and Contrasted with Christianity* (1843), *The Lands of the Bible Visited and Described* (2 vols., 1847), *The Evangelization of India* (1849), and *The History of the Suppression of Infanticide in Western India* (1855).—His son, Andrew, b. in Bombay about 1835; was employed by the East India Company; visited China; travelled in Western Thibet; is a distinguished professor in England, and author of *The Ever-Victorious Army*, a narrative of the suppression of the Tai-ping rebellion in China, and of *The Abode of Snow* (1875), an account of his travels in the Himalayas, which first appeared in *Blackwood's Magazine*.

Wilson (John), b. at Glasgow, Scotland, in 1802; became a printer and publisher at Boston, Mass., 1843, and was noted for the carefulness and elegance of the productions of his press. D. at Boston Aug. 3, 1868. Author of *Scripture Proofs and Scripture Illustrations of Unitarianism* (1833), *The Concessions of Trinitarians* (1842), *A Treatise on Grammatical Punctuation* (1844), *The Elements of Punctuation* (1856), and *Unitarian Principles confirmed by Trinitarian Testimonies* (1855).

Wilson (John), b. in Ireland in 1808; came to the U. S. in childhood; settled at Washington, D. C.; was for many years a clerk in the post-office and treasury departments; was commissioner of the general land office 1852–56, third auditor of the treasury several years from 1864; was for some time engaged in railroad business in Illinois, but subsequently returned to Washington, where he practised as an attorney until his death, in Jan., 1876.—His brother, Joseph S., was successively messenger and clerk in the treasury department; became on the organization of the interior department chief clerk of the general land-office, of which he was appointed commissioner 1860, and again 1866. D. at Washington about 1871.

Wilson (John G.), b. at New Leeds, Cecil co., Md., in 1809; became a Methodist preacher, and subsequently a minister of the so-called "Church of God," the peculiar views of which in regard to prophecy and the "second advent" he expounded in various periodicals, especially in the *Homiletic Magazine and Repository of Pastoral Theology* (1843–44), founded and conducted by him, and published *Discourses on Prophecy* (1850), *A Vindication of the Scheme of Redemption* (1858), *Writings in Prose and Verse on Various Subjects* (1860), *The Gospel of the Epiphany*, and *The Branch of David* (1867).

Wilson (John Leighton), D. D., b. in Sumter district, S. C., in 1809; graduated at Union College 1829; studied theology at Columbia, S. C.; went as a missionary to Africa 1833; labored eight years at Cape Palmas and twelve years at Gaboon; repeatedly visited all parts of the coast; mastered and reduced to writing the Grebo and Mpongwe languages, translating into them portions of the Bible, and composing grammars and dictionaries; and on his return to the U. S. became one of the secretaries of the Presbyterian Board of Foreign Missions. Author of *Western Africa, its History, Condition, and Prospects* (1856), and of various tracts on Africa, and has contributed papers to the *Bibliotheca Sacra* and to the *Journal* of the American Oriental Society.

Wilson (John Mackay), b. in Scotland about 1775; was for some years editor of the Berwick *Advertiser*. D. at Berwick-on-Tweed Oct. 2, 1835. He was the editor and principal author of an important work, of which 150,000 copies have been sold—*Tales of the Borders, Historical, Traditionary, and Imaginative* (6 vols., 1835–40), intended as a companion to the *Waverley Novels*. The last edition, revised and enlarged by Alexander Leighton, appeared in 24 vols. (Edinburgh, 1869).

Wilson (Peter), LL.D., b. at Banff, in the N. of Scotland, Nov. 23, 1746; pursued his studies in the University of Aberdeen, devoting himself especially to classical literature; removed to New York in 1763, where he began his labors as teacher; was soon called to be principal of Hackensack Academy; in 1775 threw himself with zeal into the measures leading to the Revolution and the independence of the colonies; from 1777 to 1783 served in the New Jersey legislature; in the latter year was appointed to revise and compile the laws of his adopted State, which work he satisfactorily completed; in 1789 was elected professor of the Greek and Latin languages in Columbia College, New

York; resigned in 1792, and became principal of Erasmus Hall, Flatbush, Long Island; received the degree of LL.D. from Union College 1793; was recalled in 1797 to Columbia College as professor of Greek and Latin and of Greek and Roman antiquities, which office he retained till 1820, when he retired on a liberal pension from the trustees. Published treatises on *Latin Prosody* (New York, 1810), *Greek Prosody* (1817), an edition of Sallust, Longinus, the Greek Testament, and a revision of Adam's *Roman Antiquities* (1826). D. Aug. 1, 1825. H. DRISLER.

Wilson (RICHARD), b. in Montgomeryshire, England, in 1713 or 1714; painted portraits in London; went in 1749 to Rome, where he became acquainted with Joseph Vernet, and changed from portraits to landscapes; returned in 1755 to London; became one of the founders of the Royal Academy, and for several years its librarian. D. at Llanferras, Denbighshire, in 1782. Among his most celebrated pictures are *Destruction of Niobe's Children, View of Baiæ, Carnarvon Castle, Pembroke Castle*, etc.

Wilson (ROBERT ANDERSON), b. at Cooperstown, N. Y., in 1812; resided some years in California, where he was a judge in the Sacramento mining district 1851–54; travelled in Mexico and Central America, and was for some years a clerk in the state department at Washington, D. C. Author of *Mexico and its Religion* (1855) and of *A New History of the Conquest of Mexico* (1859), in which he pronounces most of the accounts of the conquest heretofore received to be unreliable, and that the boasted civilization of the Aztecs was a myth.

Wilson (Sir ROBERT THOMAS), son of Benjamin, b. in Bloomsbury, London, England, in 1777; educated at Westminster and Winchester schools, and had commenced the study of law when he received from the duke of York a commission in the army; took part as a volunteer in the campaign in Flanders 1793–94; was on the staff in Ireland during the rebellion of 1798; served in Holland 1799, in Egypt under Abercromby 1800; accompanied Sir D. Baird to Brazil and the Cape of Good Hope 1805; went with Lord Hutchinson on a secret mission to the allied armies on the Russian frontier 1806–07; served in Portugal and Spain 1808–10, in command of the Lusitanian Legion, and afterward of a Spanish brigade; was British military correspondent at the Russian head-quarters during the memorable campaign in Germany and France 1812–14; received decorations from the allied emperors; aided in effecting the escape of Count Lavalette at Paris Jan., 1815; incurred the displeasure of the prince regent by espousing the cause of Queen Caroline; was in consequence dismissed from the army 1821, but was indemnified by a public subscription, and a few years later was restored to his rank; sat in Parliament as a Liberal 1818–31; attained the full rank of general 1841, and was governor of Gibraltar 1842–49. D. in London May 9, 1849. Author of *A History of the British Expedition to Egypt* (1802), *An Inquiry into the Present State of the Military Force of Britain* (1804), *A Sketch of the Campaigns in Poland in 1806–07* (1810), *A Sketch of the Military and Political Power of Russia* (1817), and translated Regnier's *Account of the Campaign in Egypt* (1802). Since his death have appeared his *Narrative of Events during the Invasion of Russia by Napoleon Bonaparte and the Retreat of the French Army* (1860), and his *Private Diary of Travels, Personal Services, and Public Events during Missions and Employment with the European Armies in the Campaigns of 1812–13–14, from the Invasion of Russia to the Capture of Paris* (2 vols., 1861), both edited by his nephew and son-in-law, Rev. Herbert Randolph, who also published a *Life* (2 vols., 1863) prepared from autobiographical memoirs, journals, and correspondence.

Wilson (SAMUEL FARMER), b. in New York in 1805; graduated at Columbia College 1822; was admitted to the New York bar; wrote about 1830 a small *History of the American Revolution* (new ed. 1869), which has been often reprinted; settled in New Orleans as a lawyer; became editor of the *True Delta* in conjunction with William Walker, and was subsequently editor and proprietor of the *Picayune*.

Wilson (THEODORE D.), b. in Brooklyn, N. Y., May 11, 1840; served his apprenticeship as shipwright at the navy-yard, Brooklyn; served for three months at the outbreak of the rebellion with the 13th N. Y. S. M. as a non-commissioned officer; on the return of the regiment was appointed a carpenter in the navy; served about two years afloat; was in the fight with the Merrimack in Hampton Roads; was ordered to duty with Rear-Admiral F. H. Gregory in 1863 as an inspector of the building and repairing of vessels in private establishments in New York and vicinity; was examined far, passed, and appointed an assistant naval constructor May 17, 1866; served as such in the navy-yards at Pensacola, Philadelphia, and Washington; served four years as instructor in naval architecture and shipbuilding at the U. S. Naval Academy; promoted to naval constructor July 1, 1873; member of the Institution of Naval Architects of England. Author of *Shipbuilding, Theoretical and Practical*, used as a textbook at the Naval School and by the profession in this country generally.

Wilson (Sir THOMAS), LL.D., b. at Stroby, Lincolnshire, England, about 1524, son of Thomas Wilson by his wife Anne, daughter of Roger Comberworth; educated at Eton under the celebrated Udal; was sent on an Eton scholarship to King's College, Cambridge, where he graduated 1546; took orders in the Church of England; became tutor to Henry and Charles Brandon, sons of the duke of Suffolk by Mary, the ex-queen of France, both of whom, however, soon died; wrote the biographies of his pupils in a rare Latin volume, *Vita et Obitus Duorum Fratrum Suffolcensium Henrici et Caroli Brandoni Ducum illustrissimorum, Duabus Epistolis explicata, adduntur Epitaphia, etc.* (1551); published *The Rule of Reason, conteinyng the Arte of Logique set forth in Englishe* (1551; 9th ed. 1580), and *The Arte of Rhetorike for the Use of all Suche as are Studious of Eloquence, sette forthe in Englishe* (1553; 9th ed. 1585), said to be the first critical treatises on logic and rhetoric in English, and incidentally to give the author a title to rank as the founder of English philology, the latter work having been referred to by Shakspeare, and having exerted a powerful influence to purify the English language from foreign idioms; withdrew to the Continent on the accession of Mary 1553; took the degree of LL.D. at the University of Ferrara; was imprisoned by the Inquisition at Rome on charges said to have been based on his published works; was put to the torture; obtained his liberty at the death of Pope Paul IV. 1555, when the populace broke open the prison of the Inquisition; returned to England soon after the accession of Elizabeth, to whom he became private secretary 1558, acting also as her instructor in various branches of learning; was made master of requests and master of St. Katherine's Hospital, near the Tower; published a translation of *The Three Orations of Demosthenes, Chief Orator among the Grecians, in Favor of the Olynthians, with those his fower Orations against King Philip of Macedon* (1570; 2d ed. 1572), a work which greatly pleased Queen Elizabeth by the obvious analogies it suggested between Philip of Macedon and Philip II. of Spain; issued *A Discourse upon Usury by way of Dialogue and Orations* (1572; 3d ed. 1584); went as ambassador to the Netherlands 1576; succeeded Sir Thomas Smith as secretary of state and colleague of Sir Francis Walsingham 1577, and became dean of Durham 1579. D. in London June 16, 1581. He married Anne, daughter of Sir William Winter of Lidney, Gloucestershire, and left a son, Nicholas, and two daughters. Many facts concerning him may be found in Strype's *Annals*, apparently based upon MS. documents. PORTER C. BLISS.

Wilson (THOMAS), D. D., LL.D., b. at Burton, Cheshire, England, in 1663; educated at Trinity College, Dublin; took orders in the Church of England; became curate of Winwick, Lancashire, 1686, domestic chaplain to the earl of Derby 1692; travelled with that nobleman's son, Lord Strange, on the Continent 1694–97, and was bishop of Sodor and Man fifty-seven years, from Jan. 16, 1698, until his death, Mar. 7, 1755. He was "held in the most exalted reputation for apostolic piety and unquenchable zeal in good works," and is even yet prominent in the writings of Matthew Arnold, Ruskin, and their followers as an exemplar of their doctrine of "sweetness and light." Author of *The Principles and Duties of Christianity* (1699), in English and Manx (being the first book printed in the language of the Isle of Man), *Short and Plain Instructions for the Better Understanding of the Lord's Supper* (1736), *The Knowledge and Practice of Christianity made easy to the Meanest Capacities, or an Essay towards an Instruction for the Indians* (1740), *Sacra Privata* (1800), several volumes of *Sermons*, and other treatises. His *Works* (Bath, 2 vols., 1781) were edited with a *Life* by Rev. C. Crutwell.

Wilson (THOMAS B.), M. D., b. at Philadelphia, Pa., about 1800; received an academical education; studied medicine, which he practised in Philadelphia, accumulating a handsome fortune; became eminent as a zoologist; was a leading member of the Pennsylvania Academy of Natural Sciences, of which he became president, and to which he was a munificent benefactor, its library and its splendid collection of birds being mainly his gift. D. at Newark, Del., Mar. 15, 1865.

Wilson (WALTER), b. in England in 1781; studied law at the Inner Temple; became a bookseller in London, where he accumulated a fortune, and subsequently resided for many years at Bath, where he d. in 1847. Author of *The History and Antiquities of Dissenting Churches and Meet-*

ing-Houses in London, Westminster, and Southwark, including the Lives of their Ministers, from the Rise of Nonconformity to the Present Time, and an Appendix on the Origin, Progress, and Present State of Christianity in Britain (London, 4 vols., 1808–11), and *Memoirs of the Life and Times of Daniel Defoe* (3 vols., 1830).

Wilson (William), b. in Perthshire, Scotland, in 1801; was editor of the Dundee *Review* (1821–23) and of the *Literary Olio* (1824), for which he wrote many poems; resided afterward in Edinburgh as a writer for the press; was intimate with the brothers Chambers; came to the U. S. 1833; established himself as a bookseller at Poughkeepsie, N. Y., 1834; wrote under the signatures of "Allan Grant" and "Alpin" for *Blackwood's Magazine*, *Chambers's Journal*, the *Knickerbocker*, the *Albion*, and other Scottish and American periodicals; became a partner with his son, James Grant Wilson, in the bookselling and publishing business at Chicago, Ill., 1860; edited the *Scottish Songs, Ballads, and Poems* (New York, 1855) of Hew Ainslie, and some other volumes, and left unfinished a collection of the *Poets and Poetry of Scotland*, since completed by his son. D. Aug. 25, 1860. A volume of his *Poems* (Poughkeepsie, 1870) was edited by Beeson J. Lossing.

Wilson (William), b. in England in 1822; came to the U. S. in childhood; became a ticket and passenger agent for steamers at New York; was afterward in the real estate business; was noted for great strength, which he several times exhibited in the prize ring; was a noted Democratic politician; filled various municipal offices, including that of alderman (1856), and at the outbreak of the civil war raised and commanded the famous 6th regiment of New York Vols., composed chiefly of the "roughs" of New York City, and known as "Billy Wilson's Zouaves." In 1861 he became colonel of the 69th regiment. D. at New York Nov. 13, 1874.

Wilson (William Dexter), D. D., LL.D., L. H. D., b. in Stoddard, N. H., Feb. 28, 1816. Having spent a short time at the Walpole (N. H.) Academy and several years in private study, in 1835 he entered the theological department of Harvard University; in 1842 was ordained to the ministry of the Protestant Episcopal Church, and soon after published *The Constitution of the Christian Church*, enlarged and republished in 1846 as *A Manual of Church Principles*; in 1847 edited Bishop Mant *On the Rubrics*, with additional matter, expounding the rubrics of the American Church, and in 1848 published a *History of the Reformation in England*; in 1848–49 wrote a series of articles entitled *The Church Identified*, afterward collected, published in a volume, and enlarged and republished in 1850, and reissued in various editions to the present time; in 1849 received the degree of D. D. from Geneva College, and in 1850 became professor of history and moral and intellectual philosophy in that institution; in 1856 published an *Elementary Treatise on Logic*; in 1868 received the degree of LL.D., and at the opening of the Cornell University became professor of intellectual and moral philosophy in that institution; soon after published *Lectures on Psychology, Comparative and Human*, and a new textbook on logic; in 1872 received the degree of L. H. D. from the regents of the University of the State of New York, and soon after published an *Introduction to the Study of Metaphysics and Intellectual Philosophy*, and a work on *Political Economy*; has also written many important monographs on mathematical and metaphysical subjects, which may be found in the reviews and in *Reports of the Proceedings of the University Convocation of the State of New York*. He is now engaged on a work on the *History of Philosophy*. In his philosophical works he proposes a new account of the origin and nature of knowledge, between and differing from the old theories of idealism and sensualism. He believes in an *insight* into the nature of things cognized, which accounts for the element of knowledge in dispute between the two old schools. He makes logic a science of things, and regards words as mere representatives of things. In ontology he recognizes no causes as *causæ veræ* except those denoted by concrete terms. On this he bases a *transcendental* logic which is a new method of investigating ontological questions.

Wilson Creek, tp., Grayson co., Va. P. 3231.

Wil'son's, tp., Sanford co., Ala. P. 957.

Wil'sonville, p.-v. and tp., Shelby co., Ala. P. 560.

Wil'ton, p.-v. and tp., Fairfield co., Conn. P. 1994.

Wilton, tp., Will co., Ill. P. 1118.

Wilton, p.-v. and tp., Muscatine co., Ia., on Chicago Rock Island and Pacific R. R., 24 miles from Davenport, has 7 churches, Wilton Collegiate Institute, 2 private banks, 2 newspapers, 2 elevators, 3 hotels, and 1 grist-mill. P. 2345. J. E. Stevenson, Ed. "Herald."

Wilton, p.-v. and tp., Franklin co., Me. P. 1906.

Wilton, p.-v. and tp., Waseca co., Minn. P. 668.

Wilton, p.-v. and tp., Hillsborough co., N. H. P. 1971.

Wilton, p.-v. and tp., Saratoga co., N. Y. P. 1201.

Wilton, p. v. and tp., Monroe co., Wis. P. 818.

Wilton (Joseph), R. A., b. in London, England, in 1722; studied sculpture at Brabant, at Paris, and at Rome, where he gained the jubilee gold medal of Pope Benedict XIV.; spent eight years in Italy, chiefly occupied in copying ancient statues, after which he returned to England with Cipriani, Chambers the architect, and a clever modeller named Capizzoldi; became director of the duke of Richmond's art gallery in Spring Gardens; became the most popular sculptor in England; acquired a handsome fortune; lived in great style; was a friend and patron of Richard Wilson the painter and of Baretti the lexicographer, and was one of the founders of the Royal Academy. D. in London in 1803. Among his best-known works were busts of Bacon, Cromwell, Newton, Swift, Wolfe, Chatham, and Chesterfield, and the monuments of Wolfe, Admiral Holmes, and Stephen Hales.

Wilton Junction, p.-v., Wilton tp., Muscatine co., Ia. P. 1317.

Wilts, or **Wiltshire,** an inland county in the southwestern part of England, comprises an area of 1352 sq. m., with 257,202 inhabitants. In the northern part are extensive plains well suited to agriculture and dairy-farming, which are carried on with great energy. Many hogs are reared here, and Wilton bacon and Wilton cheese are famous. The southern part is hilly, and on the bleak downs a great number of sheep of a fine breed is reared. Woollen stuffs are extensively manufactured; also some cotton, silk, and iron manufactures are carried on.

Wiltse (G. C.), U. S. N., b. Nov. 29, 1838, in New York; graduated at the Naval Academy in 1859; became lieutenant in 1861, commander in 1873; served in the Congress when she was destroyed by the Merrimack, and commended for "courageously performing his duty."

Foxhall A. Parker.

Wilt'shire (Thomas **Boleyn**), Earl of, b. in England about 1480; was created Viscount Rochford June 18, 1525, having gained the royal patronage through Henry's passion for his daughter Anne, the celebrated and unfortunate queen; was sent as ambassador to France 1527 and to the emperor Charles V. Mar., 1530, and was created earl of Ormond and of Wiltshire 1529. D. in 1538.

Wimpffen', de (Emanuel Felix), b. at Laon, department of Aisne, France, Sept. 13, 1811; began his military career in Algeria; was made a brigadier-general in the imperial guard in 1855; distinguished himself both in the Crimean and in the Italian wars; was made a general of division in 1859; commanded at Lyons, and was subsequently made governor, first of the province of Algeria, then of that of Oran. In the Franco-German war he received the command, first of the 12th, then of the 5th army corps, and during the battle of Sedan, after MacMahon had been wounded, he assumed the command of the whole army, and signed as such the capitulation of Sedan. While residing in Stuttgart he published several letters concerning the catastrophe. After the peace he retired into private life and settled in Algeria. August Niemann.

Win'amac, p.-v., Monroe tp., cap. of Pulaski co. Ind. P. 906.

Wi'nans (James J.), b. at Maysville, Ky., June 7, 1818; removed in infancy to Xenia, O.; received a common-school education; was admitted to the bar 1841; was clerk of the court of common pleas in Greene co. 1845–51; was elected to the State senate 1857, and to the assembly 1863; was chosen judge of common pleas 1864; re-elected for five years 1866, and was a Republican member of Congress 1869–71, serving on the committees on public lands and on Revolutionary pensions. D. at Xenia, O., Apr. 28, 1879.

Winans (William), D. D., b. in Pennsylvania Nov. 3, 1788; joined the Western conference in 1808; after two years volunteered to go to the Natchez country; in this pioneer work endured great hardships and performed prodigious services in Mississippi and Louisiana; rose to great eminence in his conference and in the connection; was alike powerful in the pulpit and on the conference floor. He took a prominent part in the organization of the Methodist Episcopal Church, South; was singularly methodical in his habits, plain in his attire, a close student and a correct writer; published a volume of discourses, which are perspicuous in style and forcible in argument, but severely plain. D. in Mississippi Aug. 31, 1857. T. O. Summers.

Wi'nant's Kill, v., North Greenbush tp., Rensselaer co., N. Y. P. 140.

Winch'ell (Alexander), LL.D., b. at North East, Dutchess co., N. Y., Dec. 31, 1824; graduated at the Wes-

leyan University, Middletown, Conn., 1847; was teacher of natural sciences at Amenia Seminary, N. Y., 1848–51, and at Mesopotamia Female Seminary, Ala., 1851–53; was president of the Masonic Female University at Selma, Ala., 1853; became professor of physics and civil engineering at the University of Michigan 1853, and of geology, zoology, and botany 1855; was president of the Michigan Teachers' Association 1859; State geologist of Michigan 1859–62; professor of geology in the Kentucky University 1866–69; director of the geological survey of Michigan 1869, and of that of Minnesota 1870; was chancellor of Syracuse University 1872–74, and is now (1876) professor of geology and zoology in that institution, and lecturer in Vanderbilt University, Nashville, Tenn. Author of *The First Biennial Report of the Geological Survey of Michigan* (1861), *The Grand Traverse Region* (1866), *Genealogy of the Family of Winchell in America* (1869), *Geological Map of Michigan* (1865), *Geological Chart of New York* (1870), *Sketches of Creation* (1870), *Geology of the Stars* (1872), *The Doctrine of Evolution* (1874), *Lay Theology* (1876), and of above 200 scientific memoirs, and has described 300 new species and genera, mostly fossil.

Winch'endon, p.-v. and tp., Worcester co., Mass., on Miller's River, and on Cheshire, Boston Barre and Gardner, Monadnock, and Ware River R. Rs., contains 7 churches, good schools, a library, an efficient fire department, the New England Home for orphan and destitute children, 1 Odd Fellows and 2 Masonic lodges, 1 veteran soldiers' society, 2 hotels, and several large manufactories of wooden ware. P. 3398. GEO. W. DAVIES, ED. "JOURNAL."

Win'chester, town of England, capital of Hampshire, on the Itchin, is the *Caer-Gwent* of the Britons and the *Venta Belgarum* of the Romans. After being taken in 495 by the Saxons, it received its present name, and was for several centuries the capital of England and the residence of its kings. But in the thirteenth century it lost its trade, and since that time it has gradually declined. Its cathedral, built in the eleventh century, is a vast but heavy structure, containing many interesting monuments. P. 14,705.

Winchester, tp., Litchfield co., Conn. P. 4096.

Winchester, p.-v. and tp., cap. of Scott co., Ill., on Rockford Rock Island and St. Louis R. R., 100 miles N. of the latter place, has 6 large churches, 3 banks, an excellent high school, 2 newspapers, 3 grain-elevators, 1 packing establishment, 1 saw and 2 flouring mills, and 1 plough and 1 furniture factory. P. 1661.
T. H. FLYNN, ED. "INDEPENDENT."

Winchester, p.-v., White River tp., cap. of Randolph co., Ind. P. 1456.

Winchester, p.-v., Jefferson co., Kan.

Winchester, p.-v., cap. of Clark co., Ky. P. 1616.

Winchester, p.-v. and tp., Middlesex co., Mass. P. 2645.

Winchester, p.-v., Wayne co., Miss. P. 14.

Winchester, p.-v. and tp., Cheshire co., N. H. P. 2097.

Winchester, v. and tp., Adams co., O. P. of v. 416; of tp. 1475.

Winchester, v., Knox tp., Columbiana co., O. P. 235.

Winchester, v., Madison tp., Franklin co., O. P. 633.

Winchester, p.-v., Madison tp., Guernsey co., O. P. 179.

Winchester, v., Bloomfield tp., Jackson co., O. P. 89.

Winchester, v., Gratis tp., Preble co., O. P. 430.

Winchester, p.-v., cap. of Franklin co., Tenn., on Winchester and Alabama R. R., near the foot of the Cumberland Mountains, is the site of the University of the South, and contains good schools, 1 newspaper, 2 carriage-factories, several flouring-mills, and 3 tanneries. It is a favorite resort for invalids. P. about 1800.
W. J. SLATTER, ED. "HOME JOURNAL."

Winchester, city and cap. of Frederick co., Va., on Winchester Potomac and Strasburg division of Baltimore and Ohio R. R., contains a court-house and jail, 15 churches of different denominations, 2 banks, 6 free public schools, 4 female seminaries, a male high school, 2 weekly newspapers, 2 iron foundries, 5 tanneries, and manufactories of soap, gloves, and agricultural implements. P. 4477. The place is the key to the valley of the Shenandoah, and during the civil war it was repeatedly occupied by the forces on either side, and in its vicinity were fought several battles. (See CEDAR CREEK.)

Winchester, p.-v. and tp., Winnebago co., Wis. P. 1139.

Winchester (ELHANAN), b. at Brookline, Mass., Sept. 30, 1751; began preaching to a Baptist church at Newton 1769; was pastor of a church at Rehoboth 1771, but excommunicated in consequence of his views on close communion; went to South Carolina 1774; preached to the negroes on the plantations on the Pedee River; became pastor of the First Baptist church at Philadelphia 1780, and, having adopted the doctrine of universal salvation, founded there a Universalist church 1781, after which he traversed several States to propagate his new doctrines, and preached in England 1787–94. D. at Hartford, Conn., Apr. 18, 1797. He was one of the precursors of the modern system of Universalism, his doctrines being very similar to those preached by his contemporary, Rev. Dr. Charles Chauncy. Author of numerous religious treatises, pamphlets, sermons, and addresses, and of several volumes of verse.

Winchester (JAMES), b. in Maryland in 1756; served in the war of the Revolution; settled in Tennessee; was appointed a brigadier-general Mar. 27, 1812; was defeated by the British and Indians on the river Raisin, Mich., Jan. 23, 1813, and resigned from the army Mar. 21, 1815. D. in Tennessee July 27, 1826.

Winchester (WILLIAM **Paulet** or **Poulet**), K. G., MARQUIS OF, b. in Hampshire, England, about 1475; dissipated large estates in youth; entered the personal service of Henry VII.; became comptroller and afterward (1536) treasurer of the household to Henry VIII.; was made Baron St. John Nov., 1537; received from Henry VIII. the order of the Garter; was appointed treasurer to Edward VI. 1549; made earl 1550 and marquis of Winchester Oct., 1551; presided at the trial of Somerset Dec., 1551, in the capacity of lord high treasurer, which post he managed to retain under Mary and Elizabeth, and, according to the testimony of Fuller, "trafficked so wisely and prospered so well that he got, spent, and left more than any subject since the Conquest," the secret of his prosperity being given by himself in the words, "No oak, but an osier." He built a magnificent mansion in Hampshire called Basing House, afterward celebrated for its siege by Cromwell; entertained Elizabeth there 1560, and d. there Mar. 10, 1572. He left 103 descendants. A volume entitled *The Lord Marques' Idleness, containing Manifold Matters of Acceptable Devise, as Sage Sentences, Prudent Precepts, Moral Examples, Sweet Similitudes, etc.*, was printed in 1586.

Winck'elmann (JOHANN JOACHIM), b. at Stendal, Prussian province of Brandenburg, Dec. 9, 1717, in humble circumstances; struggled hard with poverty and manifold other hinderances to reach into an atmosphere congenial to his mind; studied theology at Halle, medicine at Jena; lived for several years as tutor in a private family, and from 1743 to 1748 as co-rector at the school of Seehausen in Brandenburg, and came finally in 1748 to Dresden as librarian and secretary to Count Heinrich von Bünau. Here, under the influence of the picture-gallery, the intercourse with the painter Oeser, and other favorable circumstances, his enthusiasm for art awakened and his study of classical archæology began. Here he also published his first work, *Gedanken über die Nachahmung der griechischen Werke in Malerei und Bildhauerkunst* (1755). In this latter year he went to Rome, having joined the Roman Catholic Church, and received a pension of $200. In Rome he lived in intimate intercourse with Raphael Mengs, and his connection with the Cardinals Archinto, Passionei, and Albani afforded him unrivalled opportunities and materials for his archæological and artistic studies. Soon, also, the original and striking views which resulted from his researches attracted great attention, and in 1763 he was appointed prefect over the antiquities of Rome, and received also a position in the Vatican Library. He visited Florence, where he published *Description des Pierres gravées du feu Baron de Stosch* (1760); Naples, Herculaneum, and Pompeii, whence he sent to Dresden *Sendschreiben von den herculanischen Entdeckungen* (1762) and *Nachricht von den Neuesten herculanischen Entdeckungen* (1764); and from Rome he contributed many minor essays to various German periodicals, such as *Von der Grazie, Von der Fähigkeit der Empfindung des Schönen*, etc. In 1764 appeared his principal work, *Geschichte der Kunst des Alterthums*, and in 1767 his *Monumenti antichi inediti*. In 1768 he started on a visit to his native country, but hardly had he left Italian soil before he was overtaken by a peculiar uneasiness and restlessness, which at moments grew into a kind of mental disturbance. Arrived at Vienna, he determined to proceed no farther, but on his return to Rome he was murdered at Trieste, June 8, 1768, by a professional thief who attempted to steal some rare gold coins from him. A collected edition of his works was published in 8 vols. (Dresden, 1808–20). His *Life* was written by K. Justi (1866), and there exist various collections of his letters. By his works he founded the science of archæology and exercised a decisive influence on nearly all fields of literature and art. In his time the

Greek tragedy, the Greek temple, the Greek statue, etc., were acknowledged without dispute not only as the highest productions of art, but as the highest models of beauty. They were studied, they were imitated, but they were sorely misunderstood, and the lowest vagaries were often taken for legitimate developments of the classical art ideal. Winckelmann now undertook to analyze the actual works of Greek art and to point out the qualities which constitute their excellence; and the result was that Greek art once more arose unveiled before the eyes of mankind, while narrow prejudices, vicious instincts, and frivolous caprices fell back ashamed and hid themselves in darkness. Only a few years elapsed, and most beneficent effects became visible in literature and art, in moral and political ideas, in manners and dress, in the principles and in the trifles of life. CLEMENS PETERSEN.

Wind. See WINDS, by PROF. A. GUYOT, PH. D., LL.D.

Wind'age of a Missile. Formerly, it was customary for military surgeons to ascribe certain severe and even dangerous contusions without rupture of the surface to the "windage" of shot, the opinion prevailing that if a large missile at a high rate of speed passed near a person, he might be dangerously injured or killed outright by the rush of air. This opinion is now exploded, and it is known that shots striking at a very acute angle will produce the effects formerly ascribed to windage. In gunnery the space between the bore of the gun and the shot is called the windage.

Win'der (WILLIAM H.), b. in Somerset co., Md., Feb. 18, 1775; graduated at the University of Pennsylvania, and became a member of the Baltimore bar 1798. In Mar., 1812, he was appointed a lieutenant-colonel of the 14th Infantry, and colonel in July; commanded a successful expedition to the Canada shore from Black Rock Nov. 28, 1812; promoted to be brigadier-general Mar., 1813, he was taken prisoner at Stony Creek June 6. In May, 1814, he was appointed adjutant and inspector-general, and was in command of the 10th district when the British forces under Gen. Ross landed below Washington. He was placed in command of the militia summoned to defend the capital; he was defeated at the battle of Bladensburg, and was unable to prevent the occupation of Washington by the enemy. Returned to his profession in Maryland, in which he became distinguished, as well as the State senate, of which he was a member.—His son, JOHN H., b. in Maryland 1800; graduated at West Point in 1820; was brevetted major and lieutenant-colonel for gallantry in the Mexican war; resigned his commission of major of artillery Apr. 27, 1861, and joined the Confederate army, in which he became a brigadier-general; was the commandant of Libby Prison, Belle Isle, and Andersonville. D. at Branchville, S. C., Feb. 9, 1865.

Win'dermere, or **Winandermere,** the largest lake of England, 14 miles long and 1 mile broad, lies in Lancashire, and is celebrated for the rich beauty of its shores.

Win'desheim, in Holland, between Deventer and Zwolle, the seat of a monastery founded in 1386 by Florentius Radewini, a disciple of Gerard Groot, for Brethren of the Common Lot. It was the most famous of all their monasteries, and the seat of the general chapter of the order, which played an important part in preparing the way for the Protestant Reformation. R. D. HITCHCOCK.

Wind-Flower. See ANEMONE.

Wind'galls, in horses, are the same as synovial ganglia or "weeping sinews" in man. Tight bandaging, irritant ointments, and rest may apparently cure them, but they are liable to reappear.

Wind'ham, county of N. E. Connecticut, bordering on Massachusetts and Rhode Island, drained by Natchaug, Quinnebaug, Shetucket, and Willimantic rivers, and traversed by Norwich and Worcester, Hartford Providence and Fishkill, New London Northern, and New York and New England R. Rs.; surface broken; soil generally poor, but fertile along the streams. There are nearly 500 manufacturing establishments, including saw-mills, flour-mills, cotton-mills, woollen-mills, carriages, boots and shoes, clothing, bricks, iron castings, machinery, sewing silk, glassware, paper, and shoddy. Cattle and sheep are the chief live-stock. Staples, manufactured articles, hay, dairy and garden products, potatoes, Indian corn, oats, and wool. Cap. Brooklyn. Area, 620 sq. m. P. 38,518.

Windham, county of S. E. Vermont, bordering on Massachusetts, separated from New Hampshire by Connecticut River, and traversed by Vermont Central and Connecticut River R. Rs.; surface hilly, soil generally fertile. There are nearly 300 manufacturing establishments, including saw-mills, woollen-mills, flour-mills, tanneries, machinery, furniture, carriages, hardware, paper, and organs. Cattle and sheep are the chief live-stock. Staples, manufactured articles, hay, maple sugar, potatoes, Indian corn, oats, wool, and dairy products. Cap. Fayetteville. Area, 780 sq. m. P. 26,036.

Windham, p.-v. and tp., Windham co., Conn. P. 5412.

Windham, tp., Cumberland co., Me. P. 2128.

Windham, p.-v. and tp., Rockingham co., N. H. P. 753.

Windham, p.-v. and tp., Greene co., N. Y., 25 miles W. of Catskill, contains good schools, 1 newspaper, 2 hotels, a cabinet-warehouse, and several mills. It is a favorite resort for summer tourists. Principal business, farming and dairying. P. 1485.

COLE & HITCHCOCK, "WINDHAM JOURNAL."

Windham, p.-v. and tp., Portage co., O. P. 865.

Windham, p.-v. and tp., Bradford co., Pa. P. 1188.

Windham, tp., Wyoming co., Pa. P. 660.

Windham, p.-v. and tp., Windham co., Vt. P. 544.

Windham (SIR CHARLES ASHE), b. in Norfolk, England, in 1810; entered the British army 1826; served in Canada during the "patriot war" 1837–39; became colonel June 20, 1854; was assistant quartermaster-general in the Crimean war; distinguished himself at Inkermann Nov. 5, 1854; led the attack on the Redan Sept. 8, 1855, for which he was promoted to major-general; was made chief of staff of the Eastern army Nov., 1855; was chosen a member of Parliament for East Norfolk Mar., 1857; bore a distinguished part in the Sepoy war, especially by his defence of Cawnpore 1857; was made lieutenant-general 1863, and knighted 1865. D. in London Feb. 7, 1870.

Windham (JOSEPH), b. at Twickenham, England, in 1739; educated at Eton and at Christ's College, Cambridge; visited Rome, and made drawings of the principal monuments of antiquity; assisted Stuart in his *Athens;* wrote most of the letter-press for Cameron's *Baths of the Romans,* and for vol. ii. of the *Ionian Antiquities,* published by the Dilettanti Society, and contributed to various antiquarian publications, especially to the *Archæologia,* for which he wrote an important memoir on the temple of Diana at Ephesus. D. at Earsham House, Norfolk, Sept. 21, 1810.

Windham (WILLIAM), D. C. L., b. in London, England, May 3, 1750; educated at Eton, at Glasgow University, and at University College, Oxford; travelled on the Continent; became a member of Dr. Johnson's Literary Club and a friend of Burke and Fox, with whom he co-operated in denouncing the American war; entered Parliament for Norwich 1781; distinguished himself as an orator; was principal secretary to Lord Northington, lord lieutenant of Ireland, 1783; was one of the managers of the impeachment of Warren Hastings 1787; was a strenuous opponent of the French revolution and advocate of war with France; was secretary at war in Pitt's cabinet 1794–1801; bitterly opposed the Peace of Amiens 1802; was again secretary at war, and also for the colonies, in the Grenville administration 1806–07; after which, declining a peerage, he remained in opposition and denounced the Copenhagen and Walcheren expeditions. D. in London June 3, 1810. He had a great reputation for oratory, and was conspicuous for brilliant conversational powers, though his love for paradox fastened upon him the nickname of "the Weathercock." His *Diary* from 1784 to 1810 was published by Mrs. Henry Baring in 1866, and a *Life* by Thomas Amyot was prefixed to an edition of his *Speeches in Parliament* (3 vols., 1812). His *Select Speeches* (Philadelphia, 1837) were edited in the U. S. by Robert Walsh, who wrote a biographical sketch.

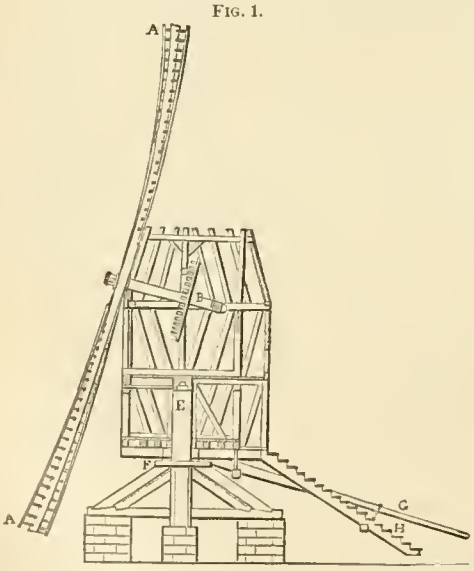
Wind'lass, a form of the wheel and axle, in which the axle is horizontal, while in the capstan it is usually vertical. The axle is made to revolve either by means of handspikes or a winch. The mathematical principles involved are precisely those of the wheel and axle.

Wind'mill, a mechanical prime-mover, in which the motive-power is derived from the currents of the atmosphere. In its ordinary form the windmill presents the appearance of a turret with a conical or hemispherical dome, from which projects a nearly horizontal shaft, carrying at its extremity four or more radiating arms at right angles to it, which support sails designed to receive the force of the wind. The windmill was probably the earliest form of mechanism used by man for making a force of nature subservient to the uses of industry. The original type was very simple in construction; and, though modern ingenuity has devised a variety of more efficient forms, this type, substantially unaltered, continues still to be most frequently met with in countries where this motor is in general use. The radiating arms of this early type of windmill are four in number, and the sails are formed of canvas. The canvas is stretched and supported by a kind of latticework constructed as follows: the arms, called the whips,

which are 30 or 40 feet long and 8 or 10 inches in diameter, are perforated through their axes at intervals of about 15 inches throughout their length, beginning at about 6 feet from the centre of motion, the perforations being at right angles to the axes, but inclined to the plane of rotation, the inclination being from 18° to 30° nearest the centre, and diminishing down to between 6° and 12°, or less, at the outer extremities. Through these perforations are passed stiff rods, which extend some 3 feet on each side the whip, but which are often made of gradually-increasing lengths from the centre outward. The ends of these rods on each side are connected and secured by longitudinal pieces, which make of the whole a sort of frame or lattice on which the canvas of the sail is to be extended. The sail is therefore not plane, but is what is called in mathematics a warped surface. This form is that which, supposing the sail to offer no resistance to rotation, whether of inertia or friction, would be necessary in order that it might nowhere obstruct the progress of the wind; and this form is therefore best for utilizing the force of the wind. In some windmills the lattice-work is wholly on one side of the whip. The central shaft, or axis, carrying sails of this magnitude, requires to be thick. In French and Dutch windmills it is 20 or more inches in diameter. It is inclined about 10° to the horizontal, experience having shown this to be a position more favorable than the truly horizontal. The plane of rotation of the sails is therefore equally inclined to the vertical. The shaft turns in a socket in the side of the dome, and is pivoted at its extremity in a strong bearing connected in the interior with the frame. If, as is usually the case, the mill is to be used for grinding or for driving any rotatory machinery, a face-geared or bevel-geared wheel upon the shaft connects with a pinion on a vertical spindle, to which it thus transmits the motion; but if it is to be employed for pumping, an eccentric or crank takes the place of the geared wheel; and in this case it is preferable that the shaft be truly horizontal.

As the direction of the wind is variable, and as the efficiency of the machine depends on the presentation of the plane of rotation of the sails at right angles to it, the dome or the entire turret must be capable of being turned about a central pivot. In general, the dome only turns, and is provided with rollers or wheels which run on circular ways; but in the ruder constructions it turns by sliding, and requires considerable force to move it. Fig. 1 shows one of the forms not infrequent in France, in which the whole

Fig. 1.



structure is pivoted on a stout mast or upright, about which it is turned by means of the lever G. The face-gear wheel is here shown, but not the grinding machinery. The lever G affords a partial support to the flight of steps H, which must not touch the ground, as it revolves with the mill. With heavy constructions of this kind it is necessary to employ a portable windlass or capstan to turn the mill. To assist in the operation, a set of posts are fixed in the ground in a circle around the mill, to which the windlass may be attached, while a rope extended from it is fastened to the lever G. It is more usual, however, to make only the dome rotary; and then this may be turned by means similar to those employed in giving rotation to the domes of astronomical observatories. A large wind-vane on the side of the tower opposite the sails is sometimes employed to make the mill adjust itself automatically; but this is not effectual except with light structures. Another contrivance of a good deal of ingenuity, designed for the same purpose by Sir William Cubitt, consists in a pair of small lateral windmills or flyers on a common axis placed at the extremity of a framework projecting out behind the dome, with their planes of rotation perpendicular to that of the sails. These, when the mill is in true adjustment, present their edges to the wind and remain at rest; but if the wind changes it strikes them on one side or the other, and sets them into rotation; and as their axis is connected by gearing with a mechanism for revolving the dome, this movement presently brings about again a true adjustment. A different and simpler mode still of effecting this adjustment was devised in 1830 by Mr. Amédée Durand of France, which consists in making the structure which sustains the horizontal shaft a completely open frame, through which the wind may freely blow, and causing the wind to take the sails from the rear, and not from the front, by which means it becomes necessarily self-adjusting. This plan serves very well in windmills used for pumping, but with grinding mills it necessitates the raising of the motor entirely above the building containing the machinery—a construction endangering its security in case of storms. In order to stop the mill, a friction-brake is used which embraces the gear-wheel on the shaft.

The extent of surface which the sails can advantageously spread to the wind does not exceed, according to Smeaton, seven-eighths of the area of the circle described by the sails in their revolution. The same authority says that the velocity of revolution, when the sails are revolving disconnected from the machinery, is to that with which they move when doing the maximum of work, in the ratio of 3 to 2; and that the useful effect varies with the square of the wind's velocity, and in sails of similar form is proportional to the cube of the length of the whip. Windmills for grinding will not work if the velocity of the wind is below 4 mètres, or about 13 feet, per second, and will not work advantageously if it is above 8 mètres, or 27 feet. Experience has consequently shown that such mills do not perform during the year more than about one-third as much useful work as they would if continually operating with the wind at mean velocity. At this velocity a mill with 12-mètre or 40-foot sails exerts an effective energy of 65,000 foot-pounds per minute, which is about equivalent to 2 horse-power.

In order to make the mill available under larger variations of wind, contrivances have been devised for varying the inclination of the sails in accordance with such changes. In a mill of six sails, introduced into France by M. Mahoudou of St. Épain, the sails, which are on one side only of the whip, are held in position by an elastic arm at the extremity of the whip, stiff enough to resist the ordinary pressure of the wind, but yielding under a greater, so as to reduce the amount of surface exposed. Another contrivance, employed by M. Formis of Montpellier in a mill of eight sails, is to hinge the sail to the whip, and from the extreme free angle of each sail to carry a cord to the top of the next following whip, whence, after passing over a pulley, it is continued down the whip to the shaft or axis of rotation, and through that shaft (which is hollow) lengthwise to the opposite extremity, where the whole system of cords is united, and, by means of a suitable joint and lever, is connected with a weight, which acts as a governor. The windmill of Thirion of Belgium, in which the sails are from twelve to twenty in number, and comparatively narrow, has a kind of circular framework to sustain them, the outer circumference being at half-sail length from the centre. At this point, and also at the inner extremity, each sail is hinged, while each is also attached at middle by its opposite edge to a second circumference or rigid ring, which is movable, and in its movement changes the inclination of all the sails. It may be set in the beginning at any inclination, which afterward cannot be diminished during the action of the machine; but in case the wind becomes violent, the inclination will be increased by the effect of a centrifugal-force governor acting on the movable circle.

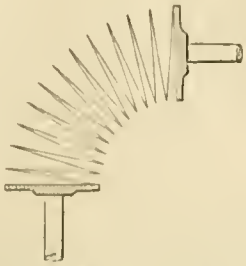
For pumping windmills, an ingenious contrivance has been devised by M. Amédée Durand, which makes the machine available not only at high velocities of the wind, but also at those low velocities where grinding mills will not operate. This is to make the course of the pump-piston, or the length of stroke, variable with the variations of the force of the wind. In order to accomplish this, the pump-piston is worked through a lever, one end of which, being moved by an eccentric on the main shaft, has a constant range, while, by making the fulcrum movable, the course of the other end, and therefore of the piston, is made variable. A centrifugal-force governor is employed to change the position of the fulcrum as the velocity of rotation varies. The work done being thus proportioned to the force of the

wind, the mill will operate under all atmospheric conditions when it is safe to spread the sails at all.

Thirion's windmill, above mentioned, has a noticeable peculiarity in the manner of transmitting rotatory motion between shafts whose axes are not parallel. A flat spiral

Fig. 2.

Fig. 3.



of steel is attached by its extremities to the ends of the two shafts, as shown in Figs. 2 and 3. The diameter of the spiral, in order to secure strength, is made considerably larger than that of the shaft, and the attachment to the shaft is made by means of a cast-iron cap, having on one side a socket for the shaft, and on the other a flat surface to receive the spiral. The diameter and breadth of the spiral will vary with the power of the mill or the maximum spread of sail, but the thickness cannot be indefinitely increased, since the cross strain upon the metal would be too great. The thickness commonly used is about a quarter of an inch; the diameter, for mills of moderate power, one foot; and the breadth about an inch and a half. These joints operate very well, and are very durable.

The disadvantage attendant on a change of direction of the axis of rotation, by whatever means the transmission of movement is effected, has led to the use, in some cases, of horizontal windmills, in which the sails are placed at the extremities of arms radiating horizontally from a vertical shaft. By employing a cylindrical frame so as to secure the sails at both extremities, any vertical dimensions may be given them that may be desired; but if the sails are plane and immovable, and coincide in direction with the radii, the machine will not rotate unless one-half of it is screened from the wind. If the sails are hemispherical cups or cones, with the concavities set in a common direction along the circumference, the effective pressure of the wind will be more than twice as great on the concave as on the convex sides, and rotation will take place. But this form of sail is not of simple construction, and is not used for windmills, though we see it in anemometers. There were formerly in New York City two or three horizontal windmills, in which the sails were plane panels of wood hinged to a light cylindrical frame by a vertical edge, and free to swing through an arc of 180°. In passing the point of the revolution opposite the direction of the wind, the sail swung outward, and presented its edge to the wind during the succeeding half revolution; in consequence of which it was made gradually to swing inward, so that in passing the point toward the wind it was pressed against the radii of the frame and held in proper position to be effective. A more recent form of horizontal

Fig. 4.

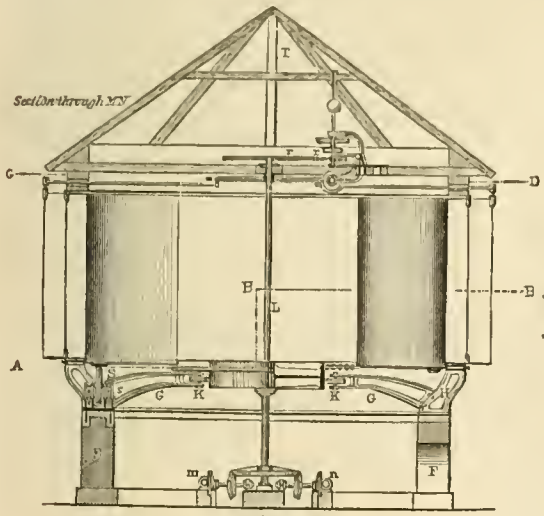
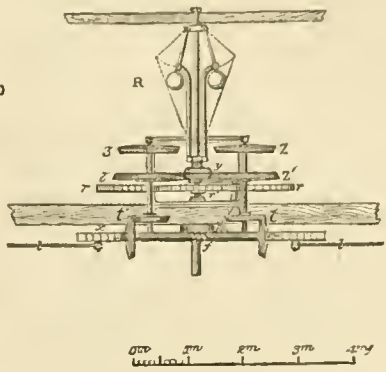


Fig. 6.



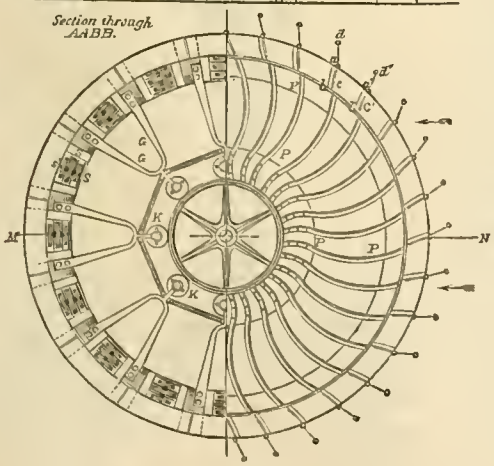


Fig. 5.

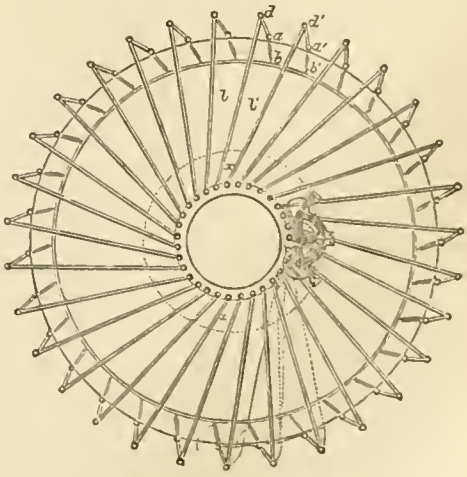


Fig. 7.

windmill with plane sails was patented in 1861 by Mr. A. Giraudat of New York, in which the sails, after being effective for a half revolution, are brought to a horizontal position during the other half. These sails are hinged by a horizontal edge. Sir David Brewster computes that, for equal numbers of sails, the power of a horizontal windmill is only about one-third or one-fourth that of a vertical mill.

The best form of horizontal windmill, however, is one in which the sails are numerous and fixed at a certain inclina-

tion to the radii, the whole rotating frame being then enclosed within a similar fixed structure, which the wind enters through openings between boards set at an obliquity contrary to that of the sails or floats. With this construction the mill is effective from whatever direction the wind may blow. The best form of windmill of this construction is that of Moerath of Vienna, Austria, which, from the peculiar form of its sails, may be called an aërial turbine. This is shown in Figs. 4, 5, 6, and 7, Fig. 4 being an elevation representing the interior of a circular structure designed to enclose the frame or wheel carrying the sails. The rotation takes place about the central axis L. The form of the sails is exhibited in Fig. 5, which also shows, in plan, a series of fixed directrices, *ab*, *a'b'*, by which the currents of the air, coming in the direction indicated by the arrows, are deflected upon the sails. These sails are of canvas, for the sake of lightness, but their form is determined by the iron arms or frames to which they are attached. These frames are secured at top and bottom to two circular plates which are fixed to the axis. Beneath the whole there is also attached to the axis a pulley which, by means of guide-rollers, represented at K (Figs. 4 and 5), maintains it in position. The weight is sustained and the level more truly preserved by means of the rollers S, Fig. 4, themselves resting by their axes upon the smaller friction-rollers *s s'*. The guiding wheels K are sustained by brackets from the frame, shown at G in both figures. The power is applied through conical gearing, as shown at *m* or *n*, or in any other way.

The structure on which the motor rests may be of wood, brick, or stone; but the chamber in which the wheel is placed is designed to be constructed of iron, except the roof. Its base H (Fig. 4) forms a cast-iron crown, to which are bolted the brackets G, and from which rise vertically, at regular intervals, a series of rolled iron plates, which form the directrices for the wind, and also the support for the superstructure. It will be seen, by comparing the positions of the directrices in the plan with the directions of the arrows, that on the side on which the wind and wheel move in harmony, the wind can enter until its direction becomes tangential to the structure; while on the other side it is cut off from entering at all by the overlapping of the borders of the directrices, up to the point where it becomes capable of such a deflection as to favor rotation. A very ingenious provision is made for guarding against excessive velocity of movement in the case of high winds. To every one of the directrices there is attached, on the outside, a shutter wide enough to close entirely one of the openings, but pivoted by the middle points of its extremities, so that instead of closing one opening entirely, it closes the adjacent halves of the two between which it is placed. Thus, when all the shutters are closed, they meet each other halfway, like the blinds of windows. In the plan, Fig. 5, these shutters are seen at *cd*, *c'd'*. In calm or in light winds they stand in the positions in which the figure represents them. But when the velocity of movement begins to rise above what is designed to be the limit, they are closed to a greater or less extent by the effect of a self-acting apparatus represented in Fig. 4, and on an enlarged scale in Fig. 6, and through a system of connecting-rods shown in Fig. 7. The main axis of rotation L carries a gear-wheel *r*, which acts on the governor, Fig. 6, through the smaller wheel *r'*, secured to the vertical axis of the governor. By the divergence of the arms of the governor the doubly-conical friction-wheel *y* is raised, and is brought at length to the point where its upper conical surface is in contact with the conical wheels Z and *z*. The wheel Z is fixed to its shaft and operates the conical gear-wheels *t*. The wheel *z* is idle, its use being merely to equilibrate the pressure. The vertical conical wheel *t* turns the tangent screw *f*, which rests on the perimeter of a large wheel, seen dotted in the plan of this part of the machine, Fig. 7. To this wheel *x* are attached a number of rods *l*, equal to the number of shutters; and these rods, by their opposite extremities, are fastened by hinge-joints to the outer extremities of the shutters, severally. An examination of the plan will show that if the wheel *x* be turned from right to left, the shutters will be drawn inward, and if the movement be sufficiently continued, they will be closed entirely. The action of the wheel Z upon the wheel *x* through the tangent screw turns it from right to left, and thus by the automatic action of the machine itself the shutters are partially closed and the impelling force diminished. The velocity diminishing, the friction-wheel *y* will descend, and Z will cease to act. If, in consequence of the reduction of the driving force, the retardation is in excess, the friction-wheel *y* will descend until it comes into contact with Z' and *z'*, of which the first is now idle, and the second turns the bevel-wheel *t'*, reversing the motion of the gear-wheel *x*, and to a greater or less extent reopening the air-passages. There may thus take place a succession of oscillations of the bevel-wheel *y*, diminishing in extent if the breeze remains steady, until a permanent adjustment is attained. But if the wind varies, whether by an increase or a diminution of its mean velocity, the bevel-wheel *y* will act anew and effect a new adjustment corresponding to the changed velocity. It is not to be understood that the wheel *x* will be acted upon in response to every momentary lull or gust, since the bevel-wheel *y* has a sufficient freedom of movement between Z and Z' to accommodate itself to these, so long as the average strength of the wind remains unchanged. But if there is a permanent increase or diminution of the wind-force, the necessary correction will be made with infallible certainty.

The governor can be thrown out of gear with the machine; and if it is desired to leave the mill at rest, the wheel *x*, after detaching the governor, may be turned by hand so as to close the shutters entirely. It is an important recommendation in favor of this form of windmill that it is not liable to damage by the most violent storms.

There are large portions of our country in which windmills are almost unknown. There are other portions, as in California, where they are extensively used, and where objects of this class frequently strike the attention of the traveller. They would be undoubtedly much more generally introduced if, in their ordinary forms, they were less rude and more efficient. They adapt themselves admirably to the circumstances of sparse settlements, in prairie districts and low alluvial regions, where streams are few and sluggish, where fuel is costly, and where the population, chiefly engaged in the cultivation of the soil and living in comparative isolation from each other, find the conversion of their grains into flour and meal for domestic uses a serious tax upon both their time and their means. To such, a mill like that just described would be very useful for the elevation of water, for drainage, for grinding, and for many of the other exigencies of rural life. F. A. P. BARNARD.

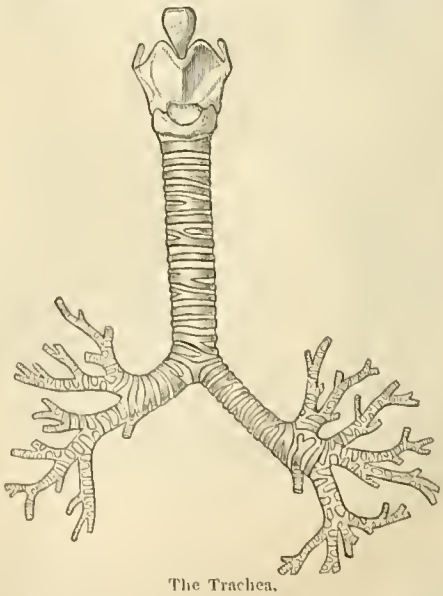
Win'dom, p.-v., Cottonwood co., Minn., on Sioux City and St. Paul R. R., 150 miles from St. Paul, has 3 churches, a handsome park, 1 newspaper, fine water-power, large graded-school building, and 1 butter-packing establishment. It is the centre of a large dairying and farming community. P. 500. E. C. HUNTINGTON, ED. "REPORTER."

Windom, tp., Mower co., Minn. P. 404.

Windom (WILLIAM), b. in Belmont co., O., May 10, 1827; studied law, and entered upon the practice of his profession in Ohio; removed to Minnesota in 1855; member of Congress 1858–68; appointed U. S. Senator July, 1870, to fill a vacancy, and elected Senator for the full term 1871–77; re-elected in 1876 for term expiring in 1883.

Win'dow-pane, a name given on certain parts of the North American coast to the *Lophopsetta maculata*, which is most nearly related, among American fishes, to the turbot of Europe. This is so called on account of its thin, transparent body. THEODORE GILL.

Wind'pipe, or **Air-Passage,** the popular name of the *trachea*, so called from its roughness [Gr. τραχύς,



The Trachea.

"rough"], a cylindrical tube of cartilage and membrane, 4½ inches long and from ⅞ to 1 inch in diameter, extending

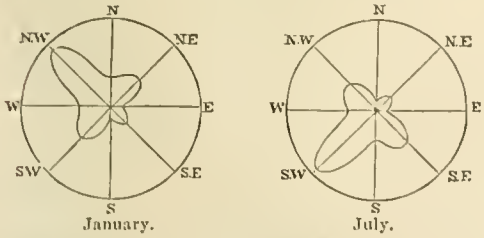
from the larynx (see LARYNX) downward to the origin of the two primary bronchial tubes. These branch off from the trachea opposite to the third dorsal vertebra, one going to each lung. The ancients termed the trachea *aspera arteria*, the great artery or channel by which the vital air was inspired; air was supposed to fill the arteries and veins, the nutritive agency of the blood being unknown and its circulation undiscovered. The trachea is an open tube, its collapse being prevented by its cartilaginous circular bodies or rings. These are incomplete, the posterior wall of the trachea being membranous, flaccid, and flat. This soft surface rests against the œsophagus, the food passage, and facilitates the ingestion of food. The trachea is often the seat of catarrh and acute inflammation, during the progress of colds, influenza, and the incipient stages of bronchitis, from the mucous membrane of the nose and throat to the lungs. The trachea is occasionally the seat of croupous membrane (see CROUP and TRACHEOTOMY), of foreign bodies, polypus, cancer.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Winds, or **Vinds.** See SLOVENTZI.

Winds. *Wind* is air in motion. The word is usually applied to currents of air more or less horizontal, though vertical or slanting currents of air, whether ascending or descending, equally deserve the name. Winds are named from the quarter of the horizon from which they come. Thus a wind blowing from E. to W. is an E. wind; one moving from N. to S. is a N. wind. The direction of the surface-winds can easily be taken from a wind-vane so located as to be free from all surrounding obstacles. For the direction of the winds in the upper part of the atmosphere, which is often very different from that of the surface-winds, we have to look to the course of the clouds. The winds from the four cardinal points, north, east, south, and west, and those from the intermediate directions, designated as north east, south-east, south-west, and north-west, are the eight principal winds usually noted in meteorological journals, and are indicated simply by their initials. Further intermediate directions give eight more winds—viz. north-north-west and north-north-east on either side of north; south-south-west and south-south-east on either side of south; west-north-west and west-south-west on either side of west; and east-north-east and east-south-east on either side of east. For the use of mariners the divisions are carried to thirty-two winds. (See COMPASS.) When greater accuracy is needed, however, it is more convenient to use the division of the circle of the azimuth compass, and, starting from one of the cardinal points, note how many degrees from it, on either side, the radius passes which indicates the direction of the wind; as, for instance, north 25° east, south 15° east, and so on. A diagram constructed like the mariner's compass, bearing the name of the winds, is called the wind-rose. By giving to the radius representing each wind a length proportional to the length of time and the velocity with which it has blown at a given place during a stated period, such as a year or a month, a wind-rose may be traced which will present at a glance the peculiar condition of this important element of climate at that place. In the two following diagrams, for instance, which represent in this way the average duration of winds in January and July in Maryland, the eye seizes at once

FIG. 1.



January. July.

the great prevalence of the north-westerly winds in winter and of the south-westerly in summer which is characteristic of the climate of the Atlantic coast. Prof. Dove of Berlin has used a similar method for showing graphically the average condition of the barometric pressure, thermometer, and hygrometer which accompanies the different winds, and calls such diagrams the barometric, thermic, and atmic (hygrometric) wind-roses of the places considered.

The velocity and force of winds vary from an almost inappreciable breath of air to the furious hurricane which sweeps everything before it. It is measured by means of the anemometer ("wind-measure"), an instrument of which various kinds have been invented. (See ANEMOMETER.) Some give the pressure exerted by the wind upon a spring, like those of Osler and Jelinceck, or on a liquid contained in a glass tube having the shape of a siphon, like that of Lind; others derive the velocity from the number of revolutions of a self-registering rod set in motion either by a vertical wheel composed of oblique plates, like that of a windmill, as in the anemometers of Wolfe and Whewell, or by four hemispherical cups placed horizontally, catching the wind, as in that of Robinson. The last form has been adopted by the Smithsonian Institution and the U. S. Signal Service. In all these instruments the velocity has to be computed by formulas based on previous experiments. It is on such trials that the various scales proposed to express the force and velocity of winds are founded. The scale adopted by the Smithsonian Institution, which is almost identical with that used by the U. S. Signal Service, distinguishes 10 grades, the names of which, with the corresponding pressures and velocities, are as follows:

Grade.	Velocity in English miles and per hour.	Pressure in pounds avoirdupois on each square foot.	Name.
0	0	0.00	Calm.
1	2	0.02	Very light breeze.
2	4	0.08	Gentle breeze.
3	12	0.75	Fresh wind.
4	25	3.00	Strong wind.
5	35	6	High wind.
6	45	10	Gale.
7	60	18	Strong gale.
8	75	.....	Violent gale.
9	90	.....	Hurricane.
10	100	.....	Most violent hurricane.

Winds may be grouped in three classes—namely, *constant, periodical,* and *variable winds;* the first two are mainly tropical, the other characterizes the temperate and cold latitudes. To understand the cause of these differences and the general circulation of the winds we must inquire into their cause.

Winds are the consequence of a disturbance of equilibrium in the layers of the atmosphere, and the tendency of their motion is to restore the equilibrium which has been destroyed; as soon as that is accomplished the movement ceases and everything settles into a calm. One of the chief conditions of this equilibrium of the atmosphere is, that any level layer should have the same density at all points; otherwise the denser portions flow under the less dense, while the lighter rise to the top. Now this occurs when the different parts of the layer are unequally heated. At the point of greater warmth the air expands, becomes lighter; then, pressed by the neighboring layers, which have remained colder and heavier, it rises into the higher layers, until it reaches a stratum of equal density with itself. The result of this process is an ascending current, and lateral currents rushing from all sides toward the spot where the temperature is higher. This is well exemplified in a heated stove. The warm and light air ascending in the pipe is replaced by a steady horizontal current of cold air rushing in from the surrounding atmosphere.

Differences in the moisture of the air will have a similar effect, for moist air is lighter than dry air of the same temperature, and will cause an ascending current, or increase the ascending power of one already in progress. Moreover, when the moisture is condensed into rain, its latent heat, becoming free, adds to the buoyancy of the air.

Land and Sea Breezes.—As an example from nature, let us see what takes place on an island alone in the midst of the ocean, remembering that the land is heated more readily than the sea. In proportion as the sun rises above the horizon, the island becomes warmer than the neighboring sea. Their respective atmospheres participate in these unequal temperatures; the fresh air of the sea rushes from all directions in the form of a *sea breeze,* which makes itself felt along the whole coast, and the warmer and lighter air of the island will ascend into the atmosphere. During the night it is the reverse. The island loses heat by radiation, and cools quicker than the sea. Its atmosphere, having become heavier, flows into that of the sea in the form of a *land breeze;* and this interchange lasts until the temperature, and consequently the density, of the two atmospheres have again become the same. This is the phenomenon observed almost daily on nearly all the seaboards.

The same again takes place on a great scale between an entire continent and the ocean, between the tropical regions and the temperate and polar regions. Southern Africa is fiercely heated by the rays of a summer sun, while the seas of India and Asia experience the low temperature of the winter. The temperature of the tropics is almost always the same, and constantly higher than that of the rest of the globe. To each of these differences of temperature, unequal in duration and amount, particular atmospheric currents, which are their consequence, correspond—to the difference of temperature between day and night, the diurnal breezes, whether along the coasts or in the interior of the continent at the foot of the mountains; to the difference of temperature between the extreme seasons, the monsoons,

which one might call the season breezes; to the difference of temperature between the tropics and the poles, the trade-winds, which are the great annual breeze, and the constancy of which is only the expression of the permanent inequality of the distribution of solar heat between the great atmospherical regions of our globe.

The general (or trade) winds are the consequence of the general form of the globe, and their direction is given by its rotatory motion. The monsoons and the breezes depend on the form and the relative situation of the lands and the seas, which govern their intensity and direction. The variable winds are due to the same causes, and to the conflict between the general opposite currents.

General Circulation of the Winds.—The regions near the equator having a higher temperature, and the heat gradually diminishing as we advance toward the poles, the atmosphere of the tropical zone is more dilated and constantly lighter than that of the temperate and polar regions. As a consequence, the denser air of the colder regions presses that of the hot on two sides, the N. and the S.; the warmer portion of the tropical atmosphere, the equatorial, rises, and two lower currents are established from the poles to the equator, and two upper currents, which carry back the air from the equator toward the poles, to commence again the same rotation.

We ought, then, to find in the northern hemisphere a general wind coming from the N., and in the southern hemisphere a wind coming from the S. But the rotation of the earth from W. to E. exercises an influence upon the direction of these currents, which causes them to deviate from their original direction. The speed of rotation, which is almost nothing in the neighborhood of the poles, gradually increases with every parallel to the equator, where it is over 1000 miles an hour. The masses of air which rush toward the equator have an acquired speed less than that of the regions toward which they go. At each step they are obliged to assume a greater rapidity of rotation; but as, in virtue of the law of inertia, a certain time is necessary for this to take place, they find themselves at every step a little behindhand, or a little farther toward the W. than would otherwise be the case. These successive retardations accumulating, gradually deflect the polar currents toward the W., changing them into a N. E. wind in the northern hemisphere, and a S. E. wind in the southern hemisphere. These two polar currents, entering the tropical zone, become those permanent winds blowing nearly from the E. which are called *trade-winds.* Approaching the equatorial zone, these masses of air, strongly heated by the rays of a vertical sun, ascend, forming there a broad *zone of calms*, and return, as upper currents, toward the poles to supply the constant outflow from the polar regions.

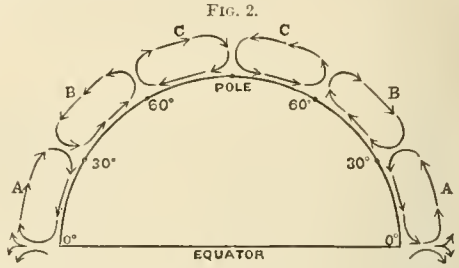
The same cause makes the upper currents, which set from the equator toward the poles, swerve, but in the opposite way. They arrive successively in the higher latitudes, with a velocity of rotation greater than that of the parallel which they enter, and are always a little in advance of the earth's motion in each place—that is, always more and more to the E. Thus, the returning equatorial currents, when descending to the surface of the earth, become the S. W. winds, so prevailing in the northern hemisphere, and the N. W. winds in the southern hemisphere.

The diagram of the normal circulation of the winds at the bottom of Map VII. shows the great wind-zones. The arrows point in the direction toward which the wind blows. We see—1st, the equatorial zone of calms, or the region of the ascending atmosphere; 2d, on both sides the zones of constant winds, or of the N. E. and S. E. trade-winds; 3d, two small zones of calms about the tropics of Cancer and Capricorn, which separate the zones of the constant from those of the variable winds; 4th, the broad zones of the variable winds in the middle latitudes, from the 30th degree to the 60th degree, with prevailing westerly winds; 5th, the zones of polar winds, with prevailing northeasterly winds. (See accompanying map.)

This circulation, arising from constant differences of density and pressure in different parts of the atmosphere, has its counterpart in permanent differences in the average height of the barometer at the level of the sea in various latitudes. In the equatorial regions the overflowing of the air from the ascending current toward the poles causes a diminution of its mass, and consequently a low barometer; while its descent about lat. 30° and the encounter of the extra-tropical air produce in that latitude an accumulation and a belt of high barometer. The constant flow of the cold air from the polar regions is manifested by a greater barometric depression within the Arctic circle. Accordingly, in the equatorial belt the mean pressure is only 29.9 inches; it rises to 30.1 and over about lat. 30°; decreases gradually to lat. 60° and 65°, where it hardly reaches 29.9; and is lowest in the polar regions, where it falls to 29.6. Whether there is a continuous belt of low barometer about lat. 60° to 65°, beyond which the barometer rises again toward the poles, as has been assumed from the record of a few cases, still remains a matter of doubt, the observations being too few, especially on the continents, to decide this question.

Our most distinguished physicist, Prof. J. Henry, accounts for the phenomena which characterize the three main zones of winds in a somewhat different manner. He assumes three distinct systems of circulation, each complete in itself, as shown in the following diagram: A, the tropical, with upper winds flowing toward the poles, descending at lat. 30°, and reappearing as surface-winds in the easterly trades; B, that of the temperate latitudes, from 30° to 60°, with prevailing south-westerly surface-winds,

Fig. 2.

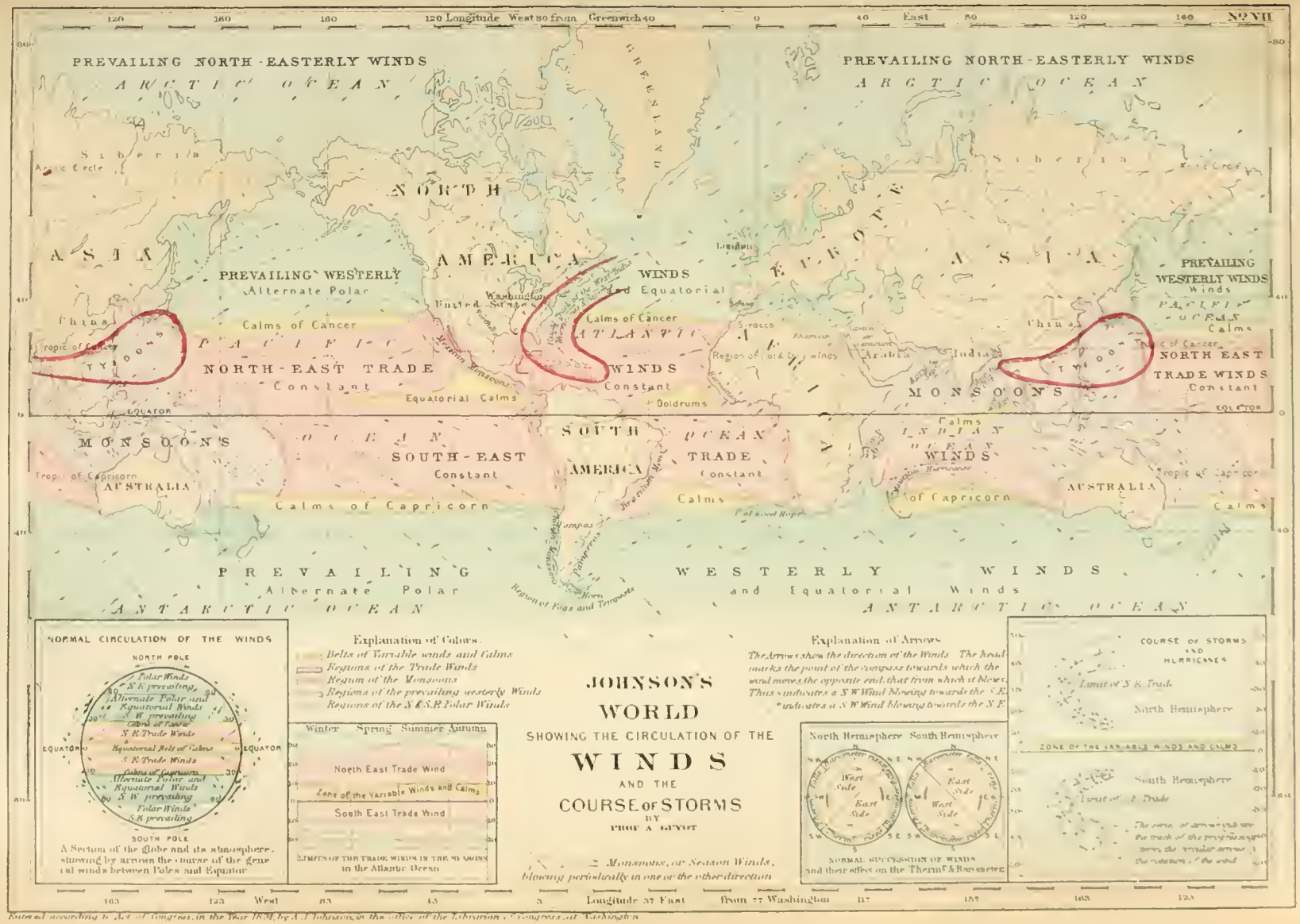


fed by a portion of the returning equatorial air, rising again about lat. 60°, and returning thence as upper currents to the regions whence they came: C, the polar, with north-easterly surface-winds, rising at the contact with the preceding system, at about lat. 60°, and returning thence toward the pole. The belts of low barometer, at the equator and lat. 60°, indicate the regions of the ascending currents; that of the high barometer, in lat. 30°, marks the place of the descending ones. This view is in accordance with the theoretical deductions of Ferrel concerning the course of atmospheric currents moving on a sphere, and explains many important phenomena. More numerous and extensive observations, especially on the upper currents of the atmosphere, and the measure of influence which can be attributed to moisture in these movements, may clear up the difficulties which are still in the way of a complete adoption of this very plausible theory.

The general circulation of the atmosphere would doubtless show great regularity if the surface of the globe were a uniform sheet of water; but the presence of the continents and their arrangement modify the normal winds in many ways, as we shall see in examining more closely the systems of winds peculiar to each of the great climatic zones. In all cases, however, the law of the winds, as expressed by Buys-Ballot, holds good—viz. the wind blows from a region of high pressure toward one of low pressure, and, owing to the rotation of the earth, is deflected to the right in the northern hemisphere, and to the left in the southern.

Winds of the Tropical Regions.—The accompanying map shows that the all-prevailing currents of air between the tropics are the trade-winds, which blow the whole year round in the same direction, and occupy the greater part of the zone. These are the gentle and constant winds which wafted Columbus across the Atlantic to discover a New World, and carried Magellan, the first navigator whose ship made a voyage round the world, across the vast ocean which he named from them the Pacific. Wherever they blow the sky is cloudless and serene, the temperature even and moderate, and the atmosphere without tempests. The trade-winds occupy from 20 to 22 degrees of latitude on each side of the equator, forming two belts—the N. E. and the S. E. trade-wind. They blow with entire regularity only on the open sea, their course and character elsewhere being modified by continental relief and other local influences. The continents partially interrupt the general atmospheric currents, and being more heated than the adjacent oceans, they modify, or even overcome, the trades in their vicinity. Owing to this disturbing influence, the trades, both in the Atlantic and Pacific, begin to blow regularly only at a considerable distance W. of the continents. Thence they sweep without interruption over the ocean-basins at a nearly uniform rate of from 15 to 18 miles per day. In the northern half of the Indian Ocean the trades are suspended entirely during the northern summer, but resume their sway in winter.

Zone of Equatorial Calms.—The width of this zone of calms, which separates the two great bodies of the N. E. and S. E. trade-winds, is not uniform, but varies on an average from 4° to 6° in latitude. It is wider in the eastern part of the three oceans, probably because the force of



Entered according to Act of Congress, in the Year 1856, by A. J. Johnson, in the Office of the Librarian of Congress, at Washington

the trade-winds is broken by the neighboring continents. It is wider again during the northern summer, especially in the Atlantic, owing to the higher temperature of the extensive continental surfaces, which draws the polar limit of the trades up to the 30th parallel. To this predominance of land over water in the northern hemisphere the fact has to be referred that in the Atlantic, as well as in the Pacific, this central zone is not on the equator, but somewhat N. of it, so that a ship sailing in the northern hemisphere encounters the S. E. trade before crossing the equator. The mean position of this zone is, in the Atlantic, between 3° and 9° N. lat.; in the Pacific, between 1° and 8° N. In the continents it is usually found between 3° S. and 1° N. lat.

It would be an error to suppose that the air in the region of calms is without motion; the horizontal trade-wind is only changed into an upward current, which appears, at the surface, like a calm. The mixture of this warm current with the colder air of the upper atmosphere causes frequent descending variable winds, and often sudden squalls, and those tremendous tornadoes (or doldrums, as they are called on the W. coast of Guinea) which are the terror of the navigator. The zone of calms, unlike the serene region of the trade-winds, has an almost daily accumulation of clouds, which soon after mid-day burst in torrents of rain, accompanied by terrific thunder and lightning. The cause of these phenomena is easily understood. The mass of warm air, charged with moisture, ascends into regions of less pressure, expands, and cools both by expanding and coming into contact with colder layers. The temperature of the dew-point is soon reached, and the moisture is condensed into clouds and rains. The upward current being strongest in the warmest part of the day, the storm takes place soon after mid-day.

The calms of the tropics of Cancer and Capricorn are probably caused by a portion of the upper returning current descending to the surface and re-entering the general trade-winds, while the other portion continues its way toward the temperate latitudes. Light but variable winds and absence of rain characterize these regions; for descending, like ascending, air prevents the development of horizontal winds, and the moisture contained in air descending from upper and colder regions into lower and warmer ones has no chance to be condensed. In the Atlantic this belt of calm is called by the American mariners the *horse latitudes*.

All these zones of tropical winds move bodily to and fro with the vertical sun—northward during our summer, southward during our winter season—as shown in the diagram indicating the limits of the trade-winds at various periods of the year. In the summer-time the trade-winds are already reached N. of the Canary Islands in the 30th, and the zone of calms in the 12th degree of latitude.

These oscillations determine the seasons of the tropics, for a place may be alternately in the region of trade-winds and have a dry season, and in that of the calms, and have abundant rains.

Monsoons.—The influence of the lands is already marked in the Pacific and Atlantic by the broader extent of the trade-wind zone in their neighborhood, but it is still more perceptible in the Indian Ocean. Here the regular trade-wind only exists in the southern half. In the northern half it is completely broken and changed into season winds called *monsoons*, which blow alternately six months from the N. E. and six months from the S. W. The region of calms is mostly S. of the equator, and quite undefined, if found at all. The disturbing effect of the land-masses is evident. During the northern summer the great continent of Asia is overheated, while the southern part of Africa has winter. The colder air, therefore, rushes toward the continent of Asia, making the S. W. monsoon, which blows from April to October. The cold winter air of Asia flowing into the warm summer air of Africa causes a N. E. monsoon, blowing from October to April. The time of the change from one monsoon to the other is marked by high winds and great tempests.

Similar monsoons play between the continents of Asia and Australia, also all along the eastern coast of Asia, from Southern China to Japan and Mantchooria, between the overheated continent of Asia and the cooler adjacent ocean, bringing with them summer rains. Others, perhaps less marked, are found along the coast of Brazil and the western coast of South America, of Mexico, and Central America.

Winds of the Temperate Regions.—If the tropical zone is that of constant and periodical winds, the temperate regions are those of *variable* winds, for all the year round they blow alternately, without apparent rule, from every quarter of the horizon. Two winds, however, in our hemisphere—the N. E. and S. W.—are more steady, and so prevailing that they may be called the normal winds of the middle latitudes. The N. E., cold and dry, is the polar wind deflected by the earth's rotation; the S. W., warm and moist, is the returning upper equatorial current, which gradually descends and reaches the surface about the 30th degree of latitude, blowing from the S. W. The polar or equatorial winds, flowing side by side, or one above the other, but in contrary directions, encounter each other, each constantly struggling for the mastery. Their fierce battles are our never-ceasing storms; our latitudes their battle-field. They control the weather. The S. W. equatorial brings us heat, cloudiness, and rain; the polar winds, clear sky, dry, cold, bracing air, and sunshine. The science of the winds is the science of the weather.

When these variable winds succeed each other, it is, as demonstrated by Dove, in a regular order, called by him the law of the rotation of the winds. In the northern hemisphere, when the S. W. blows, and the N. E. is to succeed, the wind turns rapidly, first to the W., then by N. W. to the N. and N. E., when it becomes settled. When the S. W. in its turn is to prevail, the wind first turns to the E., then to the S. E., and finally settles to the S. W. The other winds from intermediate points of the compass, therefore, are mere transition winds. The order is reversed in the southern hemisphere. The N. W. is the warm equatorial, the S. E. the cold polar wind.

The diagram in Map VII. exhibits the normal succession of winds and their influence on the meteorological instruments.

When the S. W. wind blows, the air being warm, moist, and light, the thermometer is highest and the barometer lowest. When the wind turns toward the N. E., the thermometer falls and the barometer rises. The wind turning again toward the S. W., the thermometer rises, the barometer falls, and the weather becomes once more cloudy and rainy. These constant changes of the winds are the cause of the variability so characteristic of temperate climates.

The position of the continents, however, somewhat modifies the course of the polar winds. A great extent of land being more liable to become cold by radiation than the sea, the average course of polar currents is rather along the continents, and that of the returning equatorial winds along the oceans. This accounts for the lower temperature of the interior of the continents in the middle latitudes compared with that of the oceans, marked by the course of the annual isothermal lines, and for the high barometric pressure on the continents and the low barometer in the adjacent oceans.

The northern parts of Asia and North America, with their vast radiating plains and high barometric pressure in winter, are the centres of greatest cold, and also the starting-points of the polar winds, which therefore blow from the N. W. on the eastern coasts of Asia and North America.

Influence of Winds and Marine Currents on Isothermal Lines.—The circulation of the winds just explained, together with that of the great marine currents, warm and cold, equatorial and polar, which follow the same general course, and add their influence, enable us fully to understand the remarkable deviations of the isothermal lines from the parallels pointed out in Map VI. (see under CLIMATE), and the great difference in the temperature of places situated in similar latitudes.

In the northern hemisphere all heating influences, winds and waters coming from the equatorial regions, take their course toward the N. E., and benefit the western coasts of Europe and America, which are the warm coasts. All cooling influences, winds and waters from the polar regions, are directed to the S. W., and cool the eastern coasts of Asia and North America, which are the cold coasts.

In the Atlantic the S. W. equatorial winds and the Gulf Stream travel together toward the N. E., and along their path the isothermals are pushed far to the N. Moving on the warm surface of the Gulf Stream, the winds take up a part of its heat and spread it, with their own, over Western Europe. They add thus, from this double source, a large share to the temperature due to its latitude, and make Europe the warmest continent of the temperate latitudes.

In the Pacific Ocean, the warm Asiatic Gulf Stream or Japanese Current is so far removed that it has lost its heat when its waters, after a long circuit, return from the N. and glide along the coasts of North America. As the equatorial winds alone have an influence, the increase of temperature is only one-half of what it is in Europe.

In the interior of the continents, removed from these warming influences, the isothermal lines bend again toward the equator.

In the southern hemisphere, the domain of the waters, the marine currents have the greatest sway. In the Atlantic, the S. branch of the Equatorial Current, running along the coast of Brazil, carries a tropical temperature far beyond the tropics, while the cold Antarctic current reduces the heat of the Peruvian coast down to that of the temperate latitudes. The same phenomenon is repeated in Southern Africa. The warm equatorial current of Mozambique

gives to the coast of Natal a tropical temperature, while the Antarctic waters in their northward course cool the western coast of the Cape Land. (For storms, etc., see STORMS, HURRICANES, AND CYCLONES.) A. GUYOT.

Wind'sor, town of England, in Berkshire, on the right bank of the Thames, is an ancient borough, but has undergone much alteration of late years, owing to the improvement of the castle. One side of Thames street has been pulled down, the castle hill has lost its ancient identity, and picturesque old houses have been swept away for the sake of making wider and more convenient thoroughfares. High street is the best part of the town, in which are situated the parish church, a modern structure of late much improved, and the town-hall, covering a railed-in space used as a corn-market, and consisting of a quaint chamber of the time of Queen Anne, and other apartments for municipal purposes. A public-house—the Duke's Head—at the bottom of Peascod street, is said to have belonged to the duke of Buckingham. The inn of the Star and Garter, in the same street, claims connection with the famous hostelry of Shakspeare's day. Herne's Oak has disappeared from the park, but the river-side suggests a picture of Sir John Falstaff in the clothes-basket. Not far from the spot which Shakspeare must have been thinking of when he wrote his play is Traven College, consisting of a row of comfortable houses occupied by naval officers, who receive, in addition to their residence, some allowance from funds bequeathed by the founder, whose name the foundation preserves. P. 11,769. (See WINDSOR CASTLE.) JOHN STOUGHTON.

Windsor, seaport, cap. of Hants co., N. S., on the river Avon, at the head of the Basin of Minas and at the junction of Windsor and Annapolis and Nova Scotia railways, 45 miles N. W. of Halifax; shipbuilding and the mining and exportation of gypsum are leading industries. The town has a weekly newspaper, a bank, 6 churches, gas-works, and several manufactories. It is the seat of King's College, founded in 1787. P. of sub-district, 2715.

Windsor, p.-v., Essex co., Ontario, Canada, on Detroit River, directly opposite Detroit, Mich., and just above Sandwich, the county-seat. Windsor is in Sandwich township. It is the W. terminus of Great Western Railway, 229 miles W. of Niagara Falls. It has a weekly newspaper, a dispensary, and a Roman Catholic academy, and is connected by ferry with Detroit. P. 4253.

Windsor, county of S. E. Vermont, separated from New Hampshire by Connecticut River, and traversed by Vermont Central and Connecticut and Passumpsic Rivers R. Rs.; surface mountainous in the W. part, hilly elsewhere; soil generally fertile. There are nearly 500 manufacturing establishments, including saw-mills, flour-mills, cotton-mills, woollen-mills, ironworks, tanneries, agricultural implements, carriages, saddlery, furniture, wooden ware, shoe-pegs, and lime. Sheep, cattle, and horses are very numerous. Staples, manufactured articles, hay, wool, maple-sugar, potatoes, Indian corn, oats, and dairy products. Cap. Woodstock. Area, about 900 sq. m. P. 36,063.

Windsor, p.-v. and tp., Hartford co., Conn. P. 2783.

Windsor, p.-v. and tp., Shelby co., Ill. P. of v. 518; of tp. 1593.

Windsor, p.-v. and tp., Fayette co., Ia. P. 800.

Windsor, p.-v. and tp., Kennebec co., Me. P. 1266.

Windsor, p.-v. and tp., Berkshire co., Mass. P. 686.

Windsor, tp., Eaton co., Mich. P. 1222.

Windsor, p.-v., Henry co., Mo.

Windsor, tp., Hillsborough co., N. H. P. 81.

Windsor, p.-v. and tp., Broome co., N. Y. P. of v. 325; of tp. 2958.

Windsor, p.-v. and tp., cap. of Bertie co., N. C. P. of v. 427; of tp. 3732.

Windsor, p.-v. and tp., Ashtabula co., O. P. 871.

Windsor, tp., Lawrence co., O. P. 1943.

Windsor, tp., Morgan co., O. P. 2251.

Windsor, tp., Berks co., Pa. P. 1211.

Windsor, tp., Barnwell co., S. C. P. 1021.

Windsor, p.-v. and tp., Windsor co., Vt., on Connecticut River and Central Vermont R. R., contains 4 churches, a library, 2 parks, an excellent high school, 2 newspapers, an iron-foundry, 2 banks, and manufactories of print-cloths, scythe-snathes, and shoes. The State prison is here. P. 1699. FRANKLIN BUTLER, ED. "VERMONT JOURNAL."

Windsor, tp., Isle of Wight co., Va. P. 2243.

Windsor, p.-v. and tp., Dane co., Wis. P. 1256.

Windsor Castle is built upon a chalk hill near the river Thames, about 22 miles from London, and commands a magnificent prospect in a northerly direction. The terrace on that side is a broad, long platform constructed on a level with the base of the building, and is described in a manuscript of the seventeenth century as "borne up and sustained by arches and buttresses of stone and timber." William the Conqueror built a Norman edifice on the spot, but no part of the existing castle can be identified as coeval with his time. The most ancient portions are the Garter and Cæsar towers, the latter of which forms a bastion of the castle-wall, and abuts upon the winding street called Thames street. It is one of the most curious antiquities in the whole building. These towers were erected in the reigns of Henry I., II., and III. To the same period belong the S. ambulatory of the Dean's Cloister, a door behind the altar in St. George's chapel, and the remains of Domus Regis in the N. of the chapel. The Norman gateway near the keep, the groining of the Devil's Tower and King John's Tower, and the Dean's Cloister pertain to the time of Edward III. St. George's chapel was built by Edward IV.; the choir roof by Henry VII.; the outer gateway of the lower ward by Henry VIII.; and the buildings from the Norman gate to the state apartments, including the library, were raised by Queen Elizabeth. Thus, some materials are here afforded for illustrating the history of castellated architecture in England from the thirteenth to the sixteenth century. But the castle, as it now appears, is almost entirely the creation of George IV.'s reign, when about a million sterling was spent upon the place. The architect, Sir Jeffrey Wyatville, preserving somewhat the character of an ancient fortress, transformed it into a royal residence replete with all the accessories of modern luxury and splendor. Towers were raised to a greater height, especially the round tower in the middle; the windows were altered; much of the masonry renewed; so that the external appearance became very different from what it had been under George III., when much of the Gothic architecture appeared obliterated through alterations made under Charles II. The courts, the terrace, the gardens, the slopes, and the parks, all underwent great change and much improvement; so that old inhabitants who remember it sixty years ago scarcely recognize the castle of their childhood. The internal changes are even more striking than the external. Suites of rooms decorated and furnished with the utmost magnificence, the corridor which runs round two sides of the quadrangle, and the grand staircases, immensely surpass what was to be seen in the castle a little more than half a century since. Changes have been made in the pictures, some of the old ones having been sent away and others introduced; a splendid museum of curiosities has been arranged in a small gallery on the N. side; the library has been wonderfully improved; the plate-closet, containing silver and silver-gilt services and rare table ornaments of pure gold, is the wonder of all spectators; but the engravings, the miniatures, and the drawings in rooms under the library surpass in value and in interest all the treasures of precious metal, bedecked though some of these are with precious stones.

The history of the castle is, to a large extent, the history of the successive kings, royal families, and courts of England. Here lived Henry I., II., and III. amidst their domestic troubles. Here John took refuge from his barons, and Edward III. entertained the knights of the Round Table and founded the order of the Garter. Here Henry VI. was born; and Henry VII. and Henry VIII. received noble visitors. Elizabeth walked on the terrace and hunted in the forest. The story of the Stuarts is entwined about the building. Under the Norman gate the headless body of Charles I. was carried in a snowstorm. Oliver Cromwell and his family occasionally resided in this palace of English sovereigns. Queen Anne was sitting over a cup of tea with the duchess of Marlborough, in a little closet now part of the library, when the news of the victory of Blenheim arrived. The first two Georges had little or nothing to do with Windsor. George III. and his queen lived here, and made a building at the top of Castle Hill a nursery for their children. The castle was the favorite residence of William IV., but her present majesty only occasionally occupies it. Here, however, she came on the evening of her wedding-day amidst rejoicings never to be forgotten. The writer of this article well remembers seeing her in the bloom of youth taking a drive with her consort in a little pony phaeton a day or two afterward. The surroundings of the castle and the roads in the park have been much altered since then. St. George's chapel is within the castle precincts, and is partly an ecclesiastical and partly a military foundation. The architecture is a choice specimen of the age of Edward IV. and Henry VI. The external walls, buttresses, windows, parapets, and the aisles, chapels, choir, knights' stalls, numerous monuments, and mural paintings, are interesting archæological objects. Henry VI., Edward IV. and

his queen, Elizabeth Woodville, Henry VIII. and Jane Seymour, and Charles I., are all buried in St. George's chapel. The grave of the last-mentioned monarch was opened many years ago, when a relative of the writer being present recognized the resemblance in the face to Vandyke's portrait of him. George III. and Queen Charlotte, William IV. and Queen Adelaide, the duke of Kent, father of Queen Victoria, and the duke of York, the Princess Charlotte, and other members of the Brunswick family, are buried in the royal vault. Over that vault is what used to be called Wolsey chapel, from its having been granted to him by Henry VIII. Mass was performed in it when James II. was king. This led to a riot, and the building remained neglected for many years. It has recently undergone a costly restoration. The floor is of rich marble, the walls are decorated with exquisite designs in engraved marble, emblematically illustrative of the life and virtues of the prince-consort. The buildings connected with the chapel have been much altered of late years, and the Horseshoe cloisters, as they are called, at the W. end, have been almost wholly rebuilt, yet so as to preserve their former character and to retain some of the ancient timbers.

Within a short distance of the castle is Frogmore House, forming part of the royal demesne, and inhabited by Prince and Princess Christian. In the garden are two mausoleums—one containing the remains of the duchess of Kent; the other, on which wealth and skill have been richly expended by Queen Victoria, covering the dust of her husband, Albert the Good. JOHN STOUGHTON.

Windsor Locks, p.-v. and tp., Hartford co., Conn. P. 2154.

Windsor Mills, p.-v., Richmond co., Quebec, Canada, on Grand Trunk Railway, 62 miles N. of Island Pond, Vt. Windsor Brook and St. Francis River furnish admirable water-power. Lumber, paper, and gunpowder are here manufactured. The village has a substantial brick town-hall. P. about 325.

Windward Islands. See ANTILLES.

Wine and Wine-Making. By *wine* is usually understood the fermented juice of the grape, although the name is occasionally applied also to fermented beverages derived from other fruits. Its preparation dates from the most ancient times. (See VINE-CULTURE.) The wines of the ancients, however, were very generally modified by the addition of spices and other condiments to suit the taste of the consumers—a habit still largely prevalent among their descendants on the Mediterranean shores. The taste and demand for strictly pure wines are of comparatively modern date, and their prevalence accounts in part for the decline of the reputation of some of the wines, anciently most esteemed, of Italy, Greece, Asia Minor, and Persia. Wine-making is a complex and difficult art when the best possible results are to be achieved, and owes much to the progress of modern science.

Grapes to be used in wine-making should be fully ripe; when this is not the case, the juice is deficient in quantity as well as quality, and especially poor in sugar. Should the natural conditions fail to bring about the full ripening, the defect is sought to be remedied by various devices, such as spreading the bunches on mats or straw in the sun or in warmed rooms; placing them in large vats, in mass, for several days; causing them to freeze or steaming them moderately. When the weather permits, the grapes are often allowed to become over-ripe to such extent as to make them appear to be wilted; they then yield less, but sweeter wine (*Ausbruch-wein*, Ger.). Finally, in southern countries (Spain, Italy, Greece) wine is frequently made from grapes fully dried, or raisins, the requisite water being added in crushing and pressing. In vineyards whose product is very valuable, all unripe and decayed berries are carefully handpicked from the bunches, and the latter, or even their berries, assorted as to quality.

Stemming and Crushing.—In the making of white wines, the berries are mostly either picked off by hand or separated by means of an implement resembling a coarse comb. The berries are then crushed by passing them between ribbed rollers, set so as to avoid crushing any kernels. In the manufacture of red or tinted wines the bunches themselves are fed on the crushing-mill, or are crushed by treading with clogs or sandals or pounding with wooden pestles. The "first run," or juice flowing off spontaneously after gentle crushing, is often kept apart as yielding a higher quality of wine.

Pressing.—This is effected by means of presses of every variety of pattern, from the primitive lever and wedge press to the hydraulic; and even the centrifugal process has been successfully used. When the "first run" has been separately received, the pressed juice constitutes the "second run," while the pressed residue is the "pomace," which is thereafter utilized for the production of inferior wine, vinegar, or brandy. The average amount of juice obtained usually ranges from 60 to 70 per cent. of the weight of the berries. When *raisins* are used in wine-making, they are subjected to the treading process with the addition of water, and then pressed.

Composition of Grapes and Must.—The grape-berries, according to the analyses of Fresenius and Schlieper, contain from 12.6 to 22.9 per cent. of soluble matters, 2.5 to 7.0 of insoluble matters, and from 70.0 to 85.0 of water. The mineral (ash) ingredients range between 0.4 and 0.5 per cent., of which three fourths or more are soluble, and therefore pass into the must. Berthier's analyses of grapes in the bunch give nearly the same ash percentage, the soluble portion varying from one-half to two thirds of the whole. The ash of must varies from 0.25 to 0.4 per cent. of its weight; from 80 to 85 per cent. of this ash consists of alkali (chiefly potash); P_2O_5 about 4.4. Kernels contain as much as 20 per cent. of ash, chiefly earthy phosphates and carbonates.

The *proximate ingredients* of must may be briefly stated as follows: *sugar*, in the form of grape-sugar or glucose; *gum and dextrine*; *vegetable acids*—tartaric (sometimes racemic), malic, citric; *albuminoids*; *tannin*; *coloring-matter*; *volatile aroma*, pre-existing chiefly in the husks of some kind of grapes, distinct from the wine flavor and "bouquet;" *ash ingredients*—potash, soda, lime, magnesia, alumina, iron, phosphoric and sulphuric acids, chlorine, silica.

Grape-sugar may be considered the most important ingredient of must, its amount, together with that of the vegetable acids, being usually the index to the commercial value of the product. Of all known fruit-juices, grape-must contains the largest amount of sugar, ranging, according to Mulder, from 13 to 30 per cent., and probably even higher. In fermentation the sugar is partially or wholly transformed into about half its weight of alcohol, the rest being given off in the shape of carbonic dioxide (carbonic acid). Besides common alcohol, there are formed succinic acid, glycerine, and a number of aromatic ethereal compounds, whose presence and quantity materially influence the quality of the wine. Since, moreover, a liquid containing over 12.5 per cent. of alcohol ferments slowly or not at all, any excess of sugar of over 25 per cent. will remain undecomposed and sweeten the wine. Wines containing less than 12 per cent. of alcohol seem to owe their sweetness chiefly to glycerine produced in fermentation. The determination of the amount of sugar is usually made by ascertaining the density of the juice by means of a hydrometer (Oechsle's and Massonfour's scales, Balling's saccharimeter), upon the supposition—in most cases practically nearly correct—that the specific gravity is sensibly proportional to the amount of sugar present. The polariscope and the copper-reduction test are also sometimes employed.

The *acids* of must rank next in importance to sugar. Their amount varies from 0.5 to 1.02 per cent., to a certain extent in inverse ratio to the sugar present, since during the later stages of ripening the acids undergo a rapid transformation into sugar; and as on their presence depends, to a large extent, the formation of the peculiar ethereal wine-flavors in fermentation, one cause of the lack of flavor observed in wines of southern countries is obvious. The sum-total of acids is determined, according to Pasteur, by neutralizing the juice with lime-water of known strength.

Of the special nature of the *albuminoids* of must we know but little. Their amount varies from 0.24 to 0.83 per cent., and their presence exerts a most important influence upon the fermentation and keeping qualities of wine. Being essential to the formation of yeast, an inadequate supply of these substances causes incomplete fermentation, while an over-supply, though partially precipitated in the lees, renders the wine liable to spoiling.

Tannin is not present in the pure juice, but occurs largely in the husks of some kinds of grapes, as well as in the stems and kernels. Hence, close crushing and pressing, and still more the presence of the whole pomace during fermentation, cause the wine to be rich in tannin. Under the same circumstances the coloring-matter of the husks and the acid and tannin of the stems find their way into the wine in larger quantities, thus producing the more acid and astringent qualities of red wines.

Fermentation and Ripening of Wine.—The process of fermentation naturally subdivides into two periods—1 That of violent fermentation, during which the temperature rises considerably (from 10° to 20° C.), a lively evolution of gas takes place, and most of the sugar is converted into alcohol. Its duration is from twenty-four hours to as many days—usually ten to fourteen. (2) The after-fermentation of the cleared liquid, without perceptible elevation of temperature, and without a very definite limit, lasting through

three or four months, during which the action is completed and a further deposition of lees takes place. Freshly-pressed must is clear or but slightly turbid. Under the influence of atmospheric oxygen, and of the germs afloat in the air or adherent to the berries, it becomes turbid after a period varying, according to temperature, from a few hours to several days. Gas-bubbles begin to rise, and soon bring up with them particles of yeast. If the fermentation be violent and the temperature high (15° to 25° C.), the yeast forms a dense layer on the surface of the liquid (top fermentation); if the temperature be low (between 5° and 15° C.), the yeast remains largely at the bottom, and the process is slower (bottom fermentation). The latter process, as a rule, produces wine of higher and more delicate flavor, and of better keeping qualities; hence the use of deep, cool cellars when the external temperature is high. The want of these accounts in part for the lack of aroma in the wines of southern countries, and the frequent necessity of the addition of spirit to make them keep. In the preparation of red wines the pomace is allowed to ferment with the must for a certain length of time, and is carried to the surface with the yeast. As the porous mass thus raised is liable to souring, it is best to keep it submerged by means of perforated covers.

As regards the exclusion of air during violent fermentation, practice varies widely. While too much access is unquestionably injurious, in causing the formation of vinegar, it seems also to be well proven that a total exclusion is unfavorable to the development of the finest aroma. From casks closed by means of a hydrostatic valve, through which the gas escapes, but air cannot enter, we have all degrees of transition to the open tank, which is liable to many objections. In tanks provided with floating covers, leaving an annular space all around for the escape of gas and limited access of air, we have perhaps the arrangement applicable to the majority of cases, and capable of such adjustment as experience may determine to be best in each case. Upon the subsidence of the violent fermentation, the yeast (with more or less of tartar, gummy matter, and albuminoids) settles to the bottom, the liquid clears, and is then carefully racked off into casks, to undergo the

After-Fermentation. (See above.)—During this process great care must be taken to prevent excessive access of air by refilling the casks, yet without closing them so as to incur the risk of bursting. The lees of the after-fermentation consist largely of crystalline tartar, with some yeast, and more or less of gummy and albuminous substances. At the end of this period the young wine is once more racked off into casks (usually of smaller size), in which the ripening or aging is to take place. This process, as Pasteur has definitely shown, depends essentially on the gradual action of the atmospheric oxygen, which enters through the pores of the casks. The wine again becomes slightly turbid or "muddy," and forms a deposit consisting partly of products of oxidation, partly of fungous vegetation, of which the greater part remains suspended in the wine. The problem of preserving the latter turns mainly on the suppression of this parasitic vegetation, which otherwise gives rise to a variety of "diseases." According to circumstances, the wine may incline to turn sour, forming vinegar, or it may acquire a bitter taste; it may remain permanently turbid (this may usually be remedied by aëration), or become stale in taste and apparently gummy or "ropy" (remedied by the addition of tannin), etc. The racking-off often needs to be repeated several times in order to preserve or improve the flavor; and very usually young wines are cleared from a remnant of yeasty particles by the addition of gelatine, or some other substance ("finings"), which may then be curdled and carries with it all mechanical impurities. Filtration under pressure is also resorted to. Of late, two processes have been used as preventive of these difficulties, as well as for the acceleration of the "aging" of wines. One is the heating of the young wine to a temperature of from 60° to 63° C., recommended by Pasteur; the other is the "air-treatment" of D'Heureuse, which may also be applied to must. Of these, the former has been attended with such success that it is now extensively practised in France. The principle underlying the air-treatment is carried into practice in the manufacture of the aromatic "shovel wine" of Lorraine, and in the successful use of the centrifugal press.

When, finally, after the lapse of from two to four, and even eight years, the wine remains clear when bottled, it is "bottle-ripe," and is considered finished. Most wines, however, continue to improve by age in flavor for a length of time differing for each kind. In the end, even bottled wines become too harsh and acid to be palatable.

Sparkling Wines.—Ordinary "still" wines retain only so much of the gas generated in fermentation as to impart to them a refreshing quality, which soon vanishes on exposure to the air: the wine becomes "flat." Sparkling wines, of which champagne is the type, effervesce on account of an excess of carbonic acid gas contained in them under pressure. This gas is generated in a second fermentation produced in the young wine, subsequent to after-fermentation, by the addition of sugar and (when necessary) yeast-forming matter (gelatine). This is effected in strong bottles tightly corked, and when the fermentation is completed the sediment of yeast is ejected from the mouth of the inverted bottle by dexterous manipulation. Of all wines, champagne is perhaps the most extensively imitated, partly by forcing into sweetened still wines, or even cider, such gas as is used in the preparation of soda-water, and partly by adding to the bottled wine gas-generating powders.

"Doctoring" of Wines.—Few wines reach the consumer as they result from the processes above detailed. It is the general practice to adapt the various kinds and qualities of wines to the taste of the consumers by the intermixture of such as will improve each other. To this practice no reasonable objection can be made, since from beginning to end intelligent management influences the nature of wine nearly as much as its origin, and it would be difficult to define just what should be understood by "natural wine." When, however, outside additions are made to the juice of the grape, the aspect of the question is changed. So long as these additions merely make up for deficiencies in what might be considered the normal composition of must (as is done in adding grape-sugar to vintages that have suffered from unfavorable weather), it is questionable whether the consumer has reason to complain; and hence this practice ("chaptalizing") is very general, and made no secret of. The simultaneous addition of water ("gallizing") might claim equal immunity when made on similar grounds, and not for the fraudulent increase of quantity. The manufacture of a wine-like beverage from the pomace, by extraction with sugar-water to such extent as will secure for the resulting juice a proportion of constituents similar to that of natural must ("petiotizing"), while not intrinsically objectionable, is liable to great abuse, though vastly preferable to the compounding of so-called wines from materials to which the grape is a stranger, and whose manufacture has to a great extent been supplanted by that of cheap "petiotized" wines.

Among still wines, those most commonly imitated are the heavy, sweet wines of southern countries, which are to a great extent themselves the result of a compounding process, and whose general wine-flavor it is comparatively easy to reproduce.

Classification of Wines.—The wines of commerce may in a general way be divided into—(1) *dry* wines, not obviously sweet, but possessing a more or less distinctive and high flavor—"bouquet;" (2) *liqueur* or sweet wines, permanently and decidedly sweet, and rich in alcohol, with but little aroma, mostly from southern climates. Between these two classes there are of course all degrees of transition, and a third class may be formed out of those not prominently characterized by either aroma or sweetness. In all these classes we find both white and red or tinted wines.

Wines of France.—France produces an especial abundance and variety of red wines (clarets), of which those most highly esteemed are grown in the Bordelais and in Burgundy, as well as in Dauphiné. The Bordeaux wines have a full, agreeable bouquet, a good deal of body, are spirited yet not heady, with a pleasant astringency: first-class are Château Lafitte, Château Latour, Château Margaux, Haut Brion. The Burgundy wines are rather heavy, oily, less astringent, with a fine, peculiar aroma; such as Chambertin, Clos Vougeot, etc. Second-class clarets are those of St. Julien, St. Estephe, Cantenac of the Bordelais, those of the Champagne, the Lyonnais, and Dauphiné. *Petits vins*, or *vin ordinaire*, is produced in all but 8 out of 86 departments. The white wines of France are more fiery and have more body than the Rhenish wines: first-class are those of Champagne (Sillery), the Burgundy white, and Château d'Yquem of the Bordelais, with Sauterne, Barsac, etc., as second-class. Superior dry wines are also produced in the S. of France, but most prominent are the *liqueur* wines of Perpignan, Languedoc (Frontignan, Lunel), Roussillon, and the "straw wines" of Dauphiné and Northern France.

Foremost among the wines of *Germany* are the high-flavored, dry Rhenish wines, grown from Alsace down to Coblence, in the valley of the Rhine and its tributaries. Of the white wines (known in England under the collective name of "hock," a corruption of Hochheim), those of Hochheim, Rüdesheim, Johannisberg, Forst, the Niersteiner, Marcobrunner; and among the red wines, the Affenthaler and Asmannshäuser are best known. The Moselle wines resemble those of the Rhine in flavor, but are light and acid. The same, to a less degree, is true of the wines of Franco-

nia. The wines of Northern Germany (Grünberg) are very acid.

Among the wines of *Switzerland*, those of the Jura region (Vaud, Neufchâtel, Geneva) are esteemed best. Almost all have a somewhat harsh and earthy taste, and are not exported. That of the Val Tellin has some reputation as a stomachic and tonic.

Austria is second to France in the amount of wine produced, but only the wines of Hungary and some of the liqueur wines of the Adriatic provinces are somewhat widely known in commerce, and the aggregate export is quite small. The sweet, fiery, and aromatic wine of Tokay in Hungary is by some esteemed even above that of Johannisberg on the Rhine. Many other excellent wines are in high local repute.

Italy produces abundance of wine, largely of the liqueur class; of these, the wines of Asti, Monte Pulciano, and Fiascone, and the Lachrymæ Christi—of the many excellent wines of Sicily, that of Marsala—are best known. Much good material is spoiled by bad management in wine-making.

The wine-production of the *Spanish Peninsula* is very extensive and of considerable commercial importance. Among the wines exported, the best known are those of Jerez ("sherry"), Malaga, and Oporto ("port"). The latter is essentially a dry wine, mixed to suit the English market. The wines of Malaga and Jerez are both of the dry and liqueur class, the latter being sweetened with grape-syrup, and all are strengthened by the addition of spirit. Of the same general character are the wines of Madeira, now scarcely found genuine in commerce.

Few of the wines of *Greece* enjoy a general reputation at present, although the wines of Cyprus and Chios are still praised. They, as well as those of *Turkey* in Europe and Asia, and *Persia*, suffer for want of care in preparation, and from the nature of the vessels (goat- or hog-skins, rendered waterproof by pitch) in which they are too commonly kept or conveyed.

Of *American* wines, those of California approach most nearly those of the Mediterranean countries, being, thus far, mostly fiery, sweet, and heady, but somewhat deficient in flavor. To a certain degree these defects can, and doubtless will, be remedied by judicious selection of grape varieties and appropriate treatment. The wines of the States E. of the Rocky Mountains, made from American grapes (see VINE-CULTURE) bid fair to rival those of France and Germany, from which they differ, on the whole, in possessing more or less of the "foxy" flavor of the berries, to which the European palate has not yet become accustomed.

The following table gives the volume-percentages of alcohol contained in some of the best-known wines, varying greatly of course from year to year:

Rhenish and Moselle wines	9.0 to 11.0
Grünberger, Naumburger	6.5
Burgundy, red	7.5 to 9.0
Bordeaux, first class	9.0 to 11.5
Catawba, Concord, etc.	8.5 to 10.5
California wines	10.5 to 14.0
Port	18. to 23.
Sherry	17. to 21.
Madeira	17. to 19.
Tokay	12. to 20.
Greek and Syrian wines	14. to 18.

The total wine-production of the U. S. is given by the U. S. census of 1870 at 3,092,330 gallons, of which California is credited with 1,814,656; the *American Encyclopædia* (ed. of 1873) gives 20,000,000, upon data derived from private sources, and credits California with 5,000,000 gallons. The wine-crop of the latter State is claimed by the San Francisco *Market Review* to have been 8,000,000 gallons in 1875. E. W. HILGARD.

Wine'brenner (JOHN), b. in Frederick co., Md., Mar. 25, 1797; became a minister of the German Reformed Church at Harrisburg, Pa., but in consequence of a difference of views in regard to revivals seceded from that Church in Oct., 1830, and established a new denomination under the title of "The Church of God," now more generally known as "Winebrennerians," and embracing 400 ministers and 40,000 members in 1873, their distinctive ordinances being baptism by immersion, the washing of feet, and the Lord's Supper. Mr. Winebrenner edited the *Church Advocate* of his sect for several years and published a number of books. D. at Harrisburg Sept. 12, 1860.

Winebrennerians. See CHURCH OF GOD.

Wine, Physiological Relations of. Under this heading will be discussed the relations to animal physiology of alcoholic drinks in general. As the most important properties of these beverages are due to the alcohol they contain, the effects of this fluid will first be treated of, and the individual properties of the different beverages pointed out afterward. The first point is to know what is the career of the alcohol itself within the animal system. Alcohol is a fluid of high diffusive power, and when swallowed passes at once, unchanged, into the circulation by absorption through the gastric walls. From the blood it also passes, in all probability, into the tissues by transudation through the walls of the blood vessels. It finally suffers decomposition within the body, being probably oxidized into carbonic acid and water. Here a word of comment is necessary, since the reverse of the latter statement has been affirmed and extensively believed. The history of the matter is briefly this: It used to be supposed, upon theoretical grounds, that alcohol would naturally be oxidized within the body, and such was generally believed to be the case until the year 1860. In that year three Frenchmen, MM. Lallemand, Perrin, and Duroy, published the results of some investigations of theirs, by which they claimed to have proved that, instead of being oxidized within the body, alcohol is, on the contrary, always wholly excreted unchanged. This statement, being apparently supported by the results of experiment, was very generally accepted by the medical profession and widely circulated among the laity. But not many years after this publication, fallacies were found in the method of experimentation relied upon by the French observers, and the whole subject was reinvestigated by several scientists independently (Baudot, Anstie, Dupré, Schulinus, Thudichum, Binz). Improved methods and a more rigid guarding against possible errors were adopted, and the result has been that exactly the opposite of what was asserted by MM. Lallemand, Perrin, and Duroy turns out to be the truth. In moderate quantity (up to 1½ ounces daily) alcohol wholly disappears as such within the body, and even in grossly-intoxicating doses but a minute fraction—less than 1 per cent.—escapes unchanged through the excretory organs. This point has now been so often and so overwhelmingly proven by different experimenters that it must be accepted as an established fact. The nature and seat of the transformation of alcohol are not known, but many considerations make it probable that the fluid is finally completely oxidized into carbonic acid and water, just as it is when burned in a spirit lamp. (*Binz.*) An objection to this supposition, urged by some, is that in such case the body-temperature ought to rise after ingestion of alcohol, whereas in fact it is either stationary or actually falls. But the objection is not valid. The temperature of the body is a resultant of three factors—namely, the total quantity of oxidizable matter of all kinds oxidized in a given time within the body, the quantity of life-work (muscular action, etc.) done within the same period, and the quantity of heat at the same time lost from the skin and lungs. And the whole tendency of the economy is to such a mutual adjustment of these three determining influences as that the resulting body-temperature shall be nearly constant. Hence, in general, neither physical exercise, exposure to cold or heat (within moderate limits), *nor the ingestion of food* sensibly affects body-temperature. Since fat, then, is oxidized within the system without sensibly raising body-heat, there is no reason why the same should not be the case with alcohol, whose thermotic equivalent is lower than that of fat.

Turning next to the effects of alcohol-drinking, we find that they are highly complicated, and are apparently due to a number of independent influences exercised by alcohol upon different parts and functions of the body. Some are obviously the result of actions of the alcohol itself upon the solids and fluids with which it comes into contact; others are seemingly the mere physiological consequences of the final oxidation of the fluid, and others still probably have their cause in both these agencies combined. A point of obviously-important bearing is that the several effects of alcohol are not developed with equal readiness, so that the *general resultants*—to borrow a convenient technical phrase—of different doses differ not only in degree of effect, but even in kind: as where certain effects following small doses are actually reversed with large, or where certain prominent phenomena, as those of intoxication, which are produced by large doses, are wholly wanting if the potion be small. Of equal importance, again, is the additional fact that even the resultant of a given dose is by no means invariable, circumstances often greatly modifying the usual relative intensity of the different effects. Alcohol, in short, acts very differently in different cases, the determining influences being personal idiosyncrasy, age, sex, habit of indulgence, and, above all, state of the system as regards disease. Thus, with excitable women the susceptibility to intoxication is disproportionately high, while with habitual topers the same is low, the other alcohol-effects being meanwhile as usual. In fever, again, the power of alcohol to reduce body-temperature is greater than normal, while at the same time the intoxicating power is decidedly less. A third point, still, is that circumstances of administration will greatly affect the result of drinking

a given quantity of alcohol. Most of the effects depend upon absorption of the fluid into the blood, and, other things being equal, are proportionate to the percentage of alcohol actually present in the circulation at a given moment. This is determined by the whole amount of alcohol taken, and by the relative rates of absorption on the one hand, and destruction by oxidation on the other. Now, alcohol is pretty quickly disposed of within the system, so that any cause which delays absorption will proportionately diminish the effect of the dose. Hence, a given potion produces much less effect if taken upon a full stomach than upon an empty one, and likewise if taken in divided doses rather than at a single draught. Thus, 4 ounces of whisky, which would be decidedly intoxicating to most persons if swallowed all at once, can generally be taken in small broken doses, distributed throughout the day, with very little disturbance. The several effects of alcohol, in the order of their appearance with progressively increased dosage, are as follows: There is always a local effect in the stomach, differing in kind according to the dose and its alcoholic concentration. Small dilute doses tend to quicken digestion and promote appetite, while large and strong ones produce the reverse effect, irritating and disordering the stomach, and even inducing nausea and vomiting. The next organ affected is the heart, which is impelled to more vigorous action than before. In health, both the frequency and strength of the beats are increased, but in cardiac exhaustion, where the pulse is at the same time rapid and feeble, alcohol diminishes its excessive frequency while increasing its force. The action of alcohol upon the heart is one of the earliest and most constant of its manifestations. Its intensity increases with the dose so long as the heart retains power to respond to the excitation. In Parkes's experiments a daily allowance of 1 fluidounce of alcohol (about equal to 2 fluidounces of strong brandy), superadded to an already sufficient food-ration, increased the work done by an adult heart 4 per cent., and an allowance of 8 fluidounces (equal to a pint of brandy) increased the same over 25 per cent. The next effect is a dilatation of the capillary blood-vessels, seen externally by flushing of the face and neck and suffusion of the eyes, but also general throughout the internal organs, as the brain and lungs. Associated with this effect, and dependent upon it, are a feeling of fulness of the head and of general heat, and, in warm weather, a tendency to perspire. This dilatation of the capillaries requires a relatively larger amount of alcohol to produce it to appreciable degree than does the heart affection, nor is it so constant an effect as the latter, different persons varying greatly in their susceptibility to it. Like the heart effect, its intensity progressively increases with the dose. Next in order come the well-known phenomena of intoxication, consisting of failure of power to co-ordinate muscular action, as shown by the thick speech and staggering gait, and a peculiar intellectual disturbance. In severe degree, stupor, with sensory and motor paralysis, supervenes, and death even may occur from failure of respiration. (See INTOXICATION.) During intoxication the already-described affections of the heart and capillaries persist, producing the well-known bloated red face and eyes and the throbbing arteries of the drunkard. Intoxication is commonly followed by a heavy sleep, and upon awakening there are more or less mental and physical feebleness and languor, headache, thirst, loss of appetite, nausea, and sometimes vomiting. These effects, though they vary in intensity with different persons, seem in general more related to the quantity of alcohol drunk than to the mere degree of intoxication produced. Intoxication only occurs when the dose of alcohol is comparatively large—larger than is required to affect the heart and capillaries. With fully-developed males (over twenty-five years) alcohol taken in divided doses throughout the day generally begins to affect the brain when the daily allowance reaches somewhere between 1½ and 2 ounces. (*Parkes.*) But of all the properties of alcohol, this of intoxicating is the one most profoundly affected by the circumstances of the drinker. Women, as a class, are made drunk more easily than men, but in both sexes individual susceptibility varies greatly. Habitual indulgence deadens the susceptibility, so that the confirmed toper, though otherwise suffering from his deep potations, may show but little or no intoxication. But most extraordinary is the influence of certain morbid states of the system in the same direction. For in the prostration following great loss of blood, and in the low stage of severe fevers, enormous doses of alcohol can often be taken without the slightest sign of intoxication, although the other alcohol-effects are produced in due order. Besides the foregoing, there are other effects of alcohol, which, from not being immediately apparent to the senses, are not so well known. One of these is a tendency to a reduction of body-temperature. Under ordinary circumstances this only occurs to an appreciable extent when the potation verges on the intoxicating, and even with a dangerously poisonous dose the fall does not exceed from 3° to 5° F. According to its extent, it lasts from half an hour to several hours. In fever, where the temperature is abnormally high, the reduction by alcohol is proportionately greater than in health, but with habitual drinkers, on the contrary, it is less. When the body is exposed to severe cold, it is again in all probability greater than usual, for, though thermometrical observations are wanting, theoretical considerations, and the fact that spirit-drinkers succumb to cold far more readily than teetotallers, make it all but certain that the alcoholic fall of temperature here is excessive. Hand in hand with the reduction of body-temperature, and varying in extent under the same circumstances, is a tendency of alcohol to lessen the quantity of urea and carbonic acid excreted. Finally, alcohol, within certain limits, avails for the support of life after the manner of ordinary food. If to an insufficient dietary, where the body is losing weight, a little alcohol be added, not only may the loss of weight cease, but there may even be a gain. (*Hammond.*) It is a matter of common observation, also, that those who habitually drink alcohol, even in moderation, eat less than teetotallers, and those who take it in excess often subsist on a food-allowance utterly insufficient by itself to support life. Again, in persons desperately ill of fever, where the stomach is absolutely unable to digest ordinary food, life may be supported for many days, and sometimes even weeks, on alcohol alone.

Secondary consequences from habitual drinking seldom appear unless considerable quantities of alcohol are daily consumed. Here, again, there is great difference in individual susceptibility, and also in the organs affected. In general, those who lead sedentary lives suffer more readily than those who do hard physical work in the open air. These secondary consequences of hard drinking, like the sickness following a single debauch, are more related to the quantity of alcohol consumed and the concentration of the draughts than to the degree of drunkenness. Hence, although a certain daily allowance of alcohol may not intoxicate, it by no means follows that the same is therefore innocent. Probably 1½ ounces of alcohol are as much as can be taken daily with safety, but for obvious reasons exact scientific observations on this head are wanting. (For the individual diseases which hard drinking may induce see INEBRIETY.)

Such being the physiological effects of alcohol, so far as known, the next point is to analyze them and see how they are caused. As already noted, we have with alcohol to deal with a twofold influence—namely, the action of alcohol itself while present in the system as such, and also the dynamic outcome of its final oxidation. Pure alcohol is a highly-diffusible fluid, miscible both with watery and oily matters. It is powerfully hygroscopic, speedily desiccating moist tissues immersed in it, and it coagulates albumen. It is an intense irritant, and acts strongly upon living protoplasm, a small percentage added to a fluid containing living protoplasmatic organisms arresting those movements of the latter which are the measure of their vital activity. Alcohol also arrests or prevents putrefaction and fermentation. With these powerful affinities, therefore, it is not surprising that anything beyond a small percentage of free alcohol circulating in the blood and tissues should make disturbance. But not less striking are the consequences of the final oxidation of alcohol. Physiologists are now pretty much agreed that the greater part of the "energy" (using the word in the technical sense) which appears in animal dynamics as body-heat, muscular, nervous, glandular, and vital action in general, comes directly from oxidation within the system of non-nitrogenous food-substances, such as fat and sugar. Now, alcohol is also a non-nitrogenous substance, closely allied to fat in chemical composition, and, like it, is also oxidized within the body. Hence, since all oxidation is equally attended by conversion of "potential" into "actual" energy (using the terms always in the technical sense), it follows that the oxidation of alcohol must have the same kind of influence as that of fat or sugar. And since, moreover, the dynamic equivalent of alcohol is very nearly as high as that of fat, it is plain that where much alcohol is taken the dynamic result must be considerable. Even so small a quantity as 1½ ounces of absolute alcohol liberates by oxidation a quantity of "actual energy" equal to one-sixth of the whole amount required for the average daily vital needs of an adult man.

Bearing in mind, then, these two ways by which the ingestion of alcohol may affect the economy, we may proceed to analyze the effects already described. The effect upon *digestion* is obviously due to a direct local action, and is the same as that of irritants generally within the stomach, digestion being quickened when the irritation is feeble, and arrested and disordered when it is intense. Large and strong alcoholic draughts also probably coagulate the albu-

minous elements of the food and gastric juice, and thus still further impede digestion. The effect upon the *heart* may be in small part a reflex consequence of the gastric irritation, but is probably mainly a result of a direct action of the alcohol, after absorption, upon the nerves controlling the contractions of the heart. The *dilatation of the capillaries* is doubtless wholly due to direct action of the alcohol, and is the result of paralysis of the nerves whose influence normally maintains contraction of the walls of the blood-vessels against the outward pressure of the blood. The accompanying *sensation of heat* results from circulation of an unusual quantity of hot blood, direct from the interior, in the skin, where the nerves of feeling are distributed. The affections of the *general nervous system* are complex in character, and probably also in causation. The earliest manifestation—namely, a sense of general well-being, with abatement of feelings of physical or mental exhaustion and of small aches and pains—is probably in part a reflex consequence of the gastric irritation, since something of the same effect follows the swallowing of any substance that will cause a glow in the stomach, and in part a result of the alcohol-quickened circulation and capillary fulness, which, by augmenting the blood-supply in the tired nerves and muscles, tend directly to restore vigor to the same. The *exhilaration of spirits* that accompanies this general *bien-aise* is probably also produced by the same causes; for a hearty meal, and all influences that quicken the circulation, such as a cold bath, brisk exercise, or the breathing of the very pure air of the mountains or the sea, notoriously tend to produce the same result. But with slight increase of dose this simple exhilaration merges into the peculiar one-sided excitement of *intoxication*. The phenomena of this latter state are apparently wholly due to a direct action of the alcohol upon the substance of the brain and spinal cord, except that some of the coma in profound drunkenness may be a simple consequence of brain congestion. In the early stages intoxication consists of progressive failure of power to co-ordinate muscular movements, and, mentally, of unnatural excitation of the fancy, the passions, and emotions, with simultaneous unnatural enfeeblement of the reasoning faculty, judgment, moral sense, memory, and will. Alcohol thus shows the singular property of irritating some and paralyzing other parts of the brain and spinal cord at one and the same time. This double and opposite action, though curious and inexplicable, is comparatively common among nerve-poisons, opium and belladonna exercising it in fully as striking a manner as alcohol. In the latter stage of intoxication, even those centres which at first suffered excitement finally join in the general paralysis, until in "dead" drunkenness all nervous action is suspended except that concerned in maintaining the function of the heart and lungs. In overwhelming doses the respiratory centre also may finally succumb to the paralyzing influence, and the drinker die from arrest of breathing. An erroneous common belief is that in the earlier stage of intoxication the *intellectual* faculties are "stimulated"—that is, are aroused to an unwonted display of functional activity. Precisely the reverse is the case, and the error has arisen from the confounding of two entirely different things. It is true that a carefully-adjusted wholly *non-intoxicating* alcoholic draught will, like a bowl of hot beef-tea, a cup of coffee, or a snatch of sleep, temporarily restore to a tired brain something of its wonted vigor, probably through the increased blood-supply to the brain resulting from the action of alcohol on the heart. But an entirely different thing is to take a healthy person, in full intellectual vigor, and ply him with wine till his eye glistens and his cheek flushes with incipient intoxication; for now there is a specific mental disturbance, and though the imagination and the emotions do indeed run riot, yet *intellectual power* proper—the faculty of doing real "brain-work"—is simply in process of extinction from the very first. Thus, for instance, the usually grave lawyer, who under the influence of wine keeps the dinner-table in a roar with unwonted wit and mirth, is at the very moment less instead of better fitted for real intellectual work. Let him in the midst of his best story be suddenly called upon to deal with some important professional matter, and he will find that those qualities of large grasp of mind, deep penetration, shrewd forecasting, and ready application of knowledge which have made his fame at the bar, have now sadly deserted him. In precisely the same way the feeling of increased muscular power in the earlier stage of intoxication is wholly delusive. Careful experiments have shown that a well-fed man can accomplish more physical work and with less fatigue when sober than when continuously kept *consciously* affected by drink. But it will be observed that this is a different matter again from the addition of a wholly non-intoxicating alcohol-ration to an otherwise insufficient daily dietary. The next alcohol-effects—lessening of excreta and reduction of body-temperature—are, the former wholly and the latter mainly, mere consequences of a single effect—namely, diminished oxidation. For urea and carbonic acid, the excreta affected by alcohol, are simply the refuse products—the ashes, as it were—of the oxidation constantly going on within the system both of the food derivatives in the blood, and, so far as they suffer change, of the tissues themselves. Diminished ashes therefore necessarily mean and prove diminished combustion. As to the reduction of temperature, since the animal heat is wholly maintained by the heat derived from these same oxidation processes, repression of the latter necessarily tends to fall of the former. How the retarding of oxidation by alcohol is brought about is not wholly clear. It has been proved by ingeniously contrived experiments upon animals to be entirely independent of any influence through the nervous system (*Binz*), and is probably largely due to direct interference with the function of the red blood-corpuscles in fixing and delivering oxygen. In the matter of reduction of temperature, besides the above described influence of diminished oxidation, there is undoubtedly another factor—namely, the active determination of blood to the surface of the body, caused by the alcoholic quickening of the heart's action and dilatation of the capillaries. For now, an unwonted quantity of hot blood from the interior being distributed through the exposed tissues of the skin and lungs, the loss of body-heat by radiation from those surfaces, which is continually going on, will obviously be increased. Of course, the degree of effect thus produced will vary with the temperature of the air by which the body is surrounded, and while probably but slight under ordinary circumstances, it can yet readily be imagined to be considerable during exposure to severe cold. And that the latter is really the case is made likely by the well-known fact that alcohol-drinking, even in moderation, vastly lessens the power of the body to resist external cold: for travellers in arctic regions who indulge in spirits almost invariably succumb to the effects of the low temperature before those of their comrades who abstain. The effect of alcohol in supplementing an insufficient dietary—stopping loss of weight, removing the effects of inanition, and even, in fever, temporarily supporting life by itself alone—is probably again the resultant of two factors. One of these is undoubtedly the property of alcohol of itself fulfilling a very important food-function—that, namely, of being oxidized in the system, and thus serving as fuel to supply the needs of physiological dynamics. The other factor can be conceived to be the same repression of oxidation just discussed. For where this effect obtains, the food is, as it were, less wastefully consumed within the system, and the tissues are saved from unnecessary disintegration. But as this retarding of oxidation is only appreciable where the dose of alcohol is large, it can have but little influence in the ordinary dietetic use of alcoholic drinks in health. But in fever, where the waste of tissue and rate of oxidation generally are excessive, and alcohol is given in considerable quantities, the decided repression of oxidation that now takes place has undoubtedly a powerful influence in helping to support life. Alcohol in fever thus presents the singular picture of retarding the rate of oxidation generally, while itself falling a victim to the process at the same time. In a double way, therefore, it here economizes the system's store of fuel. The *organic diseases* attributable to habitual hard drinking are obscure in their causation, but are probably the result of the direct physico-chemical action of alcohol upon the tissues of the affected organs. Thus, the chronic catarrh of the stomach so common with drunkards is undoubtedly due to direct local irritation.

Alcoholic drinks are used as ordinary beverages in health and as medicines in disease. In all cases, in the determining of dosage, regard must be had to the varying general physiological resultant under different conditions. Where an alcoholic beverage is made an item of the regular dietary in health, the ration should be so limited as that the drinker is not appreciably affected by any of the specific alcohol-disturbances, and at the same time no risk is run of secondary injurious effects. From the great difference in individual susceptibility to the different alcohol-effects, and from the lack of exact knowledge concerning the conditions under which secondary diseases appear, it is impossible to put a definite figure to the above limit, especially one that shall be applicable to all cases. But for the striking of a general average we have the following data: With adults, when the daily ration contains not more than 1½ ounces of absolute alcohol, and is taken in portions equally divided with the later meals of the day, and in a beverage whose alcoholic strength is not higher than 10 per cent., all the alcohol is disposed of within the system, none appearing in the excretions, and, with the average of males at least, none of the specific alcohol-disturbances are produced beyond a trifling and very temporary quickening of the heart's action, and possibly a slight dilatation of the capillaries. Vital statistics, moreover, fail to show that

such a limited allowance is commonly followed by any injury to health. But if the above limit be exceeded, a trace of free alcohol appears in the excretions, showing that more is taken than the system can utilize; and, though intoxication may not be produced, yet now the heart and capillaries are affected to an injurious degree, oxidation is unduly interfered with, and secondary consequences may slowly declare themselves, such as dyspepsia with loss of appetite, short-windedness, easily-fatigued brain and muscles, unnatural fattening, and permanent congestions, perhaps followed by organic disease. It may therefore be said that a daily allowance of 1½ ounces of absolute alcohol represents for all persons the extreme physiologically safe limit for habitual alcoholic indulgence, while any quantity, no matter how small, which induces conscious alcohol-disturbance is for the individual so affected too much. Even this ration, moreover, should only be taken at the times and under the conditions set forth. Among ordinary alcoholic beverages this quantity of 1½ ounces of absolute alcohol is represented by from 3 to 3½ ounces of spirituous liquors (40 to 50 per cent.); about 9 of the weaker fortified wines, such as sherry, madeira, or port (17 per cent.), or 6 of the stronger (25 per cent.); 15 of the light wines, such as claret, hock, and champagne (average 10 per cent.); about 19 of strong ale (8 per cent.); and 30 of average beer (5 per cent.). But it must never be forgotten that these beverages are not simple alcoholic solutions, but contain other ingredients whose specific effects may often require the above allowance to be still further reduced. The effects of alcohol, when the dosage is confined to the foregoing limits, are simply such as result from gentle irritation of the stomach, slight quickening of the heart's action, and the *food-rôle* played by the alcohol in its final oxidation. That is, appetite is increased and digestion promoted; functional vigor generally tends to be restored from the quickened circulation in the fatigued organs; the feeling of comfort, refreshment, and general well-being, physical and mental, which ordinarily follows a wholesome and sufficient meal is hastened and enhanced; and less solid food has to be taken to satisfy hunger and keep up the weight of the body than on a tectotal dietary. All the effects due to dilatation of the capillaries, retardation of oxidation, *decided* acceleration of the heart, and specific action on the functions of the brain and spinal cord, are now practically wholly absent. The question of the wisdom of making alcohol part of the usual dietary involves many considerations besides the physiological, and is therefore beyond the scope of the present article. From the purely physiological point of view, with which alone we are here concerned, the foregoing analysis clearly shows that to a typically healthy and vigorous man, who is not overworked, and who can command a sufficiency of wholesome and appetizing food, alcohol is wholly superfluous. But it is equally apparent that in the condition so common among sedentary workers, of feeble digestion, sluggish circulation, and constant overtaxing of the nervous system, the property of a limited alcohol-ration of quickening digestive and circulatory activity, and furnishing a promptly and easily assimilated fuel-food, is, in itself considered, advantageous.

Medicinally, alcohol is of varied use. In primary failure of the heart's action it is one of the most powerful restoratives known. After exposure to cold, when there is danger of internal congestion or inflammation from the blood being driven from the surface, an alcoholic draught, by equalizing the circulation and forcibly determining the blood back again to the skin, may avert the threatened mischief. But *during* exposure to cold, unless the same be very brief, alcohol is best avoided for reasons already given, and in prolonged exposure to intense cold, as in arctic expeditions, it should be scrupulously abstained from as in the highest degree dangerous. In exhausting fevers alcohol may be of quadruple benefit, at once sustaining and strengthening the enfeebled heart, supporting life through the outcome of its oxidation when ordinary food cannot be taken, and tending both to check the disastrous disintegration of living tissue and to moderate the dangerously high fever-temperature. But its use requires judgment, and it is by no means always necessary, or even of benefit. Other uses are to relieve trivial spasmodic seizures; to temporarily invigorate in circumstances of exhaustion where a quickly-acting restorative is necessary; to calm nervous irritability and procure sleep; and to improve appetite and digestive power. In all cases where alcoholic drinks are used medicinally, though large amounts may be sometimes required, yet the production of intoxication is to be carefully avoided.

The *special effects of different alcoholic beverages* depend on the strength of the liquor in alcohol and on the presence of various other ingredients. Draughts of high alcoholic percentage irritate the stomach, impede and disorder digestion, and, by charging the blood quickly with a considerable volume of alcohol, are especially prone to intoxicate and poison. Hence, spirit-drinkers are peculiarly apt to suffer from dyspepsia, chronic gastric catarrh, and organic disease of the liver, and communities where spirits and strong wines are common drinks show more drunkenness than those where the lighter wines and beers are consumed.

Of the other ingredients of alcoholic beverages the most important are amylic alcohol, volatile ethers, tartaric and allied organic acids, carbonic and tannic acids, sugar, various salts, and the bitter and narcotic principles of malt liquors. *Amylic alcohol* occurs in spirits containing fusel oil. Its properties are generally the same in kind as those of common or ethylic alcohol, but the specific alcoholic effects are more intense and prolonged, and more easily induced. Spirits containing fusel oil are therefore especially deleterious. *Volatile ethers* develop in wines and spirits by keeping, and tend to make the liquor less apt to disorder the stomach and produce headache, and give it greater power in strengthening the action of the heart. Old wines and spirits are therefore valuable, not merely because of their more agreeable flavor, but also for being really more wholesome than new. *Free organic acids* occur in wines and malt liquors, tartaric being the principal acid of the former and acetic of the latter. The lighter wines contain a greater quantity than the stronger. These acids are wholesome, and tend to quench thirst and promote appetite and digestion. *Sugar* is present in varying quantity in malt liquors, in liqueurs and cordials, in most wines, and is sometimes added by the manufacturer to certain of the ardent spirits, as gin. Among wines those that contain the most sugar are the fortified wines, such as sherry, madeira and port, and champagne. The lighter hocks and clarets contain very much less, and sometimes even none at all. Saccharine alcoholic beverages are decidedly more trying to the digestion than the non-saccharine, the sugar being apt to ferment and breed acidity, flatulence, and nausea. They are especially obnoxious in the diseases *diabetes* and *gout*. Various *salts* are present in wines and malt liquors; those of vegetable acids are antiscorbutic. Free *carbonic acid* occurs in all effervescing beverages. It is thirst-quenching, stomachic, and tends to repress and remove nausea. Champagne, therefore, if very dry, can sometimes be retained by an irritable stomach when all other alcoholic fluids are rejected. *Tannic acid* (tannin) is present in appreciable quantity only in red wines, and as it precipitates slowly when the wine is kept, an old wine contains less of it than a new. Tannin is astringent, and in small quantity not unwholesome. A high percentage, however, such as is found in new red wines, is apt to disorder the stomach, and also gives the wine a rough, harsh, "puckery" taste. The *bitter principle* of malt liquors, derived from the hop, is in small quantity thirst-quenching and appetizing, but in large amount induces dyspepsia and diarrhœa. The hop also gives malt liquors a decided somniferous effect. EDWARD CURTIS.

Wines (ENOCH COBB), D. D., LL.D., b. at Hanover, N. J., Feb. 17, 1806; graduated at Middlebury College 1827; was a teacher at St. Alban's, Vt., Alexandria, Va., Washington, D. C., and on board the U. S. man-of-war Constellation, in which he made a voyage to the Mediterranean 1829–32; took charge of the Edge Hill School, Princeton, N. J., 1833; became professor of languages in the Central High School at Philadelphia 1838; conducted a boarding school at Burlington, N. J., 1844–48; was licensed as a Congregational preacher 1849; was pastor of churches at Cornwall, Vt., and Easthampton, L. I.; became professor of ancient languages in Washington College, Pa., 1853; became president of the City University of St. Louis, Mo., 1859; secretary of the New York Prison Association 1862; founded the National Prison Association 1870, of which he became secretary; went to Europe as a representative of the U. S. government 1871; succeeded in convening representatives of twenty-six governments at the first International Penitentiary Congress at London, July 4, 1872, when he was appointed chairman of a commission which met at Brussels 1874 and at Bruchsal 1875, and called a second international congress to meet at Stockholm 1877. Author of *Commentaries on the Laws of the Ancient Hebrews* (1853), and of several treatises on educational, economic, and religious topics. D. Dec. 10, 1879.

Wines'burg, p.-v., Paint tp., Holmes co., O. P. 260.

Win'field, p.-v. and tp., Du Page co., Ill. P. 2211.

Winfield, p.-v. and tp., Lake co., Ind. P. 516.

Winfield, tp., Scott co., Ia. P. 991.

Winfield, p.-v. and tp., cap. of Cowley co., Kan., on Walnut River, 2 miles E. of Arkansas River, contains good schools, fine court-house and jail, 3 newspapers, 3 hotels, 2 grist-mills, and 2 banks. It is the principal trading-point for a large region. P. 472.

V. B. BECKETT, ED. "COURIER."

Winfield, p.-v., cap. of Winn parish, La. P. 94.

Winfield, tp., Montcalm co., Mich. P. 326.

Winfield, p.-v. and tp., Herkimer co., N. Y. P. 1561.

Winfield, p.-v., Dover tp., Tuscarawas co., O. P. 126.

Winfield, tp., Butler co., Pa. P. 1121.

Winfield, p.-v. and tp., Marion co., West Va. P. of v. 47; of tp. 1353.

Winfield, p.-v., cap. of Putnam co., West Va.

Winfield, tp., Sauk co., Wis. P. 758.

Wing (of an army). See ALA.

Wing (of birds). See BIRDS, by PROF. J. S. NEWBERRY, M. D., LL.D.

Wing (VINCENT), b. in England early in the seventeenth century, a mathematician and astronomer of considerable reputation, was author of *A Dreadful Prognostication* (1649), *Harmonicon Cœleste* (1651), *Astronomia Britannica* (1652), *Ephemerides from 1652 to 1658* (1652), *Ephemerides for Twenty Years, 1652–74* (1658), *Examen Astronomiæ Caroline Thomæ Streetii* (1665), *Ephemeris for Thirty Years, with Computatio Catholica* (1669), *The Art of Surveying* (1700), edited by John Wing, called "Philomath," probably his son; of a book and a sheet almanac published annually for the Stationers' Company, the latter of which is still continued under his name; and (with William Leybourn) of *Urania Practica* (1649) and *Eus Fictum Shukerbri* (1649). D. in 1669 or 1670. (See *Vincent Wing, by J. G.* (1670), perhaps by James Gregory.)

Win'gate (CHARLES FREDERICK), b. at Harlem, N. Y., Mar. 5, 1847; educated in the public schools of New York; travelled in Europe 1866–67; adopted the career of a journalist, which he has since pursued, serving in all its branches, from reporting upward; was for five years the New York correspondent of the Springfield *Republican* over the signature "Carlfried;" has been a contributor to various literary periodicals; founded in 1872 (with Howard Lockwood) *The Paper-Trade Journal*, in 1873 *The American Stationer*, and in 1875 *The Housekeeper*, a monthly magazine, of which he is editor and proprietor; published in 1876 a series of four articles in the *North American Review* on the history of the "Tammany Ring;" also was one of the editors of New York *Evening Express*.

Wingate (EDMUND), b. in Yorkshire, England, in 1593; graduated at Queen's College, Oxford, about 1614; studied law at Gray's Inn, cultivating at the same time mathematical researches; spent some years in France from 1624; taught English to the princess Henrietta Maria (afterward queen of England) and to some of the ladies of her suite, and also taught mathematics at the French court; inherited a landed estate in Bedfordshire, where at the commencement of the great rebellion he was a justice of the peace and recorder of Bedford; took the Covenant: sat in Parliament for the county; took about 1650 the oath called the "Engagement;" became a supporter and friend of Cromwell when Protector, and served as a commissioner for ejecting "scandalous" ministers from their benefices. D. in London in Dec., 1656. Author of *The Use of Proportional Rules in Arithmetic and Geometry* (in French, Paris, 1624; in English, London, 1626), *Arithmetic Made Easy* (1630), *Construction and Use of the Logarithmetical Tables* (1635), of other mathematical works and legal treatises.

Wingate (PAINE), b. at Amesbury, Mass., May 14, 1739; graduated at Harvard 1759; was ordained Congregational minister at Hampton Falls, N. H., Dec. 14, 1763; removed to Stratham, and became a farmer 1771; was a member of Congress under the Confederation 1787; U. S. Senator 1789–93; member of Congress 1793–95, and judge of the superior court of New Hampshire 1798–1809, and was the last survivor of the original members of the Senate, and was for some years the oldest graduate of Harvard. D. at Stratham, N. H., Mar. 7, 1838.

Wing'field (EDWIN MARIA), b. in England about 1570, of an opulent family; became a merchant in London; took part in the enterprise of colonizing Virginia under the patent of Apr. 10, 1606; sailed with the first company of emigrants Dec. 19, 1606; was named president of the colony by the sealed instructions opened on shipboard, but quarrelled with his associates, especially with Capt. John Smith; was deposed and replaced by Ratcliff, and returned to England in 1608, after which no further details of his life are known. His memory has been rehabilitated by the discovery of his *Discourse of Virginia* (Boston, 1860), edited in the *Transactions* of the American Antiquarian Society, vol. iv., from the original manuscript by Charles Deane of Boston.

Wing'ham, p.-v., Huron co., Ont., Can., on Great Western R. R., at the forks of the river Maitland, has extensive water-power and large manufactures. P. about 700.

Wing'ville, tp., Grant co., Wis. P. 1031.

Win'hall, p. v. and tp., Bennington co., Vt. P. 842.

Wink'elried, von (ARNOLD STRUTH), native of the canton of Unterwalden, Switzerland; decided by his patriotic self-sacrifice the battle of Sempach, July 9, 1386, in which a small Swiss force was engaged with a large Austrian army under Archduke Leopold. By gathering the lances of Austrian halberdiers into his body and bearing them down to the ground, he effected a breach in the Austrian line, through which the Swiss made the attack. A monument was raised to him at Stanz, in Unterwalden, Sept. 3, 1865. (See Kleissner, *Die Quellen zur Sempacher Schlacht und die Winkelried Sage*, Göttingen, 1873.)

Wink'worth (CATHARINE), b. in England about 1825; has translated from the German *Lyra Germanica* (1855; 6th ed., illustrated, 1860; second series, 1858; new ed. 1862), *The Life of Amelia Wilhelmina Sievking* (1863), *The Christian Singers of Germany* (1866), and *Palm-Leaves, Sacred Poems by Karl Gerok* (1871).

Winkworth (SUSANNA), sister of Catharine, b. in England about 1820; has translated from the German *The Life and Letters of Barthold Georg Niebuhr, with Essays by Bunsen, Brandis, and Lockel* (3 vols., 1851–52), *Theologia Germanica* (1854), Bunsen's *Signs of the Times* (1856) and *God in History, or the Progress of Man's Faith* (3 vols., 1868–70), *The History and Life of the Rev. John Tauler, with Twenty-five of his Sermons* (1857), and *German Love, from the Papers of an Alien* (1857), and completed, after the death of Archdeacon Julius Charles Hare, his *Life of Luther, in Forty-eight Historical Engravings by Gustav Koenig, with Explanations* (1855).

Win'lock (JOSEPH), LL.D., b. at Shelbyville, Ky., Feb. 6, 1826; graduated at Shelby College 1845; became professor of mathematics and astronomy in that institution; was employed at the observatory at Cambridge, Mass., as one of the computers of the *Nautical Almanac* 1852; became professor of mathematics in the U. S. navy 1857; was employed at the Naval Observatory at Washington, D. C., and at the Naval Academy at Annapolis, Md.; became director of the observatory at Cambridge, Mass., and Phillips professor of astronomy in Harvard University 1865; conducted expeditions to Kentucky to observe the solar eclipse of Aug., 1869, and to Spain to observe that of Dec., 1870, and made several improvements in the equipment of the observatory which have been generally adopted in similar institutions. D. at Cambridge June 11, 1875.

Winn, parish of N. Louisiana, bounded W. by Saline Bayou, and intersected by Dugdemona River; surface level, with many small lakes; soil fertile. Swine and cattle are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Winfield. Area, about 1000 sq. m. P. 4954.

Winn, p.-v. and tp., Penobscot co., Me. P. 714.

Winneba'go, county of N. Illinois, bordering on Wisconsin, drained by Pecatonia and Rock rivers, and connected by railway with Chicago; surface for the most part prairie, soil fertile. There are flour-mills, cotton-mills, paper-mills, and manufactories of agricultural implements, carriages, clothing, iron castings, machinery, and sashes, doors, and blinds. Horses, cattle, sheep, and swine are numerous. Staples, Indian corn, oats, wheat, rye, potatoes, wool, and dairy products. Cap. Rockford. Area, 508 sq. m. P. 29,301.

Winnebago, county of N. Iowa, bordering on Minnesota; surface rolling prairie-land, soil fertile. Staples, hay, wheat, oats, and Indian corn. Cap. Forest City. Area, 432 sq. m. P. 1562.

Winnebago, county of E. Wisconsin, lying on Lake Winnebago, drained by Fox and Wolf rivers, and having railroad connection with Milwaukee; surface level, soil fertile. There are numerous saw-mills, planing-mills, flour-mills, tanneries and breweries, manufactories of agricultural implements, carriages, furniture, boots and shoes, wagon materials, iron castings, machinery, sashes, doors, and blinds, matches, paper, and woollen goods. Sheep, cattle, and horses are numerous. Staples, manufactured articles, hay, wheat, oats, corn, hops, wool, and dairy products. Cap. Oshkosh. Area, 450 sq. m. P. 37,279.

Winnebago, p.-v. and tp., Winnebago co., Ill. P. 1427.

Winnebago, tp., Houston co., Minn. P. 804.

Winnebago City, p.-v. and tp., Faribault co., Minn. P. of v. 326; of tp. 780.

Winnebago Indians, a tribe of the Dakota stock, called by themselves *Hochungara* ("trout-eaters"), and by the Hurons *Ascutsicaen*, but named *Winnebago* ("men of the fetid or salt water") by the Algonkin tribes; were first found on the W. shore of Lake Michigan, surrounded by hostile Algonkin tribes. The Winnebagoes were formerly enemies of the whites, until after the Black Hawk

war, in which they took some part; were removed (in 1848) to Minnesota, where they settled on Blue Earth River, in a fine region, and prospered until 1863, when their removal was demanded by their white neighbors in consequence of unjust suspicions of their connection with the Sioux outbreak. They were then removed to Crow Creek, Dak., whence in the following year they were sent to a reservation of 128,000 acres in Nebraska, near that of the Omahas, 80 miles N. of Omaha City. Notwithstanding the ill-treatment and suffering they have endured, they are on the whole progressing. In 1874 they numbered 1445 souls in Nebraska, and several hundreds in Wood, Juneau, and Adams cos., Wis. The latter are self-supporting. Roman Catholic and Presbyterian missions have been established among them, with but little result.

Winnebago Lake, the largest lake entirely within the limits of Wisconsin, is traversed by the navigable Fox River. It is 26 miles long, and has a maximum breadth of 10 miles. Area, 212 sq. m. It is navigated by steamboats, and abounds in fish of various species. A part of its eastern shore has been curiously walled with stones by the action of the ice.

Winneconne, p.-v. and tp., Winnebago co., Wis. P. of v. 1159; of tp. 2155.

Winnemuc'ca, p.-v., cap. of Humboldt co., Nev.

Win'nepegoose, or **Little Winnipeg Lake,** a lake 125 miles long and 25 miles wide, which lies some 50 miles W. of Lake Winnipeg, and nearly parallel to it. Its waters, with those of Lake Manitoba, flow into Lake Winnipeg.

Win'neshiek, county of N. E. Iowa, bordering on Minnesota, intersected by Upper Iowa and Turkey rivers, and traversed by Milwaukee and St. Paul R. R.; surface rolling prairies and woodland; soil fertile. There are flour-mills, saw-mills, woollen-mills, breweries, and manufactories of agricultural implements, carriages, iron castings, and machinery. Horses, cattle, and swine are numerous. Staples, Indian corn, oats, hay, and dairy products. Cap. Decorah. Area, 720 sq. m. P. 23,570.

Win'nipauk, p.-v., Fairfield co., Conn.

Winnipeg, cap. of Manitoba, Can.; also known as Fort Garry (which see).

Win'nipeg Lake, of British North America, between lat. 50° and 51° N. and lon. 96° and 99° W., the great reservoir of the Saskatchewan, is 280 miles long, varying in width from 60 miles in the N. part to 3 miles at the narrows toward its S. end. It receives at its S. end Red River, upward of 750 miles long by its very tortuous course. Toward its S. end the river Winnipeg enters, coming from the E. S. E. Lake Winnipeg is apparently about 9000 sq. m. in area, or nearly one-half larger than Lake Ontario. By recent surveys it is found to be 710 feet above the sea, or 112 feet higher than Lake Superior. It is very shallow at its S. end, toward the mouth of Red River. Its E. coast from the mouth of the river Winnipeg northward is a rugged Laurentian country, from which it receives Berens River, 160 miles long, and Jack River, 150, besides lesser tributaries. Southward and along its W. coast throughout is the level Silurian plain country, where a tract adjoining the province of Manitoba has been selected by a party of Icelandic settlers for the site of a national colony. The soil is very fertile, wooded, but interspersed with rich extensive meadows, and the fisheries of the lake are very rich. From the lake south-eastward the river Winnipeg, for 250 miles, up to and through the Lake of the Woods, and about 10 miles beyond it, is the boundary between the Laurentian and Silurian formations. The small but rapidly-increasing city of Winnipeg, the capital of the province of Manitoba, is situated 40 miles up from the lake on the W. side of Red River, immediately below the mouth of the river Assiniboin.

A. J. Russell.

Winnipeg River has its source in the outlets of Lake Sal and Lake of the Woods, and flows circuitously in a N. W. direction, entering Lake Winnipeg toward its S. E. extremity. Though only about 520 miles in length, it drains a wide area of high, humid, and wooded country, and delivers about as much water into Lake Winnipeg as the Saskatchewan, though not draining half the area, having about three times the volume of the Red River. Lac des Milles Lacs (in connection with Lake Shebandowan on a tributary of Lake Superior) and other lakes, upper waters of the river Winnipeg—with Rainy Lake and the Lake of the Woods, 73 miles long, into which they flow by the large and navigable reach of the Winnipeg called Rainy River, 80 miles long, and the lower reach from the Lake of the Woods to Lake Winnipeg, which, though obstructed with rapids on parts, can be made navigable—offer a line of navigation of great capacity as an outlet of the Saskatchewan Valley. It is now partly used by a line of steamers. On its lower course the Winnipeg receives English River, about 310 miles long. On the W. side of the middle of Lake Winnipeg it receives, through Little Saskatchewan River, the waters of Lake Manitoba, 135 miles long, and Lake Winnepegoose, 118 miles, forming with Red Deer River, which enters the upper part of the latter, a tributary 514 miles long, presenting an interior extent of navigation of considerable value.

A. J. Russell.

Winnipiseog'ee Lake, lies between Carroll and Belknap cos., N. H. It is of irregular outline, and has an extreme length of 25 miles and a breadth varying from 1 to 10 miles. It is studded with picturesque islands, and is much visited in summer for its charming scenery. Area, 175 sq. m.; elevation, 472 feet. It is navigated by steamboats, and discharges its clear waters by the Winnepiseogee River, one of the head-streams of the Merrimack.

Winns'borough, p.-v., cap. of Franklin parish, La.

Winnsborough, p.-v. and tp., cap. of Fairfield co., S. C. P. 1124.

Wino'na, county of S. E. Minnesota, bordering on Mississippi River, which separates it from Wisconsin, drained by Whitewater River, and traversed by Winona and St. Peter and Milwaukee and St. Paul R. Rs.; surface mostly rolling prairie, interspersed with woodland; soil fertile. There are railway repair-shops, flour-mills, saw-mills, planing-mills, breweries, and manufactories of agricultural implements, carriages, iron castings, sash, doors, and blinds, and lightning-rods. Cattle and horses are the chief live-stock. Staples, wheat, oats, corn, hay, and dairy products. Cap. Winona. Area, 638 sq. m. P. 22,319.

Winona, city and tp., cap. of Winona co., Minn., on a beautiful plateau on the W. bank of Mississippi River. The railroad system of the city embraces Winona and St. Peter, St. Paul and Chicago, Madison and Winona extension of Chicago and North-western, connected with Winona and St. Peter by a handsome iron bridge across the Mississippi, Green Bay and Minnesota R. Rs. Two other important lines—one to Central Iowa, and the other to the lumber-producing region of the Chippewa Valley in Wisconsin—are contemplated. The completion of these enterprises will, it is believed, make Winona the largest and most important commercial centre between St. Paul and St. Louis. The first white settlement made in this place was in 1851; in 1857 a city government was organized. Since that period the growth of the place has been steady and permanent. Winona is noted for the natural beauty of its site and surroundings, for its healthfulness, for the air of taste, comfort, and culture which pervades its residences, for its excellent system of graded schools, which rank among the highest of their class in the North-west, and generally for its thrift, energy, and commercial activity. It is the seat of the soldiers' orphans' home, a State institution, and also of the first State normal school of Minnesota, an exceedingly well-conducted and successful institution for the training of teachers. The normal school building is a symmetrical and imposing edifice, erected by the State at a cost of $145,000. The high school, a very handsome structure erected by the city, cost $55,000. A second public school building, completed in 1875, cost $35,000. There are in the city 15 organized churches, a well-selected public library of 5000 volumes, and 1 daily and 3 weekly newspapers. Among the business and manufacturing establishments are 3 national banks of issue and 1 savings bank, 3 wholesale grocery stores, 8 clothing stores, 5 boot and shoe establishments, 1 saddlery hardware store, 3 large saw-mills, 5 sash and door factories, 7 flouring-mills, 2 wheat-elevators, 2 foundries, several factories of agricultural implements, ploughs, etc., 6 carriage and wagon manufactories, 1 of which employs about 40 men, and is the largest W. of Lake Michigan; 1 blank-book manufactory, 1 confectionery and vinegar manufacturing establishment, gas manufactory, a tannery, a cracker-factory, 3 steam barrel-factories. The business portion of the town is compactly and substantially built of brick and stone, the streets are wide and regularly laid out, and the whole appearance of the place betokens business activity and prosperity. Lumber and grain are among the leading staples of trade, the sales of manufactured lumber in 1874 amounting to $1,500,000, and the exports of wheat (including flour) during the same year reaching 5,500,000 bushels, thus placing Winona at the head of wheat-exporting towns in the Mississippi Valley. P. of city, 7192; of tp., exclusive of city, 487.

D. Sinclair, Ed. "Daily Republican."

Winona, p.-v., cap. of Montgomery co., Miss., on New Orleans St. Louis and Chicago R. R., 271 miles N. of the former city, contains 3 churches, 4 schools, 1 newspaper, grist and planing mills, 1 sash and door factory, 3 hotels, court-house and jail, and fair-grounds. Cotton is the principal staple. P. 2200. Jones & Money, Eds. "Advance."

Winooski. See WINOOSKI FALLS.

Winoos'ki Falls, p. o. in the v. of Winooski, in the tps. of Colchester and Burlington, Chittenden co., Vt., on both sides of Winooski River, which here makes a fall of 20 feet, supplying a water power which is largely utilized for manufacturing purposes, is on Vermont Central R. R., 2 miles N. E. of Burlington, and includes the cemetery in the latter tp., in which is a lofty granite monument over the remains of Gen. Ethan Allen.

Winooski (or **Onion**) **River** rises in Caledonia co., Vt., and takes a south westerly and afterward a northwesterly direction, flowing into Lake Champlain at a point 5 miles N. W. of Burlington. It has numerous falls, of which those at Middlesex and those at Winooski Falls, near Burlington, may be noticed.

Winsflow, p.-v. and tp., Stephenson co., Ill. P. 929.

Winslow, p.-v. and tp., Kennebec co., Me. P. 1437.

Winslow, p.-v. and tp., Camden co., N. J. P. 2050.

Winslow, tp., Jefferson co., Pa. P. 1320.

Winslow (BENJAMIN DAVIS), b. in Boston, Mass., in 1815; graduated at Harvard 1835, and at the (Episcopal) General Theological Seminary, N. Y., 1838; became assistant in the same year to Rev. Dr. (afterward Bishop) G. W. Doane in the pastorate of St. Mary's church, Burlington, N. J., and d. at Burlington Nov. 21, 1839. He is said to have been an accomplished preacher and a graceful poet. His *Sermons and Poetical Remains* (1841) were edited by Rev. Dr. G. W. Doane, who prefixed a biographical eulogy entitled *The True Catholic Churchman in his Life and in his Death.*

Winslow (CHARLES FREDERICK), M. D., b. at Nantucket, Mass., in 1811; graduated in medicine at Harvard 1834; contributed to scientific and literary periodicals; was U. S. consul at Payta, Peru, several years from 1862; visited the Sandwich Islands and other foreign countries, and was long a resident of California. Author of *Cosmography, or Philosophical Views of the Universe* (1853), *The Preparation of the Earth for the Intellectual Races* (1851), *The Cooling Globe, or the Mechanics of Geology* (1865), and *Force and Nature, etc.* (1869).

Winslow (EDWARD), b. at Droitwich, Worcestershire, England, Oct. 19, 1595, son of Edward Winslow, Esq., a member of a family of considerable note in that county; received a good education; became imbued with the doctrines of Puritanism, and having, while travelling on the Continent, made the acquaintance of Rev. John Robinson, pastor of the "Pilgrim" church at Leyden, joined his congregation 1617, and married there; embarked in the Mayflower with his wife and his brother Gilbert 1620; was one of the party in the shallop which explored the coasts of Cape Cod and discovered the port of Plymouth; lost his wife during the first winter; married Mrs. Susannah White, being the first marriage in New England; took an active part in public affairs; offered himself as a hostage to Massasoit, and paid two visits to the residence of that chieftain two days' journey inland, curing him of a severe illness on the second occasion (1623), thereby gaining his confidence and assuring his friendship; was followed to Massachusetts by three other brothers, two being Kenelm and Josiah; wrote a narrative of his visit to the Indians, which appeared in George Morton's *Relation* (1622); made a voyage to England as agent of the colony 1623, returning with a supply of necessaries and the first cattle; was chosen a magistrate 1624; made a second voyage to England, returning 1625; was chosen governor 1633; went to England again 1635, when he appeared before the council and succeeded in disconcerting a plot for abolishing the self-government enjoyed by the colonists; was thrown into the Fleet prison for seventeen weeks by order of Archbishop Laud, on complaint of Thomas Morton, for having at Plymouth taught in the church, being a layman, and having performed the ceremony of marriage as a magistrate; was again governor 1636, and a third time 1644; went to England for the last time 1649, when he was influential in the formation of the "Society for Propagating the Gospel among the Indians of New England;" remained in England during the Protectorate, being employed in several public capacities, and in 1655 was one of three commissioners sent by Cromwell to direct an expedition against the Spanish settlements in the West Indies. D. at sea of a fever, between Santo Domingo and Jamaica, May 8, 1655, and was buried at sea. A portrait, said to be by Vandyke, is preserved in Memorial Hall, Plymouth, where are also his chair and other relics. Author of *Good News from New England, or a True Relation of Things very Remarkable at the Plantation of Plimouth in N. England; together with a Relation of Customes among the Indians* (1624), *Hypocrisie Unmasked, a True Relation of the Proceedings of the Governour and Company of the Massachusetts against Samuel Gorton, etc.* (1646), reissued as *The Danger of Tolerating Levellers in a Civill State, etc.* (1649), *New England's Salamander, etc.* (1647), *The Glorious Progress of the Gospel among the Indians in New England, with Appendix* (1649), and *A Platform of Church Discipline in New England* (1653), several of which have been republished by the Massachusetts Historical Society. An elaborate *Genealogy* of the descendants of Gov. Winslow and his brothers has been prepared by Dr. David Parsons Holton of New York. PORTER C. BLISS.

Winslow (FORBES BENIGNUS), M. D., D. C. L., b. in London, England, in Aug., 1810, son of Capt. Thomas Winslow of the 17th regiment, and a descendant of the Massachusetts Winslows; studied in private schools in Scotland and at Manchester; came to the U. S. in early life; commenced the study of medicine at New York; graduated at the College of Surgeons, London, 1835; took his degree of M. D. at Aberdeen; commenced practice in London; was for some time Parliamentary reporter for the *Times*; gave special attention to insanity; was Lettsomian lecturer to the Medical Society of London 1837; opened a private asylum at Sussex House, Hammersmith, and subsequently another in London; founded in 1848 the *Quarterly Journal of Psychological Medicine and Mental Pathology*, which he conducted until 1865; became in 1857 president of the association of medical officers of hospitals and asylums for the insane, and in 1859 a commissioner of lunacy; founded *The Medical Critic* 1861; was chosen vice-president of the Juridical Society and president of the Medical Society of London 1853; was frequently examined as an expert in criminal trials involving the question of the insanity of the prisoner, and was a firm upholder of the doctrine of "moral insanity;" was a member of the leading scientific societies, "an indefatigable worker, a genial philanthropist, a good talker, and a hospitable host, and highly esteemed by a large circle of friends." D. at Brighton Mar. 3, 1874. Author of *The Application of the Principles of Phrenology to the Elucidation and Cure of Insanity* (1831), *A Manual of Osteology, A Manual of Practical Midwifery, Physic and Physicians* (2 vols., 1839), *The Anatomy of Suicide* (1840), *On the Preservation of the Health of the Body and Mind* (1842), *The Plea of Insanity in Criminal Cases* (1843), *Notes on the Lunacy Act* (1845), *On Softening of the Brain, arising from Anxiety and Undue Mental Exercise* (1849), *The Lettsomian Lectures on Insanity* (1854), *On Obscure Diseases of the Brain and Disorders of the Mind* (1860; 4th ed. 1868), *Light, its Influence on Life and Health* (1867), and other professional treatises, and was a frequent contributor to medical journals and to the London *Times* and *Pall Mall Gazette.*

Winslow (GORDON), M. D., D. D., brother of Drs. Hubbard and Miron, b. at Williston, Vt., in 1804; became an Episcopal clergyman; was rector of churches at Troy, N. Y., Annapolis, Md., and Staten Island; served as chaplain of the Duryee Zouaves 1861, and inspector of the Army of the Potomac for the Sanitary Commission 1863, and was drowned in the Potomac June 7, 1864. Author of various pamphlets and a contributor to several periodicals.—His son, CLEVELAND, b. in 1836, became colonel of volunteers in the Army of the Potomac, and d. of wounds received at the battle of Mechanicsville, Va., July 7, 1864.

Winslow (HUBBARD), D. D., brother of Drs. Gordon and Miron, b. at Williston, Vt., Oct. 30, 1799, son of Nathaniel, a distinguished instructor (1752–1832), and a descendant of Kenelm of the Mayflower; studied at Phillips Academy, Andover, Mass.; graduated with honors at Yale College 1825; studied theology under Dr. N. W. Taylor at New Haven; preached at Litchfield, Conn., 1827–28; was pastor of the First church at Dover, N. H., 1828–31, and of the Bowdoin street church, Boston, Mass., 1832–44, in which he was eminently successful; travelled in Europe; was principal of Mount Vernon (Boston) institute for young ladies 1844–53; took an active part in the discussion of educational questions; was an examiner at Harvard and a trustee of several colleges; visited Europe to inspect educational institutions 1853; edited the *Religious Magazine* and wrote for numerous periodicals; defended the doctrines of his former instructor, Dr. Taylor, against the attacks of Dr. Bennet Tyler, gaining great repute as a polemical theologian; delivered lectures on scientific, religious, educational, literary, and practical topics, including the duties of citizens; preached to the First Presbyterian church at Geneva, N. Y., 1857–59, and became pastor of the Fiftieth street Presbyterian church, New York City, 1861. D. at Williston, Vt., Aug. 13, 1864. Author, among other works, of *Controversial Theology* (1832), *The Doctrine of the Trinity* (1834), *The Young Man's Aid to Knowledge* (1836), *Woman as She Should Be* (1838), *Elements of Intellectual Philosophy* (1851), *Elements of Moral Philosophy* (1856), and *The Hidden Life* (1862).

Winslow (Jacques Bénigne), b. at Odense, Denmark, in 1669, was probably a descendant of the English Puritan family of the name at Leyden, Holland; studied medicine at Paris, where he settled; became in 1743 professor of anatomy and physiology at the Jardin du Roi; made important discoveries in anatomy, of which a memorial remains in the name "foramen of Winslow" borne by an opening in the gastro-splenic omentum. D. at Paris in 1760. Author of *Exposition anatomique de la Structure du Corps humain* (Paris, 1732), which was translated into English, German, Italian, and Latin.

Winslow (James), b. at Albany, N. Y., in 1814; passed his early business life in the hardware store of Erastus Corning in that city; subsequently came to New York, and entered the banking firm of Winslow, Lanier & Co., which had been established by his father, and which rose from modest proportions to a position of financial influence, and rendered important services to the government of Pres. Lincoln in connection with the war-loans. Mr. Winslow was identified with the rise of national banks, of several of which he was an officer. D. in New York City July 18, 1874.

Winslow (John), grandson of Gov. Josiah, b. at Marshfield, Mass., May 27, 1702; was a captain in the unfortunate British expedition against Cuba 1740; was prominent in the Kennebec and Acadian expeditions, being the principal actor in the expulsion of the Acadians from their homes in 1755; commander at Fort William Henry 1756; took part as major-general in the expedition against Canada 1758–59; became judge of common pleas for Plymouth co. 1762; was the founder of the town of Winslow in the district of Maine 1766, and was a member of the Massachusetts legislature and of the provincial council during the Stamp-Act difficulties. D. at Hingham, Mass., Apr. 17, 1774. Most of his family were loyalists, and settled in Nova Scotia during the Revolution.

Winslow (John A.), U. S. N., b. Nov. 9, 1811, in North Carolina; entered the navy as a midshipman Feb. 1, 1827; became lieutenant in 1839, commander in 1855, captain in 1862, commodore in 1864, rear-admiral in 1866. Served on the E. coast of Mexico during our war with that country, and participated in the capture of Tuspan; but the service which placed his name on the roll of fame was that performed by him on June 19, 1864, when, in command of the Kearsarge, he sent to the bottom, after an hour's action, the Confederate steamer Alabama, which had made such havoc among American merchantmen. The fight was about as fair a one as has ever been fought at sea, "the vessels being well matched in size, speed, armament, and crew," and the honorable secretary of the navy but expressed the public sentiment when, in his dispatch of July 6, 1864, he wrote: "The battle was so brief, the victory so decisive, and the comparative results so striking, that the country will be reminded of the brilliant actions of our infant navy which have been repeated and illustrated in this engagement." A story which was for some time current, that the Kearsarge was an "iron-clad," had its foundation, most probably, in the fact that her executive officer had had her sheet cables "stopped up and down her sides, so as to cover her midship section;" and as this expedient had often been resorted to before by Union naval officers for the protection of one of the vital parts of a ship (her motive-power) from projectiles, it seems somewhat singular that it should not have suggested itself to any one on board the Alabama. D. Sept. 29, 1873. Foxhall A. Parker.

Winslow (Josiah), son of Gov. Edward, b. at Marshfield, Mass., in 1629; became commander of the Marshfield military company 1652; captured Alexander, the son of Massasoit, 1656, thereby probably averting a meditated attack upon Plymouth Colony; became major and commander-in-chief of the colonial forces 1658; was chosen deputy 1657, and one of the commissioners of the united colonies 1658, to which post he was annually re-elected until 1670; served several years as assistant governor, and was governor from 1673 until his death, including the trying period of King Philip's war, when he was both *ex-officio* and by virtue of his military rank the general-in-chief of all the forces of the united colonies. D. at Marshfield Dec. 18, 1680. He was the first native-born governor of Plymouth Colony.

Winslow (Miron), D. D., LL.D., brother of Drs. Gordon and Hubbard, b. at Williston, Vt., Dec. 11, 1789; graduated as valedictorian at Middlebury College 1815, and at Andover Theological Seminary 1818; married Miss Harriet Wadsworth Lathrop; sailed for Ceylon as a missionary of the A. B. C. F. M. June, 1819; arrived at Jaffna Feb., 1820; labored there and at Oodoville seventeen years; lost his wife at the latter place Jan. 14, 1833; founded the Madras mission 1837; was president of the important native college established at that city in 1840; translated the Bible into Tamil (finished about 1835); published educational and religious books in that language; supervised the mission press; wrote largely for the *Missionary Herald* and other European and American periodicals; prepared a *Memoir of Mrs. Harriet Winslow* (New York, 1835), which was widely read for many years, republished in England, and translated into French and Turkish, and devoted three or four hours daily for nearly thirty years to the preparation of his great work, *A Comprehensive Tamil and English Dictionary of High and Low Tamil* (Madras, 1862), partly based upon MS. materials left by the Rev. Joseph Knight—a work of a highly original character, containing over 67,000 Tamil words, and constituting one of the noblest of the many contributions of American missionaries to comparative philology. D. at the Cape of Good Hope when on a voyage to America, Oct. 22, 1864. By his second wife, Anne Spiers (d. 1844), daughter of a physician of the Madras service, he had two sons—Charles, b. at Madras June 5, 1839; educated in England, also at Yale and Williams colleges, and in medicine at the University of Pennsylvania; was a surgeon in the civil war, and at its close settled and married at Ciudad Guerrero, Mexico; and Miron, b. at Madras Aug. 28, 1840; educated at Yale College; served as officer of a New York regiment in the Army of the Potomac; graduated at Columbia College Law School 1864, and practises his profession in New York.

Winslow (Octavius), D. D., b. in England about 1815; received a good education; studied theology, and became a prominent Baptist minister in London.—His mother, Mrs. Mary Winslow, was a deeply religious lady, who has become well known through her biography, entitled *Life in Jesus* (1855), by her son, Dr. Winslow, who was also author of *Views of the Atonement* (1839; 8th ed. 1861), *Midnight Harmonies* (1851), *Human Sympathy* (1853), *Morning Thoughts* (1856), *Evening Thoughts* (1857), *Hidden Life* (1857), *Helps Heavenward* (1860), and many other devotional treatises. D. Mar. 5, 1878.

Winslow (Stephen N.), b. in 1826; has been since 1844 one of the editors of the Philadelphia *Commercial List* and *Inquirer;* has written largely for other periodicals, and is author of *Biographies of Successful Philadelphia Merchants* (1864).

Win'sor (Justin), b. at Boston, Mass., Jan. 2, 1831; educated at Cambridge, Paris, and Heidelberg; contributed to the *Christian Examiner*, the *Knickerbocker Magazine*, and other periodicals; has been since Feb., 1868, superintendent of the Boston Public Library, and has much advanced the interests of students by his series of carefully-prepared special catalogues of that institution. Author of *A History of the Town of Duxbury* (1849); editor of Joseph Ware's *Journal of an Expedition against Quebec in 1775* (1852), and co-editor with Rev. George H. Hepworth of *Songs of the Unity* (1859). He has in preparation *The Life and Times of David Garrick, a View of the Eighteenth Century in England, in its Social, Literary, and Dramatic Relations, and their Influence upon Continental Life and Letters.*

Win'stanley (Henry), b. at Lettlebury, England, about 1650; became an eminent architect, designer, and engraver; published two volumes of architectural sketches of the royal palace of Audley End, and built (1696–1700) the first Eddystone lighthouse, where he perished during the storm in which it was swept away, Nov. 26, 1703.

Win'sted, p.-b. (incorporated), Litchfield co., Conn., at the northern terminus of Naugatuck R. R., 62 miles by rail from Bridgeport, and 26 miles W. of Hartford; Connecticut Western R. R. (Hartford to Millerton, N. Y.) intersects with the Naugatuck at this point. The borough contains the two villages of Winsted and West Winsted, each having a post-office (about 1 mile apart), the villages being connected by one continuous Main street, about 3 miles in length, following the winding course of Mad River (a branch of the Farmington), which furnishes an excellent water-power. The geography of Winsted is wonderfully diversified and remarkably picturesque. The business portion is mainly along the river-bank, while private residences peep out from its many sloping hillsides. Near the western limit of the borough is Long Lake, a natural body of water artificially strengthened, whose surface is about 150 feet above Main street, covering an area of about 400 acres. In addition to the superior water-power furnished by this lake, the two villages are supplied with water in pipes, the pressure being sufficient to force water over any building on Main street. A volunteer fire department is amply supplied with hose-carriages. The growth of Winsted is due to her manufacturing interests. The chief products of her manufactories are clocks, scythes, book leather, pocket and table cutlery, pins, wagon, carriage, and car axles, wagon springs, coffin trimmings, carriage bolts, planters' hoes, sewing silk, shelf

hardware, etc. Within the limits of the borough are 5 churches, excellent schools, a convent, an opera house, 3 hotels, 3 weekly newspapers, gasworks, 1 national and 2 savings banks, and a well-endowed Beardsley (public) Library. P. 4000. J. H. VAILL, ED. "HERALD."

Winsted, tp., McLeod co., Minn. P. 638.

Win'ston, county of N. Alabama, watered by affluents of Black Warrior River; surface rolling table-land, soil fertile. Swine are the chief live-stock. Staples, Indian corn, cotton, and sweet potatoes. Cap. Houston. Area, about 900 sq. m. P. 4155.

Winston, county of Central Mississippi, drained by the head-waters of Pearl River; surface undulating, soil fertile. Swine and cattle are the chief live-stock. Staples, cotton and corn. Cap. Louisville. Area, 720 sq. m. P. 8984.

Winston, p.-v. and tp., cap. of Forsyth co., N. C., on North-western North Carolina R. R., 120 miles N. W. of Raleigh, has good schools, 2 newspapers, 3 tobacco warehouses, 10 tobacco manufactories, 1 spoke and handle factory, and 2 wagon and carriage establishments. An extensive traffic is carried on in the fruit line. P. of v. 443; of tp. 1693. GEO. M. MATHES, ED. "SENTINEL."

Winston (CHARLES), F. S. A., b. in England in 1814; studied law at the Inner Temple; practised as a special pleader from about 1835 until called to the bar in 1845, and was a learned and zealous artist and antiquary. D. in London Oct. 3, 1864. He bequeathed his 800 drawings from ancient stained glass to the British Museum. Author of *An Inquiry into the Difference of Style observable in Ancient Painted Glass, with Hints on Glass-Painting* (Oxford, 2 vols., 1847), *An Introduction to the Study of Painted Glass* (1849), and of a posthumous work, *Memoirs illustrative of the Art of Glass-Painting* (1865), edited by Philip H. Delamotte, and illustrated with 40 engravings from the author's original drawings. Mr. Delamotte has since (1868) issued a new edition, similarly illustrated, of the *Inquiry*.

Winston (JOHN ANTHONY), b. in Madison co., Ala., in 1812; educated at Lagrange College and at the University of Nashville; settled in 1834 in Sumter co., where he established a large plantation; was a member of the assembly 1839–40, and again 1842, and of the senate 1843–52, being president of the latter body 1845–48; engaged in mercantile business at Mobile 1844; was an influential member of the Baltimore convention of 1848, where he was the acknowledged leader of the Alabama Democracy; was the first native-born governor of Alabama 1853–56; gained the name of the "veto governor" by his conflicts with the legislature; was delegate to the Charleston convention of 1860, and was placed on the Douglas electoral ticket; went as a commissioner to Louisiana in 1861; raised the 8th Alabama infantry in the Confederate service; commanded it as colonel at Yorktown and on the Peninsula, being distinguished at Seven Pines, but was soon forced to retire through infirm health; was chosen to the State constitutional convention 1865, and elected in 1866 U. S. Senator, but not admitted to a seat. D. at Mobile Dec. 21, 1871.

Winston (JOSEPH), b. in Virginia in 1746; joined a company of rangers and marched to the W. frontier against the Indians 1760; was twice wounded in a battle on Greenbrier River, and was granted a pension for his gallantry; removed to Stokes co., N. C., 1766; took an active part in the Revolution; raised a regiment, of which he was commissioned major, 1766; marched against the Cherokee Indians, with whom he made a treaty 1777; had various actions with the Tories of North Carolina; commanded the American right wing at the battle of King's Mountain; had a sword voted him by the legislature, in which he frequently served; was a member of Congress 1793–95, and again 1803–07. D. near Germantown, N. C., in 1814.

Win'ter, that season of the year which begins with the shortest day, Dec. 21, and ends with the vernal equinox, Mar. 21. In the southern hemisphere the winter months are June, July, and August, and in the tropical zone the rainy season corresponds to the winter.

Winter (WILLIAM), b. at Gloucester, Mass., July 15, 1836; was educated in Boston; graduated at the Harvard Law School and admitted to the Suffolk bar; began to write both verse and prose at an early age; published a volume of poems at Boston in Dec., 1854; in 1856 lectured in and around Boston on literary subjects; published a second volume of poems, entitled *Queen's Domain*, at Boston in 1858; went to New York City in 1859, and was employed as book reviewer on the *Saturday Press* for one year; wrote for *Vanity Fair* irregularly for a long time; was dramatic critic for the New York *Albion* from 1861 to 1866, and also assistant editor and literary critic; for five years was managing editor and literary and dramatic critic of the New York *Weekly Review*; in 1865 became dramatic critic of the New York *Tribune*; published a third volume of poems, entitled *My Witness*, in Sept., 1871; published *Life of Edwin Booth* (Boston, 1872). J. B. BISHOP.

Winter, von (PETER), b. in 1755 at Manheim, Baden; entered, when eleven years old, the court orchestra of his native city as a violinist; was appointed director of orchestra in 1776, and chapel-master in 1788 at the court of Munich. D. there Oct. 17, 1825. He visited Vienna in 1783 and 1794–96, Italy in 1791 and 1816, London in 1803–05, and Paris in 1805–07, bringing on the stage, with considerable success, his own operas, of which he wrote about 50. He was also an excellent singing master, and his great *Gesangschule* (Mentz, 1824) is still used.

Win'terberry, a name applied to several American shrubs, forming a sub-genus of the *Ilex* or holly, and more particularly designating the black alder (*Ilex verticillata*), which ranges from five to twelve feet in height, grows on the edges of swamps, and bears in November and December an abundance of brilliant crimson berries, sometimes employed in domestic medicine as a bitter tonic.

Win'terbottom (THOMAS MASTERMAN), M. D., b. in England in 1765; became physician to the African colony of Sierra Leone; was one of the earliest anti-slavery advocates, and founder of several charitable funds. D. at Westoe, Durham, July 8, 1859. Author of *Medical Directions for the Use of Navigators and Settlers in Hot Climates* (2d ed. 1803) and *An Account of the Native Africans in the Neighbourhood of Sierra Leone* (2 vols., 1803).

Wintergreen. See GAULTHERIA.

Wintergreen, Oil of, or **Oil of Gaultheria,** an aromatic liquid contained in the leaves of *Gaultheria procumbens* (partridge-berry, wintergreen, deer-berry, teaberry, mountain tea), also in *Betula lenta* (sweet birch), and probably in the roots of *Polygala paucifolia*, *Spiræa ulmaria*, *Spiræa tobata*, and *Gaultheria hispidula*. It is colorless when freshly prepared, but gradually acquires a yellowish or reddish hue; possesses a peculiar sweetish taste and a characteristic and very agreeable odor; has a greater density than any other of the essential oils (1.173), and boils at 412° F. Wintergreen oil contains about 90 per cent. of methyl-salicylic acid (gaultheric acid), ($C_8H_8O_3$), and 10 per cent. of a terpene termed *gaultherilene*, isomeric with oil of turpentine. (See TURPENTINE.) The former compound, which is an isomere of anisic acid, is obtained in the distillation of the oil by allowing the boiling-point to rise to 432° F., and then collecting the portion that distils over; it can also be prepared artificially by distilling a mixture of 2 parts of crystallized salicylic acid, 2 parts of wood-spirit, and 1 part of sulphuric acid (sp. gr. 1.66), or by treating wood-spirit with salicylic chlorohydrate. Methyl-salicylic acid has a sp. gr. of 1.18, boils at 431° F., and possesses the taste and odor of the oil from which it is prepared. It is slightly soluble in water, dissolves readily in alcohol and in ether, and unites with bases, forming crystalline salts. Its aqueous solution is colored violet upon addition of a ferric salt. The purity of commercial wintergreen oil can be ascertained by means of this reaction, as well as by its very high specific gravity. It is often employed to disguise the taste of disagreeable medicines, and largely in confectionery. J. P. BATTERSHALL.

Win'terhalter (FRANZ XAVIER), b. at Blasica, Baden, Germany, Apr. 20, 1806; studied art at Munich and at Rome; took up his residence at Paris 1834; became distinguished as a portrait and genre painter; "belonged to the modern French school of art, which believes in intensity of color;" was distinguished for accuracy of drawing, grace of position, and the vividness and perfection of light and shade; was in great demand as portrait-painter to royal and princely houses, visiting nearly all the European capitals; first visited London 1842, and was well received at court; painted in 1848 a group of Queen Victoria, Prince Albert, and their children, which is well known by Cousens's engraving; subsequently made several other portraits of the English royal family, also of Louis Philippe and his queen, Napoleon III. and the empress Eugénie, etc.; received the grand cross of the Legion of Honor, many other decorations, and several medals. D. at London July 8, 1873. Among his genre pictures, the most noted are *Maternal Love* (1836), *The Decameron* and *The Young Daughter of Aricia* (1838), and *Florinda and Roderick the Goth* (1852), purchased for the royal collection.

Win'terport, p.-v. and tp., Waldo co., Me. P. 2744.

Win'ter's Bark [named from Capt. John Winter, who first brought it from the Straits of Magellan in 1579], the bark of *Drimys Winteri*, a magnoliaceous evergreen shrub which grows from Southern Chili S. to Cape Horn. It is a pleasant aromatic, tasting and smelling somewhat like cinnamon. It was once considerably employed in medicine as a stimulant tonic, but is now but little used.

Win'terset, p.-v., cap. of Madison co., Ia., on Chicago Rock Island and Pacific R. R., 42 miles from Des Moines, was incorporated in 1857, and contains a fine court-house, excellent schools, 2 banks, 2 weekly newspapers, 1 woollen-factory, several flouring-mills, and good building-stone quarries. P. 1485.

CUMMINGS & SPRINGER, EDS. "MADISONIAN."

Win'tersville, p.-v., Cross Creek tp., Jefferson co., O. P. 113.

Win'terswyk, town of the Netherlands, province of Gelderland, near the Prussian frontier, is neatly built, and manufactures cotton and linen stuffs and tiles. P. 7377.

Win'terthur, town of Switzerland, canton of Zurich, on the Eulach, is surrounded with vineyards, and has large breweries, tanneries, foundries, soapworks, and manufactures of cotton, linen, and chemicals. P. 9404.

Win'throp, p.-v., Buchanan co., Ia.

Winthrop, p.-v. and tp., Kennebec co., Me. P. 2229.

Winthrop, p.-v. and tp., Suffolk co., Mass. P. 532.

Winthrop (FITZ-JOHN), F. R. S., eldest son of Gov. John of Connecticut, b. at Ipswich, Mass., Mar. 14, 1638; resided in childhood at New London, Conn.; was educated in England; held a commission under the Protector Richard Cromwell 1658; returned to Connecticut about 1670; was elected to the assembly 1671; served as major in King Philip's war; was one of the council of Gov. Andros 1686; became a magistrate in Connecticut 1689; was major-general of the expedition against Quebec 1690; was a highly-efficient agent of Connecticut in London 1693–98, and governor of Connecticut from 1698 until his death, at Boston Nov. 27, 1707. Like his father, he was well versed in natural philosophy.

Winthrop (JAMES), LL.D., son of Prof. John, b. at Cambridge, Mass., in 1752; graduated at Harvard 1769; was librarian there 1772–87; participated in the battle of Bunker's Hill, where he was wounded, 1775; was for some years chief-justice of the Massachusetts court of common pleas and register of probate. D. at Cambridge Sept. 26, 1821. He bequeathed his valuable library to Alleghany College, Meadville, Pa. Author of *An Attempt to Translate the Prophetic Part of the Apocalypse of St. John into Familiar Language* (1794), *A Systematic Arrangement of several Scriptural Prophecies relating to Antichrist* (1795), and *An Attempt to Arrange, in the Order of Time, Scripture Prophecies yet to be Fulfilled* (1803). He contributed scientific papers to the *Memoirs* of the American Academy, and was a frequent writer for the *Literary Miscellany*.

Winthrop (JOHN), b. at Groton, Suffolk, England, Jan. 12, 1587 (O. S.), son of Adam (1548–1623), a London lawyer of ancient lineage and good education, who inherited the lordship of the manor of Groton; was educated at Trinity College, Cambridge, graduating about 1605; studied law; was appointed a justice of the peace at the age of eighteen years; married a daughter of Mr. Forth of Much Stambridge, Essex, and acquired such influence among the Puritans of the eastern counties and the capitalists of the "Company of the Massachusetts Bay in New England" that he was chosen governor of that body Oct. 20, 1629; was the leader of the great emigration of the following year, when, having sold his Suffolk estates, he sailed from Yarmouth Apr. 7, 1630, in the Arbella, accompanied by Isaac Johnson and his lady, daughter of the earl of Lincoln (for whom the vessel was named), Thomas Dudley and Simon Bradstreet, late stewards of that nobleman's estates, Sir Richard Saltonstall, Rev. John Wilson, and other distinguished men, with some 900 colonists, in a fleet of seventeen vessels; wrote on board the Arbella his treatise *A Modell of Christian Charity;* landed at Salem June 12, 1630; soon removed to Charlestown, where he was one of the four original members of Mr. Wilson's church; selected the peninsula of Shawmut (now Boston) as the site of the capital town of the colony, and settled there Sept. 7, 1630; visited Plymouth with Mr. Wilson, and established a good understanding with the government of that colony; acquired in the same year the island in Boston harbor known as Governor's Island, and still owned by his descendants; was annually re-elected governor until 1635, when he was replaced by John Haynes, thereby escaping the chief responsibility for the proceedings against Roger Williams, in which he nevertheless shared as an assistant; was again defeated at the election of 1636 by the young Henry Vane, then recently arrived, who was put forward as the champion of the "Antinomian and Familist" party directed by Wheelwright and Mrs. Hutchinson; was chosen governor uninterruptedly 1637–40; had a controversy with Vane and his party, terminated by the withdrawal of the former to England and the banishment of the heads of the latter, and was again governor 1641–43, deputy governor 1644–45, and governor from 1646 until his death, at Boston Mar. 26, 1649. After the death of his first wife, by whom he had one son, John, who became governor of Connecticut, he married a daughter of William Clopton of London, who soon died, and as his third wife a daughter of Sir John Tyndal, by whom he had four sons. He was a devout, charitable man, of enlightened principles, tolerant by nature, though a vigorous asserter of the rights of authority; was a good scholar, especially on theological questions, and left an interesting and valuable body of correspondence, given in his *Life and Letters* (2 vols., 1864–67) by his descendant, Robert C. Winthrop, and a copious *Journal*, which was edited, from the original MSS., with notes, by James Savage, under the title *The History of New England from 1630 to 1649* (2 vols., Boston, 1825–26; 2d ed. 1853). The first part had already been published by Noah Webster at Hartford (1790). Many of the *Winthrop Papers* were printed in the *Collections* of the Massachusetts Historical Society (3d series, vols. ix. and x.). The facts concerning his ancestry and early life may be found in William H. Whitmore's *Notes on the Winthrop Family and its English Connections* (Albany, 1864). His statue was presented to the U. S. government by the State of Massachusetts, and was placed in the Federal Capitol in 1876.

PORTER C. BLISS.

Winthrop (JOHN), F. R. S., son of the preceding, b. at Groton, Suffolk, England, Feb. 12, 1606; graduated at Trinity College, Dublin, 1625; studied law at the Inner Temple, London; obtained a commission in the army; participated in the expedition for the relief of the Huguenot garrison at La Rochelle, France, 1627; visited Turkey as an attaché of the British embassy 1628; came to Massachusetts 1631; was chosen a magistrate 1633, and settled at Ipswich Mar., 1633; went to England the same year; obtained a commission under the grant to Robert Rich, earl of Warwick, by virtue of which he founded a settlement at Saybrook, at the mouth of Connecticut River, Nov., 1635; built a fort there and acted as governor; removed his family from Boston to Pequot Harbor 1645, and founded New London; was chosen a magistrate of Connecticut 1651, after the union of Saybrook to that colony; was chosen governor of Connecticut 1657, and annually re-elected through life; went to England 1661; obtained from Charles II. a charter uniting Connecticut and New Haven in one colony, under himself as governor; was an early member of the Royal Society (founded 1662), and a contributor to its *Transactions*, being well versed in chemistry and physics; represented Connecticut at Boston 1676 and the congress of the united colonies, and d. there Apr. 5, 1676. He married Elizabeth, daughter of the celebrated Hugh Peters.

Winthrop (JOHN), LL.D., F. R. S., a great-grandson of Gov. John, b. at Boston Dec. 19, 1714; graduated at Harvard 1732; was Hollis professor of mathematics and natural philosophy in that institution from 1738 until his death; was a profound mathematician and well versed in scholastic discussions; made accurate observations of the transit of Mercury 1740, and that of Venus Jan. 6, 1761, making for the purpose on the latter occasion a voyage to St. John's, Newfoundland; was several years judge of probate for Middlesex co.; declined the presidency of Harvard 1769, and again 1774; was a member of the executive council 1773–74, and a firm advocate of political liberty. D. at Cambridge May 3, 1779. Author of *A Lecture on Earthquakes* (1755), *Two Lectures on Comets* (1759), *Relation of a Voyage from Boston to Newfoundland for the Observation of the Transit of Venus* (1761), *Two Lectures on the Parallax and Distance of the Sun, as deducible from the Transit of Venus* (1769), *Cogitata de Cometes* (1766), communicated by Dr. Franklin to the Royal Society, and contributed various papers to *Philosophical Transactions*.

Winthrop (ROBERT CHARLES), LL.D., son of Thomas Lindall, b. at Boston, Mass., May 12, 1809; is a descendant in the sixth generation of Gov. John Winthrop, a grandson of Sir John Temple, Bart. (1731–98), and a great-grandson of Gov. James Bowdoin; graduated at Harvard 1828; studied law with Daniel Webster 1828–31; was a Whig member of the Massachusetts legislature 1836–40, and Speaker of the House 1838–40; a member of Congress 1841–42 and 1843–50; was Speaker of the 30th Congress 1847–49, distinguishing himself through a critical period by his tact as a presiding officer, no less than by his graceful eloquence on the floor and his skill in debate; visited Europe 1847, and again some years later; became at an early age a member of many literary, scientific, and philanthropic associations; delivered an address before the New England Society of New York City 1840, and the official oration at Washington at the laying of the corner-stone of the Washington Monument, July 4, 1848; was president of the Massachusetts college of electors 1848; U. S. Senator, by ex-

cutive appointment, to fill the unexpired term of Daniel Webster 1850–51; received a large plurality of popular votes for governor of Massachusetts 1851, but was defeated in the legislature; delivered at Boston, Nov. 23, 1853, an oration on *Archimedes and Franklin*, which gave rise to the statue of Franklin in that city; was the orator on the occasion of the inauguration of that monument Sept. 17, 1856, as he had been at the inauguration of the Boston Public Library 1855, as president of the city library commissioners; has been for many years the efficient president of the Massachusetts Historical Society, being also the senior member of that body; and, possessing an ample estate, has long devoted his leisure to the cause of historical literature, taking little part in recent political questions, his residence being at Brookline, near Boston. His speeches in Congress appeared in a volume of *Addresses and Speeches on Various Occasions* (1853), and a second volume, published in 1867, contained, among other notable orations, his eulogies upon William H. Prescott (Feb., 1859), Josiah Quincy (July, 1864), and Edward Everett (Jan., 1865). He has since delivered the *Introductory Lecture* (1869) to the course on the early history of Massachusetts by members of the Massachusetts Historical Society at the Lowell Institute, and an oration at the bi-centennial celebration (Dec. 21, 1870) of the landing of the Pilgrims at Plymouth. He has contributed to the *North American Review* and other periodicals, and is author of a *Memoir of Hon. Nathan Appleton, LL.D.* (1861), of the *Life and Letters of John Winthrop, etc.* (2 vols., 1864–67), and of a volume entitled *Washington, Bowdoin, and Franklin, with a Few Brief Pieces on Kindred Topics* (1876). PORTER C. BLISS.

Winthrop (THEODORE), b. at New Haven, Conn., Sept. 22, 1828; graduated with honors at Yale College 1848; travelled in Europe 1849–51 as tutor to a son of William H. Aspinwall; resided two years at Panama in the employ of the Pacific Mail Steamship Co.; accompanied Lieut. Strain's expedition and made other explorations of South and Central America; studied law at St. Louis, Mo.; was admitted to the New York bar 1855; joined the famous 7th regiment of New York on its entering the national service Apr., 1861; was commissioned major in the New York volunteers; became a member of the staff of Gen. B. F. Butler as his military secretary, and was killed at the head of an assaulting column in the earliest formal engagement of the war, at Great Bethel, Va., June 10, 1861. In the *Atlantic Magazine* from June to September of that year were published several spirited sketches of early war-scenes, which attracted great attention, and he was found to have left ready for the press the materials of five volumes of novels and essays, several editions of which were immediately sold. They were *Cecil Dreeme* (Oct., 1861; 17th ed. 1864), *John Brent* (Jan., 1862; 14th ed. 1864), *Edwin Brothertoft* (July, 1862), *The Canoe and the Saddle* (Nov., 1862), and *Life in the Open Air and other Papers* (1863), with a portrait.

Winthrop (THOMAS LINDALL), LL.D., b. at New London, Conn., Mar. 6, 1760; was great-grandson of Gov. John Winthrop, Jr. (1606–76); graduated at Harvard 1784; married in 1786 the eldest daughter of Sir John Temple, Bart., of New York, agent and consul-general of Great Britain to the U. S.; settled at Boston; became a successful merchant and a scientific agriculturist; was a member of many literary and scientific societies; president of the Massachusetts Agricultural Society, the Massachusetts Historical Society, and the American Antiquarian Society, and was lieutenant-governor of Massachusetts 1826–32. D. at Boston Feb. 22, 1841.

Winthrop (WAITSTILL), son of Gov. John of Connecticut, b. at Boston, Mass., Feb. 27, 1642; become a member of Gov. Andros's council and of that of 1692; major-general of Massachusetts militia; judge of admiralty and chief justice of the superior court of Massachusetts. D. at Boston Nov. 7, 1717.

Win'ton, p.-v. and tp., cap. of Hertford co., N. C. P. 2240.

Winwood (Sir RALPH), b. at Aynho, Northamptonshire, England, about 1565; graduated at Magdalen College, Oxford, 1582, and in law 1590; became fellow there and proctor of the university; spent some years in foreign travel; was knighted 1607; served on embassies to France, Holland, and other countries, and was secretary of state from 1614 until his death, Oct. 27, 1617. His *Memorials of Affairs of State* (3 vols., 1725) were edited by Edmund Sawyer.

Win'yaw Bay, in Georgetown co., S. C., receives the waters of Waccamaw, Pedee, and Black rivers. It is 14 miles long and 2 miles in average breadth. Large vessels ascend to Georgetown. The main entrance to the bay, called Georgetown Entrance, has a brick lighthouse on the N. side; lat. 33° 13′ 21″ N., lon. 79° 6′ 41″ W., called Georgetown Light.

Wio'ta, p.-v. and tp., Lafayette co., Wis. P. 1699.

Wire and Wire-Drawing. The manufacture of wire depends upon the ductility of metals—that is to say, upon their property of being drawn out into attenuated form. This property is quite different from a capacity for working under the hammer—copper, which is third among the metals in the order of its malleability, being sixth in ductility. Gold, however, stands first in both properties, and silver stands second in both. So far as our knowledge extends, these were the first metals from which wire was made. The first wire was fabricated by beating the metal into thin sheets, then cutting these into narrow strips or slivers, which were afterward rounded by hammering or filing, one or both. It was in this manner that the wires of the fabled net of Vulcan are said to have been made. Such wire was woven into fabrics with an admixture of textile material—literally, the cloth of gold. The grave of the wife of the emperor Honorius, discovered and opened at Rome about the year 1514, disclosed a mouldering raiment of this golden cloth, which weighed thirty-six pounds of the precious metal. The date when silver was first made into wire is uncertain, the earliest that can be fixed being the time of the later Grecian emperors. The period when the shears, the hammer, and the file gave way to the draw-plate with graduated holes or dies is not known. The terms "wire-smiths," applied to those who made wire with the hammer, and "wire-drawers" and "wire-millers," applied to those who made it with the die-plate, occur simultaneously in German records in the middle of the fourteenth century; and it was doubtless at this time that the draw-plate, which still remains, and probably always will remain, the chief appliance in the manufacture of wire, was first invented or brought into use. As the most important use for wire drawn of the precious metals was for purposes of ornamentation, the discovery that by flattening it a given weight could be wound around three times the length of textile fibre was an important step forward, this being the method in which for many purposes gold and silver is applied in ornamentation for tassels, fringe, etc., to this day. Wire was at first manufactured with the draw-plate entirely by hand, but at an uncertain date, probably before the year 1400, a machine, the inventor of which is unknown, was made to operate by water-power. In this, it is said, a lever moved a pair of pincers that opened as they came in contact with one side of the draw-plate, laid hold of the wire, drew it through the hole or die, and after drawing it a certain distance retraced their path, taking a new hold, and repeating the operation. This mechanism, or mechanism substantially the same, was in use in France for making certain kinds of wire until within the past half-century, such wire being known by indentations at intervals of about two inches along its length where the gripping pincers had taken hold. Nuremberg, so flourishing during the later portions of the Middle Ages in its arts and its manufactures, seems to have been the centre from which the art of manufacturing wire extended over Europe, although it is said to have been carried on with very great success in France and Italy. The prosperity of the manufacture in the German city was due to the system of encouraging manufactures by granting exclusive patents, sometimes given by the emperor, sometimes by the council of the city. One of these patentees, Frederick Hagelsheimer, received in 1592 a patent of fifteen years for the making of fine gold and silver wire. At the expiration of this term it was extended for fifteen years more, and the following year his patent was broadened to cover the manufacture of copper wire gilt or silvered. This patent appears to have been more than once confirmed, and when it expired in June, 1621, this same manufacturer entered into an agreement with the wire-drawers of the place, and this covenant was confirmed by still another patent granted in September of the same year, which was to continue through a period of fifteen years more. The following year this was transformed into a fief or continual privilege to the heirs male of his family. The flattening of wire appears to have been a most important branch of the manufacture; this being done by passing it between rollers. In England wire was made by hand until after the middle of the sixteenth century, and then the art making use of machinery was introduced by foreigners. The curious in this art may turn to the article "Wire-Drawing" in Beckmann's *History of Inventions* (from which I have largely drawn in the preceding portion of this sketch) for many items quaint and interesting.

Wire for industrial purposes is for the most part made of iron of the best quality. Steel, brass, and copper wire are also largely made, the methods of the manufacture being

substantially the same as with iron. But before referring to these we may refer briefly to the modern methods of making wire of the precious metals, which still forms an important though inferior branch of the art. What is known in later days as gold wire has an exterior of gold and a core of silver, being made by forming a cylindric ingot of silver and coating the latter with gold. This compound ingot is gradually reduced in size by means of the draw-plate—that is to say, by passing it through a succession of holes or dies in a hardened steel plate—first, through one only slightly smaller than the original diameter of the ingot; then through another still smaller, and so on until the requisite reduced diameter is reached. The finest wire ever made (that substituted for the spider-web lines of telescope micrometers) is made by first covering a platinum wire with solid silver. This compound wire, platinum within and silver without, is then reduced in diameter in the same manner as the gold wire with the silver core just referred to. This compound wire may be thus brought down to a diameter of about $\frac{1}{300}$th part of an inch. Assuming a platinum core to be one-tenth the whole diameter, this core will be attenuated to the $\frac{1}{3000}$th part of an inch. This fine compound wire being then dipped into hot nitric acid, the silver is dissolved and the inner core of platinum remains. Platinum wire was made by this means by the inventor, Dr. Wollaston, as fine as the $\frac{1}{18000}$th of an inch in diameter.

In the manufacture of iron wire, rods of the requisite tough quality of metal are rolled into rods at the rolling-mills; these rods are bent in coils, and these are placed in large tumbling boxes or rotating cylinders with water and gravel, in order that the abrading action exerted thereby may detach the scale from the rods. The rods are then passed through the successively diminishing holes of the draw-plate—for example, ten, fifteen, thirty, or more times, according to the degree of attenuation required. The constant compression of the molecules of metal upon each other hardens the wire, so that it has to be repeatedly annealed during the successive drawings. This is performed by placing the wire in kilns, which are first heated to redness and then allowed to cool gradually. Twenty-four hours is the time ordinarily required for annealing the smaller grades of wire. Six or eight different annealings are necessary: very small wire requires more. A scale is formed upon the wire at each annealing, and this is removed by pickling in some acid, preferably dilute oil of vitriol. Wire is sold in coils, and those of the more rigid and stiffer kinds are straightened for use by being passed alternately back and forth on two rows of alternating pins placed a slight distance apart. The wire is thus made to pass in a zigzag course through the device, which is termed a riddle, and comes out straight. Considerable skill is required in guiding the wire as it issues from the device, or the object of the operation is defeated. Cast-steel wire is made from steel rods hammered to about one-quarter of an inch square by a tilt-hammer, and afterward made round on the anvil. A spurious gold wire, called "gold wire of Lyons," is manufactured by heating copper to a red heat and exposing it to the fumes of zinc, which converts the external portion of the metal into brass. Brass wire loses its strength when exposed to the fumes of acid, and even by long exposure to a damp atmosphere. Zinc wire is flexible, and at first as strong as copper, but resumes the original crystalline state of the metal when subjected to the action of boiling water. The uses and applications of wire are too many to be noted; they range from the construction of suspension bridges to the manufacture of teeth for carding machinery, and from this down to pins and hooks and eyes, and from these, again, to the fabrication of the finest needles. One of the most unique is the production of surfaces for printing calico, in which copper wires are imbedded in the block, then filed down to a flat surface, and thus form the slightly-raised figures upon which the pattern is printed.

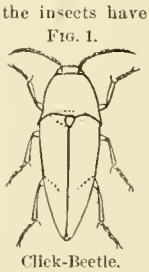
Of course, in wire-making, as in all other branches of manufacture, many improvements, some real, some futile, have been proposed. In 1856 an English projector claimed to "improve the tone in strings or wire used for musical purposes" by gilding the same, depositing "the gold by chemical means or coating by any process in which such covering can be produced." The English experiments extend back to 1768, when it was proposed to fold silver around a copper wire with borax between, and then draw the compound strip thus formed through a draw-plate to unite the metals. Silver was to be covered with a layer of gold and drawn in a similar way. Drawing zinc wire at a temperature of from 210° to 310° F. was patented in 1805. In 1852 the coating of wire with molten metal by drawing it through a bath thereof was described in a patent which also showed a method of excluding air from the bath. Among American inventions, one for which much was claimed a few years ago, was a combined telegraph wire, comprising a steel core and copper exterior, which was asserted to possess greater conductivity and strength in proportion to its weight and cost than the wire commonly used for such purposes. But probably the most valuable improvement in wire manufacture was that patented in Aug., 1858, by Henry Waterman, and which reduced the cost of tempering flat steel crinoline wire from $3 a pound to three cents. Previous to this the tempering of such wire was done by winding it in volute coils kept apart by interlaced iron wires, the coils being heated to the requisite degree in a furnace, and then plunged in a hardening bath. In the improved process the wire was drawn through the fire of a furnace, and guided directly from the fire into the hardening bath. This method of tempering is now universally applied in the production of tempered steel wire for all the purposes for which this is required. It is somewhat remarkable that among the 146,119 patents granted in the U. S. previous to the close of the year 1873, there were but five relating to the manufacture of wire, while in the following year, 1874, there were twelve American patents issued relating to this branch of manufacture.

JAMES A. WHITNEY.

Wire-Rope. See ROPE-MAKING, by CAPT. S. B. LUCE.

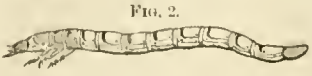
Wire'-Worm, a term applied to certain myriapods and to the larvæ of various beetles, but properly restricted to the tough, light-brown, cylindrical larvæ of various species of elaters, family Elateridæ. These beetles are well known to most persons under the popular names of "spring-beetles," "click-beetles," "skip-jacks," "snapping-bugs," etc.—names having reference to the peculiar power which the insects have of jumping with a clicking noise when placed on their backs upon any hard surface. These beetles are elongated in form, and have the posterior angles of the prothorax produced into an acute spine, so as to prevent all lateral movement. The back is convex and the legs short, so that without the peculiar jumping power they would be unable to recover the natural position when once laid on the back. If carefully examined beneath, an acute spine is found to proceed from the fore breast (presternum), and to be received at will into a groove in the middle breast (mesosternum). Placed on the back, the insect lowers the head till this comes in contact with the surface upon which it lies, and the spine is entirely thrown out of its groove; then by suddenly jerking the head upward the spine is thrown back into the groove with a clicking noise and sufficient violence to cause the elastic body to rebound. The family comprises a number of genera, and many species which vary much in size, though averaging about one-third of an inch. The prevailing color is brown, but a few are jet black and others speckled with white. The South American *Pyrophorus noctilucus* (Linn.), whose larva is injurious to the sugar-cane, is luminous, as are also several other species of the genus. The larvæ of some of the larger species, as of *Alaus oculatus* (Linn.), are more or less flattened and pre laceous, inhabiting the burrows and feeding upon the larvæ of lamellicorns. Others, again, as the large black *Melanactes piceus*, are luminous and feed upon soft-bodied animals in damp places. Still others feed upon decaying vegetation and rotten wood, but a larger number feed upon the roots of living plants, and are known by the name of wire-worms. These possess very similar habits, and they all look much alike, though a careful examination will show specific differences, especially in the structure of the terminal joint of the body. The eggs from which these worms hatch are soft, pale, and broadly oval. They are generally laid loosely in the ground, and the newly-hatched worm is invariably pale. The worms are from one to three years attaining full growth, according to the species, and undergo a larger number of moults than are necessary to most insects. According to the Swedish naturalist Bjerkander, who carefully studied these worms in that country, some of the species in that latitude remain even five years in the larval state. The head is somewhat flattened, and there are six true legs near it; the body consists of thirteen joints, and the last generally has at its base, beneath, a retractile proleg. When full grown they descend deeper into the earth, and go through their transformations within an oval cavity, most of them issuing as beetles in early summer.

FIG. 1.



Click-Beetle.

FIG. 2.



Wire-Worm.

The wire-worms are about the greatest insect pests of the farmer, doing more or less damage to all the grasses and cereals, and often eating into and ruining potatoes,

onions, turnips, and injuring various other root-crops and bulbous flowers. In Europe most of the injurious species that have been traced through their transformations belong to the genus *Agriotes*. Fitch, who, in his eleventh report as State entomologist of New York, has given the fullest account of these wire-worms yet published in America, connects two species with the perfect beetle—the one the *Melanotus communis* (Gyll.), the other *Agriotes truncatus* (Melsh.). Another, the common wheat wire-worm of Canada, has been proved by Mr. J. Pettit of Grimsby to be the *Agriotes mancus*, Say (see *Can. Entomologist*, vol. iv. p. 3), a species closely allied to, if not identical with, *truncatus*. The writer has proved by breeding that one of the commonest species in the cornfields and meadows of the West is the same *Melanotus communis* which Fitch found to be common in the East, and many of our other wire-worms doubtless belong to this last genus, which is more richly represented in America than *Agriotes*. Wire-worms are always abundant in meadows, and crops grown on pasture or meadow land recently broken suffer most from them. In this country the crops most affected are wheat and Indian corn. The remedies proposed and adopted to counteract their injuries are innumerable. They may be divided into preventive and remedial. As wire-worms cannot subsist on the soil, as does the earth-worm, and as they mostly require about three years to come to full growth, one of the most effectual ways to prevent their injuries is to fallow the land for one year, but in order to be effectual the fallow must be thorough and the ground ploughed often enough in summer to keep down the weeds. In a small plot of ground they may be trapped by strewing on the surface sliced potatoes, turnips, lettuce, or other succulent vegetables. Being unusually fond of these, the worms eat into them, and while doing so may be collected and destroyed. Fall ploughing, by which the worms are exposed to their natural enemies, especially birds, at a time when most insect-life is sluggish, and submersion where feasible, are two of the most practicable ways of destroying them on a large scale. Corn soaked over night in copperas-water before planting is generally left untouched by them. Nitrate of soda, salt, and lime each have their advocates as wire-worm destroyers, and while the use of lime is generally beneficial in invigorating the crop, it is probable that all these substances have acquired their reputation from confounding the *post quod* with the *propter quod*. When the worms were noticed to be most troublesome during the last year of their existence as such, and when they were naturally just on the point of going through their final transformations to the beetle state, and of leaving the soil, the applications have been made, when, *presto!* we have a sure remedy. It has been found that wire-worms will live in soil pretty well impregnated with these minerals, so long as they have proper food; and the Hon. A. B. Dickenson of New York wrote in 1855: "I have heard it stated that 5 bushels of salt to the acre, or 100 bushels of lime, would destroy wire-worms. I have tried both, and have sowed 10 bushels of salt to the acre, and they only laughed at my folly: I tried 100 bushels of lime, as recommended, and they fattened on my bounty." The impression is very strong among farmers—and perhaps well founded—that white mustard and buckwheat are obnoxious, and that a crop of either cleans the ground from the pests. Rape-cake was very strongly recommended in England thirty years ago. The worms have a great partiality for it, and are supposed to die from eating it. While I consider that this last opinion is founded on incorrect observation, the cake may be made to kill them by being mixed with Paris green. Thus poisoned and spread in lumps over a field from which domestic animals can be excluded, it will probably prove the best of all the remedies, and act at the same time as a manure. C. V. RILEY.

Wirt, county of Central West Virginia, intersected by Little Kanawha River; surface hilly, with much iron ore and bituminous coal; soil in the valleys fertile. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, and tobacco. Cap. Wirt Court-house. Area, 298 sq. m. P. 4804.

Wirt, tp., Allegany co., N. Y. P. 1204.

Wirt (WILLIAM), LL.D., b. at Bladensburg, Md., Nov. 8, 1772, his father being a Swiss, his mother a German; was left an orphan at the age of eight years, and brought up by an uncle; was educated at the grammar school of Rev. James Hunt of Montgomery co.; was afterward tutor nearly two years in the family of Benjamin Edwards of Maryland, father of Gov. Ninian Edwards of Illinois; studied law; commenced practice in Culpeper and Albemarle cos., Va., 1792; married and settled at Pen Park, near Charlottesville, Va., 1795; lost his wife, and removed to Richmond 1799; served three years as clerk to the house of delegates; became chancellor to the Eastern Shore of Virginia, and married a second time 1802; settled as a lawyer at Norfolk 1803, and published in the *Virginia Argus* his celebrated *Letters of a British Spy*, which have passed through 12 eds.; wrote for the *Richmond Enquirer* a series of essays entitled *The Rainbow* 1804; returned to Richmond 1806; was an assistant in the prosecution of Aaron Burr 1807; sat in the house of delegates 1807–08; wrote the collection of essays entitled *The Old Bachelor*, which originally appeared in the *Enquirer* in 1812; was appointed U. S. attorney for the district of Virginia 1816; was attorney general of the U. S. for three full terms during the administrations of Monroe and John Quincy Adams 1817–29; delivered at Washington a discourse commemorative of the death of Adams and Jefferson Oct. 19, 1826; settled at Baltimore 1830, and was the anti Masonic candidate for the Presidency of the U. S. 1832, and received for that office the electoral vote of Vermont. D. at Washington, D. C., Feb. 18, 1834. His chief work was *Sketches of the Life and Character of Patrick Henry* (Philadelphia, 1817; 15th ed., Hartford, 1852). His *Life* was written by John P. Kennedy (2 vols., 1849).—His second wife, ELIZABETH WASHINGTON GAMBLE, b. at Richmond, Va., Jan. 30, 1784; published at Baltimore in 1829 a handsomely-illustrated quarto volume entitled *Flora's Dictionary* (new ed. 1855), which was at once "a course of botany, a complete flower letter-writer, and a dictionary of quotations." D. at Annapolis, Md., Jan. 24, 1857.

Wirt Court-house, p.-v., cap. of Wirt co., West Va.

Wis'beach, or **Wisbech,** town of England, county of Cambridge, in the Isle of Ely, on the Nene, is well built, and carries on a great variety of manufactures and an active general trade. P. 9378.

Wis'by, town of Sweden, capital of the island of Gothland, was from the eleventh to the fourteenth century—when in 1361 it was taken and sacked by the Danish king Valdemar—the centre of the trade of Northern Europe, and contains many remains which show its former splendor, and are of great interest to the student of early Gothic. Its trade and manufactures are now small. P. 6430.

Wiscas'set, p.-v. and tp. and seaport, cap. of Lincoln co., Me., on Knox and Lincoln R. R., 50 miles N. E. of Portland, has a fine harbor, excellent schools, 3 banks, 1 newspaper, 2 steam saw-mills, and 2 hotels. Principal business, commerce, shipbuilding, manufacturing, and farming. Wiscasset is a favorite watering-place for tourists. P. 1977.
JOSEPH WOOD, ED. "SEASIDE ORACLE."

Wiscon'sin, one of the north-western States of the upper Mississippi Valley, lying between the parallels of 42° 27′ and 47° N. lat., and between the meridians of 86° 53′ and 92° 53′ W. lon. from Greenwich. It is bounded N. by Lake Superior, Superior and St. Louis Bays, and

The Seal of Wisconsin.

St. Louis River; N. E. by the upper peninsula of Michigan and Green Bay; E. by Lake Michigan; S. by Illinois; and W. by Iowa and Minnesota, the Mississippi River forming the dividing-line for more than half of its W. boundary, and St. Croix Lake and River for most of the remainder. Its greatest length from N. to S. is 302 miles, and its greatest breadth 258 miles. Its area is 53,924 sq. m., or 31,511,360 acres.

Topography.—Wisconsin has properly no mountains: there are two watersheds, the highest in the northern portion of the State, known as the Iron range of hills, which divides the tributaries of the Mississippi from the waters which flow into Lake Superior: this near the Montreal River in Ashland co. is about 1800 feet above the sea, but slopes downward both to the N. and W. to an elevation not exceeding 1100 feet: the other watershed is in the southern and central portions of the State, E. of the central merid-

ian, and divides the tributaries of the Mississippi from the streams falling into Green Bay and Lake Michigan; this attains at one or two points an elevation of about 1000 feet, the general elevation of the State being nearly 600 feet. In the S. W. part of the State, in Dane and Grant cos., are elevations called "mounds" of considerable height; Blue Mound in Dane co. is 1729 feet; Platte in Grant co., 1281 feet; and Sinsinnewa, also in Grant co., 1169 feet above the sea, or 1100, 680, and 570 feet respectively above the adjacent country. The affluents of the Mississippi drain four-fifths of the State, and the general slope is south-westward.

Rivers, Lakes, etc.—The rivers which discharge their waters into Lake Superior are the Montreal, Bad River, Bois Brulé, and St. Louis. They are all short, and have a descent of about 800 feet in a length of 30 or 40 miles. The Menomonee, Peshtigo, Oconto, Pensaukee, and Fox or Neenah rivers run into Green Bay. The last named is a very important stream, rising in Green Lake or Columbia co.; passing so near the Wisconsin River that a canal 1¾ miles long connects the two, and navigation is possible between Green Bay and the Mississippi River, it passes through several lakes, receiving Wolf River from the N., traverses Winnebago Lake, and between it and Green Bay has a descent of 170 feet. The Kewaunee, Two Rivers (East and West Twin), Manitowoc, Sheboygan, and Milwaukee are tributaries of Lake Michigan. The Mississippi, as already stated, forms a part of the western boundary of the State, and receives within the State the St. Croix, Chippewa, Buffalo, Trempealeau, Black, and Wisconsin rivers, as well as several smaller streams. All these rivers have numerous affluents. The Rock, Illinois, Fox, and Des Plaines rivers, all directly or indirectly tributaries of the Mississippi in Illinois, drain the southern portion of the State. The Wisconsin, St. Croix, Chippewa, and Neenah or Fox rivers are navigable for a considerable distance. The State has a coast-line of 120 miles on Lake Superior, of 200 miles on Lake Michigan, and of 400 on the Mississippi and its larger tributaries. The State abounds in lakes, many of them of great beauty. Aside from Lakes Superior and Michigan, Lake Winnebago is the largest lake in the State, being 28 miles long and 10 broad; it is about 170 feet above Lake Michigan. Lake Mendota, and many hundreds of other lakes, especially in the northern part of the State, add beauty to the landscape. Around Madison, the capital, are four very beautiful lakes. Green Bay, an arm of Lake Michigan, extends far into the State. Superior Bay, St. Louis Bay, and Chequanegon Bay project into the State from Lake Superior. The Mississippi just before receiving the St. Croix River spreads out in a wide bay known as Lake Pepin, and the St. Croix forms a similar expanse of water called Lake St. Croix. A number of islands in Lake Superior and Green Bay belong to Wisconsin.

Geology and Mineralogy.—The geological formations of Wisconsin are as follows, beginning at the oldest and lowest: (1) Laurentian, consisting of rocks of metamorphic origin, composed of many mineral ingredients, as granite, gneiss, syenite, hornblende, schist, etc. Beds of kaolin exist. This formation occupies a large area in the N. central part of the State. (2) Huronian, consisting chiefly of quartzites, diorites, schists, slates, and iron ores. The Penokie iron ridge in the N., the Menomonee iron range in the N. E., the iron hills about Black River Falls, the quartzites and porphyrites in Central Wisconsin, belong to this formation. It abounds in iron. (3) The copper-bearing series, consisting of diorites and melaphyres, interstratified and overlaid with shales, sandstones, and conglomerates, the former of igneous and the latter of sedimentary origin. Native copper is widely distributed throughout this formation, which occupies a large area in the N. W. of the State. (4) The Potsdam sandstone, with which shales and limestones are interstratified, the whole group having a thickness of about 1000 feet. It occupies a crescentic area in the central part of the State. (5) The Lower Magnesian limestone occupies a narrow, irregular belt concentric to the Potsdam sandstone on the S.; thickness, 250 feet. (6) The St. Peter's sandstone, a still narrower belt, next to the last. This is generally a pure silicious sandstone, used for glassmaking, varying in thickness with the underlying magnesian limestone, from 1 foot to 200 feet. (7) Trenton limestone, partly dolomitic, shaly in portions, abounding in fossils; it occupies a large area in the S. W. of the State, and a belt running from N. to S. in the E. central part. In the S. W. it contains extensive deposits of lead and zinc ores, which are extensively mined near Mineral Point. (8) Galena limestone, a heavy-bedded, cherty dolomite, more than 250 feet in thickness, adjacent to the Trenton, but occupying larger areas, and is the great lead-bearing formation of the State. The lead ore galenite occurs in vertical fissures and flat openings, in connection with the zinc ores, blende or sphalerite and smithsonite, as well as with iron pyrites, calcite, and other minerals. (9) Cincinnati shale, consisting of blue clays, gray, yellow, blue, and purple shales, and magnesian limestones; highly fossiliferous. Its thickness is 200 feet. It forms a narrow N. and S. belt in the E. of the State, and the mounds in the S. W. also contain it. (10) The Clinton iron ore beds, occupying limited areas in the E. part of the State. At Iron Ridge the ore is 25 feet thick, and is made up of minute concretions like flaxseed, hence called seed ore; it is easily mined. (11) Niagara limestone (dolomite), covering immense areas in the E. part of the State, and capping the mounds in the lead region. It is 800 feet thick, has six subdivisions, some of which contain the purest sedimentary dolomites known. It abounds in interesting fossils. (12) The water-lime horizon of the Lower Helderberg group, occupying two small areas in the E. part of the State. (13) The Hamilton group, the only formation of the Devonian age in the State, is found in a small area near Milwaukee, and furnishes one of the best hydraulic cements known. (14) The drift deposits consist of moraines hundreds of miles long and hundreds of feet high, and extensive deposits of boulder-clay overlaid by three successive lacustrine clays and four associated beach deposits. The former represent the Glacial period, the latter the Champlain. (15. *a*) Peat deposits of great extent and depth; (*b*) soil of great strength and fertility.

The minerals of the State, as reported by Dr. I. A. Lapham in 1872, were—gold, silver, and copper in a metallic state, found in small quantities; two or three ores of silver; eight ores of copper; nine of iron; three of zinc; four of lead; two of arsenic; two of manganese; seven varieties of crystallized quartz; three of hornblende; two of feldspar, dolomite, and sulphates, carbonates, and phosphates of lime, fluor-spar, fluorite, potter's and porcelain clays, talc or steatite, serpentine, chlorite, garnet, epidote, tourmaline, laumonite, leonhardite, stilbite, chrysocolla, and numerous other rare minerals of scientific importance, together with petroleum, asphaltum, peat, and valuable building-stones. Amethyst, carnelian, agate, jasper, chalcedony, garnet, and malachite are among its precious stones, and gypsum, graphite, kaolin, steatite, and asbestos among its economic minerals.

Soil and Vegetation.—The greater part of the soil of the State is arable, and much of it very fertile. Much of the northern portion is covered with forests which furnish many millions of feet of lumber annually. A large portion of these forests is composed of coniferous trees, and especially of the white pine, though the balsam, hemlock, spruce, and fir are also found in considerable quantities. The burr and red oak and other deciduous trees also occur. The southern half of Wisconsin is partly prairie, though under cultivation it produces a fair amount of timber and fruit trees. There are in these prairie-lands, as in Illinois, occasional islands of timber, or, as they are called, "oak-openings," the trees being mainly the burr oak. A published catalogue of Wisconsin's indigenous plants contains over 1500 species, exclusive of mosses. Of these, more than 60 are forest trees, and about 150 shrubs, 100 grasses, 175 Compositæ or compound flowering plants; about 300 are reputed to possess medicinal virtues.

Zoology.—The late Dr. Lapham had catalogued 62 species of mammals, over 300 birds, 19 species of reptiles, and over 100 mollusks, natives of Wisconsin. Some of these, as the buffalo, antelope, and perhaps the wild-turkey, are now extinct, but the elk is still occasionally found, and deer, bears, beavers, the fisher, wolf, otter, wild-cat, and porcupine are not uncommon; while the rabbit, squirrel, striped gopher, mole, bat, and field- and shrew-mouse exist in great numbers. Of the Raptores, or birds of prey, the golden and bald eagle, several species of hawk, the great white owl, and the crow are best known; of game-birds, the quail, partridge, spruce, willow, prairie, and sharp-tailed grouse, woodcock, wild-goose, many species of duck and teal, and pigeons in immense numbers, as well as the pelican, loon, etc. The lakes and rivers abound with fish, especially the whitefish, lake-trout, siskewit, muscalonge, perch, pickerel, and sturgeon. The billfish and the spoonbill sturgeon are sometimes taken. The reptiles are those common to the North-west.

Climate.—Although the State extends over 4½° of latitude, its climate is in no part severe, its temperature being greatly modified by Lakes Michigan and Superior, which form a large part of its boundary on the E. and N. Its mean annual temperature does not vary much from 42° F., being on the southern border about 45°, and at the northern limit about 40°. Snow falls in the N. before the occurrence of heavy frosts, and continues till spring, thus protecting the roots of plants, trees, and shrubs from being killed by the frost. The winters are long and cold, but nearly uniform in temperature; the springs backward; the summers short, and usually hot, often dry; the autumns generally

mild and pleasant. The rainfall is less than on the Atlantic coast. The following table gives the meteorologic data for four points of the State, Duluth, Minn., being, from its location, the best representative of the climate of Northern Wisconsin which has recorded observations:

METEOROLOGICAL DATA.	University of Wisconsin, Madison, lat. 43° 4′ 33″, lon. 89° 21′ 58″; altitude, 1088 feet.	La Crosse, lat. 43° 48′, lon. 91° 23′; altitude, 686.26 feet.	Milwaukee, lat. 43° 03′, lon. 87° 54′; altitude, 664.4 feet.	Duluth, Minn., lat. 46° 48′, lon. 92° 6′; altitude, 644.7 feet.
Temperature.	°	°	°	°
Mean annual temperature	41.8	45.9	45.8	39.4
Highest temp. of year.	86	101	98	91
Lowest " " ..	25	19	8	−21
Range of annual temp..	111	120	106	112
Mean temp. of spring..	41.5	41.7	41.3	35.6
Highest " " ...	84	96	90	91
Lowest " " ...	1	3	15	2
Range of spring temp...	82	93	75	89
Mean temp. of summer..	68.9	73.3	68.6	63.2
Highest " " ...	86	101	98	89
Lowest " " ...	51	41	44	41
Range of summer temp..	35	60	54	48
Mean temp. of autumn..	45.9	43.9	46.9	42.5
Highest " " ...	81	91	94	90
Lowest " " ...	−3	−1	8	2
Range of autumn temp..	84	92	86	92
Mean temp. of winter...	9.9	21.9	20.6	16.3
Highest " " ...	50	57	.....	53
Lowest " " ...	−25	−19	.....	−21
Range of winter temp...	75	76	...	74
Rainfall.	Inches.	Inches.	Inches.	Inches.
Amount of an. rainfall .	23.75	31.04	31.95	34.50
Rainfall of spring	5.38	6.70	7.66	4.12
" summer... ..	6.91	12.23	9.05	19.11
" autumn.. ...	7.31	8.72	8.31	9.19
" winter.	4.15	3.39	6.93	1.81
Prevalent winds in the order of mention.				
Spring	S. W., W., N. E., N. W., S. E., S., E.	S., N. W., N. W., N. E., S. W., S. E.	N. W., S. W., N. E., S. E., E., W., N.	N. E., N. W., S. W., calm, N. W.
Summer.	S., N. W., S. E., N. W., S. W., W., N. E., E.	S., S. W., N., S. E., N. W., N. E., W.	N. E., S. E., S. W., W., N. W., E., S.	N. E., calm, N. W., S. W., N., W.
Autumn.....	N. W., S. W., S., W., N	S., N. W., N. W., S. W., S. E., calm	S. W., N. W., W., S. E., N. E., calm.	S. W., N. W., N. E., calm, W., N
Winter....	W., N. W., S. W., S., N. E.	S. W., N. W., N. W., S. W., N. E., S. E., W.	N. W., S. W., S. E., W., N. E., S., N.	S. W., N. W., calm, N. E., W.

Agricultural Productions.—In 1870 the total amount of land in farms in Wisconsin was 11,715,321 acres; the assessors in 1875 reported for taxation 22,647,004 acres, or nearly double the quantity. One-half of that reported in 1870 was unimproved, but the taxation, as well as the valuation, indicates that a smaller proportion was unimproved in 1875. The census valuation of farms in 1870 was $300,414,064, which was probably about the market-value. For purposes of assessment farming-lands are never rated in the West beyond 40 per cent. of their value, yet they were valued in 1874 at $175,700,866, equal to over 450 millions of true valuation. This was aside from city and village lots, which were assessed at nearly 89 millions more. The value of farming implements and machinery in 1870 was $11,239,364; it has greatly increased since. The value of all farm products in 1870 was $78,027,052. In 1875 there were 3,406,085½ acres of growing crops of wheat, oats, corn, barley, rye, hops, tobacco, and flax, while 6 counties failed to report. The crop of Indian corn in 1875 was estimated at 24,784,000 bushels, valued at $15,613,920; of wheat, 18,436,000, valued at $15,301,880; of rye, 1,272,000, worth $992,160; of oats, 20,069,000, valued at $9,234,710; of barley, 2,304,000, worth $2,304,000; buckwheat, 375,000, worth $232,500; potatoes, 5,905,000, worth $2,978,000; tobacco, 1,500,000 pounds, worth $337,500; hay, 1,164,500 tons, worth $11,726,515. If to these be added the hops and flax, both large crops, as well as the minor crops, the product of the year will exceed $100,000,000. Dairy products in 1870 were 22,173,036 pounds of butter, 1,591,798 pounds of cheese, 2,059,105 gallons of milk sold. We have no later statistics on these products, though the advance is known to have been large. The value of all live-stock on farms in 1870 was $15,310,882, and this included 252,019 horses, 4195 mules, 308,377 milch cows, 53,615 working oxen, 331,302 other cattle (a total of 693,292 neat cattle), 1,069,282 sheep, and 512,778 swine. The estimates of live-stock in Wisconsin by the agricultural department, made in Jan., 1875, as compared with the assessors' returns, are as follows: Value of live-stock, $54,733,803, including 348,700 horses, 5100 mules, 464,800 milch cows, 135,900 other cattle (900,700 neat cattle), 1,211,300 sheep, 587,800 swine.

Commerce.—Wisconsin has a moderate foreign commerce, her only port of entry for this purpose being Milwaukee, but her coastwise and riverine commerce is very large, and is conducted for the lakes from Milwaukee, Sheboygan, Fond du Lac, and Superior City, and for the Mississippi River from La Crosse and Prairie du Chien, while steamers also ascend the Wisconsin, Chippewa, Fox, etc. The inter-State commerce by means of railways is also very large. Milwaukee claims to be the largest primary grain-port in the world; its elevators have a capacity for storing upward of 5,000,000 bushels of grain. It has also a large commerce in lumber, pig lead, etc. The total imports from foreign countries in the year ending June 30, 1875, for the customs district of Milwaukee was $56,616; the amount of domestic exports for the same year was $1,390,179. The entrances from foreign ports in the same year were 63 vessels, of 21,866 tons burden, and manned by 908 men. The clearances were 69 vessels, of 23,289 tons burden and manned by 975 men. The coastwise trade reported the entry of 7230 vessels, of 2,872,493 tons burden, with crews of 91,289 men, and the clearance of 7261 vessels, with a burden of 2,798,208 tons, and crews numbering 90,243 men. Milwaukee, for the lake-ports, reports 342 registered, enrolled, and licensed vessels, having a burden of 62,157.21 tons, and La Crosse, for the river-ports of Wisconsin, 35 vessels, of 3,497.98 tons. Twenty-five vessels of 3579.16 tons were built in the Milwaukee district in 1875, and one of 75.30 tons in the La Crosse district.

Railroads in 1875.

NAME OF ROAD.	Total miles operated in 1875.	Miles operated in Wisconsin in 1875.	Cost of road and equipment to June 30, 1875.	Total stock and funded and unfunded debt to June 30, 1875.	Proportion for Wisconsin of stock and debt.	Gross earnings for year ending June 30, 1875.	Net earnings for year ending June 30, 1875.	Number of passengers moved 1 mile in year ending June 30, 1875.	Tons of freight moved 1 mile in year ending June 30, 1875.
			$	$	$	$	$		
Chicago Milwaukee and St. Paul.....	1458	724	54,617,002	55,226,641	28,185,135	7,464,299	2,281,421	53,847,931	25,530,091
Oshkosh and Mississippi*.....	20	20	No separate report; Milwaukee and St. Paul.			Chicago	8,016§		
Chicago and Superior*.....	39	39	920,950	994,300	994,300	26,504	8,016§	298,865	
Chicago and North-western.	1991	561	67,369,714	66,866,254	.....	12,597,095	Expended in improvements, etc.	106,123,087	451,546,468
Chicago and Tomah.....	No	report.							
Galena and Southern Wisconsin.....	31	20	414,251	438,691	13,000				
Green Bay and Minnesota.....	217.5	217.5	6,032,945	13,290,162	13,290,162	300,883	28,614§	2,540,608	9,768,512
Milwaukee Lake Shore and Western.....	No	report.							
Mineral Point.....	51	49	1,131,175	1,520,000	1,428,874	104,722	29,447§	303,017	1,941,515
Prairie du Chien and McGregor.....	2	1.75	99,610	100,000	87,500	54,083	23,216	.....	881,000
Sheboygan and Fond du Lac.....	79	79	2,074,098	3,068,509	3,068,509	109,222	5,562§	937,100	2,128,560
Superior and St. Croix.....	24	15.6	.....	No report.					
Western Union.....	212.75	85.2	7,982,543	7,874,973	3,153,692	1,086,119	317,353	5,820,730	43,598,652
West Wisconsin†.....	228.5	228.5	17,140,000	17,140,000	17,140,000	803,100	62,536		
North Wisconsin*.....									
Wisconsin Central‡.....	323	323	7,091,164	.....	.....	599,754	237,422	5,310,070	14,370,688
Wisconsin Valley.....	88.7	88.7	1,901,541	2,457,598	2,457,598	112,447	31,429	626,885	1,605,112
Totals....	4761.95	2155.25‖	165,938,592	168,878,128	69,848,770	23,387,409	8,066,723	175,559,428	760,860,158

Manufactures, Mines, and Fisheries.—For so young a State, Wisconsin has achieved a fair measure of success in her manufacturing industry. Few States have such abundant, available, and permanent water-power for driving machinery, but as yet only a small proportion of it is used. In 1870 there were 7013 manufacturing establishments in the State, employing 43,910 hands (10,296 men, 2111 women, 1500 children), reporting a capital of $41,981,872, paying $13,575,642 in wages, using $45,851,266 of raw material, and producing, annually, $77,214,326 of goods. At this census she ranked thirteenth in amount of production and eleventh in capital invested. The State census of 1875 makes no return of either manufacturing or agricultural productions, but the advance in manufacturing has been very great. The largest industry of the State is in flouring-

* The miles operated of these roads are included in the Chicago Milwaukee and St. Paul.

† This road leases and includes in its statement the Chippewa Falls and Western.

‡ This road leases and includes in its statement the Milwaukee and Northern.

§ Excess of expenses over gross earnings.

‖ Adding the known mileage of roads not reporting, the total mileage of lines operated was 4875.25, and of roads in Wisconsin 2565.73 miles. There is a (so-called) ship-canal between the Wisconsin and Fox or Neenah rivers at Portage City, and another around the falls of Fox River, below Winnebago Lake.

mill products, Milwaukee ranking very high as a grain-port; in 1870, 306 grist and flouring mills, employing 1344 hands and $4,397,400 capital, produced $16,035,734 of flour and meal; 566 saw and planing mills, employing 10,905 hands, produced lumber to the value of $15,382,531, and 81 sash, door, and blind factories added $1,852,379 to the product. Iron in its various manufactures produced in 81 foundries, etc., $3,290,023; there were 485 carriage-factories, employing 2184 hands and producing $2,596,534 worth of carriages and wagons; 82 factories produced $2,393,428 worth of agricultural implements; clothing was produced in 263 shops to the value of $2,340,458; leather tanned and curried in 155 tanneries was produced to the amount of $4,373,440; malt and distilled liquors in 184 distilleries and breweries to the amount of $2,215,613; furniture in 188 shops to the value of $1,542,356; boots and shoes in 78 shops to the value of $1,181,677; machinery of all kinds in 61 machine-shops to the amount of $1,294,016; woollen goods in 48 woollen-mills to the value of $1,115,646; tobacco for chewing, smoking, and cigars, in 113 factories to the amount of $1,100,032; printing and publishing in 66 offices to the amount of $855,115; tin, copper, and sheet-iron ware in 225 shops to the amount of $769,470; saddlery and harness, $711,695; cooperage, $627,190; pig lead in 13 smelting-works, $514,402; brick in 79 brick-kilns, $509,606. In 1870 there were 80 mines and quarries reported in Wisconsin, employing 701 men and boys, with a capital of $737,728, and producing ores, etc., to the value of $510,982. This was certainly an under-estimate, as the production of lead alone exceeded this. There were also 105 fisheries reported, employing 379 hands and producing $214,190 worth of fish.

Finances.—The gross receipts of both the general and trust funds for the year ending Sept. 30, 1875, were $2,129,151.46, including a balance of $378,344.98 on hand at the beginning of the year; the disbursements for the same period were $1,851,470.02, leaving a balance of $277,681.44 at the close of the year. The trust funds held by the State (all for educational purposes) amounted Sept. 30, 1875, to $4,058,993.68. The State debt (all but $14,057 being due to these educational funds) amounted at the same date to $2,252,057.

Banks, Savings Banks, and Insurance Companies.—There were in July, 1875, 47 national banks in operation in the State, having an aggregate capital of $3,890,000, $3,424,550 in bonds on deposit, and an outstanding circulation of $3,231,986. There were also 23 State banks regularly incorporated, of which 6 were savings banks (and there were also 2 or 3 other savings banks not reporting to the State). These 23 banks had an aggregate capital of $1,113,231.33, loans and deposits to the amount of $6,909,214.80, and other liabilities amounting to $1,977,742.75. Their resources amounted to $9,990,188.88, and showed a moderate surplus over all legitimate indebtedness. There are a large number of private banking-houses in the State. There were in June, 1875, 3 joint-stock and 7 mutual fire and marine insurance companies organized for business in the State; the 3 joint-stock companies had a paid-up capital of $969,743 and net assets of $1,534,559; their reinsurance reserve was $386,060; amount of risks written, $64,258,847; of premiums received during the year, $948,266; of losses paid, $561,560. The 7 mutual companies had $879,945 paid-up capital and $1,716,656 net assets. Their reinsurance reserve was $590,844; amount of risks written, $32,771,135; of premiums received, $473,057; and of losses paid during the year, $312,291. There was but one life insurance company organized for business in the State—the North-western Mutual of Milwaukee, founded in 1858. Its net assets in Jan., 1875, were $15,357,567, its computed premium reserve $12,388,147, its total income for the year preceding was $3,992,660; its total expenditure for the year, $2,166,356.

Education.—(1) *Public Schools.*—The number of school districts, not including independent cities, in the year ending Aug. 31, 1875, was 5423, and adding those of Chippewa co., which did not report, 5489. There are 27 cities which have an independent organization. The number of school-houses, aside from cities, is 5428; number of children of school age (4–20) in the State, 461,829; number between these ages who have attended school during the year, 277,884; total number of different pupils in the schools during the year, 279,854; average number of days school was maintained in the counties, 149 days = 29 weeks and 4 days; average number of days in the cities, 195 = 39 weeks; number of pupils in private schools, 10,733; number of graded schools, 394; number of teachers required to teach the schools, 6224; number of persons employed as teachers during the year, 9451; average monthly wages of male teachers in the counties, $43.50, of female teachers, $27.13; average monthly wages of male teachers in the cities, $109.40, of female teachers, $39.40; number of public school-houses in the State (cities and counties), 5260, giving accommodation for pupils to the number of 330,189; number of school-houses built of brick or stone, 686; total valuation of school-houses, sites, and apparatus, $4,979,169; total receipts for school purposes in 1875, $2,728,157; total expenditures, $2,066,375. The whole amount of productive educational funds in 1875 was $4,058,992.68; the amount of income from these funds was $306,415.85, of which $186,409.05 was from the school fund proper. The number of private schools is considerable, and they have over 10,000 children in attendance. There are about 20 academies and seminaries of high character. A strenuous effort is now making to establish township high schools in every township having 3000 or more inhabitants, and to organize such schools for a part of the year, if they cannot be maintained for the whole. Many of the high schools already established are doing excellent work, and form the connecting link between the public school and the university. (2) *Normal Schools and Teachers' Institutes.*—There are 4 normal schools in the State—viz. (1) at Platteville, with 4 departments, 460 pupils in all the departments, and a faculty of 10, of whom 6 belong to the normal department. The pupils are in about equal numbers of each sex; 9 graduated at the last commencement; 88 have graduated in all. The expenses of this school are about $20,500 per annum. (2) Whitewater normal school, which has 11 members of its faculty, 96 students, and expends about $15,000 per year. (3) The Oshkosh school, which has 293 pupils—171 females, 122 males; 13 professors and teachers in all its departments, and an annual expenditure of about $17,380. (4) River Falls normal school, opened in Sept., 1875. Fifty-seven teachers' institutes were held during the year; they were attended by 3668 teachers. The following table gives such particulars as are attainable in regard to the institutions for higher and professional education in the State. The State University at Madison, Wis. (see WISCONSIN, UNIVERSITY OF), is doing a good work, and not only maintains a high grade of scholarship among its students, but aids materially in elevating the character of the teaching in the public schools:

Universities, colleges, and professional schools.	Location.	Date of organization.	Under what control.	No. of professors and instructors.	Students.				Value of buildings, grounds, and apparatus.	Amount of productive funds.	Income from productive funds.	Income from all sources.	Scholarship funds.	Volumes in library.
					Preparatory.	Collegiate.	Male.	Female.						
									$	$	$	$	$	
Beloit College	Beloit	1847	Congregational	11	146	65	211	...	88,500	121,281	12,242	14,926	15,000	8,056
Carroll College	Waukesha	1846	Presbyterian	4	151	...	83	71	15,000	.....	900	2,933	.....	
Galesville University	Galesville	1859	Meth. Episcopal	9	101	29	72	58	20,000	10,000	1,000	2,800	.....	4,500
Lawrence University	Appleton	1847	" "	11	252	86	193	145	62,500	95,000	6,151	9,600	.....	8,700
Milton College	Milton	1867	Seventh-Day Bap.	10	176	79	151	104	39,850	6,000	425	4,072	.....	1,700
North-western University	Watertown	1865	Lutheran	7	147	25	162	11	35,000	.....	.....	1,500	20,000	2,000
Col. of Our Lady of the Sacred Heart	"	1872	Roman Catholic	8	100	...	100							
Pio Nono College	St. Francis Station	1871	Roman Catholic	7	71	67	138	...	50,000					
Racine College	Racine	1852	Prot. Episcopal	15	145	45	190	...	93,000	26,000	2,080	*65,511	26,000	2,500
Ripon College	Ripon	1863	Congregational	12	219	64	158	125	63,410	55,000	7,317	10,751	.....	6,000
St. John's College	Prairie du Chien	1870	Roman Catholic	20	80	100	180	...	150,000	.....	.....	20,000	.....	3,500
University of Wisconsin	Madison	1848	State	26	120	200	236	84	165,810	411,829	53,008	77,691	.....	70,000
Wisconsin Female College	Fox Lake	1860	Congregational	6	9	51	...	60	.....	6,200	500	.....	.....	700
Milwaukee Female College	Milwaukee	1853	Non-sectarian	16	87	89	...	176	70,000	.....	.....	.....	.....	600
St. Clara Academy	Sinsinawa Mound	1848	Roman Catholic	20	37	57	...	94	60,000	.....	.....	1,400	.....	1,000
School of Science.														
College of Arts, Univ. of Wisconsin	Madison	1866	State	6	...	49	33	16	.....	235,634	16,148			
Schools of Theology.														
Nashotah House	Nashotah Mission	1842	Prot. Episcopal	6	...	50	50	...	70,000	25,000	2,000	.....	.....	6,000
Seminary of St. Francis of Sales	St. Francis Station	1856	Roman Catholic	13	...	63	63							
School of Law.														
Law department, Univ. of Wisconsin	Madison	1868	Un. of Wisconsin	8	...	25	25	...	With	univers	ity.			

* Includes board.

Charitable and Corrective Educational Institutions.—There is an institute for the education of the deaf and dumb at Delavan, which has 9 professors and instructors, and 6 other officers. It had in attendance in 1875, 181 pupils—112 males, 69 females—and on Oct. 1, 1875, 147 pupils were present. Its current expenditures are about $33,750. There is an institution for the education of the blind at Janesville, which had, Oct., 1875, 5 professors and instructors, and 2 other officers, and had during the year previous 82 pupils—36 males, 46 females. Its current expenses are about $19,000 a year. The present superintendent (1876) is a lady, the widow of the former superintendent. There is a State industrial school for boys at Waukesha. It is on the family system, having 6 family buildings, besides the main building, which contains the chapel, school-rooms, office, residence of the superintendent's family, and rooms for officers, teachers, and employés. In the year ending Sept. 30, 1875, there had been 412 boys in the school, of whom 112 had been by one method or another discharged (4 by death, 7 by escape), and 300 were in the school Oct. 1, 1875. The current expenses are about $35,500 per annum, of which about $5500 is earned by the boys. A soldiers' orphan home at Madison, which had been in existence since the war, had fulfilled its mission, and the building was handed over to the University of Wisconsin in 1875.

Charitable Institutions.—There are two hospitals for the insane in the State—the Wisconsin State hospital at Madison, and the Northern Hospital for the Insane at Oshkosh, on Lake Winnebago. The State hospital was founded in 1859. It had under treatment, during the year, 507 patients, of whom 132 had been discharged, leaving 375 residents Sept. 30, 1875—190 males, 185 females. Of the 132 discharged, 32 (16 of each sex) were recovered, 53 (27 males, 26 females) improved, 27 (16 males, 11 females) unimproved, and 20 (11 males, 9 females) died. The current expenses are about $100,000. The Northern hospital was opened in 1872, and had under treatment during the year ending Sept. 30, 1875, 351 patients—185 men and 166 women; there were resident at that date 276—142 men, 134 women. Of the 75 discharged, 21 (13 men, 8 women) were recovered, 26 (11 men, 12 women) improved, 10 (7 men, 3 women) unimproved, 18 (9 of each sex) died. The hospital was enlarged in 1876, and accommodates about 550 patients. Current annual expenses, about $128,100.

Population.

Census year.	Total population.	Males.	Females.	White.	Colored and Indians.	Natives.	Foreigners.	Density.	Ratio of increase.	No. of families.	Persons to a family.	No. of dwellings.	Persons to a dwelling.	Illiteracy.	Of school age, 5-20.	Of military age, 18-45.	Of voting age, 21 years and upward, males.	Citizens, males.
1840	30,945	18,858	12,087	30,749	196	....	.....	0.57										
1850	305,391	161,351	140,105	304,756	635	194,099	110,477	5.66	896.88	57,608	5.30	56,316	5.42	6,453†	105,080	72,516	81,479	70,512
1855*	552,109	291,795	260,314	550,927	1,182	....	.....	10.21	80.79									
1860	775,881	407,449	368,432	773,693	2,188	498,951	276,967	14.39	40.53	147,153	5.26	151,036	5.01	16,546†	271,977	161,103	193,044	154,435
1865*	868,325	452,692	415,633	866,720	1,605	....	.....	16.10	11.91	.....	....	.....	....	.....	330,263			
1870	1,054,670	541,896	509,784	1,051,351	3,319‡	690,171	361,199	19.56	21.48	200,155	5.27	197,098	5.35	55,441†	396,408	192,331	255,159	203,677
1875*	1,236,729	635,217	601,512	1,234,552	2,677	....	.....	22.93	17.26	.....	...	.....	....	.....	433,407	226,734	306,182	244,916

Prisons and Jails.—The State prison is at Waopun. It had during the year 357 prisoners, of whom 341 were men, 16 women; 109 were discharged—103 men, 4 women; and 2 died, leaving 248 remaining in the prison—236 men, 12 women. The expenditures were $100,100, of which about $48,000 was received for convict labor, etc., and about $5000 more was earned, but not paid for. The system followed is of employment by the State, not by contractors. The directors think that hereafter about $27,875 will be all that will be required annually from the State. The State board of charities and corrections speak in high terms of the management of the prison. The jails of the State are, with a few exceptions, in a deplorable condition.

Newspapers and Periodicals.—In 1870 there were in the State 190 newspapers, having an aggregate circulation of 343,385, and issuing annually 28,762,920 copies. Of these, 14 were dailies, 2 tri-weeklies, 3 semi-weeklies, 160 weeklies, 2 semi-monthlies, 9 monthlies. In 1872 the number had increased to 201, and in 1875 to 226, the increase being almost entirely in the dailies and weeklies.

Churches.

Denominations.	No. of organizations, 1870.	No. of church edifices, 1870.	Sittings, 1870.	Church property, 1870.	Church organizations, 1875.	Church edifices, 1875.	Ministers, clergymen, or priests, 1875.	Members or communicants, 1875.	Adherent population, 1875.	Church property, 1875.
All denominations‖	1864	1466	423,015	$1,890,781	2388	1855	1570	117,762	840,400	$6,905,350
Baptists (regular)	145	109	32,480	414,223	185	152	135	11,718	66,500	571,300
Baptists (Free-Will and Seventh-Day)	67	33	10,500	91,400	87	49	41	5,220	28,250	128,700
Christian Connection and Disciples	13	5	1,450	9,000	18	9	7	1,050	5,100	17,000
Congregationalists	157	140	44,960	619,550	211	197	183	13,868	68,000	753,500
Protestant Episcopalians	82	70	21,200	389,585	78	74	69	4,699	23,500	412,500
Evangelical Association	179	88	24,175	237,450	107	93	83	8,739	45,000	281,400
Friends	2	2	375	1,100	3	3	.....	400	2,000	2,300
Jews	4	3	750	8,500	5	4	5	300	1,500	12,800
Lutherans	171	156	36,780	302,860	222	201	133	24,321	100,000	401,250
Methodists	508	396	103,240	973,018	618	440	382	30,247	156,000	1,607,200
Moravians	13	10	2,500	21,700	15	11	18	2,000	8,000	29,400
New Jerusalem Ch. or Swedenborgians	5	4	800	14,000	5	5	5	300	1,500	16,500
Presbyterians (regular)	96	84	23,480	300,070	125	110	102	7,175	36,600	402,000
Presbyterians (other)	2	2	450	8,000	3	3	2	180	900	10,000
Reformed Church (late Dutch)	5	5	1,015	7,780	20	18	15	1,909	9,500	28,500
Reformed Church (late German)	18	14	3,260	24,595	35	29	20	2,450	12,000	35,300
Roman Catholics	329	304	104,000	1,334,450	455	384	305	.....	260,000	1,795,000
Second Adventists	10	3	650	9,000	9	4	6	450	2,000	10,000
Unitarians	7	5	1,900	41,000	8	7	7	400	2,000	60,000
United Brethren in Christ	34	21	5,650	37,900	69	48	29	1,695	8,950	78,400
Universalists	12	10	3,150	43,000	18	12	21	486	2,400	51,500
Union	1	1	150	500	1	1	1	80	400	800
Local mission	1	1	100	1,800	1	1	1	75	300	2,000

Constitution, Courts, Representatives in Congress, etc.—The right of suffrage is accorded to the following classes of male persons, 21 years of age or over, who have resided in the State for one year next preceding any election: (1) citizens of the U. S.; (2) persons of foreign birth who shall have declared their intention to become citizens of the U. S.; (3) persons of Indian blood who have already been declared by act of Congress citizens of the U. S.; and (4) civilized persons of Indian descent who are not members of any tribe. The executive power is vested in a governor, who, as well as the lieutenant-governor, secretary of state, treasurer, and attorney-general, is elected by the people for two years. The superintendent of public instruction is also now elected by the people for two years. The legislative authority is vested in a senate of 33 members, elected by districts for two years, and an assembly consisting of 100 members, also elected by districts, and for one year. The sessions of the legislature are annual. The judicial authority is vested in a supreme court, circuit courts, courts of probate, and justices of the peace. The supreme court consists of one chief-justice and two associate justices, who are elected by the people for six years. It has appellate jurisdiction only, and general power of review of all action of the inferior courts, and in no case which comes before it is a jury called. There are 12 judicial districts, in each of which a circuit judge is chosen by the electors of the district for the term of six years. Circuit courts are held in every county twice a year. A judge of probate is chosen in each county for two years, and the justices of the peace are elected by the towns for two years. The State is entitled under the apportionment of 1872 to 8 members of Congress.

* State censuses.

† In 1850 and 1860 the illiterate were persons twenty years old and upward; in 1870, ten years old and upward.

‡ Including 1206 Indians out of tribal relations.

‖ There were also reported, in 1870, 1 Mormon and 2 Spiritualist organizations, but no particulars were given.

Counties.—There are sixty counties, as follows:

Counties.	Pop., 1875.	Males, 1875.	Females, 1875.	Pop., 1870.	True valuation (U. S. census), 1870.	Assessed valuation, 1874-75.
					$	$
Adams	6,502	3,453	3,049	6,601	1,446,320	816,884
Ashland	730	409	321	221	167,280	1,033,920
Barron	3,737	2,068	1,669	538	665,178	
Bayfield	1,032	539	493	344	375,956	638,318
Brown	35,373	18,429	16,944	25,168	12,163,888	3,939,405
Buffalo	14,219	7,519	6,705	11,123	3,439,838	1,309,730
Burnett	1,456	779	677	706	538,832	342,021
Calumet	15,085	7,913	7,172	12,335	5,420,501	2,212,403
Chippewa	13,995	8,318	5,677	8,311	9,776,984	5,157,172
Clark	7,282	3,988	3,294	3,450	5,266,317	3,306,741
Columbia	28,803	14,725	14,078	28,802	17,420,017	8,995,169
Crawford	15,035	7,777	7,287	13,075	5,148,510	2,053,949
Dane	52,798	26,954	25,844	53,096	38,607,272	19,719,574
Dodge	48,394	24,820	23,574	47,035	34,132,064	14,158,412
Door	8,020	4,343	3,677	4,919	1,625,012	718,219
Douglas	741	389	352	1,122	1,414,422	1,325,437
Dunn	13,427	7,401	6,026	9,488	4,556,920	2,749,554
Eau Claire	15,991	8,737	7,254	10,769	5,238,944	5,743,029
Fond du Lac	50,241	25,547	24,684	46,273	35,861,740	14,802,206
Grant	39,086	20,102	18,984	37,979	30,651,881	10,201,922
Green	22,027	11,116	10,911	23,611	18,819,005	8,216,074
Green Lake	15,274	7,641	7,648	13,195	9,340,000	4,622,352
Iowa	24,133	12,410	11,723	24,544	17,941,107	5,754,300
Jackson	11,339	6,044	5,295	7,687	3,175,109	1,587,935
Jefferson	34,908	17,742	17,166	34,040	20,742,580	9,745,427
Juneau	15,300	7,996	7,304	12,372	3,817,146	2,263,425
Kenosha	13,907	7,085	6,822	13,147	12,622,543	5,762,880
Kewaunee	14,405	7,596	6,809	10,128	2,811,831	846,885
La Crosse	23,945	12,318	11,627	20,297	12,893,938	5,300,139
La Fayette	22,169	11,390	10,785	22,659	14,383,814	6,158,423
Lincoln	895	523	372	New	county.	
Manitowoc	38,456	19,536	18,921	33,364	11,316,963	5,024,427
Marathon	10,111	5,524	4,587	5,885	3,805,712	1,571,296
Marquette	8,697	4,490	4,207	8,056	1,464,227	909,278
Milwaukee	122,927	61,854	61,073	89,930	88,422,711	58,597,320
Monroe	21,026	11,047	9,979	16,550	5,038,162	2,912,576
Oconto	13,812	7,792	6,020	8,321	11,044,316	3,988,127
Outagamie	25,558	13,255	12,333	18,430	10,904,393	3,796,522
Ozaukee	16,547	8,517	8,030	15,564	5,727,248	3,180,109
Pepin	5,812	3,062	2,750	4,659	1,377,426	859,624
Pierce	15,101	8,021	7,080	9,958	5,373,662	3,044,580
Polk	6,736	3,626	3,110	3,422	1,950,365	1,254,676
Portage	14,857	7,843	7,014	10,634	4,022,646	2,138,217
Racine	28,712	14,685	14,027	26,740	20,827,105	10,133,934
Richland	17,353	8,912	8,441	15,731	6,180,000	2,442,814
Rock	39,039	19,818	19,191	39,030	40,900,000	19,192,870
St. Croix	14,957	8,015	6,942	11,035	7,796,551	3,804,704
Sauk	26,932	13,833	13,099	23,860	13,200,000	5,713,721
Shawano	6,635	3,574	3,061	3,166	2,809,159	1,199,817
Sheboygan	31,021	17,369	16,652	31,749	14,626,613	8,030,906
Taylor	819	519	300	New	county.	
Trempealeau	14,992	7,848	7,144	10,732	3,660,594	2,293,714
Vernon	21,524	11,224	10,300	18,645	9,129,411	3,271,247
Walworth	26,259	13,167	13,092	25,972	29,560,000	13,926,296
Washington	23,862	12,286	11,576	23,919	11,819,144	6,212,681
Waukesha	29,395	15,173	14,222	28,274	25,600,000	14,486,085
Waupaca	19,616	10,151	9,455	15,539	4,152,550	2,382,618
Waushara	11,523	5,957	5,566	11,279	3,784,234	1,705,665
Winnebago	45,033	23,157	21,876	37,279	25,625,512	15,165,849
Wood	6,018	3,297	2,751	3,912	1,402,374	1,277,496
Totals	1,236,729	639,217	597,512	1,054,670	702,307,329	337,758,068

Principal Cities and Towns.—Madison, the capital of the State, in 1870 had 9176 inhabitants; in 1875, 10,093; Milwaukee, 71,440 in 1870, and 100,775 in 1875; La Crosse, Racine, Fond du Lac, and Oshkosh had from 12,000 to 20,000 each in 1875; Green Bay, Eau Claire, Watertown, and Janesville, between 8000 and 11,000; Manitowoc, Chippewa Falls, Lake, Appleton, and Sheboygan, from 5000 to 8000; Baraboo, Neenah, Platteville, Jefferson, Wauwatosa, Oconto, Portage, Beloit, and Kenosha, from 4000 to 5000; Menasha, Prairie du Chien, Waukesha, Wausau, Mineral Point, Stevens' Point, Berlin, Beaver Dam, Koshkoning, Fort Howard, Ripon, and Sparta, between 2500 and 4000; while about 30 towns and villages range from 1800 to 2500.

History.—The first white settlement in Wisconsin was made at Green Bay in 1639 by the French, and during the next forty years several points, among them Prairie du Chien on the Mississippi, were occupied, and war waged with the Indians to secure the right of way through Lake Winnebago; but in the course of time this colony became so far assimilated to the Indian tribes of the region that but few traces of it now remain. It was under the laws of Canada, and the British government maintained its possession of it by a military force until 1796, when the U. S. obtained possession and annexed it for purposes of government to the North-west Territory, ceded by Virginia and other States to the U. S. In 1809 it was included in the Territory of Illinois, as then formed; in 1818, when Illinois was admitted into the Union as a State, Wisconsin was still a wilderness, and was annexed to Michigan Territory for such government as was needed. In 1827 lead was discovered in large quantities at Potosi, Mineral Point, etc., and there was a great rush of immigrants to that section. The Indians soon became troublesome, and the Black Hawk war ensued in 1832. Treaties were made with the Indians soon after, by which they removed to reservations beyond the Mississippi. In 1836 the population had increased to such an extent that a Territorial government was organized, which at first included a part of the upper peninsula of Michigan, the whole of Minnesota and Iowa, and that part of Dakota lying E. of the Missouri and White Earth rivers. On the admission of Michigan into the Union as a State, a part of the Lake Superior region was set off to her, and when the Territory of Iowa was formed, it included all the region W. of the Mississippi. The first effort to procure the admission of Wisconsin to the Union as a State was made in 1846, when Congress passed an enabling act under certain conditions. A convention was held in that year, and a constitution drafted, which was sent to Washington and submitted to the people for their acceptance. Congress passed an act admitting the State under this constitution in 1847, but the people rejected the constitution on account of some objectionable features. Another convention was called Dec. 15, 1847, which submitted a new constitution: this was ratified in Mar., 1848, and the State was admitted to the Union by act of Congress May 29, 1848. Under this constitution, with some amendments, it is still governed. The growth of the State has been rapid and peaceful. It has attracted a large immigration from the continent of Europe. In the late civil war its troops were distinguished for their courage and patriotic spirit.

Governors of Wisconsin.

(1) *Territorial Governors.*

Henry Dodge.....1836–41
James D. Doty.....1841–44
Nathaniel P. Tallmadge.1844–45
Henry Dodge.....1845–48

(2) *State Governors.*

Nelson Dewey.....1848–51
Leonard J. Farwell.....1851–53
William A. Barstow.....1853–55
Coles Bashford.....1855–57
Alexander W. Randall...1857–61
Louis P. Harvey.....1861–62
Edward Salomon (acting).....1862–63
James T. Lewis.....1863–66
Lucius Fairchild.....1866–72
Cadwallader C. Washburn.....1872–74
William H. Taylor.....1874–76
Harrison Ludington.....1876–78

Electoral and Popular Vote for President and Vice-President.

Elect. year.	Candidates who received the electoral vote of the State.	Elect. vote.	Pop. vote.	Opposition candidates.	Pop. vote.	Third-party candidates.	Pop. vote.	Fourth-party candidates.	Pop. vote.
1848	Lewis Cass P. Wm. O. Butler V.-P.	4	15,001	Zachary Taylor P. Millard Fillmore V.-P.	13,747	Martin Van Buren P. C. Francis Adams V.-P.	10,428		
1852	Franklin Pierce P. William R. King V.-P.	5	32,658	Winfield Scott P. Wm. A. Graham V.-P.	21,743	John P. Hale P. George W. Julian V.-P.	8,780		
1856	John C. Fremont P. William L. Dayton V.-P.	5	66,090	James Buchanan P. J. C. Breckenridge V.-P.	52,843	Millard Fillmore P. A. J. Donelson V.-P.	579		
1860	Abraham Lincoln P. Hannibal Hamlin V.-P.	5	86,110	Stephen A. Douglas P. H. V. Johnson V.-P.	65,021	John C. Breckenridge P. Joseph Lane V.-P.	888	John Bell P. Edward Everett V.-P.	161
1864	Abraham Lincoln P. Andrew Johnson V.-P.	8	83,458	George B. McClellan P. George H. Pendleton V.-P.	65,884				
1868	Ulysses S. Grant P. Schuyler Colfax V.-P.	8	108,857	Horatio Seymour P. Francis P. Blair V.-P.	84,710				
1872	Ulysses S. Grant P. Henry Wilson V.-P.	10	104,907	Horace Greeley P. Benj. Gratz Brown V.-P.	86,477	Charles O'Conor P. ——— V.-P.	834		
1876	Rutherford B. Hayes P. Wm. A. Wheeler V.-P.	10		Samuel J. Tilden P. Thos. A. Hendricks V.-P.		Peter Cooper P. Samuel F. Cary V.-P.			

(The writer is indebted to His Excellency, Hon. Harrison Ludington, governor of Wisconsin, for valuable documents and statistics used in preparing this article, and also to Prof. T. C. Chamberlin of Beloit College, State geologist, for documents and statistics.) L. P. Brockett.

Wisconsin, tp., Jackson co., Minn. P. 193.

Wisconsin River rises in Lake Vieux Desert (which is partly in Michigan and partly in Wisconsin), flows in a generally S. course to Portage City, Wis., where it turns to the S. W. It reaches Mississippi River 4 miles below Prairie du Chien. Breadth at its mouth, 1800 feet; elevation, 600 feet. Its length is over 600 miles. It is navigable 200 miles to Portage City, whence a short canal leads to Fox River. The channel of the Wisconsin is much injured by shifting sandbars. The upper part of the river passes through heavy pine forests. Several cataracts, of which the most famous are the Dalles of the Wisconsin and Grandfather Ball Falls, break the course of this picturesque stream. (See Fox River, and Navigation, Inland.)

Wisconsin, University of, at Madison, Wis., was incorporated in 1838 and organized in 1848. In 1849 a preparatory department was established, in 1850 the university was formally opened, in 1851 the first college classes were formed, and in 1875–76 the university comprised 27

instructors and 345 students. Congress in 1838 granted 46,080 acres of land to the Territory of Wisconsin for the support of a university, and in 1854 it made another grant of 46,080 acres of land. In 1866 the university also received those 240,000 acres of land which Congress had granted to the State in 1862 for the establishment of an agricultural school, and in 1867 it was reorganized in accordance with the conditions of this grant. Since 1866 it has received from the State appropriations to the amount of $170,000, among which were $50,000 in 1870 for the erection of the Ladies' Hall, and $80,000 in 1875 for the erection of Science Hall; and by a law of 1876 a tax of one tenth of a mill on the total valuation of the State is to be levied annually for its benefit, whereby its annual revenue will be increased to about $40,000. The general management of the institution is vested in a board of 11 regents—namely, the State superintendent of public instruction, and 10 members, one for each of the eight Congressional districts of the State, and two for the State at large, appointed for three years by the governor. The president is chosen by the board of regents. The university comprises a college of letters, consisting of a department of ancient and a department of modern classics; a college of arts, consisting of a department of general science, agriculture, civil engineering, mining and metallurgy, mechanical engineering, and military science; a school of law, organized in 1868, of whose faculty the judges of the supreme court are members; and, finally, a sub-freshman and a post-graduate course. Tuition is free to all students from the State, and since 1867 all departments are open to women.

Wis'coy, p.-v. and tp., Winona co., Minn. P. 523.

Wiscoy, p.-v., Hume tp., Allegany co., N. Y.

Wis'dom, Book of, called by the Septuagint "Wisdom of Solomon," was considered canonical by some of the Fathers of the Church, who believed that Solomon was its author, and by the Roman Catholic Church. By most Protestant churches it is considered apocryphal, as most Protestant theologians agree that its author must have been an Alexandrian Jew of the second or first century B. C. Among the numerous commentaries on the book the most remarkable are by John Rainold (Oxford, 1618), Bauermeister (Göttingen, 1828), and Grimm (Leipsic, 1860).

Wise, county of N. Texas, drained by the W. fork of Trinity River; surface undulating, soil fertile. Cattle are the chief live-stock. Staples, Indian corn, oats, and a little cotton. Cap. Decatur. Area, about 900 sq. m. P. 1450.

Wise, county of S. W. Virginia, bordering upon Kentucky; surface mountainous, with much iron ore and bituminous coal; soil in the valleys fertile. Swine and sheep are the chief live-stock. Staples, Indian corn, oats, tobacco, wool. Cap. Wise Court-house. Area, 250 sq. m. P. 4785.

Wise (Daniel), D. D., b. at Portsmouth, England, Jan. 10, 1813; came to the U. S. 1833; became a minister of the Methodist Episcopal Church; was for five years editor of *The Sunday School Messenger*, and subsequently of the *Ladies' Pearl*, *The Rhode Island Temperance Pledge*, and *Zion's Herald* 1852; was corresponding secretary of the Methodist Sunday School Union and Tract Society 1856–72, and is editor of *The Sunday School Advocate* and of all the Sunday school and tract publications of the M. E. Church. Author of more than 30 religious works for youth, some of which have been very widely circulated.

Wise (Henry Alexander), b. at Drummondtown, Accomac co., Va., Dec. 3, 1806. His father, who was a lawyer, and had been Speaker of the house of delegates in the State legislature, died in 1812, and his mother in the year following; graduated at Washington College, Pa., in 1825; studied law at Winchester, Va., and then moved to Nashville, Tenn.; returned to his native county, where he continued the practice of law with great success, and soon became actively engaged in politics until the outbreak of the late war. In 1832 he was sent as a delegate to the first national Democratic convention that ever assembled in the U. S. It met at Baltimore. In it he zealously advocated the nomination of Gen. Jackson for his second term, but positively refused to support the nomination of Mr. Van Buren for Vice-President, made by that convention. Soon after, when the question of nullification arose as a practical one in South Carolina, he took position against that doctrine, while with equal zeal he denounced the principles of Gen. Jackson's proclamation, as they were then understood in Virginia. Was elected to Congress in 1833; re-elected successively each year till 1843. He was at that time considered the greatest orator of the House. Prentiss had not as yet entered on that arena. Wise had become quite intimate with, and greatly attached to, Mr. Clay during this period of his life, and, it has been said, was a warm advocate of his nomination for the Presidency in the election of 1840. He certainly contributed greatly, by his influence, to the getting of Mr. Tyler's name put on the Harrison ticket for the Vice Presidency at that election. In 1843, Mr. Tyler nominated him minister to France. He resigned his seat in the House in expectancy of its confirmation, but the Senate, which was so decidedly at war with Mr. Tyler at this time, rejected the nomination. Wise was immediately returned again to the House by his constituents. In 1844, Tyler nominated him minister to Brazil. This appointment was confirmed by the Senate, and for three years he represented his country at Rio Janeiro. Resigning in 1847, he returned and took an active part in the Presidential election of 1848. He was a Cass elector for his State. In 1850 he was a member of the reform convention of Virginia. In 1852 he was again Presidential elector on the Pierce ticket. In 1855 came off his great canvass for the governorship of the State. In this he made his most celebrated anti-Know-Nothing fight. He was elected by a majority worthy of his effort. He continued in the office of governor until after the John Brown raid in 1859. Mr. Wise was decidedly opposed to secession in 1860, but he went with his State after her ordinance of secession. He entered the Confederate service with the commission of brigadier-general, which position he held until the close of the war. After the war he took no active part in politics, but changed his residence to Richmond, where he resumed the practice of law. D. Sept. 12, 1876.

Alexander H. Stephens.

Wise (Henry Augustus), cousin of Gov. Wise of Virginia, b. at Brooklyn, N. Y., May 12, 1819; entered the U. S. navy as midshipman 1834; served on the coast of Florida during the Seminole war, and on the Pacific coast during the Mexican war 1846–48; married a daughter of Edward Everett; was flag-lieutenant of the Mediterranean squadron 1852–55; conveyed the Japanese ambassadors home in the U. S. frigate Niagara 1861; became assistant chief of the ordnance bureau, with the rank of commander, 1862; was promoted to captain and chief of that bureau Dec., 1866; resigned his post 1868, and went to Europe for his health. D. at Naples, Italy, Apr. 1, 1869. Author of *Los Gringos, or an Interior View of Mexico and California, with Wanderings in Peru, Chili, and Polynesia* (1849), *Tales for the Marines* (1855), *Scamparias, from Gibel-Tarck to Stamboul* (1857), *The Story of the Gray African Parrot* (1859), and *Captain Brand of the Centipede* (1860); all which appeared under the *nom de plume* of "Harry Gringo."

Wise (John), b. at Roxbury, Mass., in Aug., 1652; graduated at Harvard 1673; began to preach at Ipswich 1680; was settled as pastor there 1683; was imprisoned, fined, and deposed from the ministry by order of Gov. Andros for remonstrating against a violation of charter rights in imposing a province-tax without authority from the assembly; brought a suit against Chief-Justice Dudley for denying him the benefit of the habeas corpus act; was deputy from Ipswich in the legislature of 1689, after the overthrow of Andros; was chaplain to the expedition against Quebec 1690; subsequently opposed in several publications a scheme for placing the churches of Massachusetts under the jurisdiction of ecclesiastical councils, and favored the introduction of inoculation for small-pox 1721. D. at Ipswich Apr. 8, 1725. Author of *The Church's Quarrel Espoused* (1710), a work abounding in wit and satire, and *A Vindication of the Government of New England Churches* (1717), both of which were republished in a single volume in 1860 (4th ed.) by the Congregational board of publication.

Wise (W. C.), U. S. N., b. Nov. 8, 1842, in Virginia; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served in the New Ironsides in several fights with the defences of Charleston harbor, and in the Minnesota at both the Fort Fisher fights. Commended for "gallantry." F. A. Parker.

Wise Court-house, p.-v., cap. of Wise co., Va.

Wise'man (Nicholas Patrick Stephen), D. D., b. at Seville, Spain, Aug. 3, 1802, of Irish parents; educated at Waterford, at Durham College, and in the English college at Rome, where he graduated 1824; was ordained to the priesthood 1825; became professor of Oriental languages in the Roman university, and vice-rector of the English college 1827; was advanced to the rectorship 1828; returned to England 1835; established with O'Connell the *Dublin Review*, and delivered a course of lectures on Roman Catholic doctrines at St. Mary's, Moorfields, during Lent, 1836; maintained a polemic on the "Real Presence" with Dr. Turton, bishop of Ely, and published several able works in advocacy of Roman Catholicism; lectured at Rome during Lent, 1837, at which time he induced Pope Gregory XVI. to appoint several additional vicars apostolic in England; was consecrated bishop of Melipotamos *in partibus infidelium*, and coadjutor to Dr. Walsh of the Midland dis-

trict of England June 8, 1840; became in the same year president of St. Mary's College, Oscott; visited Rome shortly after the accession of Pius IX., 1847, and gave his influence in favor of the measure then preparing for the restoration of the Roman Catholic hierarchy in England; was appointed pro-vicar apostolic of the London district 1848, and vicar apostolic on the death of Bishop Walsh 1849; was summoned to Rome Aug., 1850; aided in preparing the "apostolic letter" of Sept. 29, re-establishing the English hierarchy; was nominated archbishop of Westminster Sept. 30, and made cardinal Oct. 1, 1850—measures which gave rise to great excitement in England, where they were characterized as a "papal aggression," and gave rise to the "Ecclesiastical Titles act," prohibiting the assumption of local ecclesiastical titles by Roman Catholics, and which remained nominally in force until its repeal in 1872. Cardinal Wiseman was active in the exercise of his new functions, making frequent episcopal journeys through England and Ireland, delivering lectures and speeches, and publishing numerous volumes in support of his doctrines. D. in London Feb. 15, 1865. Author, among other works, of *Horæ Syriacæ* (Rome, 1828), *Lectures on the Connection between Science and Revealed Religion* (2 vols., 1836), *The Real Presence* (1836), *Lectures on the Doctrines and Practices of the Catholic Church* (2 vols., 1836), *Three Lectures on the Catholic Hierarchy* (1850), *Essays on Various Subjects* (3 vols., 1853), *Fabiola, or the Church of the Catacombs* (1855), and *Recollections of the Last Four Popes* (1858). PORTER C. BLISS.

Wish'art (GEORGE), supposed to be a native of Pittarow, Forfarshire, Scotland, b. about 1510; educated at a private grammar school; taught Greek at Montrose; began preaching the doctrines of the Reformation about 1535; had to flee to England about 1538; resided and taught at Corpus Christi College, associating with Bilney, Latimer, and other Reformers; published several theological tracts in Latin; returned to Scotland July, 1543; began anew to preach at Montrose, Perth, Ayr, and Dundee, with such effect that in the latter town the populace destroyed the convents and churches of the Black and Grey Friars; made a preaching-tour of the western counties; was arrested by the earl of Bothwell at Ormiston; was tried for heresy at St. Andrew's Mar. 1, before Cardinal Beaton's ecclesiastical court, composed of several bishops; condemned to the stake, and burned at St. Andrew's Mar. 28, 1546. At the stake he predicted the death "within a few days" of the cardinal, who was a spectator from the castle, and the assassination of the latter about three months afterward is alleged by recent historians to have been in pursuance of a plot to which Wishart was privy, the evidence being the mention of "a Scotishman called Wyshart" in a MS. account of the plot in the State Paper Office. A *Life* (1876) has been published by Rev. C. Rogers.

Wishart, or **Wisheart** (GEORGE), D. D., b. at Yester, East Lothian, Scotland, in 1609; educated at the University of Edinburgh; became a parish minister at North Leith and at St. Andrew's; refused to take the covenant 1639, for which he was deprived of his living and imprisoned; made his way to Newcastle, England, where he preached, and was captured by the Scottish army Oct., 1644; was for some months imprisoned in the common jail at Edinburgh, suffering great hardships; succeeded in joining the celebrated royalist leader James Graham, marquis of Montrose, to whom he became chaplain; escaped to the Continent 1646; returned to Scotland in the expedition of Montrose 1650, and narrowly escaped sharing his fate; became chaplain the same year to Elizabeth, the ex-electress-palatine and titular queen of Bohemia; accompanied her to England at the Restoration 1660; became rector of Newcastle-upon-Tyne, and was consecrated bishop of Edinburgh June 1, 1662; was averse to the intolerant policy of Charles II., and recommended leniency to the Covenanters. D. at Edinburgh in 1671. Author of a *History of the Wars of Montrose* (Paris, 1647), in elegant Latin, a copy of which was tied to the neck of the marquis at his execution. A second part, completing the history to the death of Montrose, was left by Wishart in MS., but was never printed in Latin. English translations of the valuable work were published in 1720, 1756, and 1819.

Wishart's, tp., Robeson co., N. C. P. 621.

Wis'mar, town of Germany, in Mecklenburg-Schwerin, on a deep inlet of the Baltic, has an excellent harbor, shipbuilding docks, fisheries, breweries, distilleries, and manufactures of sailcloth, cordage, tobacco, and playing-cards. P. 13,883.

Wis'ner, p.-v. and tp., Tuscola co., Mich. P. 165.

Wisner (BENJAMIN BLYDENBURG), D.D., b. at Goshen, N. Y., Sept. 29, 1794; removed when three years of age to Geneva, N. Y., where he prepared for college under Rev. Dr. Axtell; graduated with honors at Union College 1813; was principal of Johnstown Academy 1813–14; tutor at Union College 1815–18, studying theology in the mean time under Rev. Dr. Andrew Yates; graduated at Princeton Seminary 1820; was ordained pastor of the Old South church, Boston, Feb. 21, 1821; resigned that post Oct., 1832, to accept the corresponding secretaryship of the A. B. C. F. M., in which he displayed rare executive abilities; visited different parts of the country, forming missionary associations, in which labors he was highly successful, and was an influential member of several benevolent and religious organizations. D. at Boston Feb. 9, 1835. Author of *A History of the Old South Church* (1830) and of several published sermons and addresses.

Wisner (MOSES), b. at Aurelius, N. Y., in 1818; received a good education; removed to Michigan 1839; studied law; was admitted to the bar at Pontiac 1842; became prosecuting attorney for Lapeer co. 1843–44; was defeated as a candidate for circuit judge 1852; was Republican governor of Michigan 1859–61; entered the army as colonel of the 22d Michigan Vols. 1862. D. at Lexington, Ky., Jan. 5, 1863.

Wisner (WILLIAM), D. D., b. at Warwick, N. J., in 1782; was admitted to the bar, and practised law in Orange co.; was pastor of a Presbyterian church at Ithaca for some years, of a church at Rochester 1830–62, and removed in 1870 to Cedar Rapids, Ia., where he d. Jan. 7, 1871. Author of *Incidents in the Life of a Pastor* (1851) and *Elements of Civil Liberty, or the Way to Maintain Free Institutions* (1863).

Wissembourg', town of Germany, province of Alsace, on the Lauter, is strongly fortified, manufactures tiles, bricks, soap, felt hats, and paper-hangings, and carries on an active general trade. From Wissembourg to Lauterburg, along the Lauter, extends a line of fortifications called the "Lines of Wissembourg." P. 5913.

Wis'tar (CASPAR), M. D., b. at Philadelphia Sept. 13, 1761, of Quaker parents, was grandson of Caspar, who emigrated from Germany in 1717 and established a glass-factory in New Jersey; was a volunteer nurse in the hospitals after the battle of Germantown, and was thereby induced to study medicine under Dr. Redman and in the University of Pennsylvania; completed his medical education at Edinburgh 1786; travelled on the Continent; began practice in Philadelphia Jan., 1787; was professor of chemistry in Philadelphia College and physician to the dispensary and hospital 1789–92; adjunct professor of anatomy and surgery 1792–1808; thenceforth sole professor of anatomy and censor of the College of Physicians from 1794 until his death, Jan. 22, 1818. He was highly distinguished in his profession, conferred great lustre upon the Philadelphia Medical School, was for many years vice-president and president of the American Philosophical Society, and succeeded Dr. Rush as president of the Society for the Abolition of Slavery 1813. Author of *A System of Anatomy* (2 vols., 1812) and other professional works.

Wista'ria [named in honor of Dr. Caspar Wistar], an interesting genus of climbing leguminous shrubs. *W. consequana*, a native of China, is one of our most beautiful spring flowering climbers. *W. frutescens* is a smaller ornamental species, growing wild in the West and South of this country in rich wet soils.

Wis'ter (ANNIS LEE **Furness**), daughter of Rev. Dr. William H. Furness, b. in Philadelphia about 1840; married Caspar Wister, M. D.; has contributed to *Lippincott's Magazine* and translated from the German several excellent novels, among which are Blum and Wahl's *Seaside and Fireside Fairies* (1861); E. Marlitt's *The Old Mamselle's Secret* (1868; 8th ed. 1870), *Gold Elsie* (1868), *The Countess Gisela* (1869), *The Little Moorland Princess* (1873), and *The Second Wife* (1874), Wilhelmine von Hillern's *Only a Girl, or a Physician for the Soul* (1870); Hackländer's *Enchanting and Enchanted, or Fairy Spells* (1871); Volkhausen's *Why Did he not Die?* (1871); Von Auer's *It is the Fashion* (1872); and Fanny Lewald's *Hulda, or the Deliverer* (1874).

Wis'wall (ICHABOD), b. in England in 1638; came to Massachusetts in childhood; studied three years at Harvard, but did not graduate; was minister of Duxbury from 1678 until his death; was many years a prominent instructor of youth; went to England in 1689 as agent for the colony of Plymouth, and labored strenuously to prevent the annexation of Plymouth to Massachusetts Colony, but was defeated by Increase Mather. D. at Duxbury July 23, 1710.

Witch'craft. The mediæval belief in witches and witchcraft had a very complex origin. Common superstition was one of its main roots; the science of magic, transmitted from the pagan philosophy, was another, etc.

But its definite character it received from the peculiar development of the doctrine of Satan. Closely connected with the speculations concerning the first origin of evil, the true constitution of free will, the absolute difference between good and bad, etc., and yet, on the other hand, singularly independent of the results of these speculations, there grew up during the Middle Ages a view according to which the world was subject not to one god, but to two—namely, God and the devil; and this view was held by every good Christian. Of course, the pious and devout man had no doubt as to which of these two princes was the mightiest, but as little did he doubt that it was possible for him and for any man to withdraw himself from the mercy and justice of God and sell his immortal soul to the devil. By this general view of the world the idea of witchcraft was formed as a supernatural power to inflict diseases and miseries of all kinds, acquired by a bargain with the devil. There are, however, features in this curious phenomenon in which the pagan element far exceeds the Christian. Thus, for every hundred witches there was only one wizard, and again of the one hundred witches the ninety-nine were old women. The explanation of this peculiar fact cannot be doubtful. With the old Germanic tribes, and generally with all barbaric nations, the art of healing wounds and curing diseases was entirely entrusted to their women. As now this art was not accompanied by a corresponding science, but rested almost exclusively on a totally blind tradition with respect to the power of certain herbs and processes, and was developed by an equally blind personal experience, something mystical became attached to it; and it was quite natural that with old, ugly women, and to the eyes of young, suffering, and impatient men, this mysticalness should assume the aspect of wickedness. On passing into the Christian world this phenomenon lost its true and natural explanation, and received an artificial and fantastic coloring: the seduction of Eve by Satan was given by the theologians as the reason why there were more witches than wizards, but the extensive development of the worship of the Virgin, which took place at the same time, shows that the coloring was very superficial.

After creeping around among people for centuries as a dumb superstition, the belief in witchcraft finally burst out, in the fifteenth century, into an open mania; and it was no doubt the papal bulls issued in its behalf which caused this dreadful outbreak. The first dates from 1484 and was issued by Innocent VIII., charging the inquisitors to hunt up and put to death all witches and other practisers of diabolical arts. It was specially directed to Germany, and here, in 1489, Krämer and Sprenger drew up the famous *Mallus Maleficarum* ("the Witch-Hammer"), in which the whole doctrine of witchcraft is set forth in systematic form, and rules laid down for the detection and trial of the crime. Other bulls followed—in 1494 by Alexander VI., in 1521 by Leo X., in 1522 by Adrian VI., etc. The misery caused by these bulls is indescribable. In the bishopric of Bamberg 600 persons were burned or hanged for sorcery in the course of four years, and 900 in the bishopric of Würzburg. In Geneva 500 persons were burned in four months in 1516, and 1000 in the district of Como in 1521. In England a statute of Elizabeth (1562) made witchcraft by itself a capital crime, whether it had been directed to the injury of others or not; and the hold which the belief had taken of the imagination of the nation is shown by Shakspeare's *Macbeth*. But the frenzy did not develop fully until the reign of James VI., who himself wrote a treatise on demonology, while Hopkins and his "witch-finders" scoured the country from one end to the other. During the Long Parliament 3000 persons are said to have been put to death for sorcery. The colonists of New England were also staunch enemies of witches, as shown by the Salem tragedy of 1691–92. The first to oppose these dreadful errors were Johann Weier, with his *De Præstigiis Dæmonum* (1563), and Friedrich von Spee, with his *Cautio criminalis* (1631), but it was not until after the publication of Balthasar Becker's *Bezauberte Welt* (1691) and Christian Thomasius's *Theses de Crimine Magiæ* (1701) that the dense clouds of superstition, malice, ignorance, and wilful lies began to disappear. In England the laws against witchcraft were repealed in 1736, and the last witch was officially tried and executed in 1793 in Posen. (A good exposition of the whole matter has been given by W. G. Soldan in his *Geschichte der Hexenprocesse*, 1843.)

CLEMENS PETERSEN.

Witch'-Elm, Wych-Elm, or **Scotch Elm,** the *Ulmus montana*, a large fast-growing European elm, much planted for ornament and affording good timber. It is very hardy in this country.

Witch'-Hazel, a North American shrub, quite large, especially southward, the *Hamamelis virginica* of the order Hamamelaceæ. Its blossoms appear very late in autumn, just as the leaves are falling, and the fruit matures early in the succeeding autumn. Like the true hazel in Europe, its twigs are employed as divining rods, whence the name. The bark is employed in medicine, and joins somewhat aromatic to astringent and sedative qualities.

Wit'enagemot [Ang. Sax., "assembly of wise men"], the old Anglo Saxon national council, the great court of justice and supreme legislative body of the English nation before the Conquest, superior to the *scir gemot* or county assembly, and itself the offspring of the primitive *folk mot*, an old Germanic institution. The great nobles, the high ecclesiastics, and the great landholders appear to have had seats in the *witan*, or witenagemot, as well as the higher shire officers; and probably the freemen who lived near the place of meeting were allowed to sit in the assembly. The witenagemot is interesting as being the original germ of the British Parliament.

With'amsville, p.-v., Union tp., Clermont co., O. P. 254.

Withdrawing a Juror, in law, is a proceeding on the trial of a cause by which one of the jurors is dismissed from the jury-box, in order that the trial may thus be stopped, and at the same time the issues may not be decided by nonsuiting the plaintiff or ordering a verdict for him, as the case may be. The party procuring a juror to be withdrawn can bring the same cause to trial at a subsequent term by paying the costs of the former term. Recourse is generally had to this method when by means of some unexpected event or some mistake, such as the absence of an important witness, a formal defect in the pleadings, etc., one of the parties would necessarily fail without regard to the real merits, and the judge suggests or consents that a juror be withdrawn without any decision of the case. The process itself, which has come down from an early day, is sufficiently absurd. It having been arranged between the court and the counsel that such a disposition shall be made of the cause, the clerk motions a juryman to step aside out of the jury-box. This being done, he informs the court, as though the fact were a sudden discovery of his own, that there appear to be only eleven jurymen present. The court thereupon orders the names of the panel to be called, and as only eleven answer, it announces that the trial must be stopped.

JOHN NORTON POMEROY.

With'er (GEORGE), b. at Brentworth, Hampshire, England, June 11, 1588; entered Magdalen College, Oxford, 1604; was called home "to hold the plough" without a degree 1607, but soon proceeded to London 1608; studied law at Lincoln's Inn; printed in 1613 a volume of metrical satires on the manners of the time, entitled *Abuses Stript and Whipt*, for which he was thrown into the Marshalsea prison; published many political and devotional pieces in prose and verse; served as captain of horse and quartermaster-general of a regiment in the expedition sent by Charles I. against the Scotch Covenanters 1639; sold his estate and raised a troop of horse for the Parliament 1642; was soon promoted to the rank of major; was commissioned by the Long Parliament a justice of the peace; was made by Cromwell "major-general of all the horse and foot in the county of Surrey;" profited largely by the confiscations of royalist estates, but had to surrender his acquisitions at the Restoration, when he was imprisoned three years in Newgate, by order of the "Convention Parliament," on the charge (which he denied) of being the author of a "scandalous and seditious libel;" had his library taken from him, and passed his last years in poverty. D. in London May 2, 1667, and was buried in the Savoy church. His numerous poems were long forgotten, but have recovered popularity, and been frequently reprinted in the present century.

With'erite, a mineral carbonate of baryta, named after its discoverer, Withering. Crystallization right rhombic; almost as hard as fluor-spar; white, sometimes transparent; rare, so far as known, in America; one locality near Lexington, Ky.; occurs so abundantly at Fallowfield, Northumberland, England, as to be mined largely, and sold for making plate glass and for chemical uses. Molecular structures:

$$\text{The mineral, } O_6.4^{C}_{20}.2^{Ba}_{28} = 4.329 \begin{cases} \text{Dana's } \textit{Mineralogy} \ldots\ldots 4.29. \\ \text{Mohs} \ldots\ldots\ldots\ldots 4.301. \\ \text{Karsten} \ldots\ldots\ldots\ldots 4.302. \end{cases}$$

$$\text{Artificial preparations, } O_6.4^{C}_{20}.\left(\begin{matrix}Ba\,Ba\\ 28\;\;29\end{matrix}\right) = 4.216 \text{ (Schroder, 4.216).}$$

$$O_6.4^{C}_{20}.{}^{2Ba}_{27} = 4.557 \text{ (Filhol, 4.557).}$$

HENRY WURTZ.

With'ers (JONES MITCHELL), b. in Madison co., Wis., Jan. 12, 1811; studied at Greene Academy, Huntsville; graduated at West Point 1835; became second lieutenant of 1st Dragoons, and repaired to Fort Leavenworth, but resigned Dec. 5 of the same year; served on the staffs of Gen. B. S. Patterson and Gen. Jessup, commanding the Alabama volunteers for the threatened Creek war of 1836; studied law at Tuscaloosa; acted as private secretary to Gov. C. C.

Clay; was admitted to the bar 1838; settled at Mobile as lawyer and commission merchant 1841; was elected colonel of Alabama volunteers for the Mexican war 1847, but his regiment was not accepted for active service; was elected to the legislature 1855; was mayor of Mobile 1856–61; entered the Confederate service as colonel of the 3d Alabama infantry; became brigadier-general July, 1861; took command of the defences of Mobile; was appointed major-general early in 1862; had command of a division at Shiloh Apr. 6, and in the Western army organized at Tupelo June, 1862; took part in the memorable Kentucky campaign; was distinguished at the battle of Stone River Dec. 31, 1862, and afterward commanded a department with head-quarters at Montgomery. Since the war he has been editor of the Mobile *Tribune*.

Withers (Robert E.), M. D., b. in Campbell co., Va., Sept. 18, 1821; educated at a private academy and at the University of Virginia, where he graduated in medicine 1841; began practice at Danville, Va.; entered the Confederate military service in 1861 as major; was speedily commissioned colonel of the 18th Virginia regiment; was severely wounded in one of the battles near Richmond 1862; subsequently commanded the military post at Danville; removed to Lynchburg 1866; edited the *News* until 1868; was nominated by the Democratic party for governor 1869, but withdrew in favor of Gilbert C. Walker; was chosen Presidential elector at large 1872, lieutenant-governor 1873, and soon afterward U. S. Senator for the term 1875–81.

With'erspoon (John), D. D., LL.D., b. at Yester, Haddingtonshire (East Lothian), Scotland, Feb. 5, 1722, and said to be a descendant of John Knox; was educated at the University of Edinburgh; was licensed to preach 1743; was parish minister of Beith in the W. of Scotland 1745–57; joined the Pretender with a corps of militia at Glasgow; was taken prisoner at the battle of Falkirk, but released after two weeks' confinement in Donne Castle; became favorably known as a theologian by several learned treatises; was pastor of the Low church at Paisley from 1757 until 1768, when he accepted the presidency of Nassau Hall at Princeton, N. J., in which he was inaugurated Aug. 17, becoming also professor of divinity there and pastor of the church; identified himself with the interests of his adopted country, taking an active part in the political struggles of the time; was in 1776, the college being for a time broken up, chosen a member of the constitutional convention of New Jersey, and also of the Continental Congress, in which he sat "in full clerical dress" for six years, being one of the signers of the Declaration of Independence and of the Articles of Confederation; was an active worker on committees, including the "secret committee;" was the author of several of the state papers promulgated by Congress; was a member of the board of war, and visited the camps to inquire into and ameliorate the condition of the troops; sent his only son to war, in which he became a major and was killed at the battle of Germantown; opposed in Congress the repeated issues of paper currency, and showed great sagacity in anticipating political contingencies; gave lectures on moral philosophy and rhetoric at the college, of which he greatly raised the reputation and improved the financial condition; visited England in 1783, and again in 1784, to collect funds for the college, with but slight success, the war being too recent; made some unfortunate speculations in Vermont lands; married as his second wife, at the age of sixty-nine (1791), a young lady of twenty-three, and resided thenceforth on a farm near Princeton, which he called Tusculum, and was totally blind during the last two years of his life. D. at Tusculum Nov. 15, 1794. His two daughters by his first marriage married respectively Dr. David Ramsay the historian and Rev. Dr. Samuel Stanhope Smith, who succeeded him as president of the College of New Jersey. His *Works* were collected at New York (4 vols., 1800–01) and at Edinburgh (9 vols., 1804), edited with a *Memoir* by Dr. S. S. Smith; they comprise, besides academical lectures and sermons, *Ecclesiastical Characteristics, or the Arcana of Church Policy* (Glasgow, 1753), *An Essay on the Doctrine of Justification* (Edinburgh, 1756), *A Serious Inquiry into the Nature and Effects of the Stage* (Glasgow, 1757), *Essays on Important Subjects* (London, 3 vols., 1764), *Considerations on the Nature and Extent of the Legislative Authority of the British Parliament* (Philadelphia, 1774), *An Essay on Money*, and a series of essays on social and literary topics entitled *The Druid* (1781). A *Life* by Dr. Ashbel Green is in MS. in the library of the New Jersey Historical Society at Newark. His colossal statue was unveiled in Fairmount Park, Philadelphia, 1876. Porter C. Bliss.

With'ington (Leonard), D. D., b. at Dorchester, Mass., in 1789; graduated at Yale College 1811; became pastor of the First church at Newburyport, Mass., 1816, and still fills that post (1876), a colleague having been appointed in 1858. Author of *The Puritan, a Series of Essays* (2 vols., 1836), *Solomon's Song Translated and Explained* (1861), and other works.

Wit'ness [Ang.-Sax. *witnesse*], in law, is a person who testifies in a judicial proceeding as to the existence of facts material to the issue which is to be decided. In the different forms of trial known to the American and English law his testimony may be given orally in open court, or it may be taken before some officer, reduced to the form of a written deposition, and read on the hearing. The common law absolutely prohibited certain classes of persons from being witnesses, of which the following were the most important: (1) The parties in all civil actions and the accused in all criminal prosecutions. (2) Persons pecuniarily interested in the event of the action if the interest was in favor of the party by whom they were called; other kinds of interest, such as that resulting from the nearest relationship (except husband and wife) or friendship, were not grounds for rejection, and only affected the credibility of the testimony. (3) Husband and wife were not allowed to be witnesses for or against each other in civil suits, nor in criminal trials unless the prosecution was an offence committed by one against the other. (4) Persons who denied the existence of God or of a future state of reward and punishment. This rule was based upon the notion that for such disbelievers an oath would have no sanction. (5) Persons who had been convicted of a felony or other infamous crime, unless their capacity had been restored by a pardon. (6) Idiots, lunatics, and persons of unsound mind unable to apprehend the nature of the obligation assumed by them. (7) Children so young or uninstructed that they do not understand the nature of an oath. The application of this rule necessarily depends upon the circumstances of each particular case. Some of these rules were based upon a very low estimate of human nature. The second, concerning pecuniary interest, assumed that every one would certainly commit perjury if the truth and his slightest pecuniary interest were opposed. The legislatures of England and of the various States of the U. S. have at length adopted the wiser principle that every possible avenue of the truth, consistent with public morals and the privacy of domestic life, should be opened, and that the evidence of all those who have a knowledge of the facts, especially of those whose knowledge is the most immediate, should be weighed rather than rejected. As a result of this theory, several of the foregoing rules have been abrogated. The initiative in the reform consisted in removing all restrictions upon third persons pecuniarily interested in the event of the action. Statutes to this effect have been enacted in Great Britain and in most if not all of the U. S. Legislation soon followed permitting the parties in civil suits to be witnesses for themselves or for their adversaries, and husbands and wives to testify for and against each other. The latter modification of the common law is, however, subject to certain important limitations. Neither party is permitted to disclose facts and circumstances which came to their knowledge through the intimacy and confidence of the marital relation. In several States actions between husband and wife for divorce on the ground of adultery are wholly excluded from the operation of the enactment, while in other States the exclusion extends only to evidence upon the single issue of the adultery itself. In many of the States the accused parties in criminal trials are permitted, if they choose, to testify on their own behalf. There is also a difference in the details of this legislation. As all the State constitutions protect parties accused of crime from being compelled to furnish evidence against themselves, the prisoners can never be called as witnesses for the prosecution. In order that the statute may not infringe upon the constitutional guaranty, a provision has been added in some States that if the prisoner does not avail himself of the privilege and testify, this fact shall not raise a presumption against him, and shall not be animadverted upon by the court or the prosecution. It has been universally decided, however, that when the accused does become a witness, he may be cross-examined in the same manner as any other witness for the defence. The religious qualification has been wholly swept away in a great majority of the States, as being inconsistent with our policy in respect to the separation between the state and religion. The other common-law disqualifications, being based upon very different motives, have been retained. Besides the rules concerning the witnesses themselves, there are others touching certain classes of facts from which they are either privileged or prohibited from testifying: (1) No one can be compelled to state matters which would tend to criminate himself or render him liable to a penalty. This is a personal privilege of the witness, which he must assert on his own behalf or may waive. (2) An attorney or counsellor will

not be suffered to disclose facts communicated by or learned from a client in the confidence of a business relation actually existing between them. (3) This rule, which the common law admitted only in the case of lawyers, has been quite generally extended by statute to physicians and to clergymen, who are forbidden to disclose facts discovered concerning their patients or their penitents through the means of their professional relations. At the common law every witness was compelled to give his evidence under the sanction of an oath administered upon the Bible or the holy Gospels. This primitive rule has been modified by modern legislation. In the U. S. the statutes generally admit two forms of the oath—one by means of the Bible or the Gospels, the other by the uplifted hand—but in both methods the formula of the oath itself is the same, a direct appeal being made to God. If a proposed witness asserts that he has conscientious scruples against the use of an oath, he is then permitted to affirm—that is, he solemnly and sincerely declares and affirms that he will tell the truth, etc., the sanction presented to his mind being the pains and penalties of perjury. JOHN NORTON POMEROY.

Wit'son, tp., Pope co., Ark. P. 332.

Witt, de. See DE WITT.

Wittekind, or **Widukind,** in the wars between the Saxons and Charlemagne the leader of the Westphalian Saxons, as Albion was of the Eastphalians. When most of the Saxon chiefs submitted to Charlemagne at the Diet of Paderborn (777), Wittekind fled to Gotfred, king of Jutland, and with aid from him he returned in 778, while Charlemagne was in Spain, and renewed the war in the Rhine countries. But Charlemagne hastened back to Germany, and Wittekind was once more compelled to flee to Jutland. In 782, however, he again returned, and annihilated a Frankish army at Süntelberg on the Weser. Charlemagne took a cruel revenge by massacring 4500 Saxons at Verden on the Aller, but this cruelty occasioned a general rising of the Saxons under Wittekind and Albion. They were defeated, however, at Detmold and on the Hase, and the two chiefs fled to Holstein. Nevertheless, in the next year a reconciliation took place between the emperor and his two great antagonists; they repaired to his camp at Attigny in Champagne, and were baptized, after which event they are not mentioned in history, though legend still continued for a long time to be very busy with them. In 1377 the emperor Charles IV. raised a monument to Wittekind in the parish church of Enger, where he is said to lie buried. In 1842 another monument was raised to him in Minden, Westphalia.

Wit'tenberg, town of Prussia, province of Saxony, on the right bank of the Elbe, is famous as the place where the Reformation began. The houses of Luther, Melanchthon, and Lucas Cranach are still shown, also the spot, outside the Elster gate, where the papal bull was burned. In the Schlosskirche Luther and Melanchthon are buried. The university, once so famous, was incorporated with that of Halle in 1817. Breweries, distilleries, and tanneries are in operation, and woollen and linen goods manufactured. P. 11,934.

Wittenberg, p.-v., Brazeau tp., Perry co., Mo. P. 116.

Wittenburg's, tp., Alexander co., N. C. P. 848.

Witts'burg, p.-v., Smith tp., cap. of Cross co., Ark. P. 113.

Witt'stock, town of Prussia, province of Brandenburg, on the Dosse, has manufactures of woollen and linen fabrics. P. 6947.

Woad [Lat. *Isatis tinctoria;* Ang.-Sax. *waad;* Fr. *guède* or *pastel;* Ger. *Waid*], a biennial herbaceous plant, indigenous in Europe, which has been employed from the times of the Romans for dyeing blue. It is cultivated in France and Germany. The leaves possess a pungent odor and an acrid taste. These are either simply dried and sent to market, or are made into a paste by grinding, which is then prepared into balls and allowed to undergo fermentation, after which it is dried. Woad does not appear to contain either indigo-white or indigo-blue (see INDIGO), its coloring qualities being due to the presence of a body termed *indican* ($C_{26}H_{31}NO_{17}$), which is converted into indigo-blue and *indiglucine* by the action of dilute acids. At present it is chiefly used for the reduction of indigo in the "woad-vats," but is seldom employed by itself for dyeing purposes. J. P. BATTERSHALL.

Wo'burn, p.-v. and tp., Middlesex co., Mass., on Boston Lowell and Nashua R. R., 10 miles from Boston, was founded in 1640; has an area of 7750 acres; pop. about 10,000. The principal industry is the manufacture of leather, a tannery having been established here as early as 1673. There is also a gaslight company, iron foundry, chemical works, glue-factory, and the trades usual in a busy New England town. There are 1 national and 2 savings banks, a public library, 3 post-offices, 2 weekly newspapers, 11 churches, an academy, and 35 public schools. Horn Pond, a small lake in the S. part of the town, supplies pure water from a reservoir situated on Horn Pond Mountain, giving a head of 127 feet in the centre of the town, and ample pressure for fire and domestic purposes to all parts of the municipality. The Centre and N. villages are connected by a horse railroad 2 miles in length. Woburn has an excellent fire department, a military company, Masonic, Odd Fellows, Grand Army, and other associations. P. in 1870 was 8560. JOHN L. PARKER, ED. "JOURNAL."

Wod'row (ROBERT), b. at Glasgow, Scotland, in 1679; educated at Glasgow University, where he became librarian, and became in 1703 minister of Eastwood, Perthshire, where he d. Mar. 21, 1734. Author of a *History of the Sufferings of the Church of Scotland from the Restoration to the Revolution* (Edinburgh, 2 vols., 1721–22), *Lives of the Reformers and most Eminent Ministers of the Church of Scotland* (Glasgow, 3 vols., 1834–45), and *Analecta, or Materials for a History of Remarkable Providences, mostly relating to Scotch Ministers and Christians* (4 vols., 1842–43), both edited by Rev. Dr. Leishman for the Maitland Club. Many of his MSS. are preserved in the Advocates' Library. "Wodrow Society" was formed at Edinburgh in 1841 for the publication of the early writers of the Reformed Church of Scotland, and has published 24 volumes, of which the earliest consisted of Wodrow's *Correspondence* (3 vols., 1842–43), edited by Rev. Thomas McCrie.

Wof'ford College, named for Rev. Benjamin Wofford, who gave $100,000 "for the purpose of establishing and endowing a college for literary, classical, and scientific education, to be located in his native district, Spartanburg, and to be under the control and management of the conference of the Methodist Episcopal Church of his native State, South Carolina." The college was chartered by the legislature of South Carolina Dec. 16, 1851, and the board of trustees held their first meeting to organize under it at Newbury Court-house Nov. 24, 1853, when they elected a president and four professors, who opened the institution for regular scholastic exercises Aug. 1, 1854. An ample curriculum of studies was prescribed, philosophical and chemical apparatus were provided sufficient for an extended course of instruction, and the mineralogical and geological cabinet, originally selected with care, has grown in interest and importance by contributions made to it from year to year. The college library received at first valuable donations from sundry benevolent friends of literature, and with the additions made to it from time to time, both by donations and purchase, has grown to respectability and importance. The two literary societies—viz. the Calhoun and the Preston, the first organized Oct. 1, 1854, and the second Oct. 16, 1858, named respectively for the late Hon. John C. Calhoun and the late Hon. William C. Preston—are uncommonly well conducted to secure the laudable purposes for which they were instituted. The number of students has regularly increased, and now amounts in all departments to about 160. The buildings were completed Jan. 1, 1855, and consist of a large and elegant college edifice, a president's house, and houses for four professors. They stand on a beautiful and liberal campus, enclosing about 60 acres, within the corporate limits of the town of Spartanburg. The endowment of the college, originally comfortable, was almost entirely lost by the war, but the trustees and alumni society are making vigorous efforts to restore it, and are devising liberal things for the future welfare and success of the institution. The college is easily accessible by railroad to all parts of the country.

Wöh'ler (FRIEDRICH), b. at Eschersberg, near Frankfort, July 31, 1800; studied medicine and natural history, especially mineralogy and chemistry, at the universities of Marburg and Heidelberg 1819–23, then in Stockholm under Berzelius, and was appointed professor of chemistry at the Technical Institute of Berlin in 1825, at the Technical Institute of Cassel in 1831, and at the University of Göttingen in 1836. His principal work is *Grundriss der Chemie* (2 vols., 1831–40), which has been often reprinted and translated into several foreign languages. He also wrote *Die Schwefelwasserquellen zu Neundorf* (1836) and *Die Mineralanalyse in Beispielen* (1861), besides numerous papers in Poggendorf's and Liebig's *Annalen*, and translations of Berzelius's *Lehrbuch der Chemie* (4 vols.) and *Jahresberichte*.

Woide (CHARLES GODFREY), D. D., LL.D., F. R. S., b. in Poland (or Holland) in 1725; educated at German universities; became a Socinian minister; settled in England as preacher at the German chapel royal, St. James, 1770; was subsequently reader and chaplain at the Savoy; became assistant librarian at the British Museum 1782, and cultivated the less-known Oriental languages. D. in London. He edited La Croze's *Coptic Lexicon* (1775), Scholtz's

Egyptian Grammar (1778), and the Alexandrian MS. of the Greek Testament in fac-simile (folio, 1786).

Wol'cot, or **Wolcott** (Jonn), M. D., better known as Peter Pindar, b. at Dodbrooke, Devonshire, England, in 1738; served an apprenticeship of seven years to his uncle, a physician and apothecary at Fowey, Cornwall, who ultimately left him a considerable property; accompanied Sir William Trelawney, governor of Jamaica, to that island as his physician 1767; took orders in the Church of England, and obtained a curacy in Jamaica 1768, but soon returned to England on the death of his patron; spent twelve years at Truro, Helston, and other towns in Cornwall as a physician; discovered the merits of the obscure painter Opie, with whom he went to London 1780; made himself conspicuous by his poetical productions, mostly satirical, which involved him in many quarrels, one of which, with Gifford, led to a personal encounter in which he was worsted. His attacks upon the king were so effective that at one time the ministry purchased his silence by the payment of £300 per annum. In his later years he became totally blind. D. at Somers Town, London, Jan. 13, 1819. His separate publications were above 70 in number, but few of them are now read. Several editions of his collected *Works* appeared in his lifetime, the last in 5 vols. (1816).

Wolcott, p.-v. and tp., New Haven co., Conn. P. 491.

Wolcott, p.-v., Princeton tp., White co., Ind. P. 109.

Wolcott, p.-v., Scott co., Ia.

Wolcott, p.-v. and tp., Wayne co., N. Y. P. of v. 658; of tp. 3223.

Wolcott, p.-v. and tp., Lamoille co., Vt. P. 1132.

Wolcott (Oliver), LL.D., son of Gov. Roger, b. at Windsor, Conn., Nov. 26, 1726; graduated at Yale College 1747; served as a captain of New York volunteers on the Canada frontier 1748; studied medicine, but never practised; was elected sheriff of Litchfield co. 1751; became a judge of common pleas and of probate; was a member of the executive council 1774–86; commissioner of Indian affairs for the northern department 1775; was elected to the Continental Congress Jan., 1776; signed the Declaration of Independence; commanded as major-general the fourteen Connecticut regiments raised for the protection of New York; joined Gen. Gates with several hundred volunteers, and was present at the battle of Saratoga, where he gained the rank of brigadier-general of the regular army; served alternately in Congress, in the army, or on commissions throughout the war; was lieutenant-governor of Connecticut 1786–96, and governor 1796–97. D. at Litchfield, Conn., Dec. 1, 1797.

Wolcott (Oliver), LL.D., son of the preceding, b. at Litchfield, Conn., Jan. 11, 1760; graduated at Yale College 1778; served as a volunteer to repel the British attack on Danbury 1777, as volunteer aide to his father 1779, and as an officer in the commissary department 1780–81; was admitted to the bar 1781; was employed in the financial affairs of the State government, and subsequently (1784) as a commissioner to settle its accounts with the U. S.; was a member of the society of "Hartford wits;" was comptroller of public accounts of the U. S. 1788–89, auditor of U. S. treasury 1789–91, comptroller 1791–95, secretary of the treasury 1795–1800, and judge of U. S. circuit court 1801–02; removed to New York City 1802; was a merchant there until 1812; took part with his brother Frederick in founding extensive manufacturing establishments at Wolcottville, near Litchfield; was president of the State constitutional convention 1817, and governor 1818–27, after which he resided in New York, where he d. June 1, 1833.

Wolcott (Roger), b. at Windsor, Conn., Jan. 4, 1679; was apprenticed to a mechanic, and never attended a school, but acquired a good education by private study; was commissary in the expedition of 1711 against Canada; served as an officer in subsequent wars with France, and was major-general and second in command at the capture of Louisburg 1745; was successively a member of the assembly and of the executive council, judge of the county court, deputy governor, chief judge of the superior court, and was governor of the colony 1751–54. D. at East Windsor May 17, 1767. He published a volume of *Poetical Meditations* (New London, 1725), and a pamphlet on church government (Boston, 1761), and left a MS. poem of 1500 lines entitled *A Brief Account of the Agency of the Honorable John Winthrop, Esq., in the Court of King Charles the Second, Anno Dom. 1662, when he obtained a Charter for the Colony of Connecticut*, which contains a detailed account of the Pequot war. It was printed in the collections of the Massachusetts Historical Society (1st series, vol. iv.).

Wol'cottville, p.-v., Litchfield co., Conn.

Wolcottville, p.-v., La Grange co., Ind., on Grand Rapids and Indiana and Canada Southern R. Rs., has 2 churches, good schools, 1 bank, 1 newspaper, 2 hotels, and several manufactories. P. 80.

James R. Rhenbottom, Ed. "Register."

Wolcottville, v., Orange tp., Noble co., Ind. P. 80.

Wôlei, or **Ôlei,** is the *papyrus* of India. It is the palm-leaf, the ancient paper of Hindoos. It is written on with a sharp iron style. After the writing, lamp-black or any other dark pigment is rubbed into the leaves. The most ancient documents of Hindoos which are neither upon rocks or metals are written on these leaves, which seem to defy the ravages of time. The writer has seen some which are at least eight centuries old, which, as far as the leaves are concerned, are as fresh as if they were turned out yesterday. The leaves are cut in long narrow slips. Yellow at first, by age they become brown. Holes are bored in them, and the leaf-books are attached and bound together by strings passing through these holes. The books were called nine centuries ago by the poetess Anveyâr, the *nîttolei* ("long leaves"). Some of them are curiously ornamented. R. C. Caldwell.

Wolf [Ger. *Wolf*], the common name for those wild species of the family Canidæ and genus *Canis* that most resemble the dog, and which agree with the ordinary types of that animal in the possession of circular pupils to the eyes and a moderate bushy tail. The species are somewhat numerous, and the typical representatives are chiefly found in the northern hemisphere and southward to India; but allied species, which are properly called wolves, although more generally designated as wild-dogs or foxes, are also found in Africa, South America, and Australia. They agree essentially in their habits with the dogs, and hunt their prey either by surprising or running it down. At some seasons of the year they live, to some degree, in solitude, although they often associate in packs; and especially is this the case in winter, when they combine in the pursuit of game and other objects of prey. In America there are two well-marked species: (1) the large common wolf (*Canis lupus*), identical with the wolf of Europe and Northern Asia, and (2) the small prairie wolf (*Canis latrans*), occurring on the plains of the Western States and Territories. (1) The former has an average length of about four feet, with a tail of seventeen to twenty inches; its color is generally grizzly-gray above, but is quite variable, sometimes being black and sometimes white, and with various gradations between the two. These variations were formerly supposed to indicate specific differences, but as they are found in cubs of the same litter, they are now recognized as being not even of sub-specific or varietal importance. (2) The prairie wolf—or, as it is perhaps more generally known, *coyote*—is about three feet or somewhat longer, and has a tail about sixteen inches in length. Its color, as in the wolf, is generally gray, but is subject to much less variation than in the former species. It is found more generally on the plains of the great West and in the hydrographical basins of the Missouri and Saskatchewan rivers, and extends southward into Mexico. It is quite prolific, sometimes having as many as ten in a litter. It lives mostly in burrows. Theodore Gill.

Wolf, tp., Lycoming co., Pa. P. 819.

Wolf (Friedrich August), b. at Hayurode, Prussian province of Saxony, Feb. 15, 1759; studied classical literature and language at Göttingen; became teacher at the seminary of Ilfeld in 1779, rector of the gymnasium of Osterode in 1782, professor of philosophy and pedagogics at Halle in 1783; removed to Berlin in 1807, where he took a prominent part in the foundation of the new university. D. at Marseilles Aug. 8, 1824, during a journey in Southern France for the sake of his health. He was an excellent teacher and lecturer, and also a very prolific writer on philological and pedagogical subjects. His critical editions, with notes and introductions, gave the final decision on many points of long debate and great uncertainty; and his *Prolegomena ad Homerum*, in which he demonstrated that the Homeric poems were not the work of any single man, but a compilation or combination of various rhapsodies, made a sensation all over Europe, and started a multitude of new researches of the greatest critical and antiquarian interest. His biography has been written by Hanhart (1825), Körte (1833), Schulz (1836), by Gottholdt (1843), and by Arnoldt (2 vols., 1861).

Wolf (George), b. in Allen tp., Northampton co., Pa., Aug. 12, 1777, of German stock; was well educated; became a lawyer, postmaster of Easton, Pa., a clerk of the orphans' court; was in Congress 1824–29; was governor of Pennsylvania 1829–35, and was the proposer and one of the founders of the Pennsylvania public-school system; first comptroller of the U. S. treasury 1836–38, and then became collector of the port of Philadelphia. D. at Philadelphia Mar. 11, 1840.

Wolf Creek, p.-v. and tp., Mercer co., Pa. P. 555.

Wolf Creek, p.-v. and tp., Monroe co., West Va. P. 1421.

Wolf-Dog, a large variety of the domestic dog, allied to the shepherd's dog, now found almost exclusively in Spain, though formerly common in Ireland and Scandinavia.

Wolfe, county in the S. E. of Quebec, Canada, is traversed by the river St. Francis. It contains extensive forests and has much mineral wealth. Cap. South Ham. P. 8823.

Wolfe, county of E. Kentucky, lying on N. fork of Kentucky River, and drained by its affluent, Red River; surface hilly and broken, soil moderately fertile in parts. Sheep and swine are the chief live-stock. Staples, Indian corn and oats. Cap. Campton. Area, 170 sq. m. P. 3603.

Wolfe (Charles), b. at Dublin, Ireland, Dec. 14, 1791; studied at Winchester School; graduated at Trinity College, Dublin, 1814; was a tutor there 1815–56; took orders in the Church of England 1817, and became curate of the parish of Donoughmore, Ireland. After a visit to the S. of France, he d. of consumption at the Cove of Cork (now Queenstown) Feb. 21, 1823. His poetical *Remains, with a Brief Memoir of his Life* (1825; 8th ed. 1846), were published by Archdeacon John A. Russell. His *Ode on the Death of Sir John Moore* is one of the most beautiful of modern poetical compositions.

Wolfe (James), b. at Westerham, Kent, England, Jan. 15, 1726, son of Lieut. Gen. Edward Wolfe; entered the army as second lieutenant at an early age; was present at the battles of Dettingen, Fontenoy, Falkirk, and Culloden; distinguished himself at Lafeld 1747, and at the siege of Maestricht 1748; commanded a regiment in the Highlands of Scotland 1749–51; was quartermaster general in the expedition against Rochefort 1757, and brigadier-general in that against Louisburg, Cape Breton, 1758; was appointed by Pitt major-general, and placed in command of an expedition for the conquest of Canada 1759; arrived with 8000 men in the St. Lawrence in June; was repulsed by Montcalm in a first attack, July 31, and fell in the moment of victory in the battle on the Plains of Abraham, Sept. 13, 1759. He was buried at Greenwich, and monuments to his memory have been erected in Westminster Abbey and at Quebec. His *Life* has been written by Robert Wright (London, 1864).

Wolfe'borough, p.-v. and tp., Carroll co., N. H., on North Conway division of Eastern R. R., and on the N. E. shore of Lake Winnipiscogee, has excellent schools, 3 banks, 1 newspaper, 1 woollen and 1 shoe factory, 2 tanneries, and several lumber-mills. It is much frequented during the summer. P. 1995. C. H. Potter, Ed. "State News."

Wolfe Island, an island tp. and p.-v. at the outlet of Lake Ontario, directly opposite Kingston, Canada, and Cape Vincent, N. Y. It belongs to Frontenac co., Ontario, is about 18 miles long, and has a lighthouse. P. of tp. 2737.

Wolfenbüttel, town of Germany, in Brunswick, on the Ocker, has an excellent library of 220,000 volumes, of which Lessing was librarian for some time, several educational institutions, and manufactures of lacquered and japanned wares, paper-hangings, leather, and tobacco. P. 10,457.

Wolff (Albert), b. at Neu-Strelitz, Mecklenburg, Nov. 11, 1814; studied sculpture under Rauch, afterward in Rome, and was made professor at the Academy of Fine Arts in Berlin 1866. He is especially celebrated for his equestrian statues, of which he produced a great number—Frederick William III. in Berlin, Frederick William IV. in Königsberg, Ernst August in Hanover, Frederick Francis I. in Ludwigslust, etc.

Wolff (Emil), b. at Berlin Mar. 2, 1802; studied sculpture under Gottfried Schadow, and went in 1823 to Rome, where he has since resided. He treats mostly mythological subjects. Many of his works have gone to England and Russia. His *Fisher-Boy* (1833) became celebrated in Germany.

Wolff (Joseph), D. D., LL.D., b. at Weilersbach, near Bamberg, Germany, in 1795, son of a Jewish rabbi; studied at Stuttgart, Munich, and Weimar; was baptized into the Roman Catholic Church at Prague 1812; completed his education at the universities of Vienna and of Tübingen, devoting himself to Oriental languages; spent a year in the family of Count Stolberg at Frankfort; went to Rome in 1816; was presented by Niebuhr to Pope Pius VII.; admitted as a student into the Roman College, and afterward into the College of the Propaganda, from which, however, he was expelled in 1818 for heretical opinions; spent some months in the Redemptorist monastery of Val Sainte, Switzerland; went to London 1819; united with the Church of England; spent two years at Cambridge, studying Oriental languages under Dr. Samuel Lee, and enjoying the intimacy of the celebrated Evangelical theologian, Prof. Charles Simeon; was ordained as a missionary to the Jews Apr., 1821; made an extensive tour through the East, visiting Gibraltar, Malta, Egypt, Palestine, Persia, Circassia, the Crimea, and Turkey; returned to England 1826; married Lady Georgiana Mary Walpole, daughter of the earl of Orford, Feb., 1827; embarked with her in April upon another missionary tour; left her in Malta; penetrated through Persia to Bokhara, and thence to Afghanistan, Cashmere, and the Punjaub, reaching Calcutta Mar., 1833; visited Southern India; sailed from Bombay to Arabia; spent some time in Abyssinia, where he learned the Amharic language; returned to England 1834; published accounts of his labors; revisited Abyssinia, Arabia, and India 1836; proceeded thence to the U. S., reaching New York in Aug., 1837; was ordained deacon in the Protestant Episcopal Church; lectured in the principal cities and preached before Congress; reached England Jan., 1838; was ordained priest at Dublin; obtained the curacy, first of Linthwaite and afterward of High Hoyland, Yorkshire; made a second journey to Bokhara in 1843, at the instance of the British government, to attempt the release or learn the fate of Col. Stoddard and Capt. Conolly; was himself imprisoned and condemned to death, but saved by the interposition of the Persian ambassador; returned to England 1845, and spent the remainder of his life as parish priest at Isle Brewers, Somersetshire. His wife dying in 1859, he married a second time May, 1861, and d. at Isle Brewers May 2, 1862. He published, among other works, *Researches and Missionary Labors among Jews and Mohammedans* (Malta, 1835), *Journal of Missionary Labors* (1839), *A Narrative of a Mission to Bokhara* (2 vols., 1845), and an autobiography entitled *Travels and Adventures*, etc. (2 vols., 1860). Porter C. Bliss.

Wolff (Wilhelm), b. at Fehrbellin, Prussian province of Brandenburg; was educated in the royal iron-foundry at Berlin; worked afterward in the Soyer foundry in Paris and in the Stiglmayr foundry in Munich, but devoted himself more and more exclusively to purely artistic pursuits, and gained a great reputation as a sculptor of animals. Among his most celebrated groups are—*A Buffalo attacked by Greyhounds, The Lion and the Serpent, A Bacchante playing with Panthers, The Lion's Ride*, after Freiligrath's poem.

Wolffian Bodies, two fœtal organs in man and other animals which precede the development of the urinary and internal generative apparatus, and supposed to have a connection with their appearance, though how is as yet undetermined. In the human fœtus the Wolffian bodies appear almost as soon as the embryo takes shape, and at the end of one month of gestation are well-developed, symmetrical organs. They are larger than either the liver or intestine, these three viscera being the only ones formed at that early period. The Wolffian body, then at the height of its growth, is kidney-shaped, and has an internal structure resembling that of the kidney. From the first to the second month it fails to grow proportionately with the rapid increase of the fœtal body, and hence is soon relatively smaller than before, and smaller than the other organs which are appearing. Back of the Wolffian bodies the kidneys have appeared, and in front oval symmetrical bodies have sprung up which become the testes of the male or the ovaries in the female. These new bodies grow rapidly, and the Wolffian bodies waste, are scarcely noticeable after the second month, and unrecognizable at later periods of intra-uterine or fœtal existence.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Wolf-Fish, a name given to the fishes of the family Anarrhichidæ and genus *Anarrhicas* on account of their fierce aspect and large canine teeth. They are elongated, but stout fishes, closely related to the blennies, with which they have been, by most authors, associated as members of the same family. The scales are rudimentary; the head has a steep profile; the mouth is widely cleft; the jaws armed with strong conical teeth in and toward the front, and with molars in two rows on the palate and sides of the lower jaw; the dorsal fin is long and sustained by flexible spines; the anal fin is less than half as long as the dorsal, and opposite the posterior half of that fin; the caudal is distinct from the dorsal and anal fins, and rounded behind; the pectorals are large; the ventrals absent. The species are peculiar to the northern seas. The best-marked, and possibly the only ones, are the *Anarrhicas lupus*, found on both sides of the Atlantic Ocean, and *Anarrhicas denticulatus* of Greenland. On the American coast the wolf-fish is found as far southward as Cape Cod, and occasionally even beyond, but becomes rarer toward its southern limits. It is a very ravenous and ferocious fish, and with its powerful jaws can inflict a severe wound even on man. Although repulsive in its appearance, and rarely if ever eaten on the American coast, it is regarded as palatable food in

different parts of Europe, and is even praised by many on account of its positive excellence. The skin is in some places taken off and used for bags and pockets. The species occasionally attains a length of six or seven feet, and even more, although specimens of such a size are rare. It mostly lives in deep water, but approaches the shore to deposit its spawn in May and June. This species is also called in various places sea-wolf and catfish, and in the Orkney Islands swine-fish, on account of the movements of its nose, which are supposed to similate those of a hog.
THEODORE GILL.

Wolf Island, p.-v. and tp., Mississippi co., Mo. P. 652.

Wolf Pit, tp., Richmond co., N. C. P. 1239.

Wolf'ram, called **Wolframite** by Dana [Ger. possibly *Wolfrahm;* the ancient name of the mineral being *spuma lupi*, "wolf's spittle or froth" (*rahm* signifying "cream"). Agricola and other ancients considered it a spurious kind of tinstone (being found with the latter), and one name for it was *katzenzinn* ("tin's cat")], mineral *tungstate of iron,* ferrous tungstate, O_4WFe, though usually containing also from 4 to 20 per cent. of manganous oxide. It is right rhombic; dark brown or black; hardness between apatite and feldspar; lustre metalloidal; streak also nearly black, sometimes slightly magnetic; exceedingly heavy; density from 6.67 to 7.535. It is abundant with the Cornish tin ores and in many European localities; in America at Monroe, Conn., with native bismuth; Trumbull, Conn., with massive topaz; in Mecklenburg co., N. C., and a number of other localities. Its lesser hardness, dark opaque streak, and frequently greater density will distinguish it from tinstone or cassiterite, with which it so often occurs. Molecularly considered, it is probably a variable mixture of *ferberite*, ferrous tungstate, and *hübnerite*, manganous tungstate (the latter being also right rhombic), crystallized up together. Ferberite is $O_{4\cdot24\cdot20}^{W\ Fe} = 7.143$ (Breithaupt, 7.169; Genther and Forsberg, artificial crystals, 7.1); and hübnerite is $O_{4\cdot24\cdot20}^{W\ Mn} = 7.12$ (Breithaupt, 7.14). In wolframs the Fe and Mo molecules are sometimes larger and sometimes smaller. (See TUNGSTEN.) HENRY WURTZ.

Wolf River rises in Marion co., Miss., and flows S. into St. Louis Bay, an arm of the Mississippi Sound.—Another WOLF RIVER rises in Tippah co., Miss., and flows W. N. W. 100 miles, mostly in Tennessee. It reaches the Mississippi at Memphis.

Wolf River, in Wisconsin, rises in the N. E. part of the State, flows southward, and after passing through Pewaugan Lake flows into Fox River. It is navigable 150 miles for small steamboats, and affords passage to a vast amount of timber.

Wolf River, tp., Doniphan co., Kan. P. 1934.

Wolf River, tp., Winnebago co., Wis. P. 505.

Wolfsbane. See MONKSHOOD.

Wolf'scrape, tp., Duplin co., N. C. P. 1025.

Wolf Spring, tp., Lawrence co., Ala. P. 601.

Wolf'ville, port of entry of King's co., N. S., on Minas Basin, Cornwallis River, and Windsor and Annapolis Railway, 66 miles N. E. of Annapolis. It is the seat of Acadia College (Baptist), and has 4 churches, an academy, and a female seminary. Shipbuilding is a leading industry. P. of sub-district, 1697.

Wolf, von (CHRISTIAN), BARON, b. at Breslau, Silesia, Jan. 24, 1679, the son of a mechanic in good circumstances; studied first theology, then mathematics and philosophy at Jena and Leipsic, and began to lecture in the latter city, but was compelled by the invasion of Saxony by Charles XII. in 1706 to leave the country, and received in the following year an appointment as professor of mathematics and natural history at the University of Halle. Here his lectures attracted much attention and drew large audiences, and his writings, mathematical and philosophical, gained for him a great reputation all over Germany, but being opposed to the pietistical tendency which at that period characterized the University of Halle, he was formally accused of heresy by his theological colleagues, and by a cabinet order of Nov. 15, 1723, was ordered to leave Halle within twenty-four hours and the Prussian states within two days. He found refuge in Hesse-Cassel, and lectured for several years with great success at Marburg, but on the accession of Frederick II. he was recalled to Halle in 1740, made chancellor of the university in 1743, a baron in 1745, and d. there Apr. 9, 1754. He was an immensely prolific writer. He wrote on mathematics, law, and all the various disciplines of philosophy, and he often issued his works in double editions—one in Latin and one (generally abbreviated) in German. His strictly philosophical writings alone fill 22 large volumes, and exercised a decisive influence. He is a pupil of Leibnitz, and his philosophy is simply a modification and popularization of the ideas of his master; but to the development and representation of these ideas he applied the strict mathematical method, and by moving along through clear and often striking definitions he became intelligible to scores of readers who could never have understood Leibnitz himself. Thus, his prominence in the history of philosophy is due more to his method than to his ideas; and indeed his method became universally employed, not only in philosophy, but in all sciences, up to the time of Kant. (See his *Autobiography*, edited by Wuttke (1841), and the works of Ludovici on his philosophy and its influence.)

Wol'gast, town of Prussia, province of Pomerania, on the Peene, has some manufactures of soap, leather, and tobacco, some shipbuilding, and some general trade. P. 5200.

Wol'laston (WILLIAM), b. at Coton Clanford, Staffordshire, England, Mar. 26, 1659; studied at Lichfield School; graduated at Sidney-Sussex College, Cambridge, about 1678; took deacons' orders in the Church of England about 1681; became shortly afterward assistant master of Birmingham School; was ordained priest 1686; inherited a large estate from a cousin 1688, and thenceforth devoted his life to literary and philosophical studies. D. at London Oct. 29, 1724, and was buried at Great Finshorough, Suffolk. Author of a learned philosophical work, *The Religion of Nature Delineated* (1722; 8th ed. 1759). Benjamin Franklin was employed in setting type for the 2d ed. (1724), and wrote in reply to it *A Dissertation on Liberty and Necessity, Pleasure and Pain* (1725).

Wollston (WILLIAM HYDE), M. D., F. R. S., great-grandson of William, b. in London, England, Aug. 6, 1766; educated at Caius College, Cambridge, where he graduated in medicine 1793; practised some time at Bury St. Edmunds; devoted himself to scientific researches, especially to experiments in chemistry, mineralogy, and physics; became secretary of the Royal Society 1806; was an intimate friend and associate of Davy; discovered the metals palladium and rhodium (1803), and a method of making platinum malleable, for which he was awarded the medal of the Royal Society Nov. 30, 1828, and by which he gained £30,000; was the first to detect the dark or Fraunhofer lines in the solar spectrum (1802), and to demonstrate the identity of galvanism and frictional electricity; made a galvanic battery so small as to be contained within a thimble; constructed a sliding scale of chemical equivalents; invented the reflecting goniometer, the camera lucida, and the cryophorus for freezing water by means of its own evaporation; improved the construction of the microscope by means of the "Wollaston doublet" or compound lens; was the first to describe cystic oxide and three new species of urinary calculi; rendered many other services to science, and was chosen president of the Royal Society 1820. D. in London Dec. 22, 1828. He presented to the Royal Society £1000 for the encouragement of experiments. He published no book, but his 38 papers in the *Philosophical Transactions* (1797–1829) form a repository of scientific data of rare value; and he also contributed some papers to Dr. Robert D. Thomson's *Annals of Philosophy*. He may be considered the founder of modern British chemistry.

Wol'le (PETER), b. in the island of St. John, West Indies, Jan. 5, 1792, son of a Moravian missionary; educated at the Moravian schools and theological seminary in Pennsylvania; became an eloquent preacher of that denomination; was made a bishop about 1830; had a thorough knowledge of music, and revised and rearranged the hymn-tunes in use by his denomination. D. at Bethlehem, Pa., Nov. 14, 1871. He was at the time of his death the senior bishop of the Moravian Church in Europe and America.

Wollstonecraft. See GODWIN (MARY WOLLSTONECRAFT).

Wolow'ski (LOUIS FRANÇOIS MICHEL RAYMOND), b. at Warsaw Aug. 31, 1810; studied in Paris 1823–27; served in the Polish revolution of 1830; retired after its suppression to Paris; was naturalized in 1834; became professor of law at the Conservatoire des Arts et Métiers in 1839, and was a member of the Constituent Assembly of 1848, and of the Legislative Assembly of 1849, but retired from politics in 1851. He founded in 1833 the *Revue de Législation et de Jurisprudence*, and established the first Crédit Foncier bank in Paris. Among his works are *De l'Organisation du Travail* (1845), *De l'Organisation du Crédit Foncier* (1849), *Les Finances de la Russie* (1864), *La Liberté commerciale et les Résultats du Traité de Commerce de 1860* (1868). D. Aug. 4, 1876.

Wolse'ley (Sir GARNET JOSEPH), b. in Ireland 1833; entered the British service as ensign Mar. 12, 1852; colonel 1865; served with the 90th regiment in the Burmese war of 1852–53; with Sir John Cheape's expedition against the robber-chief Myattoon, and severely wounded while lead-

ing the storming party against that chief's stronghold; engaged in the siege of Sebastopol from Dec., 1854, to close of the war, being employed in the trenches as acting engineer, and wounded in sortie of Aug. 30, 1855. During the Indian mutiny of 1857–59 he served under Sir James Outram at the relief of Lucknow, the defence of the Alumbagh, and the siege and capture of Lucknow; subsequently deputy assistant quartermaster-general under Sir Hope Grant, and engaged in all the actions of that division. In the war with China (1860) he served throughout that campaign upon the staff of the quartermaster-general, participating in all the engagements. In 1870, in command of the expedition from Canada to the Red River territory, he suppressed the insurrectionary government established by Riel and others at Fort Garry, and was created a knight of St. Michael and St. George for his services on that occasion. In 1873 was appointed governor of the Gold Coast settlements, the inhabitants of which had become involved in a war with the Ashantees, and as commander-in-chief of the British forces defeated the enemy's army, occupied and destroyed Coomassie, his capital, and the king's palace, and brought the war to a speedy and successful end. For these services he was made major-general in the "fixed establishment" of the army, created K. C. B., and the thanks of Parliament and £25,000 bestowed upon him; inspector-general of auxiliary forces 1874–76, governor of Cyprus in 1878 and of South Africa in 1879.

Wol'sey (THOMAS), b. at Ipswich, Suffolk, England, in 1471, of humble parentage; was educated in Magdalen College, Oxford; studied theology; acted for some time as tutor to the sons of the marquis of Dorset; took holy orders, and received in 1500 the rectorship of Lymington, Somersetshire. Through the influence of Sir John Nafant he came into connection with the court; was appointed a chaplain to Henry VII.; went to Bruges in 1508 on a special diplomatic mission to the emperor Maximilian, and, having acquitted himself very brilliantly, was rewarded on his return with the deanery of Lincoln. Henry VIII. made him his almoner, and soon employed him in the most important affairs. He made him archbishop of York in 1511, lord chancellor of England in 1515, and showed him an almost unlimited confidence in all negotiations. Foreign princes courted his favor; the emperor and the king of France sent him great presents and bestowed pensions on him; the pope created him a cardinal in 1515 and legate in 1519; and from this last year to his fall he acted as if he were really the ruler of England and one of the sovereigns of Europe. His income was royal, and so were his expenses. He built Hampton Court; he founded Christ Church College and seven lectureships at Oxford; he kept a household of from 500 to 800 persons, and showed himself in many ways a great patron of science and art. In personal bearing he was haughty and arrogant toward his equals, exceedingly adroit in managing his superiors, and kind and generous toward his inferiors. The goal of his ambition was to become pope, and twice—on the death of Leo X., and again on that of Adrian VI.—the tiara seemed to be within his reach, but both times his plans were foiled by the intrigues of Charles V. and by the opposition of the French bishops. At last his ambition came into conflict with the king's passion. The king wished to be divorced from Catharine of Aragon, the aunt of Charles V., and Wolsey had to carry through the necessary negotiations; but this task, always difficult, proved impossible for a man who, for his own sake, had to tread cautiously and manage people with the greatest discretion. The negotiations seemed to be endless. The king lost his patience, and even began to distrust the cardinal. Moreover, after the divorce the king wished to marry Anne Boleyn, and to this marriage Wolsey was opposed, because it might endanger his own position at home by giving the widespread jealousy and enmity around him a firm centre. At last, Anne Boleyn demanded and obtained from the king the cardinal's dismissal in disgrace, and on Oct. 17, 1529, the great seal was taken from him and he left the court. He retired to his archbishopric, and seemed prepared to end his life in comparative obscurity. But the hatred of his enemies was not yet satisfied, and on Nov. 4, 1530, he was arrested at Cawood on a charge of high treason. He was conducted to London, but on the way thither he fell ill, and d. at the monastery of Leicester Nov. 29, 1530. His *Life* has been written by Cavendish (1641), Galt (1812), Howard (1824), and Martin (1862).

Wol'verhampton, town of England, county of Stafford, on the western outskirt of the rich mining districts of Staffordshire, and gradually the coal-mines and ironstone pits which occupy the whole adjacent district are supplanted by blast-furnaces, forges, rolling-mills, foundries, and every other kind of contrivance by which iron ore is transformed into pig, railway, sheet, rod, hoop, and nail iron, and worked into boiler-plates, locks, hinges, axles, bolts, vises, anvils, and edge tools. But besides hardware, in which branch of manufacture Wolverhampton is one of the leading centres of the world, it has extensive manufactures of tinware, articles of papier-mâché, and japanned and enamelled goods, such as kitchen utensils, etc. It is very indifferently built, and, as all large manufacturing places, rather unpleasant, but it has many good educational and benevolent institutions. P. 68,291.

Wolverine', the name of the GLUTTON (which see) of North America.

Wolzo'gen, von (KAROLINE), b. VON LENGEFELD, Feb. 3, 1763, at Rudolstadt, Germany; married as her second husband, in 1794, Baron von Wolzogen, chamberlain at the court of Saxe Weimar, and d. at Jena Jan. 14, 1847. Her brothers were Schiller's fellow-pupils in the Karls Schule of Stuttgart; her sister Charlotte became his wife; she herself was through the whole latter part of his life an intimate friend of his, and her book, *Schiller's Leben* (2 vols., 1830), is one of the most vivid and trustworthy pictures of him. In the field of pure imagination she also gained reputation by her romances, *Agnes von Lilien* (2 vols., 1798), *Cordelia* (2 vols., 1840), etc.

Wom'an's Rights, a term used in the U. S. to designate the movement for woman's equal social, civil, political, industrial, religious, and educational rights with man. The first convention was called July 19, 1848, at Seneca Falls, N. Y., by Lucretia Mott, Elizabeth Cady Stanton, Martha C. Wright, and Mary Ann McClintock. The meeting was held in the Wesleyan Methodist church, and largely attended by leading men and women, who took part in the debates. James Mott, tall, dignified, in Quaker costume, presided; Lucretia Mott, accustomed to public speaking, led the discussions. The convention continued two days, and the interest was sustained to the close. A declaration of rights was adopted, setting forth similar grievances under a masculine dynasty to those the colonies endured under King George. Resolutions were adopted making every demand since claimed by the most radical friends of the movement, such as equal rights in the universities, in the trades and professions—equal civil, political, and social rights for married as well as single women. At this time the condition of married women under the law was nearly as degraded as that of the slave on the plantation. The resolution asserting "the duty of the women of this country to secure to themselves their sacred right to the elective franchise" was the only one that met with opposition. Some feared a demand for the right of suffrage would defeat others they deemed more rational, and make the movement ridiculous. But Mrs. Stanton and Frederick Douglass, seeing that the right to make laws was the power by which all others could be secured, advocated and carried the resolution. The convention was extensively noticed, ridiculed, and denounced by the press and the pulpit, much to the surprise and chagrin of the leaders. The declaration was signed by over 100 persons; many withdrew their names when the storm of ridicule began to break. But the brave protests sent out from this meeting touched a responsive chord in the hearts of women all over the country. Conventions were held soon after in Ohio, Indiana, and Pennsylvania, and one in Rochester, N. Y., within two weeks, called by Amy Post, Sarah Owen, and Mary Hallowell, and held in the Unitarian church, Abigail Bush presiding. The audience was large and the convention fully reported in the city journals. The New York *Tribune*, edited by Horace Greeley, noticed these early conventions with respect.

Among the immediate causes leading to this movement were—(1) The visits of Frances Wright, a Scotch lady, to this country in 1820, who lectured on political questions, slavery, and woman. She travelled North and South, and endured a pitiless persecution for radical ideas now generally accepted by the best minds of the age. (2) The opposition to woman on the anti-slavery platform. Most of the leaders in the woman's rights reform had been educated in the anti slavery school, and, in advocating the emancipation of the black race, early found themselves compelled to defend the right of woman to speak in public assemblies. Thus, Abby Kelly, Sarah and Angelina Grimké, Lydia Maria Child, and Maria Weston Chapman had the double battle to fight of sex and color, not only with the clergy of New England, but with some of the most bigoted abolitionists, both in this country and Great Britain. Lucretia Mott, Sarah Pugh, Mary Grew of Pennsylvania, Ann Green Phillips, Emily Winslow, and Abby Southwick of Massachusetts, were delegates to the "World's Anti-slavery Convention" held in London in 1840, but were rejected. The debate on their admission occupied the first day. The leading men in favor were Daniel O'Connell, George Thompson, Wendell Phillips, and George Bradburn. William Lloyd Garrison, arriving too late for the debate, on learning the decision,

refused to take his seat in the convention. (3) The bill introduced into the New York legislature by Judge Hertell in 1837 for the property rights of married women roused a general discussion of the whole question of woman's true position in the State, the Church, and the home. Hon. John Savage, chief-justice of the supreme court, and Hon. John C. Spencer, one of the revisers of the statute laws of New York, assisted in framing this bill, which became a law in 1848. Ernestine L. Rose, a cultivated Polish lady, circulated petitions for this bill and addressed committees in the legislatures of several States about this period.

But underlying all these surface causes was the deeper one—that in the progress of civilization the time had come for the recognition of the feminine element in humanity, and women without concert of action, unknown to each other, in every civilized country began simultaneously to demand a broader sphere. The protests of Mercy Otis Warren, Abigail Smith Adams, Hannah Lee Corbin in 1776 against the exclusion of women from participation in the government; Mary Wollstonecraft's *Vindication of the Rights of Women;* Elizabeth Heyrick's demand for immediate emancipation of slavery in the British West Indies; Harriet Martineau's *Political Economy;* Madame de Staël's and Madame Roland's political utterances; Madame Anneke's influence in the German revolution; the novels of George Sand and Fredrika Bremer; Margaret Fuller's parlor conversations and *Woman of the Nineteenth Century;* the works of Eliza Woodson Farnham—were all parts of the general uprising, and helped to prepare the way for the woman's rights movement in 1848.

In 1850–51 conventions were held in Ohio by Maria Giddings, J. Elizabeth Jones, Frances D. Gage, Josephine S. Griffing, Mary A. Johnson, Caroline M. Severance, Hannah M. Tracy, Jane G. Swisshelm. They issued an able address to the women of the State, and a report on the common law. In 1851 the first convention was held in Indiana, a society organized, and annual meetings have been held ever since. The leaders were Dr. Mary F. Thomas, Amanda M. Way, Hannah Hyatt, and Mary B. Birdsall. Robert Dale Owen early exerted a liberal influence in that State, being a member of the legislature several times. In 1852, Lucretia Mott, Ann Preston, M. D., Sarah Pugh, Hannah Darlington, and others called the first convention in Pennsylvania, where the last will and testament of Martin Luther was discussed. In 1850–51 conventions were held in Worcester, Mass., and in 1855 in Boston. The leaders were Paulina Wright Davis, Abby Kelly Foster, Clarina Howard Nichols, Dr. Harriot K. Hunt, Caroline H. Dall, Lucy Stone, and others. Many distinguished men, such as Ralph Waldo Emerson, Theodore Parker, William Henry Channing, Thomas Wentworth Higginson, William Lloyd Garrison, and Wendell Phillips, took part in the discussions. The third national convention met at Syracuse, N. Y., in 1852. Ernestine L. Rose, Elizabeth Oakes Smith, Rev. Antoinette L. Brown, Lydia F. Fowler, Lydia Ann Jenkins, Matilda Joslyn Gage, Susan B. Anthony, Rev. Samuel J. May, Gerrit Smith, were the representatives of the State. The first convention, held in New York City in 1853, was disturbed by a mob, the only case of the kind in an experience of thirty years. Never was the heroism of woman more fully shown. Lucretia Mott presided over this convention, and when the fury of the mob was at its height Horace Greeley and other gentlemen on the platform counselled an adjournment. This Mrs. Mott refused to do, but held her place till the close. The immediate cause of this display of mob spirit was no doubt due to the fact that some of the same gentlemen were present who had insisted in the World's Temperance Convention the previous day that the Rev. Antoinette Brown, a delegate from the Wayne Co. Temperance Society, should be admitted as a member of the convention. The discussion was very bitter—T. W. Higginson, William H. Channing, and Wendell Phillips in favor; Bishop Potter and Rev. John Chambers of Philadelphia against; Neal Dow presided. The delegate from Wayne was rejected. In 1852, Mrs. Nichols addressed the legislature of Vermont; in 1853, Miss Brown, and in 1854, Mrs. Stanton and Mrs. Rose, that of New York; in 1855, Lucy Stone that of Massachusetts; in 1859, Mrs. Thomas, Mrs. Birdsall, and Miss Way that of Indiana; in 1861, Mrs. Jones, Mrs. Gage, and Mrs. Cutler that of Ohio. In 1855, Miss Anthony, alternately accompanied by Mrs. Rose, Miss Brown, and Carrie Filkins, held conventions in 54 different counties of New York, rolling up petitions for suffrage, and for the equal rights of married women to wages, children, and the joint earnings of the copartnership. A bill granting most of these civil rights passed in 1860.

While the agitation was increasing in this country, disturbing all organizations for temperance, education, agriculture, the movement started in England. The New York *Tribune*, containing a phonographic report of the first Worcester convention, fell into the hands of Mrs. Taylor, the future wife of John Stuart Mill, and called out her able essay in the *Westminster Review*—"The Enfranchisement of Woman"—which roused England's great philosopher to thought on the subject. In 1867 he moved an amendment to the Household Suffrage bill, then before Parliament, proposing to strike out "man" and substitute "person." He presented a petition numerously signed by distinguished people, made an able speech, and obtained 74 votes in favor of the amendment. Since the death of Mr. Mill, Jacob Bright and Mr. Forsyth have led the movement in Parliament. A large organization exists in Great Britain, with auxiliaries in Scotland, Ireland, and Wales, composed of women of rank. The last petition they sent into Parliament was signed by over half a million. Lydia E. Becker, Mrs. Butler, Mrs. Fawcett, Mrs. Tyndall, Mrs. Lucas, Lady Anna Gore Langdon, Lady Bowring, Frances Power Cobbe, Miss Julia Gaskell, Mrs. Jacob Bright, Rebecca Moore, Miss Ashworth, and Mrs. Peter Taylor are the leaders in England; Mrs. Duncan McLaren, Miss Taylor, Miss Nichol, Margaret Parker, Sophia Jex Blake, and Mrs. Wellstood in Scotland; Miss Anna Isabella Robertson, an eloquent speaker, is president of the Irish association; Lady Kane, Mrs. Knox, Deborah Webb, and Miss Ashworth are among her associates. Lydia Becker edits *The Woman Suffrage Journal*, in Manchester, and Caroline A. Biggs *The Englishwoman's Journal* in London. Women vote with the same qualifications as men in all municipal elections. They are now petitioning for the Parliamentary vote, with prospect of success. In 1875 an association of gentlemen was formed "to protect the franchise from the encroachments of women." The first lord of the admiralty, the attorney-general, Sir Henry James, Messrs. Bouverie, Childers, and Chaplin, lead this novel movement.

Switzerland has long had its organization, led by Marie Geogg. Women now vote in every canton of the republic. Its organ, *Le Droit des Femmes*, was an able journal. The association in Denmark has already secured many concessions from the government. Fröken Nathalie Zahle, Fröken Pauline Worm, Fru Professorinde Rowsing, the liberal-minded wife of Prof. Rowsing, are its leaders. In Sweden women have the right to vote on some questions, certain property rights have been secured, and the university at Upsal opened to them. The empress of Germany is the leader of the new idea in that country, and in 1874 called a general assembly of all associations at Frankfort to discuss the interests of woman. The queens of Saxony and Würtemberg and the duchess of Baden took part in the deliberations. Frau Schepler Lette, president of the Lette Verein, is actively engaged for the elevation of woman. She visited the U. S. in 1876 to study the movement. In Germany, Russia, Austria, and Prussia new industries have been opened to women under the sanction of the government. In France the most active efforts are concentrated on the civil and religious liberties of women. Mademoiselle Marie Deraismes, Madame Jennie d'Héricourt, Mademoiselle J. V. Daubrie, Madame Tirauly, are the prominent advocates. M. Léon Richer, editor of *L'Avenir des Femmes*, a journal published in Paris, is doing an effective work for the enfranchisement of woman. Italy has her societies, public meetings, and journals edited by women—*La Donna* at Venice, edited by Sig. Gualberti Alaide Beccari, and *La Cornelia* at Florence, edited by Madame Aurelia Cumino Zolliero de Suna. The Orient also shows progress. At Bucharest, in Romania, *The Dekebalos*, established in 1874, announced as one of its principles the participation of woman in the affairs of state. *The Euridike*, published in Constantinople, edited by Emilia Leonzias, aims to promote the intellectual development of woman. Egypt, India, Japan, China, Australia, and South America have all felt the force of this tidal wave of thought, and each in its own way is making progress toward woman's complete emancipation.

But in the U. S., while associations for all the varied interests of woman gradually started into existence, suffrage conventions and legislative hearings became a part of its yearly history. A National Committee, chosen at the annual conventions, controlled the movement in the beginning—Paulina Wright Davis, president; Lucy Stone, secretary until 1855; Mrs. Stanton, president; Miss Anthony, secretary until 1866, when the American Equal Rights Association was formed, with Lucretia Mott president. The suffrage conventions and other anniversaries were suspended during the war, the leaders in 1863 forming a National Loyal League—Mrs. Stanton, president; Mary F. Gilbert, Charlotte B. Wilbour, Mattie Griffith, Rebecca Shepherd, Lucy Stone, and Susan B. Anthony, committee in charge. Their purpose was to roll up a mammoth petition to Congress praying for an act emancipating all persons of African descent held to involuntary labor in the U. S. They succeeded in obtaining 300,000 signatures, the largest petition ever sent into Congress. It was pre-

sented by the Hon. Charles Sumner in an eloquent speech. From 1865 petitions from women were poured into Congress praying their representatives (1) not to insert the word "male" in the 14th amendment, and (2) to insert the word "sex" in the 15th. In 1866 a very important debate occurred in the Senate on the bill to enfranchise the black men of the District. Mr. Cowan of Pennsylvania moved to strike out "male." Able speeches were made for the amendment, and nine Senators voted in its favor. As the same persons were members of the anti-slavery and woman's rights organizations, an effort was made, after slavery was abolished, to unite them in demanding the enfranchisement of both classes. But the friends of the colored man, thinking his chance for political equality better than woman's, refused to cumber his case with another. Finding the abolitionists would not unite in demanding the political rights of women, a majority of the members of the Equal Rights Society organized in 1869 "the National Woman Suffrage Association," with the one object of securing national protection in the exercise of their right to vote. In 1867, New York held a constitutional convention. Mrs. Stanton and Miss Anthony, with Rev. Olympia Brown, Charles Lenox Remond, and Sarah P. Remond, held a series of conventions throughout the State, circulating petitions to strike "male" from Art. II. Sec. 1 of the Constitution. In presenting their petitions, numbering 20,000, they, with Lucy Stone and Henry B. Blackwell, had respectful hearings. Horace Greeley, chairman of the committee on suffrage, reported adversely, though his wife was among the petitioners. George William Curtis made an able argument, and 27 members voted in favor of woman suffrage. The question was submitted in Kansas the same year, and that State thoroughly canvassed with lectures and tracts by Lucy Stone, Henry B. Blackwell, ex-Gov. Robinson, Mrs. Stanton, Miss Anthony, George Francis Train, and Rev. Olympia Brown, the latter speaking every day for four consecutive months; 9070 votes—one-third of the whole number—were given for woman suffrage. The American Equal Rights Association sent Susan B. Anthony as their delegate to the Democratic Presidential convention held in Tammany Hall, New York, July 4, 1868. Horatio Seymour, presiding, graciously received her memorial, ordered the clerk to read it, and referred it to the committee on resolutions. In 1869 the women of Wyoming Territory were enfranchised, admitted into the courts as jurors, and Esther Morris made justice of the peace; she presided nearly two years, to the entire satisfaction of the people. The experiment there proves successful. The first national convention, held in Washington, D. C., Jan., 1869, was called by the Franchise Association of that city, Josephine S. Griffing president. Among those who joined our movement about this time were Virginia L. Minor of Missouri, Helen E. Starrett of Kansas, Lilie Peckham and Dr. Ross Wolcott of Wisconsin, Mary A. Livermore, Kate N. Doggett, and Jane Graham Jones of Illinois, Belva A. Lockwood and Sarah Andrews Spencer of Washington, D. C., Frances Ellen Burr and Isabella Beecher Hooker of Connecticut, Charlotte B. Wilbour, Elizabeth B. Phelps, Frances V. Halbock, and Lillie Devereux Blake of New York, Elizabeth Avery Meriwether of Tennessee, Elizabeth T. Schenck, Sarah J. Wallis, Laura De Force Gordon, and Ellen Clarke Sargent of California. Petitions were before Congress demanding a 16th amendment, championed by Hon. S. C. Pomeroy of Kansas in the Senate and Hon. George W. Julian in the House. During the fashionable seasons conventions were held at Saratoga, Lake George, Clifton Springs, Trenton Falls, Niagara and Newport with good success.

In the mean time, there was a division in our ranks, growing out of personal hostilities—a difference as to our affiliations, as to the discussion of social questions, and as to the true interpretation of the Constitution, the limit of State rights and Federal power. The seceders, led by Lucy Stone, centred in Boston, held their first convention in Cleveland, O., and organized the American Woman Suffrage Association in Nov., 1869. From the inauguration of this Boston movement its leaders have held annual conventions in different cities of various States, but confined their labors chiefly to New England and State work, appearing each year before their legislature and political conventions. In 1874 and 1875 they sent Margaret A. Campbell, Mary A. Eastman, and Matilda Hindman to aid in the canvass of Michigan and Iowa. But most of those who inaugurated the reform, seeing no sufficient cause for division, remained with the National Association—Lucretia Mott, Martha C. Wright, Ernestine L. Rose, Clarina Howard Nichols, Paulina Wright Davis, Sarah Pugh, Amy Post, Lydia Mott, Catharine F. Stebbins, Adelaide Thomson, Clemence S. Lozier, Rev. Olympia Brown, Josephine S. Griffing, Matilda Joslyn Gage, Elizabeth Cady Stanton, Susan B. Anthony.

Since 1869 the National Association has held two annual conventions—one at New York in May, and one at Washington in January—with hearings each year before Congress. Its leaders have seized every opportunity to make their points in testing law, rousing thought, and creating agitation. Some have tried to vote, and, being refused, have sued the inspectors; among these are Ellen R. Van Valkenburg of California, Catharine V. Waite of Illinois, Sarah R. Huntington of Connecticut, and Carrie S. Burnham of Pennsylvania. In 1871, Sarah Andrews Spencer and Sarah E. Webster, with 71 other women in Washington, D. C., marched to the city hall for registration; being refused, they took their cases into the district court, and appealed from Judge Carter's decision to the Supreme Court of the U. S. Mrs. Virginia L. Minor also appealed from the Missouri courts, and in 1874, Chief Justice Waite rendered an adverse decision. Others have succeeded in voting; among them are Mrs. Noble, Mrs. Barker of Toledo, O., Nannette B. Gardner of Detroit, Mich., Mary O. Brown and 17 others of Washington Territory, Mrs. Mansfield of Nyack, N. Y., Mrs. Miller of New York City. In 1872, Susan B. Anthony and 14 other women of Rochester, N. Y., voted, were all arrested, put under bonds, and indicted. Miss Anthony's was made the test case, tried at Canandaigua, in the U. S. circuit court of the northern district of New York, June 17, 1873, before Hon. Ward Hunt of the U. S. Supreme Court, who wrested her case from the jury, ordered the verdict of "guilty," denied a new trial—ably argued by her counsel, Hon. Henry R. Selden—and pronounced sentence of "$100 fine and costs of prosecution." She appealed to Congress to remit the sentence; her memorial was presented by Hon. A. A. Sargent in the Senate and Hon. William A. Loughridge in the House. The judiciary committees brought in majority and minority reports, the latter by Hon. M. H. Carpenter of Wisconsin in the Senate and Hon. B. F. Butler in the House, most severely rebuking Judge Hunt's arbitrary and unprecedented procedure. The fine has never been paid nor Miss Anthony imprisoned. The position that women possess the right to vote under the U. S. Constitution, with its new guarantees of the 14th and 15th Amendments, was first taken by Virginia L. Minor in 1869 in a convention at St. Louis, and by Mrs. Stanton in 1870, who with Madame Anneke, Matilda Joslyn Gage, Sarah Andrews Spencer, Isabella Beecher Hooker, Paulina Wright Davis, Belva A. Lockwood, Charlotte B. Wilbour, addressed the District of Columbia committee, urging the amendment to strike out "male," and thus enfranchise the women of the District. Victoria C. Woodhull took the same ground in 1871, when, as an individual belonging to no association, she was granted a hearing before the judiciary committee of the House, Hon. John A. Bingham chairman; her memorial was most respectfully considered, and called out majority and minority reports—an honor never before conferred on woman by the Congress of the U. S.

Women have not only protested, like Dr. Harriot K. Hunt, against the "tyranny of taxation without representation," but many have resisted it, though the price is ever confiscation. Notable among these are the Smith sisters of Glastonbury, Conn., Sarah E. Wall and Abby Kelly Foster of Worcester, Mass. Thus has this question of woman's rights in the last few years been changed from vague complainings of general grievances under State statutes into one of constitutional law. The National Association takes the ground that under the Federal Constitution women, being citizens, are possessed of the right to vote; that the States may regulate, but may not abolish the suffrage for any class; that it is the duty of the U. S. to protect all its citizens in this right, and thus secure to every State a republican form of government. And this opinion is held by many leading statesmen. When the Pembina Territorial bill was before the Senate in 1874, Hon. A. A. Sargent moved to strike out "male," and sustained his motion with an able speech; 19 Senators voted for his amendment.

Space will not admit the mention of all the consecutive conventions, legislative and Congressional hearings, and all the noble men and women who have aided in this grand reform. But the result of their labors, running through a quarter of a century, is the advance legislation granting many of the privileges demanded. In some States married women now possess the right to their property, wages, children, the right to make wills and contracts, to sue and be sued in their own names, and to testify in the courts. Women now practise law in some States, and are regularly ordained for the ministry in some sects, and practise medicine everywhere. The colleges throughout the West are open to girls, and an increasing number of the more lucrative occupations in the world of work are being daily filled by women. Woman suffrage organizations now span the continent. California and Oregon have their conventions,

journals, continual agitation in social circles, the courts, and legislative halls, as have all the Northern and some of the Southern States of the Union. Not a year passes without some step of progress. In 1874, Michigan submitted the proposition of woman suffrage to a vote of her people, and 40,000 men voted ay. Iowa and many other State legislatures have had large minority votes on the proposition. In Kansas, Minnesota, and Colorado the women hold office and vote on all school questions.

Papers in the interests of woman have been published at various times and places. The first was *The Lily*, Seneca Falls, N. Y., by Amelia Bloomer; it continued six years and reached a circulation of 4000. Mrs. Stanton was a regular contributor, and its files contain the records of the early conventions; in 1853, *The Una* at Providence, R. I., edited by Paulina Wright Davis and Caroline H. Dall; in 1855, *The Woman's Advocate* at Philadelphia, by Anne E. McDowell, the first paper in which the owner, editor, and compositors were all women; in 1868, *The Revolution* in New York, established by Susan B. Anthony; Elizabeth Cady Stanton and Parker Pillsbury, editors; in 1869, *The Pioneer* at San Francisco, by Emily Pitts Stevens; *The Woman's Advocate* at Dayton, O., A. J. Boyer and Miriam M. Cole, editors; the *Frauen Zeitung* at Milwaukee, Wis., by Mathilde Franceska Anneke; *The New Era* at New York, by Mathilde F. Wendt; in 1870, *The Woman's Journal* at Boston, Lucy Stone, Julia Ward Howe, Mary A. Livermore editors; in 1871, *The New Northwest* at Portland, Or., by Abigail Scott Duniway; in 1876, *The Ballot-Box* at Toledo, O., Sarah L. Williams editor. Thousands of tracts and essays written by able advocates have been distributed annually throughout the country.

The Centennial year was one of great activity in this reform; documents long stowed away were brought to light; reports of the early conventions collected and bound into volumes; missing links of history supplied by diligent research. A protest against calling the Centennial a celebration of the people while one-half were denied representation was issued from the Washington convention Jan., 1876; the responses to which, coming from all parts of the country, proved that American women were already in rebellion. A memorial from the District and National Associations was presented to Congress Mar. 31, the very day Abigail Adams made her protest a hundred years before, by Hon. S. S. Cox, who gracefully asked that the petition with the names of the officers should be recorded with the regular proceedings. Hon. N. P. Banks seconded the motion with an able speech. The National Association opened Centennial Parlors in Philadelphia, where public receptions were held twice a week, and from which were issued over 20,000 documents. They sent addresses and delegates to the Republican and Democratic nominating conventions. Sarah Andrews Spencer and Elizabeth Boynton Harbert were received with "respectful consideration" by the Republicans at Cincinnati, and addressed the convention. Virginia L. Minor and Phœbe W. Couzins were courteously received by the Democrats at St. Louis, and Miss Couzins spoke from their platform. But the most important work was "A Declaration of Rights," signed by a large number of the leading women of the movement, and its presentation at the celebration in Independence Square on the morning of July 4, 1876. It had been handsomely engrossed on parchment by Sarah Andrews Spencer, and tied with the national colors. A delegation of ladies, consisting of Susan B. Anthony, Matilda Joslyn Gage, Sarah Andrews Spencer, Lillie Devereux Blake, and Phœbe W. Couzins, early took the seats assigned them on the platform by Gen. Hawley, president of the Centennial Commission; and the moment Richard Henry Lee finished reading the Declaration of 1776, Miss Anthony presented the document to Vice-President Ferry, who on that occasion represented the government, and said: "Mr. President, on behalf of the women citizens of the U. S. I present to you this Declaration of Rights." It was received with a formal bow, and the ladies retired to a rostrum in front of Independence Hall, scattering copies of the Declaration on all sides. There Miss Anthony read it to assembled thousands. At 12 o'clock a large and enthusiastic meeting was held in the First Unitarian church (Rev. William H. Furness's), where the Declaration was again read by Elizabeth Cady Stanton. Lucretia Mott, in her eighty-fourth year, presided and made several effective speeches. The Hutchinsons thrilled the audience with their songs of freedom. For five consecutive hours the interest was sustained; and thus woman celebrated the close of the first century of our national life. For further information see *History of Woman Suffrage Movement*, edited by Elizabeth Cady Stanton, Matilda Joslyn Gage, and SUSAN B. ANTHONY.

Womb [Ang.-Sax. *womb*], the uterus, the chief of the female sexual organs, in which conception takes place and the embryonic organism is retained during the period of gestation, and developed from step to step of fœtal growth until its birth as a living, independent individual. The womb (see Fig. 1 in article OVARIES) in healthy adult women is located in the abdominal cavity, in the median line of the pelvis: it has the bladder in front, the rectum behind; its position is one of slight anteversion—that is, its vertical axis is thrown slightly forward. It is a pyriform body, with base above, and measures about 3 to 3½ inches in length. It is chiefly muscular in structure; is hollow, having a small canal through its lower portion, the neck or *cervix uteri*, which widens into a triangular cavity within the body or broad base above. The length of this canal and cavity is usually 2½ to 3 inches. At the upper or basic end of the cavity the angles connect by small apertures with the Fallopian tubes, which bring the ovules at the menstrual periods from the ovaries to the uterus. The interior of the womb, both neck and body, is lined with mucous membrane, arranged in folds and rich in blood-vessels, and containing numerous glands. The substance of the organ comprises three distinct sets of muscular fibres—an external, middle, and internal layer—some of which are transverse or circular, others longitudinal, and others oblique. These give the organ a powerful contractility. The organ is retained *in situ* by ligaments and the cellular tissue surrounding it. It has attachments to the bladder in front, to the rectum behind, to the pelvic bodies on either side by the broad ligaments—to the ovaries by the ovarian ligaments. When in pregnancy the womb increases to accommodate the developing infant, its muscular fibres take on increased growth, and, following the expulsion of the child and placenta, these fibres contract in the direction of the several coats, as stated, and prevent hæmorrhage. By a slow process of involution or atrophy from disuse the womb gradually returns to its normal size. (For details of its functions see CATAMENIA, OBSTETRICS, OVARIES; for diseases to which it is liable see STERILITY and UTERINE DISEASES.)

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Wombat. See PHASCOLOMYIDÆ.

Wom'elsdorf, p.-b., Heidelberg tp., Berks co., Pa., is the seat of the orphans' home of the Reformed Church. P. 1031.

Women, Medical Education of, in Europe and America. As a practical outgrowth of the higher and more liberal education of women, facilities for medical instruction are now open to them in many of the countries of the Continent, in England, and the U. S. The medical faculty of Paris have granted diplomas to a number of women who have pursued the long, full, and difficult course of study which the French school prescribes, and some of whom have acquired high awards and most honorable mention. The German universities are less favorable, and women, chiefly from abroad, go to Berlin, Vienna, and the lesser medical schools chiefly to pursue the valuable special courses of private instruction which are open to them. The University of Zurich is most frequented by women pursuing medicine, having a constant number in attendance upon the full course, and already numerous women graduates. The admission of women to, and their recognition by, the University of Edinburgh has been agitated, and is unsettled, but with a strong education party in its favor. In London there is an independent medical school for women, chiefly inspired by Dr. Elizabeth Blackwell, who is aided by an active corps of coadjutors, including some of the best scientific names of the medical faculty.

In the U. S. the medical education of women has received general encouragement, and numerous colleges, hospitals, infirmaries, and dispensaries afford ample means of study and experience. The initiative taken by the various irregular schools and unscientific and irresponsible sects of doctors in educating women, and their readiness to extend diplomas to them without adequate tests of previous education, character, or fitness, have thrown a degree of opprobrium and suspicion on the cause of female medical education and practice. But this is being steadily dissipated by the conscientious and thorough teaching afforded in the better institutions. The Woman's Medical College of Pennsylvania at Philadelphia has had an existence of twenty-seven years; has an able and full faculty, comprising men and women, in good professional standing and unquestioned scientific attainments; possesses a large and valuable college building of most approved modern construction, with every convenience of lecture-rooms, laboratories, and apparatus; and has an adjacent hospital for women and children under its immediate supervision; it graduates a steadily-increasing number each year. The New York Infirmary for Women and Children has had an existence in 1876 of twenty-two years, having been founded by the sisters Drs. Emily and Elizabeth Blackwell, who are perhaps the foremost representatives of the medical education

of women. This institution from the first was under the charge of medical women, and afforded opportunities for medical study and experience. During the past ten years it has maintained an associated but distinct medical college, with a full faculty of regular professors, clinical lecturers, instructors, etc. The curriculum is equal to that of the best medical colleges for men, and has many superiorities. Good English education is requisite in all applicants, and the course is graded, the student being rigidly examined at the close of each year before she is advanced; the examination for graduation is first conducted by the faculty, and subsequently by a superior board of examiners, comprising such eminent men as Drs. Willard Parker, Isaac Tayler, Austin Flint, Stephen Smith, and Prof. Chandler, the chemist. The confirmation of their proficiency by such authorities, whose names are appended to their diplomas, gives a guaranty to the public that the college graduates are equal to the duties and responsibilities of medical practice. The infirmary is a capacious and elegant structure on Stuyvesant Square, and a new college building to replace the older is contemplated. The personal attendance upon a number of cases of midwifery is one of the conditions of graduation. The New England Woman's Hospital of Boston has educated many able women as physicians. The medical department of the University of Michigan at Ann Arbor is open equally to both sexes; they are taught in common, with the exception of a few branches which policy and propriety dictate should be taught separately. The well-known reputation and vigorous instruction at this university have secured a numerous class of women in the pursuit of medicine. The Woman's Hospital Medical College of Chicago, the University of Wooster at Cleveland, and some few other less-known institutions are doing similar work.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Wonders, Seven. See Seven Wonders of the World.

Wonewoc, p.-v. and tp., Juneau co., Wis. P. 930.

Wood. See Timber and Timber Trees, by S. H. Shreve, in Appendix; also, Arboriculture, by J. J. Thomas.

Wood, county of S. E. Dakota, recently formed, and not included in the census of 1870. The surface is rolling, and there are a number of small lakes. Area, 576 sq. m.

Wood, county of N. W. Ohio, lying on Maumee River, drained by Portage River, and traversed by Lake Shore and Michigan Southern and Cincinnati Hamilton and Dayton R. Rs.; surface level, sometimes swampy, and generally heavily timbered; soil fertile. There are many saw-mills, flour-mills, and some manufactories of carriages and wooden ware. Horses, cattle, sheep, and swine are numerous. Staples, corn, wheat, oats, wool, hay, dairy products. Cap. Bowling Green. Area, 590 sq. m. P. 21,596.

Wood, county of N. E. Texas, lying on Sabine River; surface undulating, with considerable timber; soil fertile. Cattle and swine are numerous. Staples, cotton, corn, and sweet potatoes. Cap. Quitman. Area, 840 sq. m. P. 6894.

Wood, county of N. W. West Virginia, separated from Ohio by Ohio River, drained by the Little Kanawha, and traversed by Parkersburg branch of Baltimore and Ohio R. R.; surface hilly, and abounding in bituminous coal and iron ore; soil generally fertile. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, wheat, hay, and dairy products. Cap. Parkersburg. Area, about 400 sq. m. P. 19,000.

Wood, county of Central Wisconsin, drained by Wisconsin and Yellow rivers, and traversed by Green Bay and Lake Pepin R. R.; surface undulating, soil fertile. Cattle are the chief live-stock. Staples, hay, Indian corn, oats, wheat, and dairy products. Cap. Grand Rapids. Area, 828 sq. m. P. 3912.

Wood, tp., Clarke co., Ind. P. 730.

Wood (Alphonso), b. at Chesterfield, N. H., Sept. 17, 1810; graduated at Dartmouth College 1834; studied theology one year at Andover, Mass.; taught in Kimball Union Academy, Meriden, N. H., 1834–49; was president of Ohio Female College 1851–57; professor in Terre Haute Female College 1857–60; principal of Clinton Female Seminary, Brooklyn, N. Y., 1860–65; travelled 1865–66, and since 1867 has resided at West Farms, New York City. Botany has been his specialty, and he has published *Class-Book of Botany* (1845), which has gone through more than 50 editions; *First Lessons in Botany* (1848), *Leaves and Flowers* (1863), *American Botanist and Florist* (1870).

R. D. Hitchcock.

Wood (Anne T. **Wilbur**), daughter of Rev. Hervey Wilbur, b. at Wendell, Mass., in 1817; was editor of *The Ladies' Magazine* (Boston, 1818) and *The Ladies' Casket* (Lowell, 1848); has contributed to various periodicals, chiefly under the name of "Florence Leigh," and has translated from the French several novels, including two by Saintine and two by Edmond About.

Wood, or a **Wood** (Anthony), b. at Oxford, England, Dec. 17, 1632; graduated at Merton College, Oxford, 1652, and devoted most of his life to the collection of data illustrative of the history of Oxford University. D. at Oxford Nov. 29, 1695. Author of *Historia et Antiquitates Universitatis Oxoniensis* (folio, 1674), being a translation from Wood's original, which appeared in 3 vols., 1786–96, and of *Athenæ Oxonienses: an Exact History of all the Writers and Bishops who have had their Education in the Most Ancient and Famous University of Oxford, 1500–1695, with the Fasti or Annals of the said University* (2 vols., folio, 1691–92). For his strictures on the earl of Clarendon, Wood was expelled from the university and his book burned shortly after its publication. A second edition, with 500 new *Lives*, was edited by Tanner (2 vols., 1721), and a third edition was carefully superintended, with extensive *Additions and a Continuation*, by Rev. Philip Bliss, D. C. L., fellow of St. John's College, Oxford (4 vols., 1813–20). A fourth edition was projected by the short-lived Ecclesiastical History Society, and for it Dr. Bliss wrote vol. i., embracing the *Life of Wood* (1848), but the project was not further carried out, though abundant materials were left by the editor to the Bodleian Library.

Wood (Dr. Volson), A. M., b. at Smyrna, N. Y., June 1, 1832; graduated at the State Normal School, Albany, 1853; taught mathematics in that institution 1854–55; graduated at the Rensselaer Polytechnic Institute, Troy, 1857; was professor of civil engineering in the University of Michigan 1857–72; has been since 1872 professor of mathematics and mechanics in the Stevens Institute of Technology, Hoboken, N. J.; has invented a steam-pump, a steam or pneumatic rock-drill, and an air-compressor; brought out revised editions of Mahan's *Civil Engineering* and of Magnus's *Lessons in Elementary Mechanics;* furnished many articles on engineering and on mathematical subjects to the *Journal of the Franklin Institute* (1858–71), and is author of *A New System of Alligation* and of treatises *On the Resistance of Materials, On Bridges and Roofs,* and on *The Elements of Analytical Mechanics.*

Wood (Eleazer D.), b. at New York; graduated at the U. S. Military Academy Oct. 30, 1806, when appointed a second lieutenant in the corps of engineers. In this capacity he assisted in the construction of Castle Williams, Governor's Island, N. Y., and of Fort Norfolk, Va. During the war with Great Britain he served with Gen. Harrison's North-western army during the memorable siege of Fort Meigs, where he conducted the defence, and was engaged in the sortie of May 5, 1813; was in command of the artillery at the battle of the Thames, Oct. 5. Transferred to the Northern army in 1814, he was engaged in all the events of that campaign, including the capture of Fort Erie, July 3, the battle of Chippewa, July 5, and that of Niagara, or Lundy's Lane, July 25. After the latter battle the American army fell back to Fort Erie, which work was enlarged and extended under the direction of Cols. McRee and Wood, and placed in a state to sustain the expected attack. In the repulse of the assault on Fort Erie, Aug. 15, Col. Wood led the 21st regiment of infantry, and in the sortie of the besieged from their works, Sept. 17, 1814, he fell almost at the outset at the head of a column of which he was in command. For distinguished services in the defence of Fort Meigs he was brevetted major, and lieutenant-colonel for gallantry in the battle of Niagara. His commanding general (Brown) erected a monument to his memory at West Point. The county in Michigan in which Fort Meigs was situated bears his name, as also the U. S. fort on Bedloe's Island, N. Y.

Wood (Ellen **Price**), better known as Mrs. Henry Wood, b. at Worcester, England, about 1820; contributed to many periodicals; was for some years editor of the *Argosy* magazine, and has published numerous popular novels, among which are *East Lynne* (1861), *The Channings* (1862), and *The Shadow of Ashlydyat* (1863).

Wood (Fernando), b. at Philadelphia, Pa., June 14, 1812, of Quaker parentage; settled in New York in childhood; became a successful shipping-merchant; was elected to Congress as a Democrat 1840; was mayor of New York 1856–57, and again 1861–62, and again member of Congress 1863–65 and 1867–77.—His brother Benjamin has also been a member of Congress, and is editor and proprietor of the New York *Daily News.*

Wood (George), b. at Newburyport, Mass., in 1799; educated by the noted writer Samuel L. Knapp; studied law; settled at Alexandria, Va., 1816; was a clerk in the war department at Washington 1819–22, and in the treasury 1822–45, after which he removed to New York; wrote the

popular novels *Peter Schlemihl in America* (1848), *The Modern Pilgrims* (2 vols., 1855), *Marrying too Late* (1856), and *Future Life, or Scenes in Another World* (1858), republished with the title *The Gates Wide Open, etc.* (Boston, 1869), when it passed through 4 eds. in a single week. Mr. Wood was a contributor to the *Knickerbocker Magazine* 1846–47; returned to Washington soon afterward, and resumed his clerical labors in the treasury department, where he became chief of the navigation division, and wrote for the *National Era* and other periodicals. D. at Saratoga Springs, N. Y., Aug. 24, 1870.

Wood (George B.), M. D., LL.D., b. at Greenwich, N. J., Mar. 13, 1797; graduated at the University of Pennsylvania 1815, and in medicine 1818; was professor of chemistry in the Philadelphia College of Pharmacy 1822–31, and of materia medica 1831–35; professor of the same branch in the University of Pennsylvania 1835–50, and of theory and practice of medicine 1850–60; was physician in the Pennsylvania Hospital 1835–59; became president of the American Philosophical Society in 1859; was long president of the College of Physicians of Philadelphia, and in 1865 endowed an auxiliary faculty of medicine in the University of Pennsylvania. Author of *A Treatise on the Practice of Medicine* (2 vols., 1847; 5th ed. 1858), *Therapeutics and Pharmacology* (2 vols., 1856; 3d ed. 1868), and *Lectures and Addresses on Medical Subjects* (1859); with Dr. Franklin Bache he prepared *The Dispensatory of the U. S.* (1833; 13th ed. 1870), of which over 100,000 copies have been sold, producing to the authors about $100,000. D. Mar. 30, 1879.

Wood (G. W.), U. S. N., b. May 29, 1843, in Ireland; graduated at the Naval Academy in 1861; became lieutenant in 1864, lieutenant-commander in 1866; served in the Oneida at the capture of New Orleans and passage of the Vicksburg and Port Hudson batteries in 1862; commended for "courage, coolness, and skill." F. A. Parker.

Wood (Horatio C.), M. D., b. in Philadelphia, Pa., Jan. 13, 1841; graduated in medicine at the University of Pennsylvania 1862, and became professor of medical botany and clinical professor of diseases of the nervous system in that institution. Author of numerous papers on myriapods, Scorpionidæ, Phalangidæ, botany of the coal periods, and on fresh-water Algæ in the *Proceedings* and the *Transactions* of the Academy of Natural Sciences of Philadelphia, of the American Philosophical Society, and of the Essex Institute; also of *The Fresh-Water Algæ of North America* in the Smithsonian *Contributions to Knowledge* (1873), of original physiological investigations upon Indian hemp, nitrite of amyl, *Veratrum viride*, the pneumogastric nerves, etc., in the *Proceedings* of the American Philosophical Society, the *American Journal of Medical Sciences*, and in the Philadelphia *Medical Times*; and of a number of papers on clinical medicine in the same journals; gained the Boylston prize by his *Essay on Thermic Fever or Sunstroke* (Philadelphia, 1872), and has published *A Treatise on Physiological Therapeutics* (1874) and *A Study of Fever* (1875) in the Smithsonian *Miscellaneous Collections*.

Wood (Isaac), M. D., b. at Clinton, Dutchess co., N. Y., Aug. 21, 1793; settled in New York City in childhood; studied medicine; was attending physician in the New York Hospital 1814–16; one of the physicians of the New York Dispensary until 1825, and resident physician of the Bellevue Hospital 1826–33; rendered great services during the cholera epidemic of 1832–33; was in high repute as an ophthalmic surgeon; was for twenty-five years a manager of the New York Institute for the Blind, and was active in founding many medical and charitable institutions. He was a member of the Society of Friends. D. at Norwalk, Conn., Mar. 25, 1868.

Wood (James), b. at Winchester, Va., about 1740, son of Col. James, founder of that town; was a member of the Virginia convention of June, 1776; was commissioned colonel in the Virginia service Nov. 15, 1776; became lieutenant-governor and member of the executive council, and governor of Virginia 1796–99. D. at Richmond June 16, 1813.

Wood (James), D. D., b. in England about 1760; graduated at St. John's College, Cambridge; took orders in the Church of England, and became dean of Ely. D. at Cambridge Apr., 1839. Author of a valuable series of text-books known as the "Cambridge Course of Mathematics."

Wood (James), D. D., b. at Greenfield, N. Y., in 1799; graduated at Union College 1822; was pastor of a Presbyterian church at Amsterdam, N. Y., 1826–33; became professor in a theological seminary at New Albany, Ind., 1839; was president of Hanover College, Ind., 1859–66, and president of Van Rensselaer Institute at Hightstown, N. J., from 1866 until his death at that place Apr. 7, 1867. Author of *A Treatise on Baptism* (1850), *Old and New Theology* (1855), and other theological works.

Wood (James Frederick), b. in Philadelphia Apr. 27, 1813; educated partly in Philadelphia and partly in England, and in 1827 went to Cincinnati, where he became a bank-clerk, advancing subsequently to cashier; in 1837 went to Rome to study for the priesthood; studied there for seven years, and in 1844 was ordained priest, and returned to Cincinnati, where he was ordained assistant rector of the cathedral. He subsequently became pastor of St. Patrick's church in Cincinnati, and while in that position was appointed by papal bull coadjutor-bishop of Philadelphia, with the right of succession. He was consecrated Apr. 26, 1857, and in Jan., 1860, succeeded to the bishopric. He visited Rome by invitation of the pope in 1862, and again in 1867, and was present at the Vatican Council in 1869, recording his belief in papal infallibility, and desiring that it should be defined as a dogma of faith. On Mar. 15, 1875, the diocese of Philadelphia was raised to an archiepiscopal see, and Bishop Wood was elevated to the position of archbishop, being consecrated to that office June 18, 1875.
J. B. Bishop.

Wood (John), b. in Scotland about 1775; resided in Switzerland during the revolution of 1798; was master of the Edinburgh Academy for the Improvement of Arts in Scotland 1799; came to the U. S. about 1800; edited the *Western World* in Kentucky 1806, and the *Atlantic World* at Washington, D. C., 1817; resided afterward at Richmond, Va., where he was employed in making county maps. D. at Richmond in May, 1822. Author of a *History of the Swiss Revolution* (1799), a *History of the Administration of John Adams* (1802), suppressed by Aaron Burr and republished by Sherburne 1846, and *Trial of Aaron Burr* (1807).

Wood (John), b. at Elie, Fifeshire, Scotland, in 1811; educated at the Perth Academy; entered the East India navy 1826; explored the river Indus to Hyderabad in the first steamboat launched on that river 1835; accompanied Sir A. Burnes to Afghanistan, and explored the Oxus region of Central Asia 1838; settled in New Zealand 1841, and in Australia 1852; became in 1857 manager of the Oriental Navigation Co., and in 1861 commander of the Indus steam flotilla. D. at Highbury, near London, Nov. 13, 1871. Author of *A Journey to the Source of the River Oxus* (1841; new ed. 1872).

Wood (John George), F. L. S., b. in London, England, in 1827; educated at Ashbourne grammar school; became Jackson scholar at Merton College, Oxford, where he graduated 1848; was attached for two years to the anatomical museum at Christ Church, Oxford; took orders in the Church of England 1852; became chaplain to the Boatman's floating chapel, Oxford; was assistant chaplain to St. Bartholomew's Hospital, London, 1856–62; was examiner for the natural history university prize at Oxford 1855–57, and became in 1868 precentor of the Canterbury diocesan choral union. Author or editor of very numerous popular works on all the branches of natural history, many of them written for children; editor of *The Boy's Own Magazine* and *Every Boy's Magazine*, and contributor to several prominent periodicals. His most important works are *The Illustrated Natural History* (3 vols., 1859–63; new ed. 1865–66), with 1500 original illustrations; *The Natural History of Man* (2 vols., 1868–70), richly illustrated; *A Popular Natural History* (1866), *Homes without Hands, being a Description of the Habitations of Animals* (1864–65), *Bible Animals* (1869), *The Modern Playmate, a Book of Games, etc.* (1870), and *Man and Beasts, Here and Hereafter* (2 vols., 1874).

Wood (John Turtle), b. at Hackney, near London, Feb. 13, 1821. His father was a gentleman of moderate means. The son, after attending several grammar schools, was articled to an architect, H. E. Kendall, Jr. While pursuing his studies in Italy in 1849 he got involved in the political troubles of the country, and was imprisoned for a time. In 1858 he went to Asia Minor, under George Meredith, to assist in building the railway between Smyrna and Aidin (80 miles), and in 1863 returned to Smyrna to begin, at his own expense, the work of exploring the ruins of Ephesus (48 miles distant by rail). In 1864 he had help from the British Museum, as afterward from the British government, and continued the work of exploration, at intervals, until the spring of 1874. The discoveries made were of the greatest interest and importance. His *Ephesus* was published in 1875. R. D. Hitchcock.

Wood (Reuben), b. in Rutland co., Vt., in 1792; served as captain of Vermont volunteers in the war of 1812–15; settled as a lawyer at Cleveland, O., 1817; was State senator 1825–28; president judge of the 3d district 1833–45; Democratic governor of Ohio 1850–53, and U. S. consul at Valparaiso 1853–54. D. at Rockport, O., Oct. 2, 1864.

Wood (Robert), b. at Riverstown, Meath co., Ireland, in 1716; educated at Oxford; made several visits to Italy, and in 1750–53, with his friends Dawkins and Bouverie

and an Italian artist named Borra, made an antiquarian exploration of Asia Minor and Syria. He was appointed under-secretary of state by Pitt 1759; held that post until 1765, and d. at Putney, near London, Sept. 9, 1771. Author of magnificently illustrated volumes, *The Ruins of Palmyra, otherwise Tedmor in the Desert* (atlas folio, 1753), with 57 plates, and *The Ruins of Balbec, otherwise Heliopolis, in Cœle-Syria* (1757), with 16 plates, both of which were issued also in Paris with the text in French, and have remained the standard works on those subjects. He also printed privately *A Comparative View of the Ancient and Present State of the Troad, etc.* (folio, 1768), which after his death was edited by Jacob Bryant under the title *An Essay on the Original Genius and Writings of Homer, etc.* (4to, 1775), and was translated into French, German, Italian, and Spanish.

Wood (Silas), b. in Suffolk co., L. I., in 1769; graduated at Princeton 1789, and was a member of Congress 1819–29. D. at Huntington, L. I., Mar. 2, 1847. Author of a *History of Long Island* (1824; new ed. 1828), revised by Alden J. Spooner (1865), with the addition of a *Memoir*.

Wood (Thomas Jefferson), b. at Munfordsville, Ky., Sept. 25, 1823; graduated at U. S. Military Academy July 1, 1845; appointed brevet second lieutenant of topographical engineers, and as such engaged in the war with Mexico at Palo Alto and Monterey; transferred to the 2d Dragoons Oct., 1846, and brevetted first lieutenant Feb. 23, 1847, for gallantry at Buena Vista; adjutant 2d Dragoons and on frontier duty in Texas 1849–55; appointed captain 1st Cavalry Mar. 3, 1855, and served on N. W. frontier 1855–59; on expedition against the Sioux Indians 1855; Utah expedition 1858, etc. Promoted to be major Mar. 16, and lieutenant-colonel May 9, 1861, he was employed in organizing and mustering Indiana volunteers until Oct. 11, 1861, when appointed a brigadier-general of volunteers, and Nov. 12 attained the colonelcy of the 2d U. S. Cavalry. Commanded a division of the army of Gen. Buell in the second day's fight (Apr. 7) at Shiloh and at siege of Corinth; of the Army of the Ohio at Perryville; of the Army of the Cumberland at Murfreesboro', where wounded, and at Chickamauga; of the 4th corps at Missionary Ridge and march to Knoxville, and in the numerous battles in Sherman's Georgia campaign in 1864 from Dalton to Lovejoy's Station, Sept. 2, where severely wounded; in opposing Gen. Hood's advance into Tennessee, succeeding to the command of the 4th corps after Gen. Stanley was wounded at the battle of Franklin, Nov. 30, which he led in the battle of Nashville and pursuit of Hood to the Tennessee River. Promoted to be major-general of volunteers Jan. 27, 1865, he subsequently commanded various military districts and departments; was mustered out of the volunteer service Sept., 1866, but retained in command of the district of Mississippi until Jan., 1867, when he resumed his commission in the regular army. For gallant conduct at Chickamauga he was brevetted brigadier-general, and major-general for Nashville. He was placed on the retired list June 9, 1868, with rank of major-general, but by act of Congress of 1875 reduced to brigadier-general.

Wood (William), b. in England toward the close of the sixteenth century; was one of the original settlers of Massachusetts colony 1629; returned to England 1633; published an accurate and well-written description of the country under the title *New England's Prospect* (1634), accompanied by a map and interspersed with various passages of rhyme. He soon returned to Massachusetts; settled at Lynn; was its representative 1636; removed to Sandwich 1637; became town clerk, and d. there in 1639. His book was republished at Boston in 1764, with an *Introductory Essay* ascribed to James Otis, and in 1865 by the Prince Society.

Wood (William B.), b. at Montreal, Canada, May 26, 1779; removed in childhood to New York City, where he commenced life as a mercantile clerk; made his début on the stage at Annapolis, Md., 1798; became a popular favorite; was proprietor of the New Theatre from 1809 to 1820, when it was destroyed by fire; opened the new Chestnut Street Theatre at Philadelphia Dec. 2, 1822; sold it to William Warren 1826; opened the new Arch Street Theatre Oct. 1, 1828, and made his last appearance as an actor at the Walnut Street Theatre Nov. 18, 1846. D. at Philadelphia Sept. 24, 1861. Author of *Personal Recollections of the Stage* (1854) and of many adaptations of English plays.

Wood (William Maxwell), M. D., b. at Baltimore, Md., May 27, 1809; graduated in medicine at the University of Maryland 1829; entered the navy as assistant surgeon; became full surgeon 1838; was fleet-surgeon of the Pacific squadron 1844–46, and of the North Atlantic squadron during the civil war; became chief of the bureau of medicine and surgery in the navy department 1870, surgeon-general 1871, and was retired 1872. Author of *Wandering Sketches, etc.* (1849), *Fankwei, or the San Jacinto in the Seas of India, China, and Japan* (1859), and other works. D. Mar. 1, 1880.

Wood (William Page), F. R. S., Baron **Hatherley**, b. in London, England, in 1801; educated at Winchester School and at Trinity College, Cambridge, where he obtained a fellowship; was called to the bar at Lincoln's Inn 1827; became queen's counsel 1845; entered Parliament 1847; was vice chancellor of Lancaster 1849–51, solicitor general 1851–52, vice chancellor 1852–68; became in the latter year a chancery judge and privy councillor, and on the accession of the Gladstone administration was made lord chancellor with the title of Baron Hatherley Dec. 10, 1868. On account of failing eyesight he resigned Oct. 15, 1872. Author of *Vindication of the Marriage Law* (1861) and *The Continuity of Scripture, etc.* (1867).

Wood and Richland, tp., Texas co., Mo. P. 834.

Wood'berry, p.-v., Baltimore co., Md., on Jones's Falls and Northern Central R. R., 2 miles N. of Baltimore, contains 10 churches, a public library, 3 public schools, 2 savings institutions, 1 high school, 1 newspaper, 3 land companies, 4 large cotton-duck mills, 1 machine shop, a handsome park, granite-quarries, and 2 hotels. P. 8275.

F. L. Morling, Ed. "Gazette."

Woodberry, b., Middle Woodberry tp., Bedford co., Pa. P. 291.

Woodberry, tp., Blair co., Pa. P. 2107.

Woodbine. See Caprifoliaceæ.

Wood'bine, p.-v. and tp., Jo Daviess co., Ill. P. 959.

Woodbine, p.-v., Harrison co., Ia.

Wood (or Block) Books. See Printing, by W. S. Paterson.

Wood'bridge, p.-v., York co., Ont., Canada, on Toronto Grey and Bruce Railway, 17 miles N. of Toronto. It has a large machine-shop and foundry and a lumber-trade. P. about 800.

Woodbridge, tp., New Haven co., Conn. P. 830.

Woodbridge, tp., Hillsdale co., Mich. P. 1321.

Woodbridge, p.-v. and tp., Middlesex co., N. J. P. 3717.

Wood'bridge (Benjamin), b. near Highworth, Wiltshire, England, in 1622; was entered at Magdalen Hall, Oxford, 1638, but soon came to Massachusetts with his family; graduated in the first class at Harvard College 1642; studied divinity; returned to England, and became minister of Newbury, Berkshire, where he d. Nov. 1, 1684. Author of *Justification by Faith* (London, 1652), *The Method of Grace in the Justification of Sinners* (1656), and *Church Members set in Joynt* (1656).

Woodbridge (William), b. in Norwich, Conn., Aug. 20, 1780. His father, becoming one of the earliest emigrants to the North-west Territory, removed to Marietta in 1791; received his earliest education in Connecticut; studied law at Litchfield, and was admitted to the bar in Ohio in 1806; in 1807 was elected to the assembly; was prosecuting attorney for his county 1808–14, during which period he was also a member of the State senate; in 1814 received from Pres. Madison the appointment of secretary of the Territory of Michigan, and removed to Detroit; in 1819 was elected the first delegate from Michigan to Congress; judge of the supreme court of Michigan Territory 1828–32; in 1835 was a member of the convention called to form a State constitution; in 1837 was elected to the State senate of Michigan; in 1839 was chosen governor of the State; was Senator in Congress 1841–47. Daniel Webster, in a note to his speech in defence of the Ashburton Treaty, attributed to Mr. Woodbridge the first suggestion that was ever made to him for inserting in that treaty a provision for the surrender of fugitives, under certain circumstances, upon the demand of foreign governments. For many years before his death he lived at Detroit. D. Oct. 20, 1861. In 1867 the *Life of William Woodbridge* was published by the writer. Charles Lanman.

Woodbridge (William Channing), b. at Medford, Mass., Dec. 18, 1794; graduated at Yale College 1811; studied for the ministry, but was never ordained; was principal of Burlington Academy, N. J., 1812–14; became a teacher in M. Gallaudet's institution for the deaf and dumb at Hartford, Conn., 1817; published, in conjunction with Mrs. Emma Willard, *Universal Geography, Ancient and Modern* (Hartford, 1824); issued also *Rudiments of Geography* (Hartford, 1833), *Modern School Geography*, and other textbooks for schools, and edited, with W. A. Alcott and M. F. Hubbard, the *American Annals of Education and Instruction* (1831–38), in which, in a series of *Letters from Hofwyl*, he gave an account of Fellenberg's system of instruction. D. at Boston Nov. 9, 1845.

Wood'bury, county of W. Iowa, bounded W. by Missouri and Big Sioux rivers, which separate it from Nebraska and Dakota, and traversed by Illinois Central, Sioux City and Pacific, and Dakota Southern R. Rs.; surface undulating, soil usually fertile. Cattle are the chief live-stock. Staples, Indian corn, oats, potatoes, hay. Cap. Sioux City. Area, about 800 sq. m. P. 6172.

Woodbury, p.-v. and tp., Litchfield co., Conn. P. 1931.

Woodbury, tp., Cumberland co., Ill. P. 1067.

Woodbury, tp., Woodbury co., Ia. P. 471.

Woodbury, p.-v., Butler co., Ky. P. 171.

Woodbury, p.-v. and tp., Washington co., Minn. P. 990.

Woodbury, p.-v., cap. of Gloucester co., N. J., at the junction of West Jersey, Swedesboro', and Delaware Shore R. Rs., 8 miles S. of Philadelphia, contains 7 churches, court-house and jail, good schools, a library, 1 bank, 1 newspaper, and town-hall. P. 1965.

A. S. Barber, Ed. "Constitution."

Woodbury, tp., Marion co., S. C. P. 210.

Woodbury, p.-v., cap. of Cannon co., Tenn., on the S. bank of Stone River, 50 miles E. S. E. from Nashville, is the seat of a flourishing college, and contains 2 tanneries, 3 churches, 2 newspapers, 1 hotel, and 1 flouring-mill. Principal business, live-stock and farming. P. 400.

M. L. Ford, Pub. "Press."

Woodbury, p.-v. and tp., Washington co., Vt. P. 902.

Woodbury (Augustus), b. at Beverly, Mass., in 1825; studied theology at Harvard, and became Unitarian pastor at Concord, N. H., 1849, at Lowell, Mass., 1853, and at Providence, R. I., 1857. Author of *Plain Words to Young Men* (1858), *Campaign of the First Rhode Island Regiment* (1862), *Major-General Burnside and the Ninth Army Corps, a Narrative of Campaigns, etc.* (1867), and of various sermons, addresses, and articles in the reviews.

Woodbury (Daniel Phineas), b. at New London, N. H., Dec. 16, 1812; graduated at U. S. Military Academy July 1, 1836, appointed 2d lieutenant of artillery. Soon after transferred to the engineers, his life's services were in that corps, going through the usual round of duties connected with construction or revision of sea-coast fortifications. In 1847–50 he directed the construction of Fort Kearney, Neb., and Fort Laramie, for the protection of the route to Oregon. Subsequently (1856–60), he was in charge of the important works of fortification—Forts Jefferson (Tortugas) and Taylor (Key West). At the outbreak of the civil war, assigned to duty under the writer of this sketch, he became thenceforth associated in the arduous duties involved in providing for the defence of the capital and in the engineering organization of the Army of the Potomac. In the advance to and battle of Bull Run (which see) he took an equally prominent part in the reconnaissances upon which the battle was based, accompanying the column (Gen. Hunter's) which was to turn the enemy's left flank. When the Army of the Potomac took the field, on Woodbury, as commander of the brigade of engineers (from the volunteer service, the organization and previous drilling of which, however, is due to Col. B. S. Alexander), fell the immediate control of a large portion of the engineering operations in the siege of Yorktown and subsequent operations before Richmond. In the memorable "Seven Days," and more especially in the engineering works by which the army was able to cross the White Oak Swamp and move to the James River, Gen. Woodbury rendered conspicuous services. At the unfortunate battle of Fredericksburg his personal gallantry in throwing bridges across the Rappahannock won him the brevet of brigadier-general "for gallant and meritorious services." Detailed for the important command at Key West Mar. 16, 1863, he (Aug. 15, 1864) fell a victim to the yellow fever. A true Christian soldier, he met death as calmly as he had more than once faced it on the battle-field. "My friends, I am passing from the known to the unknown, but all is peace with me," were among his last words. Gen. Woodbury ranked high as a scientific writer. His *Theory of Arches*, while based on the researches of Coulomb and Audoy, is really developed into an original work, and is now a standard one. This and his adaptation of the beautiful geometric constructions of Poncelet to the determination of the thickness of "retaining walls" form papers in the series of the *Professional Papers of the Corps of Engineers.* J. G. Barnard.

Woodbury (Isaac Beverly), b. at Beverly, Mass., in 1819; studied music in Europe; became an eminent composer; teacher of music in the public schools of Boston; removed in 1845 to New York, and edited the *Musical Review* (1850 *seq.*) and the *Musical Pioneer.* D. at Columbia, S. C., Oct. 26, 1858. He compiled several widely-known collections of church music and glee-books, among which were the *Anthem Dulcimer* (1850), the *Cythara*, and the *New Lute of Zion*, and published several manuals of musical instruction.

Woodbury (Levi), son of Peter Woodbury, b. at Francistown, N. H., Dec. 22, 1789, descended from John Woodbury of Somersetshire, England, who settled first at Cape Ann in 1624, afterward at Naumkeag (now Salem, Mass.) in 1626–27. Levi Woodbury was graduated at Dartmouth College with the highest honors of the class in 1809; entered the law-school of Judges Reeves and Gould at Litchfield, Conn., that year; was admitted to the bar, and commenced the practice of the law in his native town in 1812. He was an earnest Democrat, and zealously supported the war then declared against Great Britain. He soon attained political distinction, and became eminent as a lawyer. In 1816, at the age of twenty-seven, he was appointed a judge of the supreme court of the State; in 1819 was married to Elizabeth, daughter of the Hon. Asa Clapp of Portland, Me., and removed to Portsmouth, N. H.; in 1823 was elected governor; in 1825 was elected Speaker of the house of representatives of the State, and to the Senate of the U. S.; in May, 1831, was appointed secretary of the navy, and in 1834 secretary of the treasury, by Pres. Jackson, and remained in the last-named position till the close of Mr. Van Buren's administration in 1841, when he was again elected to the Senate of the U. S. In 1845 he declined the mission to England, and was appointed a justice of the Supreme Court of the U. S., and held that position until his death, Sept. 4, 1851. Mr. Woodbury's mind was one of the highest order. He had great taste and aptitude for learning, and, although so much of his life was occupied with practical duties in the high public positions he continuously filled, he nevertheless found time to indulge his taste for learning, and his acquirements were large and varied. At the bar, in the legislature, in the cabinet, in the Senate, on the bench, in every body of which he was a member, he was a recognized leader, and was, at the time of his death, the candidate for the Presidency upon whom all factions of his party had agreed. For his part in the celebrated Senate debate on Foote's resolution in 1829–30 he was pronounced by Col. Benton "the rock of the New England Democracy;" was conspicuous also in the memorable called session of 1841 in defending the independent treasury system, first established under his administration of the department, and in defeating the banking system proposed by Mr. Clay, and also that proposed by Mr. Tyler's administration. He was thorough in his investigations. His reports on the preservation and supply of live-oak timber, upon cotton, currency, banking, and the independent treasury system, and his opinion in the Dorr case, illustrate this. But he was most effective in debate. In that field his ample knowledge, the earnestness imparted by his strong convictions, and his great advantage of person, manner, and voice, gave commanding force to his logical powers; and he did not impair the effect by elaboration. He was deeply imbued with the religious fervor of his race. The Psalms of David were the constant and best expression of his devotional feelings. He had a tinge of the melancholy which belongs to such natures; and it was perhaps to be cheered by the joyous spirits of his wife and children that he made his study the sitting-room of the family, whose unrestrained conversation and gayety did not at all interrupt his work, although not a word escaped him.—He had five children—one son, the eldest, Charles Levi, a lawyer, unmarried; the eldest daughter, Mary Elizabeth, married Montgomery Blair; the second, Frances Ann, married Archibald H. Lowery; the third, Virginia Lafayette, married G. V. Fox; the fourth, Ellen De Quincy, unmarried. His widow died in 1873.

Montgomery Blair.

Wood-Carving, an art which dates from immemorial antiquity in China and Japan, which countries are still noted for the wonderful skill of their artisans in this department. It was also brought to great perfection in Germany during the Middle Ages, especially in connection with the adornment of churches and convents. (See Engraving.)

Wood-Charcoal. See Charcoal.

Wood'chat, the *Lanius rutilus*, a shrike of the Old World which has a very wide geographical range. In South Africa it is called "magistrate bird," from its habit of impaling and hanging its victims. In some systematic treatises it is named *Enneoctonus rufus*, the "red nine-killer," from the belief that it kills nine victims before it begins to eat.

Wood, Chemistry of. Wood is chiefly made up of *cellulose*, the substance of the plant-cells, with the so-called "*incrusting matters*" of the cells, the soluble constituents

of the *sap*, with the water of the same, and the mineral matters of the *ash*. CELLULOSE (see this head) has been thoroughly described by Prof. Chandler. It forms the great mass of dry wood, cotton, hemp, linen, and other vegetable substances. The incrusting matters are not so well known. In dried wood they must be very mixed in character, comprising of course all the substances left during the drying up of the sap, which contains saline substances, albuminoid matters, tannin substances, gummy matters, and sugar. Payen claimed to have distinguished a definite solid incrusting matter of the cells, which he called *scleroyen*, but others have denied its individuality. In the making of paper from woody or other fibre, as also during the bleaching of vegetable tissues, almost or quite everything is dissolved and removed except pure cellulose and some albuminoid matter, which still gives a yellow-brown stain with nitric acid (see XANTHOPROTEIC ACID); and the writer has observed that the presence of woody fibre in paper can be proved by this stain with nitric acid, which is given by most of our printing paper, but not by letter paper, the latter being doubtless chiefly made from white rags, from which repeated washing has abstracted all but pure cellulose. Cotton also, when raw, contains little or none of this albuminoid, as nitric acid will show. (The paper on which this work is printed is found by the writer to stand this nitric-acid test perfectly.) Some woods, particularly if cut during winter, contain also *starchy* matters, as the iodine-test will indicate. Water is one of the most practically important constituents of wood, green or fresh-cut wood being usually completely filled in every pore with it. Indeed, as cellulose is a definite substance of a definite density (1.525), it is probable that the amount of water contained in fresh-cut woods will furnish a pretty close index to their relative degree of *porosity*. The following figures, from Schübler and Hartig, show the proportions of water in different kinds of common woods when just cut:

Willow	26.0	Red beech	39.7
Sycamore	27.0	Aspen	43.7
Ash	28.7	Elm	44.5
Birch	30.8	Italian poplar	48.2
Oak	34.7	Larch	48.6
Horse-chestnut	38.2	White poplar	50.6
Pine	39.7	Black poplar	54.8

Seasoned or air-dried wood contains much less, of course, but still the proportion is quite important, though some of it is possibly combined in a manner similar to that of water of crystallization. At any rate, Rumford found that a temperature above that of boiling water, but short of that which produced any chemical alteration of the fibre (277° F.), was needed to expel all this water. He thus removed from air-seasoned woods additional water, as follows:

Oak	16.64 per cent.
Elm	18.20 " "
Beech	18.56 " "
Maple	18.63 " "
Birch	19.38 " "
Poplar	19.55 " "

What is usually called dry wood, used for fuel after exposure to the air for several months, may be regarded as containing still at least 20 per cent. of water.

Specific Gravity.—The fact that most wood floats on water must not be regarded as any indication of its true density. When sawdust or thin shavings are boiled with water, so as to expel the air from their pores, they are found then to sink readily, and have a density of about 1.5, approaching that of pure cellulose, 1.525. An instructive experiment is to dampen a wad of raw cotton with alcohol (which expels the air from its pores), squeezing out the excess. It will be found then to sink in water with great facility. The sinking of water-soaked wood is familiar to all.

The Ash.—Woods of different kinds, and even of the same kind, vary much in amount of ash and in its composition. Under ASHES (and also under POTASH, by H. WURTZ) will be found some information on these points. Oak wood was found by Berthier to contain 3.3 per cent. of ash, by Mollerat 1.4, and by Saussure only 0.2. In oak bark both Berthier and Saussure found 6 per cent. of ash. In pine wood Berthier found 0.83, Mollerat 1.8, and Saussure 2.9 per cent. Analyses of ashes of red-beech wood by Böttinger gave—

Chlorine	0.133
Silica	1.459
Sulphuric acid	1.351
Phosphoric "	3.065
Ferric oxide	0.803
Lime	63.244
Magnesia	11.270
Potash	15.794
Soda	2.887
	100.000

HENRY WURTZ.

Wood'chuck, Ground-Hog, or **Maryland Marmot,** the *Arctomys monax*, a large rodent mammal of North America, everywhere common except on the great Plains and westward. It is some eighteen inches long, and has a grizzled reddish brown fur, which has a limited industrial use. The creature is very prolific, eats clover, young cabbages, and beans, hybernates in cold weather, and is sometimes used for food, for which it is quite unfit. It is a courageous creature, and will often successfully contend with a dog of larger size than itself. It digs a deep burrow. (See SQUIRREL.)

Wood'cock, a name applied to two different game-birds of the snipe family. The European woodcock (*Scolopax rusticola*, Linn.) ranges over the Eastern continent from Japan to the British isles, and attains a length of fourteen inches, while the American bird (*Philohela minor*, Gray), which attains only eleven inches, is found abundantly in the Northern U. S. and in Canada. Both are highly prized by epicures for the delicacy of their flesh.

Woodcock, p.-b. and tp., Crawford co., Pa. P. of b. 220; of tp. 1723.

Wood'deson (RICHARD), D. C. L., b. at Kingston-upon-Thames, Surrey, England, May 15, 1745; educated at Pembroke and Magdalen colleges, Oxford; became Vinerian scholar 1766, and fellow of Magdalen 1771; became deputy Vinerian professor of civil law at Oxford 1772; was full professor 1777–93, and subsequently bencher of the Middle Temple and commissioner of bankrupts. D. in London Oct. 29, 1822. Author of *Elements of Jurisprudence* (1783) and *A Systematical View of the Laws of England* (3 vols., 1792–93; 2d ed. 1831; Philadelphia, 3 vols. in 1, 1842), considered by good jurists superior to Blackstone.

Wood Duck, or **Summer Duck** (*Aix sponsa*), one of the most beautiful members of the family of Anatidæ, and whose only congener is the still more beautiful mandarin duck (*Aix galericulata*) of China. Both of these have in common the bill shorter than the head, high at the base, where the upper lateral angle runs back much behind the lower edge, the nail very large and hooked, the lamellæ broad and distant, the nostrils very large and open, the wing-coverts nearly as long as the feathers, and the tail truncate at the tip. The species has the head green, glossed with purple, with a line from the upper corner of the bill, one from behind the eye, and two bars on the side of the head confluent with the chin, and upper part of throat white, the jugulum and tail at sides purple, the under parts white, the sides yellowish, banded with black, and subterminally with white, the speculum bluish-green, the primaries silver white at tip, and the back uniform with various reflections. It is about nineteen or twenty inches long. (*Baird.*) The species range over most of North America—in the warmer regions as a permanent resident, and in the northern as a summer migrant. In this last respect, rather contrasting with most of the other ducks, it is called the "summer duck." It chiefly builds its nest in a hollow tree, and this habit gives origin to the name "wood duck." Its favorite haunts are "the solitary deep and muddy creeks, ponds, and mill-dams of the interior," and it makes "its nest frequently in old hollow trees that overhang the water." (*Wilson.*) Its eggs are smaller than a hen's, and have surfaces like polished ivory. It is generally seen in pairs, and rarely in flocks of more than three or four. It feeds chiefly on acorns, the seeds of wild oats, and insects. The flesh is tolerably good food. THEODORE GILL.

Wood-Engraving. See ENGRAVING.

Wood'ensburg, p.-v., Baltimore co., Md. P. 54.

Wood'fall (HENRY SAMPSON), b. in London, England, in 1739; was son of the proprietor of the London *Public Advertiser*, and succeeded to the management of that paper, which he edited from 1760 to 1793, including the period during which the celebrated *Letters of Junius* appeared in that paper (1769–71); was prosecuted and tried for their publication June, 1770; printed the standard edition of *Junius* in 1772, and became master of Stationers' Hall 1797. D. at Chelsea Dec. 12, 1805. He probably never knew the secret of Junius, though an argument to the contrary has been alleged by the advocates of the Franciscan theory, from the fact that he was a schoolfellow of Philip Francis. —His son GEORGE, b. about 1780, succeeded to the business; brought out a famous edition of the Bible (4to, 1804), in which only one erratum has been detected, and employed Dr. John Mason Good to edit the *Letters of Junius* (1812), whence that edition is usually called *Woodfall's Junius*, and is supposed to derive peculiar authority from the name of its publisher. In fact, however, the only real *Woodfall's Junius* is the edition of 1772, and Good's edition of 1812 is the most misleading of all, from the fact that it includes a multitude of anonymous letters under different signatures, culled from the columns of the *Public*

Advertiser by Dr. Good, and attributed by him to Junius without any warrant.

Woodfall (William), brother of Henry Sampson, b in London, England, about 1745; assisted for some time his father and brother in the editorship of the *Public Advertiser*; established and conducted the *London Packet*, the *Morning Chronicle* 1772–89, and *The Diary* 1789 *seq.* In the latter paper he printed with great accuracy the *Parliamentary Debates*, also published separately (21 vols., 1794–99), which in great part were reported by himself. He was endowed with a wonderful memory, and sometimes wrote out many columns of a debate without any consultation of notes. D. in London Aug. 1, 1803.

Wood'ford, county of Central Illinois, lying on Illinois River, and having railway connection with Chicago: surface level, with an abundance of coal; soil fertile. Horses, cattle, and swine are numerous. Staples, Indian corn, oats, wheat, hay, and dairy products. Cap. Metamora. Area, about 500 sq. m. P. 18,956.

Woodford, county of Central Kentucky, lying on Kentucky and Elkhorn rivers, and traversed by Louisville Cincinnati and Lexington R. Rs.; surface diversified, soil fertile. Horses, mules, cattle, and swine are numerous. Staples, Indian corn, wheat, oats, hay, wool, and hemp. Cap. Versailles. Area, 185 sq. m. P. 8240.

Woodford, p.-v. and tp., Bennington co., Vt. P. 371.

Woodford (Edward), LL.D., b. near Elgin, Scotland, Apr. 15, 1800; educated at King's College, Aberdeen; was a classical tutor successively at Aberdeen, Edinburgh, and Jedburgh; became a royal inspector of schools for Scotland 1850, and was for many years principal of the Madras College at the University of St. Andrew's. D. at Edinburgh Jan. 6, 1869. Author of *Eclogæ Horatianæ* (1849; new ed. 1855), *Elements of the Latin Language* (1854; 3d ed. 1862), *Tables of Latin Verbs* (1855; new ed. 1862), an *Epitome of Cæsar's Commentaries* (4th ed. 1860), which enjoyed a wide reputation, and other works, religious and educational.

Woodford (James Russell), D. D., b. at Henley-on-Thames, England, Apr. 30, 1820; studied at Merchant Taylors' School, London; graduated with both classical and mathematical honors at Pembroke College, Cambridge, 1842; took orders in the Church of England 1843; was incumbent of Easton, Somersetshire, 1847–55, vicar of Kempsford, Gloucestershire, 1855–68; was for some years examining chaplain to Bishop Wilberforce of Oxford, who in 1867 appointed him an honorary canon of Christ church, Oxford; was vicar of Leeds 1868–73, select preacher before the University of Cambridge 1864, 1867, and 1873, and was consecrated in Westminster Abbey as bishop of Ely Dec. 14, 1873. Author of several volumes of *Sermons*, of *Lectures* on the Creed (1855), *Ordination Lectures* (1861), *Lectures on the Church, Past and Present* (1852); edited the third series of *Tracts for the Christian Seasons* (4 vols., 1863–64), and contributed to *Sermons for the Working Classes* (1858) and the Oxford *Sermons during Lent* (1865).

Woodford (Samuel), D. D., b. in London, England, in 1636; educated at Wadham College, Oxford; studied law at the Inner Temple; took orders in the Church of England 1669; became rector of Hartley-Maudnit, Hampshire; prebendary of Chichester 1676, and of Winchester 1680. D. in 1709. Author of *A Paraphrase upon the Psalms of David* (1667; 3d ed., 2 vols., 1713) and *A Paraphrase upon the Canticles and some Select Hymnes of the New and Old Testaments, with other occasional Compositions in English Verse* (1679), in the introduction to which he discusses the merits of Milton's blank verse, and commends his recently-issued *Paradise Lost*.

Woodford (William), b. in Caroline co., Va., in 1735; distinguished himself in the French and Indian wars; was appointed colonel of the 2d Virginia regiment on the assembling of the Virginia troops at Williamsburg in the autumn of 1775; repulsed the fleet of Lord Dunmore from Hampton Roads, sinking five vessels; commanded at the battle of Great Bridge on the Elizabeth River, Dec. 9, 1775, winning a signal victory; called to arms the militia of Norfolk and Princess Anne counties; occupied Norfolk in triumph Dec. 14; took command of the 1st Virginia brigade; was commissioned brigadier-general by Congress early in 1777; was wounded at Brandywine; took an active part in the battles of Germantown and Monmouth; went to the relief of Charleston, S. C., with Virginia and North Carolina recruits, marching 500 miles in 28 days; reached that city Apr., 1780; was taken prisoner during the siege, and carried to New York, where he d. Nov. 13, 1780. Counties in Kentucky and Illinois bear his name.

Wood Grouse. See Capercailzie and Tetraoninæ.

Woodha'nus, tp., Henry co., Ala. P. 600.

Wood'head (Abraham), b. at Malham, Yorkshire, England, in 1608; graduated at University College, Oxford, about 1628; became a fellow there 1633; took orders in the Church of England; travelled repeatedly on the Continent; was proctor of Oxford University 1641; visited Rome in that year, and secretly became a Roman Catholic; was deprived of his fellowship by the Parliamentary visitors 1648; was restored 1660, but soon refused to conform to the Church of England, and spent the remainder of his life in concealment, chiefly at Hoxton, near London, writing controversial books of great ability in favor of Roman Catholicism. D. at Hoxton May 4, 1678.

Wood'house (James), M. D., b. at Philadelphia, Pa., Nov. 17, 1770; graduated at the University of Pennsylvania 1787, and in medicine 1792; served as a surgeon in Gen. St. Clair's expedition against the Western Indians 1791, and was professor of chemistry in the University of Pennsylvania from 1795 to his death, June 4, 1809. Author of *The Young Chemist's Companion* (1797), *Experiments and Observations on Vegetation* (1802), and other treatises; edited Parkinson's *Chemical Pocket-Book* (1802) and Chaptal's *Chemistry* (2 vols., 1807).

Woodhouse (Robert), b. at Norwich, England, Apr. 28, 1773; was a cousin of Mrs. Amelia Opie; graduated at Caius College, Cambridge, as senior wrangler and first Smith's prizeman 1795; became a fellow there 1798; Lucasian professor of mathematics 1820; Plumian professor of astronomy and experimental philosophy 1822, and first superintendent of the Cambridge Observatory 1824. He married a sister of William Wilkins, the architect, 1823. D. in London Dec. 23, 1827, and was buried in the chapel of Caius College. Author of *The Principles of Analytical Calculation* (1803), *Plane and Spherical Trigonometry* (1809; 5th ed. 1827), *Isoperimetrical Problems and the Calculus of Variations* (1810), and *An Elementary Treatise on Plane Astronomy* (1812), republished under the title *A Treatise on Astronomy, Theoretical and Practical* (2 vols., 1818–23). These works "produced a revolution in mathematical studies," and their author was regarded on high authority as "one of the most philosophical thinkers and useful guides of his time."

Woodhouselee. See Tytler (Alexander Fraser).

Wood'hull, p.-v., Henry co., Ill.

Woodhull, p.-v. and tp., Shiawassee co., Mich. P. 776.

Woodhull, p.-v. and tp., Steuben co., N. Y. P. of v. 392; of tp. 1997.

Woodhull (Nathaniel), b. at Mastic, Suffolk co., L. I., Dec. 30, 1722; served in the French war of 1755–63 as colonel of the 3d New York regiment; sat in the provincial legislature 1769–76; was president of that body 1776; took command as general of Long Island militia on the landing of the British in August; was surprised and taken prisoner a few days later by a party of British light-horse near Jamaica, when, after delivering up his sword, he was so brutually wounded that he died at Gravesend Sept. 20, 1776. A narrative of his capture and death was published by H. Onderdonk, Jr. (New York, 1848), and his *Journal* of the expedition to Montreal in 1760 was printed in the *Historical Magazine* for Sept., 1861.

Wood Ibis. See Ibis.

Wood Island, off the entrance to Saco and Winter harbors, Me., has a stone lighthouse, showing a flashing red light; lat. 43° 27′ 23″ N., lon. 70° 19′ 25″ W.

Wood'land, p.-v., cap. of Yolo co., Cal.

Woodland, tp., Carroll co., Ill. P. 906.

Woodland, tp., Fulton co., Ill. P. 1602.

Woodland, p.-v. and tp., Decatur co., Ia. P. 782.

Woodland, p.-v. and tp., Barry co., Mich. P. 1376.

Woodland, tp., Wright co., Minn. P. 593.

Woodland, tp., Burlington co., N. J. P. 389.

Woodland, tp., Sauk co., Wis. P. 891.

Wood'land Planta'tion, tp., Aroostook co., Me. P. 174.

Wood'lawn, tp., Dallas co., Ala. P. 1045.

Woodlawn, p.-v. and tp., Monroe co., Mo. P. 935.

Wood'-Louse, a popular name for various sessile-eyed, fourteen-footed isopod crustaceans, of the families Armidillidæ and Oniscidæ, and of the genera *Porcellio*, *Oniscus*, *Armadillo*, etc. They are otherwise called slaters, and the larger ones are also called sow-bugs and pill-bugs. They inhabit moist places, rotten wood, cellars, etc., and are often found under stones.

Wood'man, p.-v. and tp., Grant co., Wis. P. 559.

Woodman (John Smith), b. at Durham, N. H., in 1819; studied at South Berwick Academy; graduated at Dartmouth College 1842; taught school at Charleston, S. C.,

1842–46; made a tour of Europe on foot 1847–48; studied law at Dover, N. H.; practised his profession there and at Rollinsford; was professor of mathematics at Dartmouth College 1851–56; taught also in the Chandler Scientific School from its establishment in 1852; became in 1856 professor of civil engineering, vice president, and practical head of that institution, and retained those posts until his death, at Durham, N. H., May 15, 1871.

Wood'-Oil, a fine aromatic drying oil used in making varnish, in preventing insect ravages, in making lithographic ink, and in medicine as a cure for gonorrhœa. It comes from Burmah, and is produced by the *Dipterocarpus turbinatus* and other trees.

Woodpecker. See PICIDÆ.

Wood, Preservation of. See PRESERVATION OF TIMBER, by H. WURTZ, A. M.

Wood-Rat. See RAT.

Wood'ruff, the *Asperula odorata*, a favorite herb of the European peasants, belonging to the order Rubiaceæ. It has, when dry, a pleasant odor, somewhat like that of the Tonquin bean or sweet clover. The Germans put it into their May-drink (*Maitrank*) and into homemade beer. In this country they substitute *Galium triflorum*, a related plant with a similar smell.

Woodruff, county of N. E. Arkansas, lying on White River, and intersected by Bayou Deview and Cache River; surface generally level, soil fertile. Swine and cattle are the chief live-stock. Staples, cotton and Indian corn. Cap. Augusta. Area, 575 sq. m. Pop. 6891.

Woodruff, tp., Spartanburg co., S. C. P. 1108.

Wood-Rush. See LUZULA.

Woods (ALVA), D. D., son of Rev. Abel Woods, a Baptist minister, and nephew of Dr. Leonard Woods of Andover Seminary, b. at Shoreham, Vt., Aug. 13, 1791; fitted for college at Phillips Andover Academy under Dr. John Adams; graduated at Harvard 1817, and at Andover Seminary 1821, having spent one year (1819) as assistant principal in Phillips Academy; was professor of mathematics and natural philosophy in Columbian College, D. C., 1821–24, spending one year of the time in Europe; professor of mathematics and natural philosophy in Brown University 1824–28; president of Transylvania University, Lexington, Ky., 1828–31, and president of the University of the State of Alabama at Tuscaloosa 1831–37. Since 1839 he has resided in Providence, R. I. The degree of D. D. was conferred upon him by Brown University in 1828. He has founded a lectureship of elocution in Newton Theological Seminary and five scholarships in Brown University. He has published several baccalaureate and other academical discourses. R. D. HITCHCOCK.

Woods (CHARLES R.), b. in Licking co., O., about 1831; graduated from the U. S. Military Academy July 1, 1852, when appointed brevet second lieutenant of infantry; served in garrison and on frontier duty until 1861. In the attempt to relieve Fort Sumter (Apr., 1861) he commanded the troops on the steamer Star of the West; served in the West Virginia campaign, and appointed colonel 76th Ohio Vols. Oct. 23, 1861. Engaged with his regiment at Fort Donelson and Shiloh; in command of brigade during siege of Corinth, of regiment at Chickasaw Bayou, Arkansas Post, and during siege of Vicksburg. Commissioned brigadier-general of volunteers Aug., 1863, and engaged in battle of Chattanooga. In Sherman's Atlanta campaign and subsequent march to Savannah and through the Carolinas to Washington he commanded a division of the 15th corps, participating in all the actions of those campaigns, and retained in the volunteer service, in command of districts, etc., until Sept. 30, 1866, when he resumed his regular army duties, having been appointed lieutenant-colonel 33d Infantry July 28, 1866. Became colonel 2d Infantry in 1874, in December of which year he was retired from active service. For gallantry in action during the civil war he was brevetted lieutenant-colonel, colonel, brigadier and major general.

Woods (LEONARD), D. D., b. at Princeton, Mass., June 19, 1774; graduated at Harvard 1796; studied theology; was ordained pastor of the Congregational church at West Newbury 1798; took an active part in the Unitarian controversy, vindicating "orthodox Calvinism" against Drs. Ware, Buckminster, and Channing; was prominent in the organization and management of tract, education, temperance, and foreign missions societies; was professor of theology in Andover Seminary from its establishment in 1807 until 1846, and emeritus professor from that time until his death, Aug. 24, 1854. Among his works were *Letters to Unitarians* (1820), *Reply to Dr. Ware's Letters to Trinitarians* (1821), *Lectures on the Inspiration of the Scriptures* (1829), *Letters to Rev. N. W. Taylor* (1830), *Memoirs of American Missionaries* (1833), *An Examination of the Doctrine of Perfection, etc.* (1841), *Reply to Mr. Mahan on the Doctrine of Perfection* (1841), *Lectures on Church Government* (1843), and *Lectures on Swedenborgianism* (1846). A collective edition of his *Works* appeared at Andover (5 vols., 1849–50; 4th ed. 1860). He left in MS., nearly completed, a *History of the Andover Theological Seminary*, which has not been published.

Woods (LEONARD, JR.), D. D., LL.D., son of the preceding, b. at Newbury, Mass., Nov. 24, 1807; graduated at Union College 1827, at Andover Seminary 1830, and was tutor there 1831; was ordained to the Congregational ministry 1833; translated George Christian Knapp's *Lectures on Christian Theology* (2 vols., 1831–33); edited the *Literary and Theological Review* (New York, 1834–37); was professor of sacred literature in Bangor Theological Seminary 1836–39, and president of Bowdoin College 1839–66. He received the degree of D. D. from Harvard in 1846 and of LL.D. from Bowdoin in 1866. In 1867 he visited Europe to obtain documentary materials on the early history of Maine. He published occasional orations and discourses. D. at Boston, Mass., Dec. 24, 1878.

Woods'boro', p.-v. and tp., Frederick co., Md. P. 2064.

Woods'dale, p.-v. and tp., Person co., N. C. P. 1596.

Woods'field, p.-v., Centre tp., cap. of Monroe co., O. P. 753.

Wood's Hole, p.-v., Barnstable co., Mass.

Wood'side, p.-v. and tp., Sangamon co., Ill. P. 1385.

Woodside, tp., Essex co., N. J. P. 1472.

Wood'son, county of S. E. Kansas, drained by branches of Neosho and Verdigris rivers, and traversed in the N. E. corner by Missouri Kansas and Texas R. R.; surface generally undulating, soil fertile. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, wheat, hay, potatoes, butter, and wool. Cap. Defiance. Area, 504 sq. m. P. 3827.

Wood'sonville, p.-v. and tp., Hart co., Ky. P. of v. 110; of tp. 1420.

Wood-Sorrel. See OXALIS.

Wood-Spirit, and the Alcohols. In the article HOMOLOGY will be found a table of the alcohol-series, of which wood-spirit or METHYL ALCOHOL (which see, by PROF. CHANDLER) is the first member. The chemical properties of this compound have been described by Prof. Chandler, and the object of this present article is to present a very brief discussion of the alcohols as a natural group, and of their relations to each other and to other bodies (supplementary to what will be found under the two heads ALCOHOL and ALCOHOLS, also by PROF. CHANDLER), and particularly to convey an idea of the *molecular volumic* relations (see VOLUMES, MOLECULAR: also WATER OF CRYSTALLIZATION, by HENRY WURTZ) between the alcohols themselves, and between them and their derivatives; which have formed special subjects of investigation of the present writer.

The earliest important view regarding the constitution of common alcohol was presented by Dumas, to the effect that it was a compound of *water* and *ethylene*: $H_2O + H_4C_2$ C_2H_6O. By simply doubling the assumed formulæ of all the alcohols—a step for which many strong reasons may be cited; among others, that this series is thus brought into immediate relation with the directly-derived *ether* series—they may *all* be brought under the view of Dumas, and expressed as compounds of two molecules of water with *n* molecules of ethylene: $2H_2O.nH_4C_2$. Dumas's suggestion was superseded, in the minds of chemists, by the *alcohol-radical* hypothesis, which was supposed to establish an analogy between the alcohols and the "hydrates" of metallic oxides, the ethers being likewise thus made analogous to simple metallic oxides. The alcohol-radicals, having been invented for the purpose of establishing these entirely fallacious and delusive analogies, seem to have been adhered to, apparently, from habit, no other reason appearing clearly, since the invention of the radical *hydroxyl* (OH), now so much in vogue, and which in the school-books of the present day is represented as an essential constituent, with the alcohol-radicals themselves, of the alcohols.

One mode of derivation which is now imagined for the alcohols is from marsh-gas and its homologues, by substitution of hydroxyl for hydrogen. Several series are thus derived, according to the number of hydrogen-equivalents so replaced: but we have now only to deal with the so-called *monatomic* or ordinary alcohols, in which there has been but one such imaginary replacement. The substantial warrant for this view appears to be found in the fact that marsh-gas and chlorine react and form a compound having the formula CH_3Cl, which on treatment with potash yields

wood-spirit (CH_4O), there being here three assumptions made, that the product of the first reaction is $(CH_3).Cl$, chloride of methyl, and that of the second $(CH_3).OH$, potash itself being also assumed to be $K.(OH)$. The reactions may, on these hypotheses, be stated very simply, as follows:

$$CH_4 + Cl_2 = (CH_3)Cl + HCl;$$

and $$(CH_3)Cl + K(OH) = \overset{\text{Wood-spirit.}}{CH_3.OH} + KCl.$$

In like manner, common alcohol is derivable from the next homologue in the marsh-gas series, C_2H_6 (see HOMOLOGY); but it is usually considered as being also derived from marsh-gas itself, by the further substitution of methyl for another equivalent of hydrogen; thus, $C.H.H.H.H$ becomes $C.H.H.OH.CH_3 = C_2H_6O$. If, instead of methyl, ethyl (C_2H_5) be the substituting agent, we get propionic alcohol ($C.H.H.OH.C_2H_5 = C_3H_8O$). Thus, "*ethylic*" alcohol contains *methyl*, and "*propylic*" alcohol contains *ethyl*. In the language of this newer theory, however, it would appear that ethyl may be regarded as $H_2C.H_3C$, and propyl as $H_2C.H_2C.H_3C$; thus *two alcohol-radicals only* being really admitted as essential. This is certainly a great step in simplification over the original alcohol-radical hypothesis.

A highly important element in the newer system is the reduction of compounds to *typical* groups, which is always sought for. The alcohols are regarded as belonging to the marsh-gas type. No idea of molecular structure appears to be attached to these types, except an arbitrary connection by the so-called "bonds of atomicity," which may even be *provisionally* placed upon the same plane, showing conclusively the artificiality of the system, and the impossibility that it can represent any true relations, such as must exist in nature. (See TYPE-THEORIES.) No definite entity seems even to attach to the group H_2C, although it occurs in the notation far oftener than any other group. It has been only considered as a "residue," representing so much atomicity or equivalence, and not as a compound radical; certainly not in the same sense in which *ammonium* and *cyanogen*, for example, are known to be compound radicals. The fact that in the alcohols and in all other series of homologues this group (H_2C) constitutes the invariable increment, seems strangely to have passed out of consideration altogether in the so-called "new" or "atomistic" chemistry. The idea of *serial relation*, and the fact itself, are indeed altogether and studiously suppressed, being swallowed up in that of *derivation from types*. The marsh-gas homologues or petroleum hydrocarbons themselves must be, on this system, and often are, looked upon as all derivable from the same type, by the help of the old alcohol-radicals; thus,

$$\begin{aligned} CHHH.H &= CH_4, \\ CHHH.CH_3 &= C_2H_6, \\ CHHH.C_2H_5 &= C_3H_8, \\ CHHH.C_3H_7 &= C_4H_{10}, \\ CHHH.C_4H_9 &= C_5H_{12}. \end{aligned}$$

Nevertheless, the present writer has ventured to conclude, from special studies of his own, that a return to the idea of universal *serial* relations, and of derivation of chemical compounds in series, instead of from types, is necessary to further real progress in the science of chemistry, and believes that conclusive evidence of this may be presented. Under VOLUMES, MOLECULAR, it has been shown that a simple chemical molecule is always reducible to a *cubical equivalent volume;* and the application of this discovery to the study of homologous series has proved—as there also shown—that the group of elements (H_2C) is a distinct *compound radical*—as much so as *ammonium* or *cyanogen*. The proof is moreover positive that it is impossible to accept any other group of C and H, such as H_3C, methyl, or H_5C_2, ethyl, as fulfilling any *radical* function, either real or imaginary.

This being the case, the application to the alcohol-series becomes a matter of immediate interest. The first step is to ascertain the increments of volume which accompany the derivation of each member of the series by the addition of successive molecules of H_2C, or *homologen*. In order to do this the *density* of each member of the series must be found, as closely as possible, at the temperature of 28° F. (see ZERO), that at which ice *begins to melt*, which has been found to be the standard point to which volumes are to be referred. An empirical or approximate rule has been arrived at by the writer for reducing densities taken at melting ice to this point, by deducting their products into .004. Column 4 of the following table contains these corrected figures, derived from the means, in Column 3, of *all the densities on record*, taken at melting ice. Column 5 contains the computed equivalent volumes (multiplied by 1000, as explained under VOLUMES, MOLECULAR). It should be stated that these volumes are double those usually calculated, the usual formulæ of the whole series having been doubled. The reason for this will appear at once, the demonstration of the necessity of this doubling being contained in the table itself:

1.	2.	3.		4.	5.	6.	7.
	Compounds.	Experimental densities.		Mean densities, corrected by deducting .004 D.	Equivalent volumes, corrected.	Increments of volume, representing $2H_2C$.	Theoretical cubical increments, according to the geometric law.
		Determinations on record at 0° C.	Mean of determinations at 6° C.				
1.	Wood-spirit	3	.8176	.8143	78595	.....	$4 \times (27)^3 = 78732$
2.	Spirit of wine	7	.81065	.8074	113946	35351	$2 \times (26)^3 = 35152$
3.	Propionic alcohol	5	.82062	.8173	146825	32879	$(25)^3 + (26)^3 = 33201$
4.	Butyric alcohol	6	.8252	.8219	180048	33223	" " $= 33201$
5.	Fusel oil	18	.8271	.8238	213644	33596	" " $= 33201$
6.	Caproic alcohols: Mean of Heeht	2	.8286	.8253	247171	33527	" " $= 33201$
7.	Dominant (normal?) form	5	.834	.8307	245576	31932	$2 \times (25)^3 = 31250$

Sums of increments 1 to 6 ..... 168576 167956
167956

Total error ..... = 620
Average error for each increment ..... = 125 = $\frac{1}{1250}$ +.

With regard to *capraic alcohol*, the view of the writer is that two isomeric modifications are indicated. Those who reject this view, however, will find that the result of averaging the whole (taking in then, of necessity, a still lower zero-figure of Buff, believed by the writer to indicate a third isomere) will give a still closer correspondence to the law of cubes, making the average of the eight figures .83, and the increment of No. 6 = 33130.

The conclusion drawn from these facts is, that the alcohols are derived from wood-spirit by successive additions of two molecules of the radical H_2C, *dihomologen*. Representing this by Hm_2, the alcohols must be $2(CH_4O).Hm_2$; $2(CH_4O).Hm_4$; $2(CH_4O).Hm_6$, and so on.

It remains, then, to be considered what is the constitution of the nuclear compound $C_2H_8O_2$, or wood-spirit. Analogy at once leads us to regard it as also containing dihomologen, H_4C_2; and on taking away from it this group we find remaining the nucleus H_4O_2, or the equivalent of $2H_2O$. Two hypotheses now beset us, which are susceptible of being tested and investigated by the geometric law. These involve the question whether this nucleus is really made up of two molecules of water, or contains the elements in dissociated forms, as H_4 and O_2; the latter being found to be unmistakably the case in large numbers of other organic series. (See, for example, the volumic formulæ of the *Fatty Acids* in the article upon WATER OF CRYSTALLIZATION.) Computations far too voluminous to be repeated here have established conclusively the probabilities in favor of the first hypothesis that wood-spirit actually contains H_2O, and in the cubical volume which it occupies in *ice*, the symbol adopted for which (see VOLUMES, MOLECULAR) is $\overset{H\delta}{27}$. The alcohol-series becomes then, constitutionally,

1. $\overset{H\delta}{27}.\overset{H}{27}$,
2. $\overset{H\delta}{27}.\overset{H}{27}.\overset{H}{26}$,
3. $\overset{H\delta}{27}.\overset{H}{27}.\overset{H}{27}.\left(\overset{H}{25}\ \overset{H}{26}\right)$,
4. $\overset{H\delta}{27}.\overset{H}{27}.\overset{H}{27}.\overset{H}{26}.\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right)$,
5. $\overset{H\delta}{27}.\overset{H}{27}.\overset{H}{27}.\overset{H}{26}.\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right)$,
6. $\overset{H\delta}{27}.\overset{H}{27}.\overset{H}{27}.\overset{H}{26}.\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right).\left(\overset{H}{25}\ \overset{H}{26}\right)$;

there being doubt remaining as to whether the sixth dihomologen or ethylene molecule in No. 6 may not be $2\overset{H}{25}$. (See the previous table.)

It appears, therefore, that by volumic investigation of the alcohols we are distinctly remanded back to the track

first indicated by Dumas, and must decide that they are really and truly compounds of water (or at least of H_2O) and *ethylene*. We learn further, however, that ethylene itself is not a simple radical, as inferred by Dumas, and still held by many, but is itself compounded of two groups, alike and equal. It must therefore be called dihomologen. We should expect, therefore, to find this double radical divided in some cases. This is found to be the case in the ether-series, in which the successive incremental volumes have been found to be single cubes, and which have been proved, by a mode of investigation similar to that applied to the alcohols, to have the constitution (for the dominant series)—

4. $\frac{H\delta}{26}\cdot\frac{2}{27}\cdot\frac{2}{28}$;
5. $\frac{H\delta}{26}\cdot\frac{2}{27}\cdot\frac{2}{28}\cdot\frac{H}{26}$;
6. $\frac{H\delta}{26}\cdot\frac{2}{27}\cdot\frac{2}{28}\cdot\frac{H}{26}\cdot\frac{H}{25}$;
7. $\frac{H\delta}{26}\cdot\frac{2}{27}\cdot\frac{2}{28}\cdot\frac{H}{26}\cdot\frac{H}{25}\cdot\frac{H}{24}$;
8. $\frac{H\delta}{26}\cdot\frac{2}{27}\cdot\frac{2}{28}\cdot\frac{H}{26}\cdot\frac{H}{25}\cdot\frac{H}{24}\cdot\frac{H}{26}$.

The numbers refer to the number of equivalents of carbon contained in each, serving to designate them—with an avoidance of all hypothesis—as *4-carbon, 5-carbon, 6-carbon ether*, and so on. The geometric molecule of H_2O here contained is that which predominates in ordinary liquid water. The question naturally arises whether these geometric or cubical molecules of H_2O, or *hydor*, are of the same nature as those of crystal-water $\frac{H\delta}{24}$. (See article WATER OF CRYSTALLIZATION.) The reply that we appear to be conducted to by the course of investigation is that the difference is of the kind that has been called, in previous articles upon this subject, a *typical* one. Crystal-water, as it occurs in salts, $\frac{H\delta}{24}$, and in glacial sulphuric acid, $\frac{H\delta}{23}$ and $\frac{H\delta}{22}$, belongs to the Diametric Type 3, while the $\frac{H\delta}{26}$ and $\frac{H\delta}{27}$, found in liquid water and in the ethers and alcohols, belong to Type 1.

(The limits of this article forbid the adequate following up further of this subject, for which reference must be made to pending articles in the *American Chemist* and other scientific journals.) HENRY WURTZ.

Wood's Shop, tp., Chambers co., Ala. P. 1231.

Wood'stock, port of entry, cap. of Carleton co., N. B., on New Brunswick and Canada Railway, on the river St. John, which is navigable at high and medium stages of water. It is 12 miles E. of Houlton, Me., and is in a fertile region. Red hæmatite iron ore, charged with manganese, abounds here, and the town has iron-furnaces whose product is of the best quality for steel, and which is shipped to England for use in plating ships of war. The town has a county grammar school and a convent, and 1 monthly and 1 weekly periodical. P. of sub-district, 3963.

Woodstock, port of entry, cap. of Oxford co., Ont., Canada, on Great Western Railway, 28 miles E. N. E. of London, and on the river Thames and Cedar Creek, which affords water-power. It is well built, and finely situated in a healthy and fertile region, and has 9 churches and several fine schools, including the Canadian Institute, an academy, and the county grammar school. There are 3 five-story steam oatmeal mills, and 2 weekly newspapers. P. 3982.

Woodstock, p.-v. and tp., Windham co., Conn. P. 2955.

Woodstock, p.-v., cap. of McHenry co., Ill., on Northwestern R. R., 51 miles N. of Chicago, has 6 churches, 1 seminary, a public-school building, 1 bank, 2 newspapers, pickling and canning works, 2 mills, and 1 hotel. Principal business, farming and dairying. P. 2500.
G. S. SOUTHWORTH, ED. "SENTINEL."

Woodstock, tp., Schuyler co., Ill. P. 1503.

Woodstock, tp., Wright co., Ia. P. 144.

Woodstock, tp., Oxford co., Me. P. 994.

Woodstock, p.-v., Howard co., Md.

Woodstock, tp., Lenawee co., Mich. P. 1365.

Woodstock, p.-v. and tp., Grafton co., N. H. P. 405.

Woodstock, p.-v. and tp., Ulster co., N. Y. P. 2022.

Woodstock, v., West Farms tp., Westchester co., N. Y. P. 307.

Woodstock, p.-v. and tp., cap. of Windsor co., Vt., has a fine park, extensive water-power, utilized by a large number of manufactories, 2 banks, 6 churches, and 3 newspapers. P. 2910.

Woodstock, p.-v., cap. of Shenandoah co., Va., on the Valley branch of Baltimore and Ohio R. R., and on the N. branch of Shenandoah River, has 5 churches, good schools, 1 savings bank, 1 large manufactory, 2 newspapers, and 3 hotels. Principal business, manufacturing and farming. P. 1400. J. C. OTT, ED. "SHENANDOAH DEMOCRAT."

Woods'town, p. v., Salem co., N. J., 25 miles S. of Philadelphia, with which it has communication by railway and steamboat, contains 6 churches, 1 academy, 1 bank, 1 newspaper, and 1 manufactories. Rich beds of marl exist here. P. 1911. WM. TAYLOR, ED. "REGISTER."

Woods'ville, p.-v., Grafton co., N. H.

Wood'-Swallows, or **Swift Shrikes,** a group of birds greatly resembling swallows in habits and appearance, but assigned to the Ampelidæ or chatterers, and to the sub-family Dicrurinæ. In the East Indies and Australia they abound. The *Artamus sordidus*, an Australian species, has the habit of forming clusters like those formed by honey-bees on their hives, the whole flock clinging together, and sometimes forming a mass as large as a bushel basket. They eat insects and seeds.

Wood Type. See PRINTING, by W. S. PATERSON.

Wood'ville, p.-v. and tp., Jackson co., Ala. P. 993.

Woodville, tp., Greene co., Ill. P. 1352.

Woodville, p.-v., McCracken co., Ky. P. 68.

Woodville, tp., Wascca co., Minn. P. 1031.

Woodville, p.-v., cap. of Wilkinson co., Miss.

Woodville, tp., Bertie co., N. C. P. 1535.

Woodville, v., Wayne tp., Clermont co., O. P. 72.

Woodville, p.-v. and tp., Sandusky co., O. P. 1118.

Woodville, p.-v., cap. of Tyler co., Tex.

Woodville, tp., Calumet co., Wis. P. 1023.

Woodville, or **Wydeville.** See RIVERS, EARL OF.

Woodville (RICHARD CATON), b. in Baltimore, Md., about 1825; educated at St. Mary's College; studied at Düsseldorf 1847–50, and at Paris 1851–53, and became a distinguished genre painter. D. at London, England, Sept. 13, 1855. Among his best pieces are *The Card-Players* (1847), *The Game of Chess* (1850), *Waiting for the Stage*, and *The Sailor's Wedding*.

Wood'ville Planta'tion, tp., Penobscot co., Me. P. 170.

Wood'ward, tp., Clearfield co., Pa. P. 1031.

Woodward, tp., Clinton co., Pa. P. 1061.

Woodward, tp., Lycoming co., Pa. P. 737.

Woodward (ASHBEL), M. D., b. at Wellington, Conn., June 26, 1804; graduated in medicine at Bowdoin College 1829; has since practised his profession at Franklin, Conn., and was for many years president of the Connecticut Medical Society. Author of *A Vindication of Gen. Putnam* (1841), *An Historical Account of the Connecticut Medical Society* (1859), *Biographical Sketches of the Early Physicians of Norwich* (1859; new ed. 1862), *Medical Ethics* (1860), *A Memoir of Col. Thomas Knowlton* (1861), *Life of Gen. Nathaniel Lyon* (1862), *An Historical Address, delivered in Franklin, Conn., Oct. 14, 1868, etc.* (2d ed. 1870); rendered assistance in Hollister's *Connecticut*, Bond's *Watertown*, and Stiles's *Ancient Windsor*, and contributed to medical and miscellaneous periodicals, having printed about 40 papers in the *Genealogical Register*.

Woodward (BERNARD BOLINGBROKE), F. S. A., son of Samuel (1789–1838), b. at Norwich, England, May 2, 1816; educated at Norwich School; was for a short time tutor in a private school, then clerk in the banking-house of Messrs. Gurney at Great Yarmouth; studied theology in the Independent college at Highbury, near London, 1839–40; took his degree of B. A. at London University 1841; was settled in 1843 as minister of a Congregational church at Wortwell, near Harleston, Norfolk; assisted his friend, the printer John Childs, in some of his larger undertakings, especially in preparing a new edition of James Barclay's *Universal English Dictionary* (1848); edited his father's *Norwich Castle* (1847); settled in London as a professional man of letters 1849; wrote for many periodicals; wrote a *History of Wales, from the Earliest Times to its Final Incorporation with England, etc.* (2 vols., 1850–52); completed a *History of the U. S. of North America to the End of the Administration of President Polk* (3 vols., 1855), which had been commenced by William Henry Bartlett; was co-editor (with John Morris and W. Hughes) of Maunder's *Treasury of Knowledge* (1859); wrote several admirable works for the young, including *First Lessons on the English Reformation* (1857); was appointed librarian in ordinary to Queen Victoria and keeper of the prints and drawings at Windsor Castle July 6, 1860; edited a *History of Hampshire* (1859–62), for which he wrote the portion relating to Winchester; founded the *Fine Arts Quarterly Review* (1863), a periodical of a high class, which was discontinued for lack of support 1865; published *Windsor Castle, Thirty Photographs, printed in Permanent Color,*

with Descriptive Text (1869), and *Specimens of the Drawings of Ten Masters, from the Royal Collection at Windsor Castle, with 20 Photographs* (1869), and translated Elisée Reclus's *The Earth* and *The Ocean, Atmosphere, and Life;* and was actively engaged upon his chief work when he d. at London Oct. 12, 1869. He had been a valued literary counsellor and assistant of the queen and of Prince Albert, and was much esteemed for his genial manners and his wide culture. He had projected at the outset of his literary career an historical and chronological cyclopædia for students and general readers, and in 1860 associated in the task Mr. William L. R. Cates, who completed and issued *The Encyclopædia of Chronology, Historical and Biographical* (1872), a work of the highest accuracy and value. Mr. Woodward had commenced, some years before his death, a *Life of Leonardo da Vinci*, to be illustrated by that artist's anatomical drawings in the royal collection at Windsor, and contemplated important works on the archæology of England and Wales.

Woodward (E. T.), U. S. N., b. Mar. 8, 1843, in Vermont; graduated at the Naval Academy in 1861; became lieutenant in 1864, lieutenant-commander in 1866; served in the Scioto at the capture of New Orleans and passage of the Vicksburg batteries in 1862, and was handsomely mentioned in official reports. FOXHALL A. PARKER.

Woodward (GEORGE W.), b. at Bethany, Pa., Mar. 26, 1809; received an academic education; became a lawyer; was a member of the State constitutional convention of 1837, president judge of the fourth judicial district 1841–51, judge of the supreme court of Pennsylvania 1852–67, and Democratic member of Congress 1867–73. D. at Rome, Italy, May 10, 1875.

Woodward (HENRY), F. G. S., brother of Samuel P., b. at Norwich, England, about 1825; obtained distinction as a geologist and writer on palæontology, having given special attention to the structure and classification of the fossil Crustaceæ, on which subject he wrote several reports for the British Association and several papers in the scientific periodicals, and contributed a monograph on the *Merostomata* to the volumes of the Palæontological Society. He is now (1877) assistant keeper of the geological department of the British Museum and editor of the *Geological Magazine*.

Woodward (JOHN), M. D., F. R. S., b. in Derbyshire, England, May 1, 1665; was originally a linen-draper; studied medicine, comparative anatomy, and natural history under Dr. Peter Barwick at the seat of Sir Ralph Dutton in Gloucestershire; received the degree of M. D. from Archbishop Tenison; devoted his attention to the fossils occurring in the shelly limestones of Gloucestershire, whence he derived an idea of the formation of the earth by the deposition of strata; travelled over the greater part of England, noting in a journal his geological observations; opened a correspondence with scientific men in foreign countries for the purpose of extending his geological data, and as the result of his inquiries published *An Essay toward a Natural History of the Earth and Terrestrial Bodies, especially Minerals; as also of the Sea, Rivers, and Springs, with an Account of the Universal Deluge, and of the Effects that it had upon the Earth* (London, 1695; 4th ed. 1726; in Latin, 1704), which was attacked by Arbuthnot, John Hutchinson, Lister, and others, ably defended by Dr. John Harris, and, though containing much that is fanciful and visionary, had a remarkable and permanent influence on the progress of English geology. It was subsequently criticised by Leibnitz and by Elias Camerarius, professor at Tübingen, to whose objections Woodward replied in a Latin treatise, *Naturalis Historiæ Telluris illustratæ et auctæ* (1714). He had settled in London as professor of physic in Gresham College 1692; became a fellow of the Royal Society 1693, and subsequently of the College of Physicians; attracted much attention by his *Account of Roman Arms and Antiquities digged up near Bishopsgate* (1712), in which he claimed to have discovered the iron "shield of Camillus," containing a representation of Rome previous to its destruction by the Gauls; wrote against Drs. Mead and Freind on the subject of small-pox, and collected a considerable museum of fossils and objects of natural history, which he bequeathed to the University of Cambridge, where by his will he founded that professorship of geology which has been held in the present century by Mitchell and Sedgwick. D. in London Apr. 25, 1722. He left many MSS., and from them was compiled *An Attempt toward a Natural History of the Fossils of England, or a Catalogue of English Fossils in the Collection of John Woodward, M. D., containing a Descriptive and Historical Account of each* (2 vols., 1729).

Woodward (SAMUEL), b. in Norwich, England, in 1789; spent most of his life as a clerk in the banking-house of Messrs. Gurney, and was a noted geologist and antiquary. D. at Norwich in 1838. Author of *A Synoptical Table of British Organic Remains* (Norwich, 1830), *Outline of the Geology of Norfolk* (1833), *The Norfolk Topographer's Manual* (1842; revised and augmented by W. C. Ewing), and *The History and Antiquities of Norwich Castle* (1847), edited by his son Bernard. He also privately printed four maps of Roman Norfolk and Norwich, and contributed papers to the *Archæologia* and to the *Magazine of Natural History*.

Woodward (SAMUEL BAYARD), M. D., b. at Torringford, Conn., June 10, 1787; began practice as a physician at Wethersfield 1809; became physician to the State prison; sat for several years in the State senate; was one of the founders of the Hartford Retreat for the Insane; was superintendent of the Massachusetts lunatic asylum at Worcester 1832–46, and was the projector of an asylum for inebriates and of the Massachusetts School for Idiotic Youth. In 1846 he settled at Northampton, Mass. D. Jan. 3, 1850. He published a valuable series of *Annual Reports* and various other professional treatises.

Woodward (SAMUEL PECKWORTH), PH. D., F. G. S., son of Samuel (1789–1838), b. at Norwich, England, Sept. 17, 1821; studied at London University 1839–41, being at the same time employed in the library of the British Museum; was sub-curator of the museum of the Geological Society of London 1839–45; professor of botany and geology in the Royal Agricultural College at Cirencester 1845–48; became assistant in geology and mineralogy in the British Museum 1848; was subsequently examiner in natural history to the military colleges of Woolwich and Sandhurst, and in geology to the University of London; was a leading member of the council of the Geological Society; contributed to many scientific periodicals; assisted Prof. Owen in the invertebrate portion of his *Palæontology;* prepared the geological map of England and Wales published by the Useful Knowledge Society; gained the Wollaston prizes for 1854 and 1857 by his paper on the *Rudistes* family, and was the first to work out the affinities of the family *Hippurites*. D. at Herne Bay, Kent, July 11, 1865. His chief work was *A Manual of Mollusca, or a Rudimentary Treatise on Recent and Fossil Shells* (London, 3 parts, 1851–54–56; 2d ed. 1866), illustrated by A. N. Waterhouse and J. W. Lowry. An *Appendix* appeared in 1869.

Woodwaxen, or **Woadwaxen.** See DYERS' BROOM.

Wood'worth (FRANCIS C.), nephew of Samuel, b. at Colchester, Conn., in 1812; was for eight years a printer, afterward for three years a minister, and subsequently devoted himself to juvenile literature, editing fifteen vols. of the *Youth's Cabinet*, a monthly magazine; issued *The American Miscellany of Entertaining Knowledge* (6 vols.), *Uncle Frank's Home Stories* (6 vols.), *Boys' and Girls' Library* (6 vols.), *Picture-Gallery* (2 vols.), *Theodore Thinker's Stories for Little Folks* (12 vols.), and published several volumes during a residence in England. D. at sea, on a voyage from Savannah to New York, June 5, 1859.

Woodworth (JOHN), b. at Schodack, N. Y., Nov. 12, 1768; graduated at Yale College 1788; studied law at Albany; commenced practice at Troy 1791; settled at Albany 1806; was surrogate of Rensselaer co. 1793–1804; member of the assembly 1803, of the senate 1804–07, attorney-general of New York 1804–08, commissioner (with W. W. Van Ness) to revise the laws of New York 1811–13, and judge of the supreme court of New York 1819–28. D. at Albany June 1, 1858. Author of *Reminiscences of Troy from its Settlement to 1807, etc.* (1853).

Woodworth (SAMUEL), b. at Scituate, Mass., Jan. 13, 1785; served an apprenticeship as a printer in the office of Russell's *Columbian Centinel;* commenced a short-lived weekly paper at New Haven, Conn., 1807; settled in New York 1809; conducted during the war of 1812–15 a weekly paper, *The War*, and a monthly Swedenborgian magazine, *The Halcyon Luminary*, both unsuccessful; wrote a romantic history of the war entitled *The Champions of Freedom* (2 vols., 1816); published a small volume of poems 1818, and another 1826; was one of the founders of the *New York Mirror* 1823–24; edited the *Parthenon* 1827, and wrote a number of dramatic pieces. D. in New York Dec. 9, 1842. His *Poetical Works* appeared in 2 vols. (1861), with a *Memoir* by George P. Morris. He is chiefly remembered by his song, *The Old Oaken Bucket*.

Wool (JOHN ELLIS), b. at Newburg, N. Y., Feb. 20, 1784; after engaging in the book-business for a time in Troy, the destruction of his stock by fire led to his turning his attention to the study of law, which he abandoned in Apr., 1812, to accept a commission in the army as captain of the 13th Infantry. At Queenstown Heights, his first action, he led his company, and was severely wounded Oct. 13, 1812; promoted to be major 29th Infantry Apr. 13,

1813, he again distinguished himself at Plattsburg (Sept. 11, 1814), and was brevetted colonel for gallantry. Under the act of Apr. 24, 1816, providing for the general staff, Wool was appointed (Apr. 29) inspector-general with the rank of colonel, which position he retained until June 25, 1841, when appointed a brigadier-general, to which rank he had been brevetted in 1826. As inspector general he made in 1832 a professional tour of Europe, examining the various systems then prevailing there, and in 1836 negotiated the transfer of the Cherokee Indians W. of the Mississippi. In the war with Mexico he superintended the organization of Western volunteers, and after despatching some 12,000 to the seat of war, conducted himself a force of 3000 on the march from San Antonio to Saltillo, a distance of 900 miles, where he joined the army of Gen. Taylor as second in command. At Buena Vista, before the arrival of Taylor, he was in command during the early part of the day, and had made the disposition of the troops for the battle, which was approved of by Taylor on his arrival. After Taylor's return to the States, Wool remained in command of the army of occupation until the close of the war. For his services at Buena Vista he was brevetted major-general, and in 1854 Congress passed a joint resolution of thanks and presented him with a sword for his Mexican services. The State of New York also presented him with a sword. Returning East in July, 1848, he commanded the Eastern military division until 1853, the department of the East 1853–54, that of the Pacific 1854–57, when again in command of the Eastern department until 1860. In Aug., 1861, he was placed in command at Fort Monroe, Va., and in May, 1862, occupied Norfolk and Portsmouth. He was promoted to be major-general May 16, 1862; was in June placed in command of the Middle military department, including the 8th army corps; transferred to New York Jan., 1863, he commanded the department of the East until July 15, when relieved, and Aug. 1, 1863, was placed on the retired list. D. at Troy, N. Y., Nov. 10, 1869.

Wool and Wool-Trade. See APPENDIX.

Wool, Chemistry of. See KERATINE.

Wool'ery's, tp., Carroll co., Md. P. 2148.

Wool'lett (WILLIAM), b. at Maidstone, Kent, England, Aug. 27, 1735; was apprenticed to John Tinney, an obscure engraver at London, but soon adopted a style of his own, uniting in a single plate the use of aquafortis, the burin, and the dry needle; gained a high reputation, especially by his landscapes, in which he was unrivalled in representing foliage, water, and rocks, and became engraver to George III. D. in London May 23, 1785. His masterpieces are nine English landscapes after Richard Wilson, *The Death of Gen. Wolfe*, and *The Battle of La Hogue*, after Benjamin West. He has a monument in Westminster Abbey.

Wool'man (JOHN), b. at Northampton, Burlington co., West Jersey, in Aug., 1720; worked on a farm until his twenty-first year, when he became clerk to a shopkeeper at Mount Holly, and began to speak in the meetings of the Society of Friends; opened a school for poor children at Mount Holly; learned the trade of tailor, by which he supported himself during a tour with Isaac Andrews to visit the Friends in the back settlements of Virginia (1746); adopted itinerancy as his regular mode of life, visiting the societies of Friends in nearly all the colonies; spoke and wrote frequently against slavery; visited the Indians on the Susquehanna 1763; subsequently went to England. D. at York Oct. 7, 1772. He published *Some Considerations on the Keeping of Negroes* (Philadelphia, 1753; 2d part, 1762), *Considerations on Pure Wisdom and Human Policy, on Labor, on Schools, and on the Right Use of the Lord's Outward Gifts* (1768), *Considerations on the True Harmony of Mankind, and how it is to be maintained* (1770), and *An Epistle to the Quarterly and Monthly Meetings of Friends* (1772). He left various MSS., which appeared in an edition of his *Works* (1775). The *Journey of his Life and Travels in the Service of the Gospel* (1775) has been many times reprinted, and was edited with an *Introduction* by John G. Whittier (1871). Woolman's writings were enthusiastically praised by Charles Lamb, and have been highly esteemed by all who have read them.

Wool Manufacture. See APPENDIX.

Wool'ner (THOMAS), R. A., b. at Hadleigh, Suffolk, England, Dec. 17, 1825; educated at Ipswich; became a distinguished sculptor; was chosen an associate of the Royal Academy 1871, and an academician Dec., 1874. Among his principal statues are those of Lord Bacon and Prince Albert at Oxford, Lord Macaulay and Prof. Whewell at Cambridge, Lord Lawrence at Calcutta, Sir Bartle Frere and David Sassoon at Bombay. He has executed busts of Cobden, Sedgwick, Tennyson, Carlyle, Darwin, Gladstone, Hooker, Browning, Dickens, Father Newman, and other English celebrities; statuettes *Elaine*, *Guinevere*, and *Ophelia*, and has published a volume of poems, *My Beautiful Lady* (1863; 3d ed. 1866), which has received critical approval.

Wool-Printing. See APPENDIX.

Wool'rych (HUMPHREY WILLIAM), b. in England about 1795; became an eminent barrister and sergeant-at-law of Lincoln's Inn. D. in London July 2, 1871. Author of numerous and valuable professional treatises, of a *Life of Sir Edward Coke* (1826), *Series of the Lord Chancellors, Keepers of the Seal, etc.* (1826), *Memoirs of the Life of Lord Jeffreys* (1827), and *Lives of Eminent Serjeants-at-Law* (2 vols., 1869). He maintains that "Jeffreys's merits have not been sufficiently understood."

Wool'sack, the seat of the lord chancellor in the British House of Lords, a large cushion stuffed with wool. It is a long parallelopiped, without back or sides, and bears no resemblance to a sack or a cushion. Wool being formerly regarded as the principal source of England's wealth, the woolsack, covered with red cloth, was first introduced into the House in Queen Elizabeth's time to commemorate an act forbidding the exportation of wool.

Wool'sey (MELANCTHON B.), U. S. N., b. Aug. 11, 1818, in New York; entered the navy as midshipman Dec. 24, 1832; became lieutenant 1847, commander 1862, captain 1866, commodore 1871; served with gallantry on the Western waters during the civil war, and, refusing to leave the Pensacola yard during the prevalence of yellow fever there, although he had permission to do so from the secretary of the navy, he was attacked by that fearful disease, and died in the heroic discharge of his duty Oct. 2, 1871. Com. Woolsey was a man of refined tastes and most amiable character. FOXHALL A. PARKER.

Woolsey (THEODORE DWIGHT), D. D. Harvard 1847, LL.D. Wesleyan 1845, b. in New York Oct. 31, 1801; graduated at Yale College 1820; studied theology at Princeton; was a tutor in Yale College 1823–25; licensed to preach in 1825, and studied the Greek language in Germany 1827–30; elected professor of Greek in Yale College in 1831; elected president in 1846, resigned this office in 1871; has since resided in New Haven, giving occasional instruction in the law school, and busily occupied in researches and studies chiefly in political science; was ordained at the time of his inauguration, and has frequently preached in the college chapel and elsewhere with great acceptance; edited the *Alcestis* of Euripides (1833), the *Antigone* of Sophocles (1835), the *Electra* of Sophocles (1837), the *Prometheus* of Æschylus (1837), the *Gorgias* of Plato (1842); published his inaugural discourse on *College Education* (1846), an *Historical Discourse upon Yale College* (1850), *An Introduction to the Study of International Law* (12mo, Boston, 1860; 4th ed., New York, 1871), *An Essay on Divorce and Divorce Legislation* (New York, 1869), a volume of sermons entitled *The Religion of the Past and the Future* (New York, 1871), two sermons, *Serving our Generation* and *God's Guidance in Youth* (New Haven, 1871), several occasional sermons, many of them memorial and biographical, and numerous papers in the *New Englander* and other periodicals. After the death of Prof. Francis Lieber (1872), Pres. Woolsey re-edited, with notes, his work on *Civil Liberty and Self-Government* (Philadelphia, 8vo, 1874), also his *Manual of Political Ethics* (2 vols., 8vo, Philadelphia, 1874). Pres. Woolsey was for several years one of the regents of the Smithsonian Institution, and is now a member and the chairman of the American division of the committee for the revision of the New Testament. He is at present preparing a work upon political science, which will contain the results of the researches and reflections of many years. As a scholar, Pres. Woolsey is distinguished for the exactness of his knowledge, the extent of his erudition, and the breadth and sagacity of his judgment; as a teacher, for the glow of his imaginative and ethical spirit, and for the rigor of his impartiality in searching after and imparting the truth; as a theologian, for the extent of his biblical knowledge, the catholicity and candor of his theological opinions, and the fervor of his childlike faith; as a friend, for the warmth and endurance of his attachments; and as a man, for a rare assemblage of qualities which have secured to him an enviable place in the love and respect of his generation. Few men have been more distinguished in this country for eminence in so great a variety of departments of scholarship and culture, and few men have secured for themselves the solid respect of so great a number of their countrymen for high personal and moral excellence. NOAH PORTER.

Wool'ston (THOMAS), b. at Northampton, England, in 1669; graduated at Sidney-Sussex College, Cambridge, about 1688; became a fellow there; took orders in the Church of England; made a careful study of the works of Origen; wrote *The Old Apology for the Truth of the Christian Religion against the Jews revived* (1705), in which he

maintained, ostensibly in the interest of Christianity, that many seemingly historical portions of the Bible, including the Pentateuch, are to be interpreted allegorically, Moses and his miracles being merely types of Christ; maintained this view in letters addressed to Drs. Whitby, Waterland, Whitton (1720); and in letters to Dr. Bennet (1720) argued that the Quakers approach nearer in doctrine and organization to the primitive Church than any other religious body; went to reside in London 1720; was deprived of his fellowship 1721 on account of the scandal occasioned by his writings; published *The Moderator between the Infidel and the Apostate* (1725) and *Six Discourses on the Miracles of our Saviour* (1727–29), addressed to six bishops, in which he maintained the allegorical character of those miracles—a publication which elicited no less than sixty replies. Woolston was in consequence indicted for blasphemy at the instance of the attorney-general, tried, and convicted at the Guildhall Nov., 1729, fined £100, imprisoned for a year in the queen's bench prison, and failing to provide security for not repeating the offence, spent the rest of his life within the rules of that prison, dying Jan. 27, 1733.

Wool'wich, town of England, county of Kent, on the southern bank of the Thames, 9 miles below London, extends for a distance of 2 miles along the river, and has an excellent dockyard, provided with dry and wet docks, from which some of the largest ships of the English navy have been launched. This is also the seat of the chief arsenal of England, and contains all the different kinds of workshops in which cannons, bombs, shells, etc., are made. It has a military academy and extensive barracks. P. 41,695.

Woolwich, p.-v. and tp., Sagadahoc co., Me. P. 1168.

Woolwich, tp., Gloucester co., N. J. P. 3760.

Woonsock'et, p.-v. and tp., Providence co., R. I., on Providence and Worcester R. R. and on the Blackstone River, 16 miles from Providence and 37 from Boston by the Woonsocket branch of New York and New England R. R., of which the town is the present southern terminus. It is noted chiefly for its extensive manufacturing industries, and possesses an unusual prestige by reason of the numerous manufacturing villages that cluster about it and contribute to its trade and general business. Its water-power is the finest on Blackstone River. The town contains 9 churches (2 Roman Catholic, 2 Congregational, a Methodist, Universalist, Episcopal, Friends, and Baptist); the Harris Institute, an imposing and comely edifice, founded and permanently endowed by Edward Harris, embracing a free circulating library of about 7000 volumes, the first in the State, a lyceum, reading-rooms, hall, etc.; 6 national banks, 5 savings banks; a high school and 8 school edifices; 2 fine hotels; 2 daily, 1 semi-weekly, and 2 weekly newspapers; 6 Masonic, 5 Odd Fellows, 3 Hibernian, 1 Knights of Pythias, and 7 temperance organizations; and 2 opera-houses and several public halls. It has an efficient police system, a paid fire department, and negotiations are pending for an electric fire-alarm. In the southern suburbs is a fine agricultural and trotting park. The prosperity of the town is derived largely from the extensive manufactories, $6,000,000 of the $10,000,000 town valuation being thus invested. Among the leading industries are woollen and cotton mills, rubber works, wringing-machine manufactory, a tool and worsted company, lastings and serge mills, twist drill, loom harness, machine-works, foundry, 1 sewing-machine establishment, 1 washing-machine company, a braid company, several planing mills, and other industries. The pop. of the town proper is 11,527 (census 1870), one-third being Americans, one-third Irish, and one-third Canadians.

LE ROY B. PEASE, ED. "DAILY REPORTER."

Woorari, or **Woorara.** See CURARI.

Woos'ter, p.-v. and tp., cap. of Wayne co., O., on Pittsburg Fort Wayne and Chicago R. R., 130 miles W. of Pittsburg, is the seat of WOOSTER UNIVERSITY (which see), and has 13 churches, 5 banks, 2 newspapers, fire department, waterworks, and manufactories of reapers, mowers, threshers, clover-hullers, engines, boilers, mill-gearings, straw-board, woollen goods, flax, flour, furniture, wire goods, whips and lashes, sash and doors, organs, carriages and wagons, and 5 excellent hotels. P. of v. 5419; of tp., exclusive of v., 1145. J. G. SANBORN, ED. "REPUBLICAN."

Wooster (DAVID), b. at Stratford, Conn., Mar. 2, 1710; graduated at Yale College 1738; married a daughter of Pres. Clap 1740; commanded a sloop-of-war in the expedition against Louisburg 1745; went to Europe in charge of a cartel-ship; visited England; was presented at court, and made a captain in Pepperell's regiment; was appointed colonel of the 3d Connecticut regiment 1755; served as brigadier-general in the northern campaigns of 1758–60; was one of the originators of Arnold's expedition for the capture of Ticonderoga Apr., 1775; was appointed brigadier-general June 22, 1775; succeeded to the command in Canada on the death of Montgomery; became major-general of State militia 1776; mortally wounded in the defence of Danbury against Tryon, dying there May 2, 1777. A monument was erected by the State in 1854.

Wooster University, an institution of learning at Wooster, Wayne co., O., was organized by joint action of the four synods of the Presbyterian Church of Ohio in 1866, 21 acres of forest-land on a commanding elevation 1 mile N. of Wooster being donated as a site, and $110,000 contributed by citizens of the county, with which a spacious brick building was erected and furnished for recitation-rooms, society halls, etc. A commodious chapel was also added, with rooms for library, museum and laboratories. Endowment to the amount of $250,000 was obtained from friends in the State, and liberal contributions were made for a valuable library, extensive museum, and apparatus for the various departments. Three courses of study were projected—classical, philosophical, and scientific—for the collegiate department. A full faculty of professors and teachers was chosen, Rev. Willis Lord, D. D., being inaugurated president, and in 1870 the university was opened for instruction to students of both sexes on equal terms. The standard of scholarship was established on a level with that of the best American colleges. The first year there was graduated a senior class of 6, formed mainly of students from other institutions. The second graduating class numbered 8, the third 13, the fourth 28. The same year a contract was made with the Charity Hospital Medical College of Cleveland by which it became the property of the university as its medical department, and G. C. E. Weber, M. D., was appointed dean of the medical faculty, with above 50 students in attendance. A preparatory department was organized at Wooster in 1872, and passed at once into successful operation. In 1874–75 there were in the medical department 71 students, in the collegiate 160, in the preparatory 75; total, 306. The plan of the co-education of the sexes has proved most satisfactory, the students attending the same classes. In 1874 one young lady was graduated in the scientific course, and in 1875 four—two in the classical and two in the scientific—above 40 young ladies being in attendance during the latter year. Dr. Lord having resigned the presidency in 1873, Rev. A. A. E. Taylor, D. D., of Cincinnati was inaugurated as his successor the same year. This is the only college owned and operated by the Presbyterian Church in Ohio, which Church has a membership of 60,000 and stands second in wealth among the Protestant churches of the State. The foundation of the university is substantial and secure; its endowment is being vigorously prosecuted; and its tone and grade of scholarship are faithfully maintained by a system of strict and frequent examinations. Being situated on Pittsburg Fort Wayne and Chicago R. R., there is easy access to it from all parts of the country, and students are already drawn to it from many States. A. A. E. TAYLOR.

Worces'ter, or **Worcestershire,** an inland county of England, on both sides of the Severn and its affluent the Avon, comprises an area of 738 sq. m., with 338,848 inhabitants. The surface is undulating and well wooded; the elm grows luxuriantly, and has received the name of "the weed of Worcestershire;" fruit trees also succeed well. Wheat, hops, vegetables, and pears are extensively cultivated. Coal and iron abound, and about one-third of the inhabitants are engaged in mining. Among the different manufactures which are carried on are those of carpets at Kidderminster, the most remarkable.

Worcester, town of England, capital of Worcestershire, on the Severn, has a fine cathedral, interesting remains of antiquity, and extensive manufactures. Tanning, currying, dressing, and staining of leather, glove-making, the manufacture of porcelain, vinegar, sauce, and chemicals, are the principal branches of industry, and several of them—as for instance, those of sauce, china, and gloves—enjoy a great reputation. P. 33,241.

Worcester, county of S. E. Maryland, bordering on Delaware and on the Atlantic Ocean, forming a part of the peninsula between Delaware and Chesapeake bays, and traversed by Wicomico and Pokomoke and Worcester R. Rs. Along the coast are low sandy beaches, separated from the mainland by inlets. Cattle, sheep, and swine are numerous. Staples, Indian corn, oats, and wool. Cap. Snow Hill. Area, 550 sq. m. P. 16,419.

Worcester, county of Central Massachusetts, bordering on New Hampshire, Connecticut, and Rhode Island, drained by Blackstone, Chicopee, Nashua, Ware, and other rivers, and traversed by numerous railroads. The surface is generally undulating; most of the soil is naturally or artificially fertile and under high cultivation. There are

nearly 2000 manufacturing establishments, among which are agricultural implements, axes, and edge tools, boots and shoes, bricks, cotton goods, carriages, combs, cutlery, flour-mills, furniture, firearms, flax and linen goods, hardware, hats, hosiery, iron castings, leather, musical instruments, machinery, paper, planing-mills, saw-mills, soap and candles, shoddy, straw goods, steel, woollens, worsted goods, wire and wire fabrics. Horses and cattle are the chief live-stock. Staples, manufactured articles, hay, potatoes, Indian corn, and garden and dairy products. Cap. Worcester. Area, about 1500 sq. m. P. 192,716.

Worcester, city, cap. of Worcester co., Mass., near the centre of the State, in one of the richest and most productive agricultural and manufacturing districts of New England. Boston and Albany R. R. runs through it, and it is the terminating point of four other important railroads—Norwich and Worcester, Providence and Worcester, Worcester and Nashua (which has a through line to Portland, Me.), and Worcester and Gardner, which goes into New Hampshire. It is noted for its various and extensive manufacturing industries. The census of 1875 reported the manufactures of Worcester as follows:

Manufactures of the City of Worcester, Census of 1875.

Names of industries.	No. of estab.	Capital invested.	Value of goods made.
Arms and ammunition	4	$166,000	$247,000
Agricultural implements	2	156,000	187,584
Artisans' tools	21	773,125	629,188
Boots and shoes	32	1,674,150	5,377,309
Boxes, paper and wooden	3	43,000	140,000
Clothing	66	244,585	782,096
Cotton goods	4	56,000	138,885
Food preparations	41	150,697	711,356
Furniture	10	151,500	288,292
Leather	11	246,050	461,880
Machines and machinery	36	1,429,650	1,730,834
Metals and metallic goods	42	2,228,300	2,570,385
Musical instruments and materials	7	359,700	487,200
Paper	2	150,000	489,903
Printing and publishing	18	215,070	301,664
Tobacco	14	38,000	128,876
Wooden goods	27	241,690	531,349
Woollen goods	12	563,500	1,725,220
Worsted goods	1	70,000	176,000
Miscellaneous	558	2,264,148	6,393,356

There are three large establishments for the manufacture of machine-card clothing; extensive rolling-mills that manufacture large amounts of railroad iron and car-wheels; establishments for the manufacture of railroad cars; and shops for the manufacture of firearms of all kinds, which do a large business; shops for brass-work, for the manufacture of musical instruments, and for manufactures not mentioned in the schedule above. Worcester has an excellent system of graded free schools, which includes a classical and English high school. The Roman Catholic College of the Holy Cross is situated on high ground in the south-eastern part of the city. The Worcester County Free Institute of Industrial Science, a very important institution established in 1868, is finely situated in the northern part. There is a State normal school in the city. Among the more important private schools are the Highland Military Academy, the Worcester Academy, and the Oread Institute. The city has an electric fire-alarm, and works for supplying the city with water. A horse-railroad, 3 or 4 miles long, runs through Main street from Lincoln Square to Webster Square. There are two parks. On one of them, known as the Old Common, stands the imposing soldiers' monument, designed and executed by Randolph Rogers, and also a beautiful monument erected to the memory of Col. Timothy Bigelow, a gallant Worcester soldier of the Revolution. There are 13 public halls in the city, the largest and most important being Mechanic Hall, which is one of the finest rooms of the kind in the country. Worcester has a well-endowed city hospital and a home for aged women. There is also in the city a State lunatic asylum, which will accommodate 550 patients. The city has a flourishing free public library, with well-furnished circulating and reference departments and free reading-rooms. The hall of the American Antiquarian Society, with its library of about 70,000 volumes, is here. This society was founded by Isaiah Thomas, and incorporated in 1812. Three daily papers are published in Worcester. Among its more important and prosperous societies for mutual and general improvement are a mechanics' association; a lyceum and natural history association, which has a valuable cabinet of specimens; a very successful horticultural society, a law library association, 2 medical societies, and the Worcester County Musical Association, which has much reputation for excellence. There are 7 banks for discount, a safe-deposit and trust company, 4 savings banks with deposits amounting to $12,851,326, and 5 insurance companies.

The settlement of Worcester began in Apr., 1675, after several years of preparation. There was a formal purchase of the land from the Indians, who, for "twelve pounds in lawful money of New England," gave the settlers a deed of a tract 8 miles square. King Philip's war brought hostile Indians against the settlement, which was broken up for a time. Attempts to re-establish it were harassed by Indian hostilities until 1713, when the settlement became permanent and prosperous. The situation of Worcester being very favorable, it became important. It grew to be a flourishing town, and finally became the second city of the State in population, business, and wealth. During the Revolutionary war this was one of the most patriotic towns in the country. The first public reading of the Declaration of Independence in Massachusetts took place in Worcester on the steps of the Old South church, the reader being Isaiah Thomas. Mr. Thomas established the first printing-press in Worcester, and the first thing printed in the town was the *Massachusetts Spy* of May 3, 1775, which contained an account of the battle of Lexington. The first city government was organized in 1848. The growth of the city has been remarkable for an Eastern town. Since 1860 the population has more than doubled. There are in Worcester 10 Congregational churches (including 2 Unitarian), 7 Methodist, 4 Baptist, 5 Roman Catholic, 2 Episcopal, 1 Universalist, 1 Quaker, 1 Campbellite, and 1 Second Adventist. The oldest church in the city is the Old South, which was organized by the first settlers, and existed alone until 1786. In 1845 the pop. of Worcester was 11,556; in 1870, 41,105; it now exceeds 50,000.

JOHN D. BALDWIN, ED. "WORCESTER DAILY SPY."

Worcester, p.-v. and tp., Otsego co., N. Y. P. 2327.

Worcester, p.-v. and tp., Montgomery co., Pa. P. 1587.

Worcester, p.-v. and tp., Washington co., Vt. P. 775.

Worcester, EARL OF. See TIPTOFT (JOHN).

Worcester (EDWARD **Somerset**), SECOND MARQUIS OF, b. at Raglan Castle, England, about 1601, was the eldest son of Henry Somerset, Lord Herbert of Chepstow, created in 1642 first marquis of Somerset, a distinguished leader of the Roman Catholic party; received a careful education; spent some years in foreign travel; married in 1628; devoted himself to mathematical and mechanical researches at Raglan Castle; entered the military service of Charles I. in 1641, along with his father, raising and commanding a body of troops; was known from 1642 by the courtesy title of Lord Herbert; is alleged to have been created earl of Glamorgan by Charles I. Apr. 1, 1644; was sent to Ireland as a secret agent of the king to treat with the Irish Roman Catholics 1645; was imprisoned on the discovery of his errand, and at first disowned by the king; was released, and succeeded to the earldom 1646, and went into voluntary exile in France Mar., 1648; returned to England 1652; was imprisoned in the Tower 1652–55; drew up while in the Tower a little work entitled *A Century of the Names and Scantlings of such Inventions as at present I can call to mind to have Tried and Perfected*, etc. (1663), in which he describes a steam-engine as "an admirable and most forcible way to drive up water by fire," and spent a large sum of money upon the erection of water-works at Vauxhall. D. Apr. 3, 1667. He was regarded as a visionary by most of his contemporaries, but is now recognized as one of the greatest mechanical geniuses that have ever lived. A well-written account of his *Life, Times, and Scientific Labors* (1865), including a reprint of the *Century of Inventions*, was issued by Mr. Henry Dircks, who also published *Worcesteriana* (1865), consisting of notices of 180 works relating to the marquis or his connections.

Worcester (JOSEPH EMERSON), LL.D., b. at Bedford, N. H., Aug. 24, 1784; graduated at Yale College 1811; taught school at Salem, Mass.; studied theology two years at Andover Seminary; settled at Cambridge, Mass., 1819, and devoted himself thenceforth to the preparation of a series of valuable textbooks and of his dictionary, for which purpose he visited Europe 1830–31. D. at Cambridge Oct. 27, 1865. Among his works were a *Geographical Dictionary, or Universal Gazetteer* (2 vols., Andover, 1817), *Elements of Geography, Ancient and Modern* (1819), *Sketches of the Earth and its Inhabitants* (2 vols., 1823), *Elements of History, Ancient and Modern* (1826), *Elements of Ancient Classical and Scripture Geography* (1839), *The American Almanac* (1831–43), a revised edition of Todd's *Johnson's Dictionary* (1827), an abridgment of *Webster's Dictionary* (1829), a *Comprehensive Pronouncing and Explanatory Dictionary of the English Language* (1830), a *Universal and Critical Dictionary* (1846), and his great work, *A Dictionary of the English Language* (Boston, 1860, with 1000 illustrations), which divides with that of Webster the suffrages of the English-speaking world.

Worcester (NOAH), D. D., b. at Hollis, N. H., Nov. 25, 1758; received only a common-school education; served three

years as fifer and fife-major in the Continental army 1775–77, being present at Bunker Hill and at Bennington; taught school at Plymouth, N. H.; settled at Thornton, where he filled several civil offices, and was chosen to the legislature; turned his attention to theology; published a *Letter to Rev. John Murray concerning the Origin of Evil* (Newburyport, 1786); was pastor of the Congregational church at Thornton 1787–1809, receiving a salary of $200, and made up the deficiency by farming and shoemaking; removed to Salisbury, N. H., 1810, supplying there the pulpit of his brother Thomas until 1813, when he settled at Brighton, Mass.; edited the *Christian Disciple* 1813–19, and a quarterly magazine, the *Friend of Peace*, 1819–29; founded the Massachusetts Peace Society in Jan., 1816; was its secretary until 1828; published *Solemn Reasons for Declining to adopt the Baptist Theory and Practice* (1809); *Bible News, or Sacred Truths relating to the Living God, His Only Son and Holy Spirit* (Concord, 1810), which was censured by the Hopkinton Association as unsound on the doctrine of the Trinity; *Impartial Review of Testimonies in Favor of the Divinity of the Son of God* (1810), and other controversial treatises against the Trinitarians; *A Solemn Review of the Custom of War* (1814; 11th Amer. ed. 1833); *The Atoning Sacrifice a Display of Love, not of Wrath* (Cambridge, 1829); *The Causes and Evils of Contentions among Christians* (1831), and *Last Thoughts on Important Subjects* (1833). D. at Brighton Oct. 31, 1837. A *Memoir* (1844) was issued by Rev. Henry Ware, Jr., D. D.

Worcester (Samuel), D. D., brother of Noah, b. at Hollis, N. H., Nov. 1, 1770; graduated at Dartmouth College 1795; was pastor of the Congregational church at Fitchburg, Mass., 1797–1802, and thenceforth of the Tabernacle church at Salem; became corresponding secretary of the American Board of Commissioners for Foreign Missions at its organization in 1810; published several sermons and orations, and *Three Letters to Dr. Channing* (1815) on the Trinitarian controversy, and edited *Christian Psalmody* (1815) and *Watts and Select Hymns* (1818). D. at Brainerd, Ga., June 7, 1821. His *Life and Labors* (2 vols., 1852) were described by his son Samuel Melanchton, and a posthumous volume of his *Sermons* appeared in 1823.

Worcester (Samuel Melanchton), D. D., son of Samuel, b. in Fitchburg, Mass., Sept. 4, 1801; graduated at Harvard 1822; studied one year at Andover; was tutor in Amherst College 1823–25, and professor of rhetoric and oratory 1825–34; was pastor of the Tabernacle church in Salem 1834–60, when he resigned on account of impaired health; and, after having been a member both of the Massachusetts senate and house of representatives, d. in Salem Aug. 16, 1866. He re-edited his father's *Watts and Select Hymns*, with 240 additional hymns, in 1834, and also published *Essays on Slavery* (1826) and *Memorial of the Tabernacle, Salem* (1855). R. D. Hitchcock.

Worcester County Free Institute, at Worcester, Mass., was founded by John Boynton of Templeton by a gift of $127,000; the late Hon. Ichabod Washburn established the machine-shop, and otherwise enlarged the resources of the institute to a total amount of $130,000; further endowments by Hon. Stephen Salisbury of $250,000, and the State of Massachusetts of $50,000, increased the available annual income to $25,000. The school is free to all citizens of the county of Worcester, and 23 students, residents of the State of Massachusetts but not of the county of Worcester, may receive free tuition. Residents of any other place may be admitted upon payment of a tuition-fee of $100 per annum. The institute offers facilities for acquiring theoretical and practical knowledge of mechanical engineering, civil engineering, chemistry, physics, modern languages, and drawing. The course of study extends through three and a half years for mechanics, and three years for all others. The grounds of the institute cover nearly 11 acres in an elevated and attractive locality. Two buildings have been erected—Boynton Hall and the Washburn machine-shop. Boynton Hall, named in honor of the founder of the institute, is a three-story granite building, 146 feet long by 61 feet wide, built by citizens of Worcester at an expense of about $67,000, and devoted to recitations, lectures, and the general exercises of the institution. The Washburn machine-shop is a three-story brick building, 100 feet long by 40 feet wide, with a wing 65 by 40 feet for engine, boilers, and blacksmith-shop. The first floor is fully equipped for the manufacture of machinists' tools, the second floor for wood-work, and the third for general purposes. It is part of the gift of Hon. Ichabod Washburn. The institute confers the degree of bachelor of science in course upon all full graduates, and promises recognition of professional success in an honorary degree. There are 12 instructors, and the pupils number 105. C. O. Thompson.

Word [Ang.-Sax. *vor-d*, the *v* as Eng. *w*, as in Lat. *ver-b-um*; akin to Gr. εἰρ-ω, "I say, speak, tell"], the smallest portion of human language forming a grammatic part of speech; a voeable. Words may be as short as *a, O, go, 'm, hm*, or as long as *incomprehensibility*; they may be chiefly monosyllabic, as in Chinese, or extremely polysyllabic, as in Aztec, where it requires a combination of fourteen syllables to say "Curse not each other;" or in Chippeway, of which the Rev. Th. Hurlbart (in a letter) gives the analysis of an example in sixteen significant syllables meaning in their aggregate, "We will not desire to be able to come and cause the poor ones to see pleasantly." Some nations have many words composed of vowels and semi-vowels, as the Hawaiian *ai*, "food;" *ao*, "light;" *ia*, "fish;" *heiau*, "temple;" *wawae*, "legs;" *Beritani*, "Britain." Other languages have words composed chiefly or entirely of consonants, as English in *hnskt, speakst, raspt, strike, screw*; and Bohemian in *mlz*, "a dainty;" *mnich*, "monk;" *mrsk*, "whip;" *mrzce* (*c* as *ts*), "ugly;" *jdauci* (*j* Ger. and Lat., Eng. *y*), "to go;" *jméno*, "name;" *jsem*, "am;" *smrt*, "death." These examples are illustrative of the fact that nations proceed differently in the construction of language.

English "go" is a simple word and a primitive; "going," "go-ne," "ga-ng," are derivatives. Compound words are derivatives composed of two or more integral or entire words, as "undercurrent," where both "under" and "current" are derivatives, but not simple words. In most compounds the earlier portion defines the later, which determines the part of speech, as in "wildgoose," "waylay." In forming derivatives, the parts should be taken from the same family of speech, but in a heterogeneous language like English, hybridism cannot be altogether avoided. "Chandelier" is properly formed on a basis in the Romish languages, but as "gas" (gaz) is based upon the Teutonic *ghost*, "gaselier" is a hybrid, and the affix "el" is without function. So "*joy*-ous" on a Romish basis is correct, while "*joy*-ful" is a hybrid. "Centennium" (formed like "millennium") is correct, but a proposed form "centenniad" (like "myriad") assigns a Greek suffix to a Latin base.

Words are chiefly used for the conveyance and interchange of ideas, and on this account many exclamations cannot be admitted as parts of speech, such as cries of pleasure, pain, fright, surprise, or annoyance, often made unintentionally and independently of a listener, whilst such as are intended to attract attention are true words. Exclamations and imitations are to a great extent the basis of words; and although this view has been strongly opposed, it seems to be founded on fact. (See Haldeman, *Relations between Chinese and Ind.-Eur. Langs.*, Amer. Assoc., Albany, 1856.) For the manner in which English (also Greek and Latin) words are constructed by means of additions to a root or stem consult Haldeman, *Affixes . . . exhibiting the Etymologic Structure of English Words* (Philadelphia, 1865, 1871). There (p. 247) the word "consti-tu-t-ion-al" is thus analyzed: *-al*, "pertaining to;" *ion*, "that which;" *-t-*, "has been;" *-tu-*, "caused to;" *sti-*, "stand;" *con-*, "together;" or, "consistent with that which has been mutually established."

S. S. Haldeman.

Worde, de (Wynkin), b. in Lorraine about 1455; was an assistant to Caxton in his first English press at Westminster, and after his master's death (1491) succeeded to the business; made many improvements in the art; introduced Roman letters and many fonts of different sizes, which he sold to other printers; was the first to adopt title-pages and to employ Greek characters; enjoyed the patronage of the queen-dowager Margaret, and was an intimate friend of Richard Pynson. D. in 1534. He had printed 408 works, many of them being grammatical and other schoolbooks, and all remarkable for neatness and elegance. The best specimens of his press are Higden's *Polycronicon* (1495) and Stephen Hawes's *Pastime of Pleasure* (1517).

Wor'den (John Lorimer), U. S. N., b. Mar. 12, 1818, in New York; entered the navy as midshipman Jan. 10, 1834; became lieutenant in 1846, commander in 1862, commodore in 1868, rear-admiral in 1872; commanded the Monitor in her famous fight with the Merrimack, Mar. 9, 1862, and the Montauk in the attacks on Fort McAllister of Jan. 27 and Feb. 1, 1863, and the first Fort Sumter fight Apr. 7, 1863. By his heroic conduct in the engagement with the Merrimack, Worden gained a world-wide reputation. Toward the close of that action a shell, exploding against the pilot-house of the Monitor, fractured one of the great iron logs of which it was composed, and filled his eyes with powder, so that for a long time he was blind. While lying in this condition after the battle an intimate friend, Lieut. Thomas A. Wise, U. S. N., visited him from shore, and, warmly grasping his hand, exclaimed, "Worden, you have whipped the Merrimack and saved the Minnesota." "Then," replied Worden quietly, "I am content." A few

days after this Mr. Lincoln called to see Worden at Wise's house in Washington, where he lay in bed with his eyes closely bandaged. "Mr. President," said the sufferer as Mr. Lincoln took his seat beside him, "you do me great honor." "No, sir, no, sir," answered the kind-hearted President hastily, and averting his face to conceal his emotion from Mrs. Worden, who was present at the interview; "it is you who do me honor and confer honor on the country." FOXHALL A. PARKER.

Words'worth (CHARLES), D. C. L., son of Dr. Christopher (1774–1846), b. at Bocking, Essex, England, in 1806; educated at Harrow School; graduated at Christ Church, Oxford, 1830, gaining a studentship and two chancellor's medals, and being distinguished for athletic exercises; took orders in the Church of England; was a tutor at Cambridge 1830–33, having among his pupils W. E. Gladstone, Cardinal Manning, and the late duke of Newcastle; was second master of Winchester College 1835–46, and first warden of Trinity College, Glenalmond, Perthshire, Scotland, 1846–51; contributed largely to the establishment of that institution on a firm basis, and built the college chapel (costing £8800) at his own expense; became bishop of the united dioceses of St. Andrew's, Dunkeld, and Dunblane 1853; has distinguished himself by his efforts to procure "a united Church for the United Kingdom," and by his vindications of the Anglican doctrines, and is one of the "New Testament Company for the revision of the authorized version of the Bible." Author of numerous theological and critical treatises, and of a Greek grammar in extensive use, *Greek Grammatica Rudimenta* (1839).

Wordsworth (CHRISTOPHER), D. D., youngest brother of William, b. at Cockermouth, Cumberland, England, June 4, 1774; studied with his brother at Hawkshead School, Lancashire; graduated at Trinity College, Cambridge, 1796; was elected a fellow there 1798; took orders in the Church of England; became chaplain to the bishop of Norwich, subsequently archbishop of Canterbury, 1802; rector of Ashby, Norfolk, 1801, dean of Bocking, Essex, 1808, rector of St. Mary's, Lambeth, of Sundridge, Kent, 1816, and of Buxted, Sussex, 1820; was master of Trinity College, Cambridge, 1820–41, and was instrumental in adding the new quadrangle or "court" to that famous seat of learning. D. at Buxted Feb. 2, 1846. Author of *Ecclesiastical Biography* (6 vols., 1810; 4th ed., 4 vols., 1853), *Sermons on Various Subjects* (1814), *Who Wrote Eikon Basilikè?* (1824), maintaining the authenticity of that work; *King Charles II. the Author of Eikon Basilikè further Proved* (1828), and *Christian Institutes, selected from the Writings of the Most Eminent Divines of the English Church* (4 vols., 1836).

Wordsworth (CHRISTOPHER), D. D., son of the preceding and nephew of the poet, b. at Ashby, Norfolk, England, in 1807; educated at Winchester School; graduated at Trinity College, Cambridge, 1830, having twice gained the chancellor's medal for English poems, and having also taken the Browne medals (1828) for the best Latin ode and Greek epigram; became a fellow; took orders in the Church of England; travelled in Greece 1832–33; prepared *Athens and Attica, Journal of a Residence there* (1836; 4th ed. 1869), *Inscriptiones Pompeianæ* (1837) and *Greece, Pictorial, Descriptive, and Historical* (1839; 4th ed. 1867); was appointed public orator of the University of Cambridge 1836; married Susanna, niece of John Hookham Frere, 1838; was head-master of Harrow School from Apr., 1836, until Nov., 1844, when he was made canon of Westminster Abbey by Sir Robert Peel; was Hulsean lecturer at Cambridge 1847–48; became vicar of Stamford-in-the-Vale, Berkshire, 1850; was consecrated bishop of Lincoln Feb. 24, 1869, and took a prominent part in the "Old Catholic" Congress held at Cologne Sept., 1872. Author, among other works, of several volumes of *Sermons* and *Charges*, of *Theophilus Anglicanus, or Instructions concerning the Church and the Anglican Branch of it, etc.* (1843; 9th ed. 1865), *Discourses on Public Education* (1844), *A Diary in France* (1845), *On the Canon of the Scriptures of the Old and New Testaments and of the Apocrypha* (1848; 6th ed. 1867), and *Lectures on the Apocalypse* (1849; 3d ed. 1852), being the Hulsean lectures for 1847 and 1848 respectively, *Memoirs of William Wordsworth* (2 vols., 1851), *St. Hippolytus and the Church of Rome* (1853), a volume of hymns, *The Holy Year* (1862; 5th ed. 1868), and *A Journal of a Tour in Italy* (2 vols., 1863); edited *The Correspondence of Richard Bentley* (2 vols., 1842), the works of *Theocritus* (1844), the Greek text of the *Apocalypse* (1849) and the *New Testament* (4 parts, 1856–60), and *The Holy Bible, with Notes and Introductions* (5 vols., 1864–70), and was a prominent contributor to Dr. Smith's *Dictionary of the Bible*.

Wordsworth (WILLIAM), b. at Cockermouth, Cumberland, England, Apr. 7, 1770, second son of John Wordsworth, attorney-at-law, and Anne Cookson, a mercer's daughter. A headstrong boy, with a moody, daring, and violent temper, but imaginative and meditative as a child, and early much given to books—which he took up pretty much as he liked, with little direction save his own tastes and an early requirement of his father that he should commit passages of the best English poets to memory—his first verses, written in his fifteenth year as a task imposed by one of his teachers, were not in themselves remarkable, being, as he says, "but a tame imitation of Pope's versification;" yet they first put it into his head to write poetry independently. In his eighteenth year (Oct., 1787) he entered St. John's College, Cambridge, at which he was graduated in Jan., 1791. His university life was not happy. He was self-willed, impatient of restraint, with much self-conceit and much contempt of others who differed from himself, with little taste for scholastic habits, and thus finding little sympathy between himself and the intellectual life of the university. This he afterward regretted. After leaving the university he spent over a year in France, catching the spirit of the French revolution, and embracing it enthusiastically and with a full share of self-willed impracticability. The political judgments which he thus formed were subsequently greatly modified and largely abandoned. At the close of 1792 he returned to England, with no pecuniary means, with no plans for life, urged by his friends to take orders as a clergyman, but unable to find any inner impulse that way, with his mind ill at ease, disturbed by his own opinions, by the state of society in France and England, by the uncertainty which hung over all his prospects, and by the coldness of his relatives, who were displeased and disappointed that he had done so little at the university, and that he seemed to them so little disposed to do anything now. In 1793 he published, "with great reluctance," as he himself says, two little poems, *The Evening Walk* and *Descriptive Sketches*, in order to show that he "*could* do something." He also revolved a plan for starting a monthly miscellany, to which he proposed "to communicate critical remarks on poetry, the arts of painting, gardening, etc., besides essays on morals and politics;" but the plan came to nothing. Next, he hoped he might find a maintenance by writing for a London newspaper, but before any arrangement of this sort was consummated he received in 1795 a legacy of £900 from a friend, which at once decided his course. He resolved to devote himself to poetry, and with his sister Dorothy, to whom he was ardently attached, and whose influence beguiled him of much of his waywardness, he settled down in a small and secluded house at Racedown, Dorsetshire, where the slender income which the annuity furnished, joined with his simple habits and frugal tastes, left him free to his meditations. In 1797, Coleridge paid him a visit, and the two were so charmed with each other that Wordsworth and his sister left Racedown for the neighborhood of Coleridge, and the three soon after went to Germany together, providing themselves with funds for the journey by publishing a thin volume of *Lyrical Ballads*, of which Coleridge's *Ancient Mariner* was the first, and all the rest by Wordsworth. Returning to England in 1798, Wordsworth and his sister found their home in the beautiful Westmoreland and Cumberland Lake country, to which Coleridge and Southey also resorted, and from which he and they received the name of "Lake poets"—a name at first of derision, but which has won for itself an abiding-place of dignity in the history of English literature. These three poets, differing in almost every other particular, agreed in their antagonism to the stiff and formal style of the poetry then in vogue—an antagonism, however, which each represented in a way peculiar to himself. In Wordsworth's case this antagonism was rooted in the same soil as his political sentiments. Imbibing, as he did so largely, the spirit of the French revolution, enthusiastic in behalf of the rights of the people, and earnestly opposed not only to hereditary kings and nobles, but to all social distinctions and privileges which the will of the people had not decreed, it was very easy for him to feel also that poetry should take its direction from the popular heart, and that the true poet should seek to represent exactly the sentiments which the common people feel, and in exactly the language which the common people employ. Into this theory he threw himself with all the ardor of his impetuous nature, with much self-will and no little self-conceit, illustrating it by poems in which the homeliest incidents were clad in the homeliest garb, and defending it by arguments in which he seeks to show that the nature exercised in common life needs only to be revealed to convey to any mind the sentiment of the supernatural. In a narrow circle his poems were at once welcomed with enthusiastic admiration, but with the general public they got little favor. The *Edinburgh Review* ridiculed them unmercifully, and their sale was for a long time small. But he kept on writing; his views of life grew larger; he became mellower and less

self-willed; and while the tender and thoughtful in common life still appealed to him as the fit theme for poetry, he relaxed somewhat from his extreme views of poetic construction, while his thoughts also took on a wider range; nature with its manifold mystery, and the human life wherever found—with its "first affections," its "shadowy recollections," its "obstinate questionings of sense and outward things"—gave him increasing inspiration; the circle of his readers and admirers grew; criticism ceased to jeer; and though he never possessed any sense of humor, and never could make merriment, he was recognized before he died, foremost in his generation, as the poet both of nature and of human life. This judgment of his contemporaries meets but little dispute since.

He was married in 1802, made poet-laureate on the death of Southey in 1843, and d. Apr. 23, 1850, the anniversary of Shakspeare's birth and death. J. H. SEELYE.

Work. In abstract mechanics this term generally designates the quantity which results from multiplying the intensity of a force by the distance passed over by its point of application; for instance, the force which is called *weight*, being the total action of gravity upon a body, is a force which passes through the centre of gravity of the body, and is measured by a certain number of units of weight (pounds in English measures); and when a weight falls through a given distance expressed in units of length (feet in English measures), the product Wh is called the work of the falling body, W representing the total weight and h the height of fall. So also the pressure (P) of steam against a piston may be represented by a single force acting through the centre of pressures, and the length of stroke the distance passed over by this centre, and $P \times s$ will represent the work of the pressure of the steam during one stroke, this pressure being supposed constant. As action and reaction are always at each instant equal and directly opposed, the work of the resistance offered to the falling of the weight W in the first instance, and to the motion of the piston in the second, will also be equal respectively to $W.h$ and $P.s$.

In machines the action of the resistance at the working-point is usually denominated the work of the machine. Thus, if the action of a machine be to raise a body from one level to another, the work of the machine will be the product Wh. The work of a tool, such as a planing-machine, is the product of the resistance offered by the material to the cutter, multiplied by the distance passed over by the latter. In machines for accomplishing a particular kind of work there is always one part or piece which receives directly the action of the power, which is connected by other pieces with the part which performs the specific *work*. The action of the power must necessarily be sufficient not only to drive the working-point against the *useful* resistance to be overcome, but also to overcome the resistances in the machine itself, such as inertia, friction, and weight. In many machines the useless work of inertia and weight of moving parts may be avoided, but the work of friction always exists to absorb a part of the action of the power; and hence the efficiency of a machine can never be perfect; in other words, the work of the power must always be greater than the work of the useful resistance to be overcome.

The *rate of work* of a machine is the quantity of work which it performs in a given time, and is usually expressed in units of work per hour or per second; and the total work, if the rate be uniform, will be the rate multiplied by the time, the latter being measured in units of time corresponding to the unit employed for the rate of work. Thus, the *horse-power* (in English measures), a rate of work equivalent to 33,000 foot-pounds per hour, or 550 foot-pounds per second, multiplied by the time in hours or seconds, as the case may be, will give the total number of foot-pounds of work in the given time. Since velocity involves the element of time as well as of distance, the rate of work may also be expressed in terms of velocity. For instance, suppose a horse to exert a force of 200 pounds in drawing a plough at the rate of 2 feet a second, the number of foot-pounds per second of work performed will be 400, or 24,000 foot-pounds per hour. Representing the force of the draught, or the resistance overcome, by R, and the velocity or space traversed in one second by V, the rate of work per second will be R.V, and the total work in the time T by R.V.T.

W. P. TROWBRIDGE.

Workhouse. See PAUPERISM, by REV. C. L. BRACE.

Work'ington, town of England, county of Cumberland, on the Derwent, near its mouth, has a good harbor lined with convenient quays, furnished with a breakwater, and provided with docks. Breweries, distilleries, and factories for the manufacture of sailcloth, cordage, and chemicals are in operation, and large quantities of coal from the rich collieries of the vicinity are exported. P. 7159.

Work'sop, town of England, county of Nottingham, on the Ryton, is celebrated for its malt. P. 7215.

Wor'man (JAMES H.), b. at Berlin, Prussia, about 1835; educated at the university of that city; came to the U. S. 1860: became professor of modern languages in Knox College, Galesburg, Ill.; has been since 1867 librarian and instructor in Drew Theological Seminary, Madison, N. J., and on the death of Dr. John McClintock became assistant in the non-biblical department of McClintock and Strong's *Cyclopædia of Biblical Literature*. Author of several text-books for the modern languages, especially the German, including a *History of German Literature* and a *Complete German Dictionary*.

Worms. See APPENDIX.

Worms, town of Hesse-Darmstadt, on the Rhine, is one of the oldest cities of Germany. It existed before the time of the Romans, was the residence of Charlemagne, and the seat of the famous diet before which Luther was summoned in 1521, and which he would meet "even though there were as many devils in the city as tiles on its roofs." In 1689 it was taken and sacked by the French, and only the cathedral, a fine structure, built 996–1016 of red sandstone in Byzantine style, and a few houses, escaped destruction. It was soon rebuilt, but it never recovered its former prosperity. It manufactures leather, tobacco, and soap, and in its vicinity is produced the celebrated Rhenish wine called *Liebfraumilch*. P. 14,484.

Worm'seed, the name given in this country to the fruit of *Chenopodium anthelminticum*, a wild herbaceous plant, native in the U. S., and most commonly met with in the Southern States. The plant possesses a peculiar aromatic but disagreeable smell. Wormseed is found in commerce in the form of very minute grains, which have the characteristic odor of the plant. When distilled, they yield a volatile oil (*oleum chenopodii*). In Europe the term "wormseed" (*Semen cinæ, Semen santonici, Semen-contra*) is given to the small unexpanded flowers of *Artemisia vahliana, A. sieberi*, and *A. incalta*. The first (Levant wormseed) is indigenous in Persia and Asia Minor; the second (African or Barbary wormseed) is found in Persia, Barbary, and Arabia; the third is said to furnish the East Indian wormseed, but, according to some authorities, the latter is simply the *A. sieberi* mixed with turmeric. These varieties contain a volatile oil, an active principle (santonine or santonic acid ($C_{15}H_{18}O_3$); see SANTONINE), resin, with extractive matters, and other ordinary constituents of plants. The oil (*oleum cinæ, essence de Semen-contra*—which appears to be identical with *oleum chenopodii*) is prepared by distilling the wormseed with water, and forms a yellow or brownish-yellow liquid, possessing the peculiar disagreeable odor and aromatic burning taste of the plant; it has a sp. gr. ranging from 0.925 to 0.935, and boils at 340° to 350° F. The purified oil contains an oxygenated compound, $C_{10}H_{18}O$ (cinæbene-camphor), and a hydrocarbon, $C_{10}H_{16}$ (*cynene* or *cinæbene*), which is isomeric with, and resembles in some of its properties, oil of turpentine. (See TURPENTINE.) The oil is somewhat soluble in water, much more so in alcohol and in ether; on exposure to the air it gradually thickens and assumes a deeper color; when treated with *dilute* nitric acid, it yields either oxalic or toluic acid. Wormseed is employed in medicine as a vermifuge, but lately santonine has been generally used in its place. In the U. S. the seeds and oil of *Chenopodium anthelminticum* are most generally employed as an anthelmintic remedy. J. P. BATTERSHALL.

Worm'wood [Ang.-Sax. *wormod*; Ger. *Wermuth*; Fr. *absinthe*], the leaves and flower-tops of *Artemisia absinthium*, a perennial plant indigenous in Europe, but naturalized in the U. S. It possesses a strong, peculiar odor and a very bitter, unpleasant taste, which are imparted to its aqueous and alcoholic infusions. The dried plant furnishes by distillation a dark-greenish oil (*oleum absinthii*, $C_{10}H_{16}O$), which is isomeric with ordinary camphor, has a specific gravity of 0.932, and possesses the odor and taste of the plant. The bitter principle of wormwood (*absinthine* or *absynthiine*) is obtained by agitating the concentrated alcoholic extract of the leaves with ether, evaporating the solution so obtained to dryness, and purifying the residue by digesting it with dilute hydrochloric acid, dissolving in alcohol, precipitating by plumbic acetate, decomposing the precipitate with sulphuretted hydrogen, and evaporating the solution; or by agitating the concentrated aqueous infusion with animal charcoal, extracting the absinthine therefrom by treatment with alcohol, and then partially purifying it as directed above, afterward by precipitation with tannic acid and crystallization from alcohol. Absinthine forms a yellow, pulverulent mass, is neutral to test-papers, and has the odor and taste of wormwood; it is slightly soluble in water, but readily dissolves in alcohol and ether; fuses at about 218° F., and dissolves in concentrated sulphuric acid to a greenish-blue liquid which assumes a beautiful blue color on addition of

a little water; it is considered an aldehyde, with the composition $2C_{20}H_{28}O_4,H_2O$. The remaining constituents of wormwood are chlorophyl, albumen, fibrine, lignine, starch, and saline matters. It is occasionally employed externally in medicine as an antiseptic and discutient, and was formerly used also as a tonic. The volatile oil of wormwood, upon which its active qualities depend, possesses narcotic properties, and if given in large dose produces epileptiform convulsions, and even death; when mixed with oil of anise, fennel, etc., and dissolved in alcohol, it forms the well known *liqueur* ABSINTHE (which see). J. P. BATTERSHALL.

Wor'num (RALPH NICHOLSON), b. at Thornton, Northumberland, England, Dec. 29, 1812; educated at University College, London; made a preliminary study of art at London; visited the continental art-galleries 1834-39; became a portrait painter in London; wrote largely on art for the *Penny Cyclopædia*, the *Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge, the *Art Journal*, and Dr. Smith's *Dictionary of Greek and Roman Antiquities* (1841); was appointed to prepare the official catalogue of the National Gallery 1845; became lecturer on art to the government schools of design 1848; librarian to those schools 1852, and keeper and secretary of the National Gallery 1855. Author of *A Sketch of the History of Painting* (1846; 4th ed. 1861), *Analysis of Ornament* (1856), *The Epochs of Painting, a Biographical and Critical Essay on Painting and Painters of All Times* (1864), and a *Life of Holbein* (1867); edited Walpole's *Anecdotes of Painting* (1849; new ed. 1862), the *Lectures on Painting* by the Royal academicians Barry, Fuseli, and Opie (1848), and has published many essays, reports, and catalogues.

Wor'saae (JENS JACOB ASMUSSEN), b. at Veile, Jutland, Denmark, Mar. 14, 1821; studied Scandinavian history and archæology; travelled much in Great Britain and Ireland, France, Germany, and Italy, and was appointed professor of Northern archæology at the University of Copenhagen in 1854, director of the Museum of National Antiquities in 1861, and minister of public education in 1875. His principal works are—*Danmarks Oldtid* (1843; translated into English by Thoms as *The Primeval Antiquities of Denmark*, 1849), *Minder om de Danske og Nordmændene i England, Skotland og Irland* (1852; translated into English as *Account of the Danes in England, Ireland, and Scotland*, 1852), *Den Danske Erobring af England and Normandiet* (1863), *Danevirke* (1848), *Om Danmarks tidligste Bebyggelse* (1861), etc.

Wor'ship [Ang.-Sax. *weorth-scype*, to "deem worthy," "respect," "honor," "revere," "adore," "offer honor," etc.; to perform offices of honor, etc., social, civil, or religious, to God, men, angels, or other objects, used commonly only of religious worship]. Religion is the highest business of life; worship is the chief act of religion, and its natural expression. It is universal among men and angels. It belongs to the whole life, though specially manifested in exercises revealed or invented. Worship is *internal*, consisting of the inward homage which we owe to God, as in love and trust; and *external*, the outward expression of homage by the observance of God's ordinances. It is required by God, prompted by gratitude and hope, by the apprehension of God's infinite excellence and grace, and by our confidence in him as our chief good and only happiness. True worship is spiritual, and must be offered sincerely and with the whole soul, to God alone, through Christ as the only Mediator. It is inspired by the Holy Spirit, who reveals the will of God, helps our infirmities, teaches how and for what to pray, enlightens the understanding, and gives insight into divine truth. (See HOLY GHOST.) Worship involves faith, love, loyalty, dependence, desire for God, thankfulness, admiration, delight, reverence, humility, holiness, cheerfulness, purity, and entire devotion; and by its reflex influence assimilates the worshipper to the object of his worship. It is performed in various ways, from fetichism, the lowest form of human worship (see FETICH), to the highest adoration "in spirit and in truth" of Him who is the Supreme Spirit.

The *objects* of worship are the true God in the three persons of the Trinity (see GOD), angels, spirits of ancestors, saints, powers and objects of nature, relics, pictures, idols, etc. The Schoolmen emphasized the distinction between *latria* (service), rendered only to God, and *idolatria*, rendered to images. (See IDOLATRY.) Later distinctions (in theory rather than in practice) have been added—viz. *dulia*, to saints and angels—*hyperdulia*, to the Virgin Mary.

In the Old Testament worship, sacrifice appears as the central observance. Christian worship rests on the acknowledgment of a sacrifice offered "once for all." (See SACRIFICES.) Every pagan worship centres in sacrifices. (See PAGANISM.) They are offered to propitiate the divine favor and under a sense of guilt, or in thanksgiving, or to secure mercy and favor, or sometimes to serve as food or drink for the gods. Human sacrifices are offered under the notion that the most precious gift will buy the largest favor. As fire is deemed purifying, mysterious, and sacred, the highest sacrifice is by burning. In the Old Testament, sacrifice appears at first as an expression of faith in a present God, as an act of propitiation and thanksgiving, and a pledge of a covenant. Blood is the life; therefore the best sacrifices are bloody. The offerings were of "clean" domestic animals, grain, fruits, wine, oil, etc., offered on altars of stone and earth or metal, in sacred places, under trees, groves, on "high places;" later in the tabernacle and the temple. Sacred times were sabbaths, new moons, the feasts of the Passover, Pentecost, Atonement, Tabernacles, Trumpets, Jubilee, Dedication, Purim. (See FEAST.) In the completed temple service to sacrifice were added prayer, praise, instrumental and vocal music, instruction, purification; also circumcision, vows, tithes, etc. The synagogue-service, in which prayer took the place of the sacrifices of the temple, consisted of (1) prayer, with written forms; (2) reading of Scripture in three parts—(*a*) Shema (three extracts from Numbers and Deuteronomy); (*b*) the Law; (*c*) Prophets; (3) expounding the Scriptures. Services were held Saturday, Monday, and Thursday, morning, noon, and evening, and were conducted by the "elders," ministers or "angels," and deacons. (See SYNAGOGUE.)

The early Christians organized their services on the synagogue model, the essential elements of which were sanctioned and spiritualized by Christ, and to which he added preaching and the Lord's Supper. They met in private houses, or solitary places, or temple-courts at any convenient and safe time. No stress was laid at first on a particular order. They read from the Old Testament, and later from the Gospels and Epistles, explaining the passage in free discourse, in which at first all could join. Individual gifts were used under the promptings of the Spirit, according to mutual regard and utility. Singing and prayer followed. Then the love-feast (see AGAPÆ) and the covenant supper were solemnized, the kiss of charity given, and the voluntary offerings made. By the end of the second century the service was divided into the *missa catechumenorum*, called "Scripture reading"—in which were psalmody, Scripture lessons, the sermon, and some of the prayers—and the *missa fidelium*, called "prayers." In the latter the prayers, which were all offered at the altar, were for consecration, for the whole Church, for the peace of the world, and all orders of men. There were also the Eucharist, hymns, thanksgivings, and doxologies. (See MASS.) By the third century Christian temples were frequent, and sometimes splendid. They were divided into the porch, nave—where the pulpit stood—and the sacristy. (See CHURCH.) In the fourth century triumphant Christianity built magnificent churches or appropriated public buildings (see BASILICA), and adorned its clergy with peculiar costumes, kindled lights on the altars, used incense, and gave more attention to artistic music and responses. The agape was separated from the Lord's Supper and became a feast. With the union of Church and State the liturgical tendencies were rapidly developed, forms were multiplied, and became wordy and theatrical, and the ministers came to be held as a peculiar class. (See CLERGY.) One of the ideas of Christianity distinguishing it from Judaism and heathenism is that of the priesthood of all believers.

The worship of the Church includes—(1) Prayer, in the vernacular or some sacred though often unfamiliar tongue, written and formal or unstudied, standing or kneeling, rarely prostrate, with uncovered heads, with or without responses. (See PRAYER.) (2) Reading of Scripture in regular order, or not. (3) Preaching, exposition, exhortation, etc., founded or not on the passage read. (4) Singing, in the words of Scripture or human compositions, with or without instrumental accompaniment, by the congregation, or later by choirs. "Hymns are prayers in the festive dress of poetry," rendered with music on account of the strong influence it exerts on the emotions. (See HYMNOLOGY.) (5) Confession of faith. (6) Voluntary offerings; and (7) Sacraments, baptism, the initiatory rite, and the Lord's Supper, the rite of witnessing, and edification. The latter was celebrated every day, or every Lord's Day, or at longer intervals. (See SACRAMENT.) Christian worship has been held on the Lord's Day, or on daily or on yearly festivals or fasts which commemorate special events. (See FEAST.)

Public worship is of divine appointment, and can be rightly observed only according to God's prescribed way. It has been honored by God in the temple and by Christ in the synagogue. It is fitted to our social natures, and is of indispensable obligation. It sustains all worship, pri-

vate and social. Its regular recurrence wakens and cultivates the spiritual life, celebrates the communion of believers, gives opportunity for moral and religious instruction, and impresses the truth by social influences and by constant reiteration. It unites men, and makes them unselfish and humble. It should be orderly as to times, places, customs, and the persons who direct it.

The liturgical class emphasize the sacrificial side of worship—others, especially the Reformed churches, the didactic side. A multiplicity of ceremonies is commended, on the ground that they give expression to varied sentiments—that they enliven and increase devotion and piety by moving the senses, and lead the illiterate more easily to a knowledge of the mysteries of religion. It is condemned on the ground that it diverts the attention from the simple principles of worship, and that, as worship is a divine ordinance, nothing is to be allowed except that which is divinely ordained.

Worship implies the ascription of divine perfections to its object, the possession of such perfections giving the only claim for such homage. The Church has from the beginning made God in Christ the central object of its worship, offering to him and the Holy Spirit worship in its highest form, usually addressing the Father in the name of the Son and by the assistance of the Spirit, though also worshipping each Person immediately. The early Church forbade the worship of saints, martyrs, angels, etc., as superstitious and idolatrous, and giving to the creature that which is due to God alone. But in the fourth century the worship of saints had been developed from the veneration of martyrs. The worship of the Virgin Mary has gradually greatly increased from early days. In the Old Testament angels appear as mediators. They were supplicated by the later Jews and the Gnostics, and some of the Christian councils allowed the custom. Idolatry is the ascription of divine attributes to a creature. (See IDOLATRY.) The first commandment forbids the worship of any being except God, as it detracts from the supreme honor and love due to him. The second forbids the making and worshipping of images and every false mode of worship. The use of images and pictures was allowed by the Council of Nice (787), and the adoration of relics by the Council of Trent (1545). The use of images is defended on the ground that they adorn the churches, instruct the ignorant, impress the mystery of the incarnation and examples of saints, and excite pious feelings, and that in or by them God is worshipped. They are opposed on account of their universally and almost inevitably dangerous tendencies—that they displace God and become themselves the object of worship, and are forbidden. ISAAC RILEY.

Wors'ley (PHILIP STANHOPE), b. in Kent, England, about 1832; educated at Cholmeley School, Highgate, and at Corpus Christi College, Oxford, where he was elected scholar 1854, and subsequently fellow; took orders in the Church of England; gained the Newdegate prize for his poem, *The Temple of Janus* (1857); contributed poems to *Blackwood*; published a volume of *Poems and Translations* (1863), *The Odyssey of Homer, translated into English Verse in the Gregorian Stanza* (Edinburgh, 2 vols., 1861–62), and *The Iliad of Homer, translated into English Verse in the Spenserian Stanza* (vol. i., 1865), both of which have taken a high place among the versions of Homer. D. at Freshwater Bay, Isle of Wight, May 8, 1866.

Worsley (Sir RICHARD), BART., b. in the Isle of Wight, England, 1751; was for many years English diplomatic resident at Venice; gathered there, at a cost of over £25,000, a fine collection of antique bassi-rilievi, busts, statues, and gems, of which he printed an elaborate description in English and Italian under the title *Museum Worsleyanum* (2 vols. folio, 1794–1803; new ed., 12 parts, 1824); became a member of Parliament for Newport, comptroller of the royal household, and governor of the Isle of Wight, where he d. Aug. 8, 1805. He edited, with additions, a *History of the Isle of Wight* (1781) from the MS. of his grandfather, Sir James, and his father, Sir Thomas Worsley.

Worsted. See WOOL, MANUFACTURE OF.

Wort [Ang.-Sax. *wyrt*; Ger. *Meisch*; Fr. *moût*], the sweet infusion of malt obtained in the preparation of beer. (See BEER.)

Wörth, village of Alsace, with about 1200 inhabitants, at the junction of the Sulzbach and the Sauerbach, is noted as the point where the first decisive encounter took place between the French and German armies, Aug. 6, 1870. The principal point in the French position was Froschweiler. (See FRANCO-GERMAN WAR.)

Worth, county of S. W. Georgia, drained by Flint and Little rivers, and traversed by Brunswick and Albany R. R.; surface level, soil sandy. Cattle, sheep, and swine are the chief live-stock. Staples, cotton, Indian corn, and sweet potatoes. Cap. Isabella. Area, about 900 sq. m. P. 3778.

Worth, county of N. Iowa, bordering on Minnesota, and drained by Shell Rock River; surface undulating prairie, with much woodland. Cattle are the chief live-stock. Staples, wheat, oats, Indian corn, and hay. Cap. Northwood. Area, 432 sq. m. P. 2892.

Worth, county of N. W. Missouri, bordering on Iowa, and drained by Grand River; surface undulating, with much timber-land. Horses, cattle, sheep, and swine are numerous. Staples, corn, oats, wheat, hay, wool, and dairy products. Cap. Grant City. Area, 225 sq. m. P. 5004.

Worth, tp., Cook co., Ill. P. 1747.

Worth, tp., Woodford co., Ill. P. 1000.

Worth, tp., Boone co., Ind. P. 1343.

Worth, tp., Boone co., Ia. P. 975.

Worth, tp., Sanilac co., Mich. P. 1434.

Worth, tp., Jefferson co., N. Y. P. 727.

Worth, tp., Butler co., Pa. P. 893.

Worth, tp., Centre co., Pa. P. 650.

Worth, p.-v. and tp., Mercer co., Pa. P. 1084.

Worth (WILLIAM JENKINS), b. at Hudson, N. Y., Mar. 1, 1794. On the outbreak of war with Great Britain in 1812 he entered the army as a private soldier, but was appointed Mar. 19, 1813, a first lieutenant of the 23d Infantry, and during the campaign of that year served on the staff of Maj.-Gen. Lewis. In the campaign of 1814 he was on the staff of Gen. Scott, and engaged in the battles of Chippewa and Niagara, gaining the brevet of captain for the former and of major for the latter battle, where he was severely wounded. His promotion to captain in the 23d followed Aug. 19, and at the close of the war he was retained in the 2d Infantry, but transferred to the 1st Artillery on the reorganization of the army in 1821. From 1820 to 1828 he was commandant of cadets and instructor of infantry tactics at West Point; was director of the artillery school of practice at Fort Monroe 1829–30, and in garrison there until May, 1832, when transferred to the ordnance corps with the rank of major, having been brevetted lieutenant-colonel in 1824. Appointed colonel of the 8th Infantry July, 1838, he commanded the northern department during the insurrectionary movement on the Canada border 1838–39. In 1840 he was ordered to Florida, and in 1841 placed in command of the army there. During this and the next year the hostile Seminoles were subdued, and the greater part of them removed to the Indian Territory. For gallantry and highly-distinguished services in Florida he was brevetted brigadier-general Mar. 1, 1842, and retained in command of the department of Florida until 1846, when again called to the field by the outbreak of the war with Mexico. The battle of Monterey was his first opportunity for distinction, where his command stormed the heights commanding the Bishop's Palace, and carried the palace itself. He was now brevetted major-general and placed in command at Monterey, but soon after detached with his command from Gen. Taylor's army to support the movement under Gen. Scott by way of Vera Cruz, his brigade of regulars making the descent upon that city Mar. 9, 1847. He was one of the commissioners to negotiate the terms of capitulation, and in command of the city after the surrender. In the subsequent operations during the march to Mexico he commanded the first division, which was engaged in the battle of CERRO GORDO, Apr. 17–18 (which see), and which occupied the castle and town of Perote Apr. 19. Upon the resumption of active operations in August, Worth was directed, Aug. 20, to attack San Antonio, which was soon in his possession, and returning he was engaged in carrying the works of Churubusco the same day. (See CHURUBUSCO.) Reinforced by Cadwallader's brigade and Sumner's cavalry, his command fought the battle of Molino del Rey, Sept. 8, was engaged in the storming of CHAPULTEPEC (which see), and of the San Cosme Gate, and the occupation of the City of Mexico, Sept. 13–14, 1847. For his distinguished services at Monterey, Congress presented him with a sword of honor, and similar testimonials were bestowed upon him by his native State and county, and by the State of Louisiana. In Nov., 1848, he was placed in command of the department of New Mexico and Texas. D. at San Antonio, Tex., May 7, 1849. A handsome memorial monument was erected by the city of New York at the junction of Broadway and Fifth Avenue, beneath which rest his remains.

Worth'ing, town of England, county of Sussex, on the English Channel, is in a flat district, but has a beautiful promenade along the shore, and is much resorted to as a bathing-place. P. about 8000.

Worth'ington, p.-v., cap. of Barnes co., Dak.

Worthington, p.-v., Greene co., Ind., on Indianapolis and Vincennes and Terre Haute and Worthington R. Rs., 71 miles S. W. of Indianapolis, has an excellent graded school, 2 newspapers, 1 stock bank, 3 flouring, 1 woollen, and 2 planing mills. Large quantities of corn and wheat are grown here. P. 2028. F. N. MILLER, ED. "TIMES."

Worthington, p.-v. and tp., Hampshire co., Mass. P. 869.

Worthington, p.-v., cap. of Nobles co., Minn., on Sioux City and St. Paul R. R., 177 miles S. W. of the latter city, has 3 churches, 1 seminary and good public schools, 1 bank, 1 newspaper, a large public hall, 3 hotels, 1 flouring-mill, a public library, and Masonic and other societies. P. about 800. A. P. MILLER, ED. "ADVANCE."

Worthington, p.-v., Franklin co., O.

Worthington, tp., Richland co., O. P. 1876.

Worthington, p.-b., Armstrong co., Pa. P. 216.

Worthington, p.-v., Lincoln tp., Marion co., West Va. P. 127.

Worthington (JOHN), D. D., b. at Manchester, England, in 1618; educated at Emmanuel College, Cambridge, where he became a fellow; took orders in the Church of England; was master of Jesus College, Cambridge, from 1650 until after the Restoration, when he became curate of St. Benet Fink, London, and after that church was destroyed by the Great Fire was rector of Ingoldsby, Lincolnshire; became prebendary of Lincoln 1668, and lecturer at Hackney in Nov., 1670. D. at Hackney in 1671. He edited, with additions from the MSS., the *Works* of Joseph Mede (2 vols. folio, 1664) and the famous *Select Discourses* of John Smith of Cambridge (1660), and left many MSS., from which were posthumously published, at considerable intervals, *Miscellanies* (1701) and *Select Discourses* (1725). His *Diary and Correspondence* were edited by James Crossley for the Chetham Society (2 vols., 1847–55). His letters to Hartlib and others contain valuable biographical data concerning many literary and ecclesiastical celebrities of the great rebellion and the Restoration.

Worthington (THOMAS), D. D., b. at Blainscough, Lancashire, England, about 1552; studied in the English colleges at Douay and Rheims; became a priest; labored as a missionary in England some years; was imprisoned in the Tower 1581; was banished 1585; corrected the Douay version of the Bible; was president of Douay College 1599–1613, and spent his latter years in England, where he joined the Society of Jesus about 1625. D. in Staffordshire in 1626. Author of *Annotations on the Old Testament* (2 vols., 1609), *Catalogus Martyrum Pontificiorum pro Religione in Anglia occisorum 1570–1612* (1612), *An Anker of Christian Doctrine, etc.* (2 vols., 1618–22), and wrote some of the *Notes* appended to the Rheims version of the New Testament (1582).

Wort'ley, town of England, county of York, manufactures cloth, clay, pipes, firebricks, and alum. P. 12,028.

Wor'ton, p.-v. and tp., Kent co., Md. P. 2451.

Wot'ton (Sir HENRY), b. at Boston (or Boughton) Hall, parish of Boughton Malherbe, Kent, Mar. 30, 1568; educated at Winchester School, at New College, and at Queen's College, Oxford, distinguishing himself in the study of optics; spent several years (1589–97) on the Continent, residing a year at Geneva, where he frequented the society of Beza and Casaubon; three years in Germany and five years in Italy, chiefly at Rome, Venice, and Florence, becoming well acquainted with Italian literature, science, and art; was for some time secretary to Robert Devereux, earl of Essex, whom he accompanied to Spain and Ireland, and at whose fall (1600) he took the precaution to revisit Italy, whence he was despatched by Ferdinand I., grand duke of Tuscany, to warn King James of a plot against his life 1602; made his way to Scotland in disguise *viâ* Norway, under the assumed name of "Octavio Baldi;" delivered his message to that monarch at Stirling, gaining his favor; returned to Florence; proceeded to England soon afterward on the accession of James, by whom he was knighted, and sent ambassador to Venice; wrote in an album at Augsburg while on his way to his post the often-quoted witticism, "An ambassador is an honest man sent abroad to lie for the good of his country," which, being maliciously printed by Scioppius some years later, caused him much inconvenience; was intimate at Venice with the celebrated Fra Paolo Sarpi; returned to England 1610; is believed to have sat in Parliament 1614; went on a mission to the Netherlands 1615; was reappointed to the Venetian embassy 1616; was sent to the duke of Savoy 1619, several times to Germany upon business connected with the claims of the elector-palatine, and went a third time to Venice; returned to England with broken fortunes 1623; became provost of Eton College July 26, 1625, and (as a condition of retaining that post) took orders in the Church of England 1627. D. at Eton in Dec., 1639. His *Poems* have been many times reprinted, usually in connection with those of Raleigh, but he is best known by his miscellaneous remains, entitled *Reliquiæ Wottonianæ* (1651), edited by his friend Izaak Walton, who prefixed a *Life*. Other of his works were *The Elements of Architecture* (1624) and *The State of Christendom* (1657).

Wotton (WILLIAM), D. D., b. at Wrentham, Suffolk, England, Aug. 13, 1666, son of Henry, minister of that place, who taught him Latin, Greek, and Hebrew in his earliest childhood, with such results that this has been pronounced "the most remarkable of well-authenticated cases of intellectual precocity;" was able at five years of age to translate chapters and psalms from the Hebrew, Greek, and Latin into English—attainments which were minutely described by his father in a pamphlet published the following year (1672); was admitted to Catherine Hall, Cambridge, in his tenth year, when Dr. John Eachard, master of the college, certified (Apr. 1, 1676) that his classical attainments were equal to those of Hammond or Grotius, "nec Hammondo nec Grotio secundus;" graduated as bachelor of arts at twelve years of age (1679), at which time he was acquainted with twelve languages and was able to repeat an entire sermon after a single hearing; became fellow of St. John's College, Cambridge, 1685; took orders in the Church of England, and was presented with the sinecure living of Llandrillo, Denbighshire, 1691; became chaplain to the earl of Nottingham, who gave him the rectory of Middleton Keynes, Buckinghamshire, 1693; was made prebendary of Salisbury 1705; retired to his Welsh living 1714, and was able soon afterward to preach in Welsh. D. at Buxted, Essex, Feb. 13, 1726. Author of *Reflections upon Ancient and Modern Learning* (1694), *A History of Rome from the Death of Antoninus Pius to the Death of Severus Alexander* (1701), *Traditions and Usages of the Scribes and Pharisees* (2 vols., 1718), translated from the Mishna, and editor of the *Laws of Hoel the Good* (1730), in Welsh and Latin, with a glossary.

Wounds. Wounds are classified according to the nature of the injury, as (1) punctured wounds, made with pointed instruments; (2) incised wounds, produced by cutting instruments or sharp edges; (3) lacerated wounds, in which the borders of the wound are irregular, ragged, and torn, and the result of great force, dull instruments, or tearing; (4) poisoned wounds, in which either an animal venom or virus or some impure, poisonous, or irritating matter has gained entrance to the injured tissues and contaminated the blood; (5) gunshot wounds, which as a rule are penetrating and may be lacerated, but are peculiar from other wounds, owing to the character of the missile, the shock they give to the part and to the nervous system, and the grave complications to which they are liable. (6) Contusions and "contused wounds" are also classed with wounds, but the contusion is not properly a wound, since there is no actual solution of continuity of the flesh, unless it be an abrasion of the skin; and a contused wound is simply a punctured, incised, or lacerated wound whose borders and adjacent tissue are severely contused. The tissues at the seat of a contusion are often seriously injured, many minute blood-vessels are ruptured, and the escaped blood, settling in the tissues, causes an "ecchymosis," a black or blue-black mottling of the part. As the blood is decomposed and slowly absorbed, this color changes to blackish-green, greenish-yellow, dark leather-color, and lighter shades till it disappears. In other contusions there is subcutaneous laceration of tissues, or such shock to their vitality that they speedily disintegrate, and the devitalized part sloughs in a mass or becomes the seat of ulcers. Punctured wounds are relatively the most serious class, for they are often poisoned by the entrance, if not of venom or virus, of foreign matter, as rust, dust, splinters, clothing, etc., which cause suppuration at the bottom of the deep puncture, and lead to grave inflammation, erysipelas, and contamination of the blood by retained unhealthy pus. The punctured wound is to be well washed, cleansed of all blood-clots and dirt, and if deep, or in the vicinity of dense fibrous tissue, as in the hand or foot, or near joints, must be freely cut and converted into an incised wound. Incised wounds heal in several ways. They heal most promptly and simply when perfectly-smooth, clean cuts, free from clotted blood, and in the flesh of persons in perfect health. Thus, a clean cut, whose borders do not gape or separate, may, if instantly closed and sealed from the air by plaster or collodion, heal in a few hours, and approximately warrant the designation "immediate union." More often a day or two is required; the wound, being cleansed of clots or foreign matter, is exposed for a moment to the air, and closed either by adhesive plaster or stitches of silk or silver wire. The opposed surfaces are

glazed over by a film of coagulated nutritive fluid, exuded from the blood, and this, filling the interspace, agglutinates the walls of the wound and organizes a firm "scar" or cicatrix of fibrous tissue. This scar, if a mere line, may soon disappear by absorption and the part seem again perfect. Such speedy healing is termed "union by first intention" or "primary union." When a wound has been lacerated, or a considerable area of tissue has been removed, the deficit has to be made up by a slower process of new tissue-growth; new cells develop one by one, in superimposed strata, until the level of the surface is reached, when the skin begins to heal and shoot over the raw area. This is the process of "healing by granulation," far slower than the others, and, if the wound be large, a severe tax upon the strength and health of the patient. In lacerated wounds the more ragged points if left will be destroyed by ulceration or sloughing before the wound can begin to heal, and the delay often converts the wound into a suppurating, weak, and indolent ulcer; therefore, it is better, in cases of ulceration, to remove the irregularities and convert them into incised wounds, either straight or irregular, which can be brought together and heal. When an incised wound has failed of union by "first intention," its walls become granular; they may be approximated, and soon unite, constituting the process of "union by second intention." In the granulation the growth of tissue may become exuberant and rise above the surrounding healing parts on the healthy, intact surface. Such excess of granulation is popularly termed "proud flesh." It must be reduced by use of astringents or compression, or destroyed by caustics, and the site stimulated to a healthier action. Poisoned wounds, as a rule, should be laid freely open by incision, treated by disinfectant lotions, and the general strength of the patient sustained by diet, tonics, and stimulants. Contusions often call for stimulating lotions, as turpentine and oil, to counteract the shock of the part, and hot cloths to maintain the temperature and restore the circulation when cold. The healing of a wound is facilitated by pure air, regular hours for sleep, plain but rich diet, and abstinence from alcohol.

E. Darwin Hudson, Jr. Revised by Willard Parker.

Wou'vermans (Philip), b. in Haarlem, Netherlands, 1620. His father was an historical painter of no reputation; his teacher was Jan Wynants, a painter of landscape, but his genius led him to methods of his own, and he became not only the most popular of Dutch landscape painters, but one of the most eminent in the world; he delighted in subjects where horses were prominent, for he rendered them with wonderful spirit and truth. He is said never to have left Holland, but the variety in his landscapes makes that statement hard to believe. He worked carefully, but rapidly. His catalogued pictures are nearly 800 in number; they are seen in all large European galleries. Some of the most famous are familiar through engravings. D. in 1668.—Peter Wouvermans, younger brother of Philip, was also a landscape painter, after the manner of his brother, inferior in excellence; yet so good an imitator of his style that the two have been confounded. O. B. Frothingham.

Wrack [Fr. *varec*], or **Sea-Wrack**, names applied to many sea-weeds, especially to the Fucaceæ, useful as manures and as sources of iodine; also to wrack-grass, eel-grass, or grass-wrack, *Zostera marina*, a naiadaceous plant useful as manure, and extensively used for packing glass and pottery.

Wran'gel (Karl Gustav), Count, b. Dec. 13, 1613, at Skokloster, the family estate, on Lake Mälar, near Upsala, Sweden; received a military education, and fought in the Thirty Years' war under Gustavus Adolphus, Bernhard of Saxe-Weimar, Bauer, and Torstenson. In 1643, after the death of Admiral Flemming, he received the command of the Swedish fleet which was destined to join the Dutch fleet and carry the Swedish army from the Danish peninsula to the islands, but was defeated off the island of Femern, Oct. 13, and shut up in the Bay of Kiel. In 1646 he was made commander-in-chief of the Swedish force in Germany; joined Turenne, and defeated the Austro-Bavarian forces repeatedly. Under Charles X. he commanded in the campaigns in Poland (1655) and in Denmark (1658), and in 1674 led the army of 16,000 men which suddenly invaded the country of the elector of Brandenburg, who was a member of the coalition against Louis XIV., and stood with his whole force in the Rhine countries. But Wrangel's health failed, the elector hastened back with astonishing rapidity, and the Swedes were defeated at Rathenow and Fehrbelin, and driven out of Brandenburg. D. in the island of Rügen in July, 1676.

Wran'gell, von (Ferdinand), Baron, b. in Esthonia about 1795; was educated in the naval academy of St. Petersburg; accompanied Capt. Golownin on his journey around the world 1817–19; commanded an expedition to the Polar Sea Nov. 2, 1820–Aug. 15, 1824; made a second voyage around the world 1825–27; was governor of the Russian possessions in North America 1829–34, and received on his return various high positions in the naval department, and was made an admiral. D. at Dorpat June 6, 1870. His account of his polar expedition was published in Russian (2 vols., 1841), but an extract from his diaries appeared in German in 1839, and was translated into English by Mrs. Sabine in 1840—*Wrangell's Expedition to the Polar Sea in 1820–23*. The tract of land in the Arctic Ocean bearing his name was discovered in 1867 by Capt. Long.

Wrang'ham (Francis), F. S. A., b. at Raisthorpe, Yorkshire, England, in 1789; educated at Magdalen College and at Trinity Hall, Cambridge, where he graduated with high honors in classics 1790; was for some time a tutor; took orders in the Church of England; became curate of Chobham, Surrey, 1794, vicar of Hunmanby, Yorkshire, 1795, rector of Thorpe Basset 1819, archdeacon of Cleveland 1820, prebendary of York 1823, of Chester 1825, rector of Dodleston, Cheshire, 1827, and archdeacon of the East Riding of York 1828. He gained the Seatonian prize for the best English poem on a sacred subject 1794, 1800, 1811, and 1812. D. Dec. 27, 1843. Author of several volumes of poems and poetical translations from the Latin and Italian; revised Langhorne's translation of Plutarch (6 vols., 1808) and the second edition of *The British Plutarch* (6 vols., 1812), and published 3 vols. of *Sermons* (1816).

Wrang'ler [so called because formerly required to engage in public disputation], one of the first class of honormen of the mathematical tripos in the University of Cambridge, England. The number of these is not limited. The first of them is called the senior wrangler.

Wrasse [W. *gwrachen*], a name commonly applied in Great Britain to sea-fishes of the genus *Labrus*, family Labridæ. The species are numerous, not large, and mostly inferior as food. The ballan wrasse or oldwife (*L. maculatus*) is one of the most common sorts. It is employed as fish-bait, but is not considered fit for food.

Wra'tislaw (Albert Henry), b. in England in 1821, of Bohemian parentage: studied at Rugby School; graduated in 1844 at Christ's College, Oxford, where he was successively scholar, fellow, and tutor; became head-master of Felstead Grammar School 1852, and of that at Bury St. Edmund's on the resignation of Dr. J. W. Donaldson in 1855; has published several volumes of poems and prose translated from the Czech and other Slavonic languages, and has written several schoolbooks and educational and religious treatises.

Wrax'all (Sir Frederick Charles Lascelles), Bart., grandson of Sir Nathaniel, b. at Bologne, France, in 1828; educated at Shrewsbury and at St. Mary's Hall, Oxford; was assistant commissary of the field train in the Turkish contingent, with the rank of captain, during the Crimean war 1855–56; was editor of the *Naval and Military Herald* 1858, and of the *Welcome Guest* 1860–61; contributed largely to periodical literature from 1850, and succeeded to the baronetcy by the death of a maternal uncle May, 1863. D. at London June 11, 1865. He published many translations, including Victor Hugo's *Les Misérables* (3 vols., 1862), and was author of numerous volumes of military and historical memoirs, and of several novels.

Wraxall (Sir Nathaniel William), Bart., b. at Bristol, England, Apr. 8, 1751; was employed in civil and military service in India 1769–72; travelled for several years in Europe; was confidential agent of Caroline Matilda, queen of Denmark, in her negotiations with her brother, George III., 1774–75; entered Parliament 1780; was created a baronet 1813; and was imprisoned three months in 1815 for a libel on Count Woronzow in an autobiography published in that year. D. at Dover Nov. 7, 1831. Author of several amusing volumes of anecdotical history, including *Memoirs of the Kings of France of the House of Valois* (2 vols., 1777), *History of France from Henry III. to Louis XIV.* (3 vols., 1795), *Memoirs of the Courts of Berlin, Dresden, Warsaw, and Vienna 1777–79* (2 vols., 1779), *Historical Memoirs of My Own Time, 1772–84* (2 vols., 1815; 3d ed., revised, 3 vols., 1818), and *Posthumous Memoirs of his Own Time, 1784–90* (3 vols., 1836; 3d ed. 1845).

Wray (Daniel), F. R. S., b. in London, England, in 1701; graduated at Queen's College, Cambridge, 1722; was one of the authors of the celebrated *Athenian Letters* (4 vols., 1741–43), edited by Philip Yorke; became a distinguished antiquary; contributed to the *Archæologia*; collected a magnificent library, and was deputy teller of the exchequer 1745–82. D. in London Dec. 29, 1783.

Wray (John). See Ray.

Wray (Robert Bateman), b. at Broadchalk, Wiltshire, England, Mar. 16, 1715; became a seal engraver, a branch of business which he first raised to importance in England, deriving great celebrity, especially in Italy, from his accurate copies of ancient gems, and settled in 1759 at Salisbury, where he d. in 1770. Among his best works are reckoned a *Dying Cleopatra*, a *Medusa's Head*, a *Magdalen*, heads of Milton, Cicero, Shakspeare, and Pope, and three ideal female heads.

Wreck. This term at the common law denoted all goods, merchandise, parts of a vessel, or even a vessel itself, which might be driven on shore by the force of the elements during or after a shipwreck. All such matter originally belonged to the Crown, without any regard to the claims of owners, and the right to what should be found upon a certain coast was often granted to the lord of an adjacent manor. By a statute of Henry I. it was enacted that if any person escaped alive, it should not be considered a wreck; and under Henry II. this provision was extended, so that if any animal, even a cat or a dog, escaped or was found alive among the ruin, there was no wreck. The rule was finally established that in all cases of wreck the merchandise and other articles of value should be taken into possession by a local officer; any that were perishable should be sold and the proceeds kept, and if no claim was made on behalf of an owner within a year and a day, the property fell to the Crown. When articles do not actually come to the shore, they are not legally wreck, but were designated in the old law by the following barbarous names: *jetsam* is what is thrown overboard and sinks, *flotsam* is what floats, and *ligan* is what sinks, but is identified or the place marked by a buoy or float. These all belong to their original owners if claimed by them; otherwise, to the Crown. The foregoing common law rules have been greatly modified in the U. S., but while the right of the true owner to his wrecked or derelict property is fully protected, the principles of the English legislation have been closely followed. The maritime States have generally passed statutes which provide that articles driven on shore without an owner shall be kept in safety by a public officer for a designated time, and if no owner finally appears, that they shall be sold and the proceeds applied to some public use. The finders of goods or vessels derelict at sea, and those who aid in saving ship or cargo from a wreck on coasts, are entitled to be paid a compensation called *salvage* by the owner when he appears and claims his property, or from the proceeds when no claimant appears. (See Salvage.)

John Norton Pomeroy.

Wren. See Troglodytinæ, in Appendix.

Wren (Sir Christopher), b. at East Knoyle, Wilts, Oct. 20, 1632, son of Dr. Wren, dean of Windsor and chaplain in ordinary to Charles I.; was distinguished in boyhood for mathematical and inventive genius; entered Wadham College, Oxford, at the age of fourteen; at twenty-one was elected a fellow of All Souls', being already distinguished; at twenty-five was appointed professor of astronomy at Gresham College, Oxford, which three years later he resigned for the Savilian professorship. The Royal Society, established soon after the Restoration, owed to him, in considerable measure, its reputation, and even its existence. He was appointed by Charles II. assistant to the surveyor-general, Sir John Denham, and in 1663 was commissioned to report a plan for the reconstruction of St. Paul's cathedral; visited Paris in 1665. The great fire of 1666, which destroyed a large part of London, laid St. Paul's in ruins, and made necessary its entire rebuilding. Wren's scheme for rebuilding the waste city was rejected; his plan for the new cathedral was but partially adopted. The first stone was laid June 21, 1675; the choir was opened 1697; the whole was finished in 1710. D. Feb. 25, 1723, and buried in the crypt. Before the work was begun, in 1672, the architect was knighted; in 1680 was made president of the Royal Society; was elected to Parliament, but sat only a few times. Wren's fame rests chiefly on St. Paul's cathedral. His other churches are less admired—St. Stephen's, Wallbrook; St. James's, Westminster; St. Clement's, Eastcheap; St. Martin's, Ludgate; Christchurch, Newgate. The W. towers of Westminster Abbey, the steeples of Bow church and St. Bride's, Temple Bar, and Marlborough House were his constructions. His best work was ecclesiastical. Wren passed the best years of his long life in seclusion at Hampton Court, his office of surveyor-general having been taken from him by George I. and bestowed on an incompetent rival. He was twice married. His son Christopher in chief part composed the *Parentalia*, memoirs of the Wren family.

O. B. Frothingham.

Wren'tham, p.-v. and tp., Norfolk co., Mass. P. 2292.

Wrest'ling, a struggle without arms, ending with one of the adversaries throwing the other, formed an essential part both of the old Teutonic and of the ancient Greek and Roman education, and was by the latter developed into an intricate art, the palæstra or wrestling ground forming a separate department of the gymnasium.

Wrex'ham, town of England, in Denbighshire, North Wales, has a fine church of the fifteenth century, rich coal and lead mines in the vicinity, and extensive breweries, ironworks, and paper mills. P. 8576.

Wriet'zen, town of Prussia, province of Brandenburg, on the Oder, has valuable fisheries, extensive cultivation of fruit and vegetables, and wool and cotton weaving factories. P. 6433.

Wright, county of Central Iowa, intersected by Boone and Iowa rivers; surface generally undulating, soil fertile. Cattle are the chief live-stock. Staples, wheat, Indian corn, oats, and hay. Cap. Clarion. Area, 625 sq. m. P. 2392.

Wright, county of Central Minnesota, lying on the Mississippi, drained by Crow River, and traversed by St. Paul and Pacific R. R.; surface undulating, and diversified by prairie, woodland, and small lakes. Cattle are the chief live-stock. Cap. Buffalo. Area, 708 sq. m. P. 9157.

Wright, county of S. Missouri, drained by Gasconade River and the head-streams of White River; surface somewhat hilly, soil fertile. Cattle, sheep, and swine are the chief live-stock. Cap. Hartville. Area, about 650 sq. m. P. 5681.

Wright, p.-v. and tp., Greene co., Ind. P. 1101.

Wright, tp., Wayne co., Ia. P. 953.

Wright, tp., Hillsdale co., Mich. P. 1811.

Wright, tp., Ottawa co., Mich. P. 2077.

Wright, tp., Schoharie co., N. Y. P. 1525.

Wright, tp., Luzerne co., Pa. P. 603.

Wright, tp., Darlington co., S. C. P. 1535.

Wright (A. H.), U. S. N., b. Sept. 27, 1815, in Ohio; graduated at the Naval Academy in 1863; became lieutenant in 1867, lieutenant-commander in 1868; served on board the Richmond at the battle of Mobile Bay, and was commended for "coolness and courage." F. A. Parker.

Wright (Asher), b. at Hanover, N. H., in 1803; graduated at Dartmouth College 1828, and at Andover Theological Seminary 1831, and was a missionary of the A. B. C. F. M. to the Seneca Indians upon the Buffalo Creek and Cattaraugus reservations from 1831 until his death, at Cattaraugus in 1875. He acquired the Seneca language, into which he translated portions of the New Testament, which he printed at the mission-press; prepared several elementary schoolbooks in the same language, as well as a hymn-book, and for some time printed a small periodical. He was an accomplished scholar, possessed a good knowledge of medicine, and did much for the moral and material improvement of the Senecas.—His wife, Mrs. Laura Sheldon Wright, b. in Massachusetts about 1808, also possessed the Seneca language, in which she wrote a number of hymns.

Wright (Ambrose Ransom), b. Apr. 26, 1826, in Louisville, Jefferson co., Ga.; read law when between fourteen and fifteen years of age in the office of Hon. Herschel V. Johnson; was admitted to the bar, and after coming of age opened an office in Louisville. His talents soon won him distinction in his profession. He very soon entered the political arena as a Democrat, and became one of the most distinguished popular orators in the State. In 1851 he espoused the side of the American party, and remained one of its most distinguished leaders as long as that organization existed. In 1858 he was the candidate of his party for Congress, but was defeated by his Democratic competitor, Hon. John J. Jones; in 1860 removed to Augusta, Richmond co., and on the defeat of the Bell-Everett ticket for President and Vice-President that year, which he zealously supported, he, with many others of the most prominent leaders of his party, espoused the cause of secession. The secession convention of Georgia appointed him a commissioner to Maryland for the purpose of inducing that State to cast her fortune with her Southern sisters. In the discharge of the duties of this office he won considerable distinction. In Apr., 1861, he enlisted as a private in the Confederate Light Guards of the 3d Georgia regiment, and soon after the regiment was ordered to Virginia he was elected its colonel. His first service was in the battle of Chicamicomico, off the coast of North Carolina, where, being chief in command, he displayed great gallantry and military skill, and achieved an important victory. He was subsequently promoted to the rank of brigadier-general, and then to that of major-general, which position he held at the close of the war. After the surrender of the Confederate armies he resumed the practice of his profession in Augusta; became editor of the *Chronicle and Sentinel*, one of the leading journals in the Southern States, and

opposed with great ability the reconstruction measures of Congress. In 1872 he was elected a member from the 8th Congressional district to the 43d Congress as a Democrat, but d. (Dec. 21, 1872) before taking his seat. As a jury lawyer and popular orator Gen. Wright had few superiors in the State. ALEXANDER H. STEPHENS.

Wright (AUGUSTUS R.), b. at Wrightsborough, Ga., June 16, 1813; was educated at the university of the State, but left before graduating, and entered the law school of Hon. William T. Gould in Augusta, and was admitted to the bar in 1834; first settled in Crawfordville, then moved to Cassville, after the Cherokee Indians were removed from that country. Here he soon rose to the highest eminence in his profession; in 1842 was elevated to the circuit court bench; in 1854 was elected to the 34th Congress, and was re-elected to the 35th; opposed secession, but yielded to the sovereign will of his State, and espoused the Confederate cause with all his ability, serving as a member of Congress. After the war he resumed his profession at Rome, Ga., and has ever been an earnest advocate for the restoration of peace and harmony throughout all sections of the country upon the principles of the Constitution. Judge Wright is distinguished for integrity, probity, and piety. As an orator he is graceful, brilliant, and eloquent. He (Apr., 1876) resides in Rome.
ALEXANDER H. STEPHENS.

Wright (BENJAMIN), b. in Wethersfield, Conn., Oct. 10, 1770; had scanty advantages for improving his taste for the study of mathematics until 1786, when he entered the home of his uncle at Plymouth, where he had access to books and instruments, and made himself familiar with the art of surveying. With his parents in 1788 he located at Fort Stanwix (now Rome), N. Y.; became actively employed in laying out the purchases of the new settlers, and laid the foundation for his future success as civil engineer, his first employment as such being the execution of a map and profile of Wood Creek for the Western Inland Lock Navigation Co.; was further engaged to make a survey of the Mohawk from Fort Stanwix to Schenectady, and propose a plan for the improvement of that river; in 1811–12 conducted for the canal commissioners a survey of the N. side of the Mohawk from Rome to Waterford, and of the country from Seneca Lake to Rome, thence the S. side of the Mohawk to Albany, a complete report of which he made; was repeatedly elected to the State legislature, and during the war with Great Britain was appointed county judge, which office he relinquished in 1816 upon receiving the appointment of engineer of the middle section of the Erie Canal, and to him, with James Geddes, is mainly due the credit of the successful completion of the enterprise; was at different times chief engineer of the Delaware Canal, Chesapeake and Ohio Canal, Harlem R. R., St. Lawrence Ship-Canal; was street commissioner of New York 1834; conducted the survey for the route of the New York and Erie R. R. 1834–36, when he returned to Virginia. D. at New York City Aug. 24, 1842.

Wright (BENJAMIN H.), b. in New York Oct. 19, 1801; graduated at the U. S. Military Academy July 1, 1822; resigned June, 1823, to engage in the profession of civil engineering; by his personal efforts railroads were first introduced into the island of Cuba, the preliminary survey and subsequent construction of the first road, from Havana to Guines in the interior, being executed under his superintendence, as well as various other roads on that island. For a time he was associate principal engineer of Cuba, under the Spanish government.

Wright (CRAFTS J.), b. in New York about 1806; graduated at the U. S. Military Academy July 1, 1828, but, without serving, resigned and entered upon the practice of law in Cincinnati; was editor of the Cincinnati *Gazette* 1847–53; in the civil war became colonel of the 13th Missouri Vols. Aug., 1861; colonel of the 22d Ohio Vols. June 17, 1862, and served at Forts Henry and Donelson, Shiloh, and Corinth; resigned Sept. 16, 1862, and engaged in farming near Glendale, O.

Wright (EDWARD), b. at Garveston, Norfolk, England, about 1560; educated at Caius College, Cambridge, where he became a fellow; was noted for mathematical attainments and for mechanical ingenuity; was the projector of the water-supply of London from the New River at Ware; sailed on a voyage to the Azores with George, earl of Cumberland, 1589, in order to study practical navigation; devised the sea-chart now in use under the name of "Mercator's projection;" published *Certain Errors in Navigation detected and corrected* (1599; new ed. 1610; 3d ed. 1657); translated from Stevinus *The Haven-Finding Art, etc.* (1599), subsequently appended to the former treatise; was mathematical tutor to Prince Henry, son of James I., for whom he caused to be constructed in Germany a sphere which not only showed the motions of the heavenly bodies, but sufficed to foretell eclipses for 17,100 years; delivered lectures on navigation for the East India Company; wrote a *Description and Use of the Sphere* (1613) and a *Short Treatise of Dialling, shewing the Making of all Sorts of Sun-dials* (1614). D. in London in 1615. He left in MS. a translation of Napier's description of his canon of logarithms, which was printed in 1616 by his son Samuel, who was also a fellow of Caius.

Wright (ELIZUR), b. at South Canaan, Conn., Feb. 12, 1804; graduated at Yale College 1826; taught in the Lawrence Academy at Groton, Mass., 1827–28; was professor of mathematics and natural philosophy in Western Reserve College 1829–33; became secretary of the American Anti-Slavery Society 1833; edited the paper *Human Rights* 1834–35 and the *Quarterly Anti-Slavery Magazine* 1837–38; removed to Boston 1838; became editor of the *Massachusetts Abolitionist* Apr., 1839, of the *Daily Chronotype* 1845, and of its successor, the Boston *Commonwealth*, 1850; has since edited for short periods the Boston *Daily Chronicle* and the *American Railway Times*; was commissioner of insurance for Massachusetts 1858–66; translated La Fontaine's *Fables* (2 vols., 1841); wrote an introduction to Whittier's *Ballads and other Poems* (London, 1844); has contributed to the *Atlantic Monthly*, and published several anti-slavery pamphlets.

Wright (FANNY). See D'ARUSMONT (FRANCES).

Wright (GEORGE), b. in Vermont in 1803; graduated at West Point 1822; served in the Florida and Mexican wars; was brevetted lieutenant-colonel for gallantry at Churubusco Aug. 20, 1847; commanded the storming-party at Molino del Rey, where he was wounded Sept. 8, gaining the brevet of colonel; was distinguished in campaigns against the Indians of Washington Territory 1856 and 1858; became brigadier-general of volunteers Sept. 28, 1861; commanded the department of the Pacific Oct., 1861, to July, 1864, and the district of California 1864–65, and was drowned July 30, 1865, in the wreck of the steamer Brother Jonathan.

Wright (GEORGE G.), brother of Joseph A., b. at Bloomington, Ind., Mar. 24, 1820; graduated at the Indiana State University 1839; read law with his brother; removed to Iowa 1840; served as prosecuting attorney 1847; was elected to the State senate 1849; chosen chief-justice of the supreme court of the State 1854, and re-elected 1860 and 1865; was professor in the law department of the State University 1865–71; elected Republican U. S. Senator 1871.

Wright (GEORGE NEWNHAM), b. in England about 1812; graduated at Brasenose College, Oxford, 1835; took orders in the Church of England; became rector of St. Mary Woolnoth, London, and subsequently master of Tewkesbury grammar school. Author of *Landscape Historical Illustrations of Scotland and the Waverley Novels from Drawings by Turner, etc.* (1836), *Life and Reign of William III.* (2 vols., 1837), *Life and Campaigns of the Duke of Wellington* (4 vols., 1839–41), *Life and Times of Louis Philippe* (1841), *Lancashire, its History, Legends, and Manufactures* (2 vols., 1844); of the descriptive texts to illustrated works by T. Allom on *China* (4 vols., 1844), *France* (4 vols., 1847), and *Belgium, the Rhine, Italy, Greece, and the Mediterranean* (2 vols., 1849); edited the *London Cyclopædia* and the *Works of Bishop Berkeley, with a Life* (2 vols., 1843), of Dr. Thomas Reid (2 vols., 1843), and the *Philosophy of the Human Mind* by Dugald Stewart (1843).

Wright (HENRY C.), b. Aug. 29, 1797; was for many years a noted anti-slavery lecturer and advocate of peace and of socialism, and latterly of spiritualism, on all which points his convictions were vehement and were delivered with considerable eloquence. D. at Pawtucket, R. I., Aug. 16, 1870. Author of *Man-Killing by Individuals and Nations wrong* (1841), *A Kiss for a Blow* (1843; new ed. 1866), *Defensive War proved to be a Denial of Christianity* (1846), *Human Life Illustrated* (1849), *Marriage and Parentage* (1851), and *The Living Present and the Dead Past* (1865).

Wright (HORATIO G.), b. at Clinton, Conn., Mar., 1820; graduated at U. S. Military Academy, and commissioned second lieutenant in the corps of engineers July 1, 1841. After serving two years at West Point as instructor in the departments of French and of engineering, he was in 1846 sent to the Gulf coast, and for ten years had charge of the construction of Fort Jefferson, commanding the harbor of Tortugas, Fla., and for a portion of that period superintended the construction of Fort Taylor, Key West, being also charged with the duties of lighthouse engineer and the improvement of St. John's River. In 1856 he was called to Washington, and served as assistant to the chief of engineers until the outbreak of the civil war in 1861. As chief engineer he accompanied the expedition for the destruction of the navy-yard at Norfolk, Va., in Apr., 1861, and in May crossed the Potomac with Gen. Heintzelman's

column, and laid out and commenced Fort Ellsworth, covering Alexandria. At the first battle of Bull Run he was chief engineer of Heintzelman's division. He was commissioned a brigadier general of volunteers Sept. 14, 1861, and assigned to the command of a brigade of the land forces of the Port Royal expedition, which, as chief engineer, he had been engaged in organizing since July. In Feb., 1862, he set out from Port Royal with a brigade of volunteers, and by the middle of March had occupied Fernandina, Jacksonville, St. Augustine, and retaken possession of Fort Marion and Fort Clinch. Returning to South Carolina in April, he commanded a division in the assault on Secessionville, June 16; was promoted to be major general of volunteers in July, and commanded the department of the Ohio until Mar., 1863. In May, 1863, he was assigned to the command of a division of the 6th corps, and engaged at Gettysburg on the second and third days of the battle and subsequent pursuit of Lee's army. In the spirited assault on Rappahannock Station (Nov. 7, 1863), he commanded the corps, and was brevetted lieutenant colonel for gallantry. After the Mine Run affair, in which he led his division, he was called to Washington as a member of a board to devise modifications of our system of sea-coast defences. Returning to the army in the spring of 1864, he led his division in the severe fighting in the Wilderness and Spottsylvania battles (in the last of which he was wounded), succeeding to command of the 6th corps May 9, on the fall of Sedgwick. His subsequent war-record is that of the 6th corps. With the Army of the Potomac he was present at every engagement up to July, 1864, when summoned from the front of Petersburg with his corps to the defence of Washington, then threatened by the Confederates under Gen. Early. In the pursuit which followed the latter's retreat Wright, in command of all the troops, overtook Early, and after a sharp skirmish defeated him at Snicker's Gap. In the ensuing campaign of the Army of the Shenandoah under Sheridan he led his corps at Opequan and Fisher's Hill, and was in command of the army at Cedar Creek, where, after the surprise of the 8th corps on the morning of Oct. 19, he had re-formed the army in a favorable position upon the arrival of Sheridan, when, though wounded, Wright resumed command of his corps. The disposition of the troops by the latter was approved by Sheridan, and at the close of the day Early was hopelessly defeated and his army a wreck. The 6th corps was soon after returned to the Army of the Potomac, and bore a prominent part in succeeding operations resulting in the surrender of Lee. At Petersburg it was the first to break through the enemy's lines, thus ending the siege and effecting the capture of the city, and with the cavalry it fought the last battle and won the last victory of that army, at Sailor's Creek, Apr. 6, 1865. After the surrender of Lee the corps was sent to Sherman's aid in North Carolina, but upon the surrender of Gen. Johnston returned to Washington, where mustered out in June, 1865. In July, Wright was placed in command of the department of Texas. Mustered out of volunteer service in Sept., 1866, he returned to duty with the corps of engineers, in which he had attained a lieutenant-colonelcy Nov., 1865. For gallantry at Spottsylvania he was brevetted colonel; brigadier-general for Cold Harbor; and major-general for capture of Petersburg. Member of the board of engineers for permanent fortifications since 1867. G. C. Simmons.

Wright (Ichabod Charles), b. at Maperly Hall, Nottinghamshire, England, in 1795; educated at Eton; graduated at Christ Church, Oxford, 1817; was for some time a fellow of Magdalen College; became a wealthy banker at Nottingham; married the eldest daughter of Chief-Justice Denman 1825; wrote some able pamphlets on currency, and occupied his leisure with literary pursuits. D. at Nottingham Oct. 14, 1871. He published translations into English rhyme of Dante's *Inferno* (1833), *Purgatorio* (1837), and *Paradiso* (1840), collectively entitled *The Vision and Life of Dante* (3 vols., 1845; illustrated ed., "Bohn's Lib.," 1854), and *The Iliad of Homer, translated into English Blank Verse* (3 parts, books i.–xiv., 1859–64), and in reply to criticisms on the latter work by Prof. Matthew Arnold wrote *A Letter to the Dean of Canterbury on the Homeric Lectures, etc.* (1861).

Wright (James), b. in Rutlandshire, England, about 1644; educated at Oxford, and in law at the Middle Temple. Author of *The History and Antiquities of the County of Rutland* (1684), *Dugdale's Monasticon Anglicanum epitomized in English* (1693), and other antiquarian and historical works. D. about 1715.

Wright (Sir James), b. at Charleston, S. C., about 1720, son of Robert, who was chief-justice of that colony; became a lawyer at Charleston; served as attorney-general and as agent of the province in England; was appointed chief-justice and lieutenant-governor of South Carolina May 13, 1760; became royal governor 1764; was created a baronet Dec. 8, 1772; managed the affairs of the colony with prudence and success during a long administration, but ultimately became unpopular from his unwavering loyalty to the Crown; was imprisoned by the Revolutionary party Jan., 1776, but soon escaped to England; returned with the fleet 1779, and resumed the government, which he held until the evacuation of South Carolina, when he went to England, and his large estates in Georgia were confiscated. D. in England in 1786.

Wright (John C.), b. in 1783; settled as a lawyer at Steubenville, O., about 1805; was for many years a judge of the supreme court of Ohio; was a member of Congress 1823–29, and was long editor and proprietor of the Cincinnati *Gazette*. D. at Washington, D. C., Feb. 13, 1861, while a delegate to the national Peace convention. He published *Reports of Cases in the Supreme Court of Ohio* (1835).

Wright (Joseph), b. at Derby, England, in 1734; studied portrait-painting under Thomas Hudson; resided in Italy 1773–75; settled in the practice of his profession at Bath 1775; removed to Derby 1777, remaining there through life, occupied chiefly with portraits, but painting also historical and figure pieces; was especially fond of representing storm-scenes and the effect of firelight, which he had carefully studied in Italy during an eruption of Vesuvius; exhibited at Covent Garden in 1785 a collection of twenty-four of his pictures, the most striking of which was the *Destruction of the Floating Batteries off Gibraltar*. D. at Derby Aug. 29, 1797. Among his works were some fine copies of the frescoes of Michael Angelo in the Sistine Chapel, views of the so-called "villas of Cicero and of Maecenas" at Tivoli, *The Blacksmith's Forge*, *The Dead Soldier*, *Belshazzar's Feast*, a view of Lake Ullswater, Westmoreland, and the *Storm-Scene in the Winter's Tale*, painted for Alderman Boydell. His moonlight pieces are much admired, and some of his landscapes are considered equal to those of Wilson and Claude.

Wright (Joseph), b. at Bordentown, N. J., in 1756; went with his family to England 1772; became a successful artist; painted a portrait of the prince of Wales; pursued his studies in Paris under the care of Dr. Franklin; was shipwrecked on a voyage to America, narrowly escaping with his life, and painted three portraits of Washington, by whom he was appointed first draughtsman and die-sinker in the U. S. mint, the first national coins and medals being his handiwork. D. at Philadelphia in 1793.

Wright (Joseph A.), b. in Pennsylvania Apr. 17, 1810; settled at Bloomington, Ind., early in life; studied at the Indiana University; was admitted to the bar 1829; sat in both houses of the legislature; was a member of Congress 1843–45, governor of Indiana 1849–57, minister to Prussia 1857–61, U. S. Senator 1861–62, U. S. commissioner to the Hamburg exhibition 1863, and again minister to Prussia from 1865 until his death, at Berlin May 11, 1867.

Wright (Martha Coffin), b. at Nantucket, Mass., in 1807; was a friend of temperance, anti-slavery, and woman suffrage; with her sister, Lucretia Mott, joined in the call for the first woman's rights convention in 1848; attended the National Woman's Rights conventions from year to year; was the presiding officer on many occasions. Though not a public speaker, her counsel and presence were invaluable at all times in preparing resolutions, criticising speeches, and suggesting new modes of agitation. Her place of residence was Auburn, N. Y. She was president of the National Woman Suffrage Association at the time of her death, Jan. 4, 1875. Susan B. Anthony.

Wright (Sir Nathan), b. in England in 1653; was called to the bar at the Inner Temple Nov., 1677; assisted at the trial of the seven bishops June, 1688; supported the Revolution; was knighted and appointed king's sergeant Jan., 1697; was appointed lord keeper of the great seal May 21, 1700, and was deprived of that post Oct. 11, 1705. D. in Warwickshire Aug. 4, 1721.

Wright (Robert), b. in Kent co., Md., about 1765; was at one time a member of the State executive council; was U. S. Senator 1801–06, governor of Maryland 1806–09, and member of Congress 1810–17, 1821–23. D. Sept. 7, 1826.

Wright (Robert E.), b. at Allentown, Pa., in 1810; became a distinguished member of the Pennsylvania bar. He published *Pennsylvania State Reports, etc.* (14 vols., 1861–66), edited William Graydon's *Forms of Conveyancing* (1845) and Samuel Roberts's *Digest of Select British Statutes, etc.* (1847), prepared several manuals of special legislation, and has printed several essays and addresses on legal and political topics.

Wright (Silas), b. at Amherst, Mass., May 24, 1795; graduated at Middlebury College 1815; studied law; was admitted to the bar 1819; settled at Canton, St. Lawrence

co., N. Y.; cultivated with his own hands a small farm; was appointed surrogate of that county 1820; became a magistrate and postmaster of Canton; was elected to the State senate as a Democrat 1823; distinguished himself as an opponent of the policy of Gov. De Witt Clinton; developed in a report to the senate in 1827 the financial policy with which he was identified throughout his political career; was commissioned brigadier-general of State militia 1827; was a member of Congress 1827–29; advocated the protective tariff of 1828 and the adoption of preliminary measures looking to the abolition of slavery in the District of Columbia; was comptroller of New York 1829–33, and U. S. Senator 1833–44; served on the committee on finance; supported Clay's Compromise bill and defended the removal of the deposits from the U. S. Bank by Pres. Jackson, 1833; opposed the recharter of the U. S. Bank, the distribution of the surplus Federal revenues among the States, and the admission of Texas; supported the tariff of 1842; maintained, in reference to the abolition of slavery, the right of petition, the inviolability of the mails, and the sovereignty of Congress over the Territories 1838; was chosen governor of New York in the exciting campaign of 1844; opposed in 1845 the revision of the State constitution by a convention; vetoed a bill appropriating money for canal improvements; took decided ground against the anti-rent rioters, declaring Delaware county in a state of insurrection; repeatedly declined appointments to foreign missions, as well as an offer of a seat in the cabinet or on the Supreme bench by Pres. Tyler, and of the secretaryship of the treasury by Pres. Polk, 1845; was defeated as a candidate for re-election 1846, and retired to his farm at Canton, where he d. Aug. 27, 1847. He appeared twice as a lawyer before the Supreme Court of the U. S.; enjoyed a high reputation as a consulting lawyer; and, though not distinguished as an orator by comparison with his colleagues, Webster, Clay, and Calhoun, was considered an eminently clear and practical statesman, a reputation which has become traditional. Biographies were published by John S. Jenkins and by Jabez D. Hammond (1848).

Wright (Thomas), F. S. A., b. on the Welsh border, near Ludlow, Shropshire, England, Apr. 21, 1810; studied at the Ludlow grammar school; graduated at Trinity College, Cambridge, 1834; began while an undergraduate to write for *Fraser's* and other magazines upon the archæological and historical subjects to which he devoted his life; settled in London as a professional man of letters 1835; was one of the founders of the Camden Society (1838), the Percy and Shakspeare societies (1840), and of the British Archæological Association (1843), editing its *Journal* and other publications until 1850, when he withdrew in consequence of the divisions which led to the foundation of the Society of Antiquaries, of which he became a fellow; has been a prominent contributor to the *Archæologia;* rendered services to M. Guizot's French record committee, which procured him, while still young (1842), the honor of an election as corresponding member of the Institute (Académie des Inscriptions et Belles-Lettres); was the originator in England of the annual archæological congresses (1844), and has successfully conducted the excavations upon several Roman sites in Britain, especially those which brought to light the remarkable ruins of the Roman Uriconium at Wroxeter, Shropshire. He has written or edited above 100 volumes, nearly all connected with British history, philology, or archæology, and was selected by the emperor Napoleon III. to translate his *History of Julius Cæsar* (2 vols., 1865–66). He has edited many of the literary relics of the Middle Ages in English, Anglo-Norman, French, and Latin. Among his original works are *The History of Ludlow and its Neighborhood* (2 parts, 1841–43; new ed. 1852); *Biographia Literaria* (2 vols., 1842–46), comprising the Anglo-Saxon and Anglo-Norman periods of Great Britain and Ireland; *The Archæological Album* (1845), *Essays on Subjects connected with the Literature, etc., of England in the Middle Ages* (2 vols., 1846), *England under the House of Hanover, illustrated from Caricatures, etc.* (2 vols., 1848), *A History of Ireland* (3 vols., 1848–52), *The Celt, the Roman, and the Saxon* (1852; 3d ed. 1875), *Wanderings of an Antiquary* (1854), *A Dictionary of Obsolete and Provincial English* (2 vols., 1857), *Essays on Archæological Subjects* (2 vols., 1861), *A History of Domestic Manners in England during the Middle Ages* (1862), *A History of Caricature and Grotesque in Literature* (1865), *Womankind in Western Europe* (1869), and *Uriconium, an Historical Account of the Ancient Roman City* (1872). D. Dec. 23, 1877.

Wright (William), b. at Clarkstown, N. Y., in 1791; was a volunteer in the war of 1812–15 for the defence of Stonington, Conn.; was mayor of Newark, N. J., 1840–43, a Whig member of Congress 1843–47, a Democratic U. S. Senator 1853–59, and again from 1863 to his death, at Newark, N. J., Nov. 1, 1866.

Wright (William), Ph. D., LL.D., b. in Bengal, India, Jan. 17, 1830; educated at the universities of St. Andrew's and Halle; was appointed professor of Arabic in University College, London, 1855, in Trinity College, Dublin, 1856, and in the University of Cambridge 1870; has been employed in the MS. department of the British Museum since 1861, and became assistant keeper 1869. He has received the honorary doctorate of laws from the four universities of Cambridge, Dublin, Edinburgh, and St. Andrew's, and that of philosophy from the University of Leyden. He has edited in Arabic the *Travels of Ibn Jubair* (Leyden, 1852), Al-Makkari's *Analects* (1855), *Opuscula Arabica* (1859), and El-Mubarrad's *Kamil* (1864–74); has issued *The Book of Jonah in four Semitic Versions—Chaldee, Syriac, Ethiopic, and Arabic—with Glossaries* (London, 1857), a revised translation of Caspari's *Grammar of the Arabic Language* (2 vols., 1859–62; new ed. 1875), *Ancient Syriac Documents relative to the Earliest Establishment of Christianity in Edessa, etc.* (1864), *Contributions to the Apocryphal Literature of the New Testament, collected and edited from Syriac MSS. in the British Museum, with an English Translation and Notes* (1865), *The Homilies of Aphraates, "the Persian Sage"* (1869), *An Arabic Reading-Book* (1870), *The Apocryphal Acts of the Apostles* (Syriac and English, 2 vols., 1871), *A Catalogue of the Syriac MSS. in the British Museum* (3 vols., 1870–72), and *Oriental Series of Fac-similes of Ancient Manuscripts* (1876).

Wright (William Aldis), b. in England about 1836; educated at, and became librarian of, Trinity College, Cambridge; was the principal contributor in biblical geography and biography to Dr. Smith's *Dictionary of the Bible* (3 vols., 1860–63), and corrected the proofs of that important work; edited with notes and glossarial indexes Bacon's *Essays* (1862) and his *Advancement of Learning* (1869); was co-editor with William George Clark of *The Cambridge Shakspeare* (9 vols., 1863–66), and the Globe edition of Shakspeare's *Complete Works* (1 vol., 1864), and has edited *The Bible Word-Book* (1866), Chaucer's *Clerke's Tale*, and the *Metrical Chronicle* of Robert of Gloucester.

Wright's, tp., Morgan co., Ill. P. 2022.

Wrightstown, p.-v. and tp., Bucks co., Pa. P. 823.

Wrightstown, p.-v. and tp., Brown co., Wis. P. 1446.

Wrights'ville, p.-v., cap. of Johnson co., Ga.

Wrightsville, v., Monroe tp., Adams co., O. P. 63.

Wrightsville, p.-b., York co., Pa. P. 1544.

Wriothesley. See Southampton, Earls of.

Writ [Lat. *breve*], in law, is a formal instrument, issued by or in the name of a court, commanding the person to whom it is addressed to do a certain act therein specified. It is written in the form of a mandate from the highest authority in the state—the king in Great Britain, the President, people, or commonwealth in the U. S.—attested by the chief judge of the court, sealed and signed by the clerk, and may be issued either at the commencement of an action or proceeding, or during its progress, to the sheriff or to some other person, for the purpose of procuring various acts to be done in connection with such action or proceeding. Anciently, actions in the courts of law were commenced by a species of writs termed "original," which were issued by officers of the chancery, and were considered as the direct mandates of the king, stating the nature of the claim; but they were long ago abolished, and all writs became "judicial"—that is, were in the nature of process from the court in which the suit was brought or was pending. In the common-law practice the number of writs was very great; a separate one was adapted to every special proceeding and to almost every important stage in an action, and each had its appropriate name. Among the most familiar were the writs of "*capias*" and of "summons" for commencing legal actions, the writ of "*subpœna*" for summoning the defendants in an equity suit and for compelling the attendance of witnesses (see Subpœna), the writs of "error" and of "*certiorari*" for the review of judgments and other judicial decisions, and the writ of "*habeas corpus*" for the production of a person imprisoned in order that the cause of his detention might be inquired into. (See Habeas Corpus.) A large part of the common-law writs have been abolished by statute both in this country and in Great Britain. A few of the most common and important have been retained in those States which adhere to the ancient system of practice, while in those States which have adopted the reformed system writs have been wholly abrogated in civil actions, and simple orders of a court or a judge, or notices, have been substituted in their place. In these States, however, a few important writs belonging to the criminal practice, together with the writs of *habeas corpus* and of *certiorari*, are still used, though in a somewhat modified form. (See the articles Process and Procedure.) John Norton Pomeroy.

Writer's Cramp. See SCRIVENER'S PALSY.

Writers to the Signet, or **Clerks to the Signet,** a body of legal practitioners in Edinburgh, corresponding generally to the highest class of attorneys in London, derived their name from their original position as clerks in the office of the secretary of state, where the different writs that passed under the king's signet were prepared, and began to act as agents in the court of session in the latter part of the seventeenth century.

Writing, the art of conveying ideas by means of signs inscribed on some material, is either ideographic or phonetic. Ideographic writing, again, in which the signs represent the ideas themselves, is either pictorial, representing the ideas by direct imitation of the corresponding objects in nature, or symbolical, representing the ideas by hints or associations. Phonetic writing, in which the signs do not represent the ideas, but the sounds by which in speech they are conveyed, is either syllabic, each sign standing for a whole syllable, or alphabetic, each sign representing only a single sound. When writing was invented is not known, but it was certainly one of the oldest arts, and it is more than probable that its development passed from the merely pictorial stage, which is still occupied by savage tribes, through the symbolical to the phonetic; there are also various facts which show that the phonetic signs were originally derived, with slight modifications, from the pictorial. At present, however, the phonetic signs for the same sound are very different, not only in the different alphabets which have been created, but also, in many cases, in the various languages in which the same alphabet has been adopted; and very different methods of writing have been developed—in columns, such as the Chinese and Japanese use, or in lines, from the right to the left, such as the Semitic people use, or from left to right. (See for further details ALPHABET, CUNEIFORM INSCRIPTIONS, HIEROGLYPHICS, CHINESE, ARABIAN, EGYPT, ASSYRIA, GREEK LANGUAGE, WÖLEI, etc.)

Writing-Machines. See APPENDIX.

Wrottes'ley (JOHN), D. C. L., F. R. S., SECOND BARON **Wrottesley,** b. at Wrottesley Hall, England, Aug. 5, 1798; graduated as first-class in mathematics at Corpus Christi College, Oxford, 1819; assisted in founding the Royal Astronomical Society 1820; was called to the bar at Lincoln's Inn 1823; received the gold medal of the Astronomical Society for his *Catalogue of the Right Ascension of 1318 Stars* (1839); succeeded to the barony 1841, and was president of the Royal Society 1851–57. D. at Wrottesley Oct. 27, 1867. Author of a *Treatise on Navigation* (4 vols., 1829–38), *Thoughts on Government and Legislation* (1859), and of several occasional essays and addresses.

Wry'neck [named from its habit of twisting the neck in a serpentine manner], the *Yunx torquilla*, a common European woodpecker of the group Yunginæ, not represented in the U. S. It is easily tamed, and is a great favorite with boys, who tie a string to its leg and allow it to climb trees, to run over their clothes, etc. It lives mostly on ants and caterpillars.

Wulf'enite, mineral *molybdate of lead*, O_4MoPb, named after the mineralogist Wulfen, who first distinguished the mineral in 1781 at Carinthian localities, where it had been mistaken by Klaproth for calcium-tungstate; called also *yellow lead ore, gelbbleierz,* and *bleigelb.* Dimetric in crystallization, having about the hardness of calcite; yellow or orange in color, sometimes red (containing then *vanadic acid*, as discovered by Dr. Lawrence Smith); sometimes translucent; found in several American localities, notably in very fine crystals at Phœnixville, Pa., where one variety is red, from vanadium. The geometric molecular forms of lead-molybdate are generally sharply defined:

$O_{4\cdot 24\cdot 27}^{Mo\ Pb} = 6.766$ { (Haidinger, 6.76). The melted lead and *minimum*-galena lead-molecule.

$O_{4\cdot 24\cdot 26}^{Mo\ Pb} = 7.039$ { (Cited as *maximum* by Dana, 7.01). The *maximum*-galena lead-molecule.

$O_{4\cdot 21\cdot 22}^{Mo\ Pb} = 8.118$ (Manross, artificial crystals, 8.11).

The yellow Phœnixville allotrope appears to contain the dominant elemental-molecule of lead, being therefore more complex:

$$O_{16}\cdot 4^{Mo}_{24}\cdot\left(3^{Pb\ Pb}_{26\cdot 27}\right) = 6.968 \text{ (J. L. Smith, 6.95).}$$

HENRY WURTZ.

Wulf'stan, or **Wolstan,** b. in Worcestershire, England, about 1007; educated in the monastic school at Evesham, and afterward in the seminary at Peterborough; became a monk and prior of the monastery at Worcester; was appointed bishop of Worcester in 1062, on the promotion of Aldred to the archbishopric of York; offered a vigorous resistance to the efforts of that prelate and of his successor to appropriate the estates of the see of Worcester; paid successful court to William the Conqueror; had the diocese of Worcester transferred to the jurisdiction of the archbishop of Canterbury; enjoyed the favor of William Rufus; defended the city of Worcester against the rebels led by Roger de Montgomery, and rebuilt Worcester cathedral. He was the last of the Anglo-Saxon prelates. D. at Worcester Jan. 19, 1095. There are two accounts of him by William of Malmesbury—one in his work, *De Gestis Pontificum*, the other a separate *Life* in 3 books, printed in Wharton's *Anglia Sacra* (2 vols., 1691). He has been supposed, though not on sufficient evidence, to be the author of the concluding portion (from 1034) of the *Anglo-Saxon Chronicle*.—Another WULFSTAN, b. about 950, was a prelate of considerable note; was bishop of Worcester 1002–16, and archbishop of York from 1002 until his death, in 1023, and was the supposed author of the Saxon *Sermones Lupi Episcopi*, published at Oxford by Elstob in 1701.

Wup'per, or **Wipper,** a short but copious stream which joins the Rhine 50 miles below Cologne. Elberfeld and Barmen lie on its banks, and the valley it forms is the most densely-peopled district, and the seat of the most extensive manufacturing industry, in Germany.

Wurm'ser, von (DAGOBERT SIGMUND), COUNT, b. in Alsace in 1724; entered first the French, afterward the Austrian army; fought in the Seven Years' war and the Bavarian succession war, and was made a general in 1787, and appointed military commander in Galicia. In the wars between Austria and the French republic he achieved some successes on the Rhine, and in 1796 he was sent to Italy with a reinforcement of 15,000 men to supersede Beaulieu as commander-in-chief. Advancing from Trent toward Mantua, which was besieged by Bonaparte, he marched his army in two columns, one on each side of the Lago di Garda, but Bonaparte at once raised the siege, fell with his whole force on the one column under Quosdanowich, and beat it back into the Tyrol, and then attacked the other under Wurmser himself, defeated him at Castiglione, Aug. 5, and compelled him too to retreat into the Tyrol. At the head of a new reinforcement he advanced toward Mantua a second time, through the valley of the Brenta, but Bonaparte, who in the mean time had penetrated into the Tyrol, now took him in the rear, beat him at Roveredo, Sept. 4, Bassano, Sept. 8, and under the walls of Mantua, Sept. 13, and shut him up in the fortress. Alvinczy, who was sent to his rescue, was defeated at Arcoli Nov. 15, and Rivoli Jan. 14, 1797, and on Feb. 2 Wurmser capitulated. Retiring to Vienna, he was appointed military commander of Hungary, but d. before entering his new position, Aug. 22, 1797.

Wur'no, town of Central Africa, on the Rima, an affluent of the Niger, is an extremely filthy place, but has some importance as a cotton-market. P. about 13,000.

Wür'temberg, a kingdom forming part of the German empire, and comprising an area of 19,503 quadrate kilomètres, with 1,881,505 inhabitants, bounded N., W., and S. by Bavaria and Baden, E. by Bavaria; on its southern frontier it is separated from Switzerland by Lake Constance. The larger part of it is mountainous, traversed by the Schwarzwald and the Rauhe Alp; the rest is plateau and terraces. The average elevation is 1535 feet; the highest peak rises 3732 feet; the lowest point is situated 437 feet above the level of the sea. The country is well provided with water. A minor part of it belongs to the basin of the Danube, the rest to that of the Rhine. The Danube traverses the southern part of the country for a distance of 90 miles. The Neckar, which rises in the south-eastern part of the country, where the Schwarzwald and the Rauhe Alp meet, flows northward to the Rhine for a distance of about 180 miles. The principal affluents of the Neckar are—to the right the Jaxt and the Kocher, and to the left the Enz and the Nagold. The Kocher, an affluent of the Main, flows through the northern part of the country. Of the canals the Wilhelmscanal is the most important, making the Neckar navigable from Cannstadt to Heilbronn. Lakes are numerous; a part of the Lake of Constance belongs to the country. The climate is moderate and healthy. The soil is good and well cultivated. Of the total area, 43 per cent. is arable land, 13½ meadow, 4 garden and vineyard, 7¾ pasture-land, and the rest mostly forest. Agriculture is flourishing. Of cereals, spelt, oats, millet, maize, rye, and wheat are raised in abundance, together with leguminous plants and tobacco, hops, chicory, etc. The garden and fruit cultivation is famous. Also, the vine cultivation is considerable; 150,000 eimers of wine are annually produced. Cattle-breeding is extensively carried on; the country has about 100,000 horses, 1,000,000 horned cattle, 700,000 sheep, 250,000 swine, 50,000 goats, and 120,000 beehives. The mining, which is chiefly in the hands of the government, is almost exclusively engaged in the production of iron and salt; 20 mines, 39 blast furnaces, and 8 salines produce annually 2,500,000 cwts., valued at about $3,500,000. The manufacturing industry, supported

by the copious water-power, is flourishing and steadily progressing. Noteworthy are the flax spinning and weaving establishments, the manufactures of iron goods and other metal ware—especially represented by the machine-factories of Stuttgart and Esslingen—the tileworks and manufactures of earthenware, glass, and chemicals, the rapidly-developing cotton manufactures, the dyeworks, the old, celebrated wool manufactures, the tanneries, the sugar-refineries, the manufactures of paper, tobacco, wooden ware, etc. The commerce is mostly confined to the country itself; the traffic with other countries shows a greater exportation than importation. The most important commercial places are Heilbronn, Cannstadt, Ulm, Friedrichshafen, Stuttgart, Reutlingen, and Tuttlingen. The principal articles of export are corn, cattle, wood and wooden ware, wool and woollens, cotton goods, salt, metal ware, fruit, and wine; and of import, colonial ware, cotton, coal, fancy articles, etc. The navigation on the Neckar, Tauber, Danube, and the minor streams, as well as on Lake Constance, is very lively, and the country is well provided with good roads and railways. In 1875 there were 1227 kilomètres of railway in operation. In 1874 the postal department comprised 488 offices, despatched 18,778,788 letters, 909,180 postal-cards, 3,527,946 official communications, 274,590 sample-cards, and 3,224,754 printed matter; total, 26,715,258 articles, besides 25,343,943 newspapers. The receipts amounted to 10,086,945 marks, the expenses to 9,972,374. At the end of 1874 the telegraph had 303 stations, 2414 kilomètres of line, 5620 kilomètres of wire, and carried 861,728 despatches; expenses, 459,612 marks; receipts, 437,337. The educational standard of the country is good. There are numerous elementary schools, and education is compulsory. There are 85 realistic and 76 Latin schools, 7 gymnasiums, 4 lyceums, 3 Roman Catholic and 5 Evangelical seminaries, a university at Tübingen, an agricultural academy at Hohenheim, a military school at Ludwigsburg, a veterinary school, a polytechnic school, an art school, an architectural school, a music conservatory at Stuttgart, and numerous industrial schools. Among the benevolent institutions there are 2 orphan asylums, 4 asylums for the deaf and dumb, and 2 for the blind. The population belongs in the southern part to the Alemannian, in the central to the Suabian, and in the north-eastern to the Frankish race. According to creed, 68 per cent. is Evangelical and 30 Roman Catholic; there are about 12,000 Jews and 4000 belonging to other denominations. The government is a constitutional monarchy. The crown is hereditary also in the female line. The constitution dates from Sept. 25, 1819. The representation consists of two chambers. The first chamber, the chamber of the peers, contains 45 members, of whom 36 are members by birth, and 9 are chosen for life by the king. The second chamber contains 93 members, chosen for six years—13 by the nobility, 6 by the Evangelical and 3 by the Roman Catholic clergy, 1 by the university, 7 by the cities, and 64 by the rural communities. The state council consists of the chiefs of the ministries and such persons as the king may see fit to call. There are six ministries—of justice, the interior, public education and worship, finance, war, and foreign affairs, but the two last are of little importance, as all military and diplomatic affairs are under the authority of the German empire. The military force forms the 13th corps of the German imperial army; it is commanded by a Prussian general and is under the inspection of the crown prince of the German empire; the other officers are appointed by the king. With respect to the finances, the budget of 1875–76 showed the following items (in marks): receipts, from domains, forests, mines, etc., 21,227,836; railways, post, telegraphs, etc., 40,120,529; direct taxes, 10,100,575; indirect taxes, 11,171,175, etc.; total brutto, 102,713,363, netto, 44,337,267. Expenses: royal appanage, 1,836,683; public debt, 15,892,766; pensions, 1,244,732; justice, 3,159,175; interior, 2,610,553; contributions to the imperial chest, 5,801,276. In 1875 the public debt amounted to 290,394,087 marks, of which 233,000,000 were borrowed for the construction of railways. For administrative purposes the country is divided into four circles—Neckar, Scharzwald, Danube, and Jaxt. Cap. Stuttgart.

History.—In olden times Würtemberg was occupied by the Sueves, a Germanic race. Afterward it came under Roman authority, and out of the Roman colonies grew up the cities. At the period of the great migration the Alemanni penetrated into the country. In 496 the Franks defeated the Alemanni, and about 900, under the German emperors of the Carlovingian dynasty, the duchy of Suabia was formed. The family of the counts of Würtemberg first appears in the eleventh century, but it soon enlarged its possessions in the country. The most remarkable of these counts was Eberhard VII., who was made a duke in 1495. In 1520, Würtemberg came under the dominion of Austria, but only for a short time. In 1633 the country entered into an alliance with Sweden against Austria, and was fearfully devastated by the imperial troops. It also suffered much from the French troops under Melac (1688–92), and still more from Duke Eberhard Ludwig and his concubines (1693–1733). In 1796 it became implicated in a war with France, and was compelled to cede Mömpelgard, but in 1803 Duke Frederick II. Wilhelm Carl received as a compensation the electoral dignity and extensive territories, which were formed into a particular division of the state and called Neu-Würtemberg. On Oct. 5, 1805, an alliance was concluded with Napoleon I., and on Jan. 1, 1806, the elector was made a king and his country much enlarged. The kingdom became a member of the Rhenish confederacy, and on May 14, 1809, Ulm, Mergentheim, etc. were added to it, but it had to furnish an army of 18,000 men for the campaign in Russia. By the Treaty of Fulda (Nov. 2, 1813) Würtemberg broke its alliance with France and joined the other German princes against Napoleon, having all its new and old possessions guaranteed by the allies. King William (1816–64) gave the constitution of Sept. 25, 1819, but pursued a particularistic policy, though leaning toward Austria. His successor, Carl, married to a daughter of Nicholas I. of Russia, sided with Austria in the war of 1866, and the Würtemberg army corps was defeated (July 24) at Tauberbischofsheim. On Aug. 13 peace was concluded with Prussia. Würtemberg paid 8,000,000 florins in war indemnities, and formed an offensive and defensive alliance with Prussia, agreeing to reorganize its army after the Prussian model. On Nov. 25, 1870, it joined the other German states in the formation of the German empire.

AUGUST NIEMANN.

Wurts'boro', p.-v., Mamakating tp., Sullivan co., N. Y. P. 797.

Wurtz (CHARLES ADOLPHE), b. at Strasbourg Nov. 26, 1817; studied medicine and chemistry in his native city; settled at Paris in 1843; was appointed professor of medical chemistry at the Institute in 1854, and received in 1865 the biennial prize of 20,000 francs. Besides contributions to the *Annales de Chimie et Physique* and the *Répertoire de Chimie pure*, which he has edited since 1858, he has published *Traité élémentaire de Chimie médicale* (3 vols., 1864–65), *Leçons élémentaires de Chimie moderne* (1866–68), *Dictionnaire de Chimie pure et appliquée* (1868), etc. Selections from his works have been translated into English—*Chemical Philosophy according to Modern Theories* (1867) and *Theory from the Age of Lavoisier* (1869).

Wurtz (HENRY), A. M., b. at Easton, Pa., June 5, 1828; graduated at Princeton 1848; studied at the Lawrence Scientific School at Cambridge, Mass., and also privately under Prof. John Torrey of New York, giving his chief attention to chemistry; became in 1850 assistant in charge of the laboratory of the Yale (now Sheffield) Scientific School at New Haven, Conn.; was State chemist of New Jersey 1854–56, being also engaged on the geological survey of that State; was subsequently professor of chemistry in Queen's College, Kingston, Canada, professor in the National Medical College at Washington, D. C., 1858–59, and chemical examiner in the U. S. patent-office 1858–61; edited the *American Gas-Light Journal* 1871–75; has made several important discoveries in chemistry, among which are the use of sodium in the amalgamation of the ores of precious metals, the determination of alkalies in silicates by fusion with chloride of calcium (presented to the American Association 1850), and, above all, the discovery of the geometrical laws of the condensation of chemical molecules, first published in 1876, which will have important results in the reconstruction of the sciences of chemistry and chemical physics upon an exact basis. (For some account of the latter discovery see his articles VOLUMES, MOLECULAR, WATER OF CRYSTALLIZATION AND OF CONSTITUTION, and WOOD-SPIRIT, in this *Cyclopædia*.) Prof. Wurtz has published more than 60 scientific papers, a partial list of which may be found in Prof. B. Silliman's account of the labors of American chemists, prepared for the Priestley Centennial celebration (1874). He is also the originator of the *dynamic theory of metamorphic heat* in geology, having communicated the same to the American Association ten years since—in 1866. Of this Mallet's *theory of vulcanicity* is only an extreme case. (See article METAMORPHISM in this work.) PORTER C. BLISS.

Würz'burg, town of Bavaria, on the Main, which here is crossed by a splendid stone bridge of eight arches, was formerly the capital of the bishopric of Würzburg, which until 1803, when it was secularized and its territory conferred on the elector of Bavaria, formed an independent and very wealthy ecclesiastical principality of Germany. The episcopal palace, built in 1720, is one of the most magnificent royal residences of Europe. The cathedral, built in the eleventh century, is an elegant edifice. The univer-

sity, with which are connected a magnificent hospital and a library of 100,000 volumes, enjoys a great reputation, especially for its medical department. Besides its university, the city has many other good educational institutions, and manufactures of leather, tobacco, cloth, woollen fabrics, and surgical and mathematical instruments. The vicinity produces very fine wine. P. 40,005.

Wurz'en, town of Germany, kingdom of Saxony, on the Mulde, has large bleaching establishments and manufactures of linen, hosiery, felt, paper-hangings. P. 6408.

Wutt'ke (Heinrich), b. at Brieg, Silesia, Feb. 12, 1818; studied history at the University of Breslau; began to lecture in Leipsic in 1841; took part very energetically in politics; wrote against the Poles, the Danes, etc.; was appointed professor of history at Leipsic in 1848, and published, besides numerous minor essays, *Erdkunde und Karten des Mittelalters* (1851), *Die Völkerschlacht bei Leipzig* (1863), *Die deutschen Zeitschriften und die Entstehung der öffentlichen Meinung* (1866), *Denkschrift über das geistige Eigenthum* (1866), etc. D. June 14, 1876.

Wyncon'da, tp., Clarke co., Mo. P. 885.

Wyaconda River rises in Davis co., Ia., and after a S. W. course flows into the Mississippi at La Grange, Mo.

Wyalu'sing, p.-v. and tp., Bradford co., Pa. P. 1707.

Wyalusing, p.-v. and tp., Grant co., Wis. P. 800.

Wyandot', county of N. W. Ohio, traversed by Sandusky River and by several railways, and has a level surface, partly wooded and partly prairie. Staple productions, wheat, Indian corn, butter, wool, and hay. Sheep are numerous. Area, 350 sq. m. Cap. Upper Sandusky. P. 18,553.

Wyandot Indians. See Hurons.

Wyandotte', county of N. E. Kansas, separated from Missouri by Missouri River, intersected by Kansas River, and traversed by Kansas Pacific and Missouri Pacific R. Rs.; surface varied and well timbered, soil fertile. Cattle and swine are the chief live-stock. Staples, Indian corn, wheat, potatoes, and hay. Cap. Wyandotte. Area, 155 sq. m. P. 10,015.

Wyandotte, tp., Butte co., Cal. P. 731.

Wyandotte, p.-v. and tp., cap. of Wyandotte co., Kan., at the confluence of Missouri and Kansas rivers, on a gently undulating slope rising 250 feet above the surface of the rivers; is connected with Kansas City, Kan., by two free bridges, and is within 15 minutes' walk of the union dépôt at Kansas City, Mo. Wyandotte contains 8 churches, an academy and parochial school under the auspices of the Roman Catholic Church, a public library, a State blind asylum, 2 public schools, 2 banks, 3 hotels, 3 grist-mills, 2 public halls, and 2 weekly newspapers. It is the sixth city in population and importance in Kansas. Its prosperity and importance are derived from the machine-shops of Kansas Pacific R. R., the Kansas stock-yards, the Kansas rolling-mills, the immense pork and beef packing-houses, and large cooper-shops located in its outskirts, which give employment to hundreds of machinists, mechanics, artisans, and laborers. Nine railroads centre within 15 minutes' walk of its business-centre. It has 2 street-railways,—1 in operation and 1 in course of construction. It is underlaid with coal, two veins of which have been tested and will pay to mine. The pipes are being laid to utilize the gas which flows from a natural gas-well discovered in boring for coal, and from which 20,000 cubic feet of gas escape every hour; the company expects to be able to supply the city with sufficient gas for all heating and illuminating purposes by the 1st of Sept., 1876. A joint-stock company has been chartered to utilize the water-power afforded by Kaw River, which will afford abundant power for mechanical and manufacturing purposes, a preliminary survey showing a fall of 15 feet in 3 miles. It is surrounded by one of the richest and best agricultural districts to be found in the Missouri Valley, while the climate is peculiarly adapted to fruit-growing. P. of v. 2910; of tp., exclusive of city, 1851. V. J. Lane, Editor "Herald."

Wyandotte, city, Wayne co., Mich., on Canada Southern and Lake Shore and Michigan Southern R. Rs., and on Detroit River, 12 miles below Detroit, contains 7 churches, large brick union and ward school-houses, 2 newspapers, 1 savings bank, extensive rolling-mills and blast furnaces, an iron shipyard, large silver-smelting works, and several saw-mills; incorporated 1867. P. 2731.

Henry A. Griffin, Ed. "Wayne County Courier."

Wyandotte Cave, in Jennings tp., Crawford co., Ind., 5 miles N. of Leavenworth, a town on the Ohio River. The cave is in the St. Louis limestone, and is the rival of the Mammoth Cave in extent and grandeur. It has been explored for 22 miles (including the side-galleries), and numerous diverging branches have not yet been measured. It exceeds the Mammoth Cave in the number and variety of its stalagmites and stalactites, and in the size of some of its chambers, one of which is 350 feet long and 245 feet high, containing a hill 175 feet high, on which are three fine stalagmites. It has, however, no such large bodies of water as the Mammoth Cave. It has a rich cave fauna, consisting chiefly of articulate organisms. Epsom salts, nitre, and alum have been procured from the earth of this cave.

Wyanet', p.-v. and tp., Bureau co., Ill. P. 1750.

Wy'att (Sir Francis), b. in England about 1575; was governor of the colony of Virginia 1621–26, and again 1639–41; waged a protracted war with the Indians, and established the first courts of justice. D. at Boxley, England, in 1644.

Wyatt (James), R. A., b. at Burton Constable, Staffordshire, England, Aug. 3, 1746; accompanied Lord Bagot, minister to Rome, 1760; studied architecture there and at Venice; returned to England about 1766; was the architect of the famous Pantheon in Oxford street, London, 1770–72; built many country-seats for the nobility and gentry, especially the famous Fonthill Abbey of Beckford, 1795; succeeded Sir William Chambers as surveyor general to the board of works 1796; built the military academy at Woolwich 1796; designed the House of Lords 1800; made alterations in Windsor Castle, and erected a Gothic palace for George III. at Kew, now demolished. In 1802 he succeeded West as president of the Royal Academy. D. Sept. 5, 1813.

Wyatt (Matthew Cotes), b. in England in 1775; educated at Eton; showed an early talent for the arts of design; was employed when only nineteen years of age by George III. in the execution of a cenotaph to Princess Charlotte in St. George's chapel; became an eminent sculptor, producing the monument of Nelson at Liverpool, that of the duchess of Rutland at Belvoir Castle, the equestrian statues of the dukes of York and Wellington, and the horse for the statue of George III. in Pall Mall. One of his finest specimens was his *Bashaw*, the favorite Newfoundland dog of the earl of Dudley. D. at Paddington Jan. 10, 1862.

Wyatt (Sir Matthew Digby), F. S. A., b. at Bowle, Wiltshire, England, in 1820; educated at Devizes; studied architecture in the office of his brother Thomas in London, and also at the Royal Academy; gained a prize from the Architectural Society for an essay when only sixteen years of age; spent two years on the Continent 1844–46, examining the monuments of art and antiquity in France, Germany, and Italy, publishing in fac-simile on his return a series of studies from churches; arranged and decorated the New Adelphi Theatre 1848; was employed by the Society of Arts to report upon the Exposition of Industry at Paris 1849; was associated as secretary with those members of the Society of Arts who originated the project of the Universal Exposition held at London in 1851, the appointment being confirmed by the royal commission; assisted Messrs. Paxton, Cubitt, Fox, and Owen Jones in settling the general plan of the Crystal Palace in Hyde Park, and superintended its erection; received for his services a gold medal from Prince Albert and a testimonial worth £1000 from the royal commission; was associated with Brunel in designing the Paddington station of the Great Western Railway and in other works; superintended the fine arts department and the decorations of the Crystal Palace at Sydenham 1852–54, visiting various parts of Europe to collect works of art; published guidebooks to that exposition; was one of the jurors of the French International Exposition of 1855, for which he had selected and arranged (with Dr. Royle) the contributions of the East India Company, and was reporter to the British government upon the department of decorative art; was created by Napoleon III. a knight of the Legion of Honor; became surveyor to the East India Company Dec., 1855, for which he made designs for great public works in India and for several important buildings in England; performed the confidential and laborious duties of superintending the transfer to the Crown of the vast properties owned by that corporation at the date of its dissolution in 1859; has since been architect to the council of India; has erected or restored many noble mansions for private individuals; was honorary secretary to the Royal Institute of British Architects 1855–59; was a commissioner of the Society of Arts to the Italian Exposition of Industry; was prominently connected with the British Universal Exposition of 1862; received Her Majesty's gold medal for architectural excellence 1866; was knighted Jan. 14, 1869, and was Slade professor of fine arts at Cambridge for the first term of three years, 1869–72. Author, among other works, of *Geometrical Mosaics of the Middle Ages* (1848), *Industrial Arts of the Nineteenth Century* (2 vols., 1851), *Metal-Work and its Artistic Design* (1852), *Notices of Sculpture in Ivory, etc.* (1856), *Art-Treasures in the United Kingdom* (1857), *What Illuminating Was*

—*What it Should Be* (1861), and *An Architect's Note-Book in Spain* (1872). D. in London May 22, 1877.

Wyatt (Richard James), b. in London, England, May 3, 1795; was apprenticed at an early age to Charles Rossi, an eminent sculptor, with whom he remained seven years, studying meanwhile at the Royal Academy and gaining two medals; spent some time in Paris in the studio of Bozio 1820–21, and in the latter year entered the studio of Canova at Rome, where he gained considerable reputation, and resided until his death, May 28, 1850. Among his most noted productions are—*Ino and the Infant Bacchus, Glycera, Musidora*, two *Nymphs*, and a *Penelope* executed for Queen Victoria.

Wyatt (Sir Thomas), b. at Allington Castle, Kent, in 1503, son of Sir Henry (d. 1538), a prominent friend of Henry VII.; educated both at Oxford and at Cambridge, where he graduated at St. John's College 1518; made the tour of Europe; married Eleanor, daughter of Lord Cobham; became a gentleman of the king's bed-chamber; took part in a famous tournament before the king at Greenwich, Christmas, 1525; gained a high reputation at court by his poems, his skill at arms, in music, and in repartee, and his knowledge of continental languages; officiated for his father as "ewerer" at the coronation of Anne Boleyn July, 1533; soon fell into disfavor with the king on her account; was tried for seditious language, but acquitted and restored to favor; was knighted by the king Mar. 18, 1536; was made high sheriff of Kent early in 1537; was sent as minister to Spain Apr., 1537, and again along with Bonner in May, 1538; accompanied Charles V. to Nice in June; returned to England June, 1539; was accused by Bonner of treasonable correspondence with Cardinal Pole, but maintained his favor at court; was sent as ambassador to Charles V., whom he accompanied in his journey in France Dec., 1539; resided at the imperial court while at Brussels and at Ghent, and aided Cromwell in promoting the match between the king and Anne of Cleves (1540), thereby losing the favor of Henry; was involved in the fall of Cromwell, thrown into prison, and tried on the old charges brought by Bonner, but acquitted June, 1541; again recovered the royal favor; was created high steward of the king's manor of Maidstone, and received valuable grants of lands. D. at Sherborne Oct. 11, 1542. He left a considerable number of poems, which were published together with those of his friend the earl of Surrey 1557, and frequently reprinted. He was also an accomplished prose-writer, as shown by his state papers and his letters to his son. Among recent editions of his *Poems*, those of Gilfillan (1858) and of Robert Bell (1866) are the best. The best edition of his *Complete Works* is that of Rev. Dr. George F. Nott, along with those of Surrey (2 vols., 1815–16), with notes and a glossary.

Wyatt (Sir Thomas), called the Younger, only son of the above, b. at Allington, Kent, about 1521; married at the age of sixteen; succeeded to his father's titles and estate 1542; led for some time a life of reckless dissipation; was imprisoned in the Tower Apr., 1543, for riotous conduct in the streets of London, along with the earl of Surrey; was soon released; raised a body of soldiers at his own expense and took part in the siege of Landrecies 1544; commanded the English forces at Boulogne 1545, and was subsequently second in command there under Surrey, remaining there until that place was surrendered to the French 1550; lived in retirement at Allington until the accession of Mary, when he was involved with the duke of Suffolk in a conspiracy against her in favor of Lady Jane Grey; assembled a body of Kentish men under pretext of resisting Mary's marriage with Philip II.; took Rochester Castle Jan. 16, 1554; was joined by the forces sent against him under the duke of Norfolk Jan. 29; marched upon London and entered Southwark Feb. 3; retired to Kingston Feb. 6; returned to London, and attempted to surprise Ludgate Feb. 7; was captured in Fleet street; was tried and condemned to death Mar. 15, behaving with little self-control and implicating the princess Elizabeth and others in his confessions. He was executed on Tower Hill Apr. 11, 1554. His ill-judged movement proved fatal to Lady Jane Grey, who had been some months in prison, and was brought to the block a week after the attempt upon the city.

Wy'atville (Sir Jeffrey), originally Wyatt, b. at Burton-upon-Trent, England, Aug. 3, 1766, was a nephew of James Wyatt, under whom he studied architecture; was for many years engaged as a building contractor; was selected by George IV. in 1824 to remodel Windsor Castle, a task which employed him the remainder of his life; changed his name to Wyatville 1824, and was knighted 1828. D. at Windsor Feb. 18, 1840, and was buried in St. George's chapel. Among the mansions he designed or altered are Chatsworth, Longleat, Wollaton, and Ashridge halls. His great work, *Illustrations of Windsor Castle* (2 vols. columbier folio, 1841), was posthumously edited by Henry Ashton. Sir Jeffrey had spent £3000 upon the drawings and engravings connected with that work.

Wych'erley (William), b. at Clive, near Shrewsbury, England, about 1640; educated at Angoulême, France, where he became a Roman Catholic; returned to England 1660; studied at Queen's College, Oxford, where he conformed to the Church of England; was entered at the Middle Temple, London, but never called to the bar; produced with success in 1672 his play, *Love in a Wood, or St. James's Park*, which procured him the patronage of the duchess of Cleveland, who introduced him at court; was favored by the duke of Buckingham and by the king, who afforded him employment at court; brought out three other plays, *The Gentleman Dancing-Master* (1673), *The Country Wife* (1675), and *The Plain-Dealer* (1677); married clandestinely, about 1680, the countess-dowager of Drogheda, who soon died, leaving him her fortune, which, however, was disputed at law by her relatives, and having lost favor at court was several years a prisoner for debt in the Fleet until after the accession of James II., by whom his debts were paid and a pension of £200 settled upon him; succeeded to his paternal estates soon after, and published dull volumes of *Poems* (1704), corrected by Pope. D. in London Jan. 1, 1715. His *Posthumous Works* (1728) were published by Theobald, and his collected *Plays* (1712) were edited by Leigh Hunt in 1840, in connection with those of Congreve, Vanbrugh, and Farquhar. They are chiefly notable for licentiousness.

Wyck'off (Isaac Newton), D. D., b. at Hillsborough, N. J., Aug. 29, 1792; graduated at Rutgers College 1812; taught in academies in New York City and at Somerville and New Brunswick, N. J., pursuing also a course of theological studies in the seminary at the latter place, where he graduated 1817; was pastor of the First Dutch Reformed church at Catskill, N. Y., 1818–36, and of the Second Reformed church in Albany from 1836 to his death, Mar. 28, 1869. He was an eloquent preacher, an active worker in benevolent and charitable enterprises, received over 1000 communicants into his church, published many occasional sermons and addresses, and rendered great assistance to Dr. W. B. Sprague in his *Annals of the American Pulpit*.

Wyckoff (William H.), LL.D., b. in New York City Sept. 10, 1807; studied two years at Hamilton College; graduated at Union College 1828; was for many years from 1828 principal of the classical department of a collegiate school in New York City, in which he became a partner; fitted for Columbia College and New York University a larger number of students than any other private institution; was the founder and editor for several years (1839–46) of the *Baptist Advocate* (now the *Examiner*); was for many years president of the Young Men's City Bible Society and of the Baptist Domestic Mission Society; aided in the organization of the American and Foreign Bible Society 1835, and of the American Bible Union 1850; was corresponding secretary of the former 1846–50, and of the latter 1850–77, and was called to the ministry by the Laight street Baptist church 1846. Author of *The Bible Question, or the American Bible Society and the Baptists; The Bible, its Excellence; Rollin's Ancient History, condensed for Schools; The Bible Primer; The Early Guide to Knowledge*, and other religious or educational works, and was joint author with Rev. Dr. Everts of a *Scripture School-Reader*. D. in Brooklyn, N. Y., Nov. 2, 1877.

Wyc'liffe, Wickliffe, or **Wiclif, de** (John), b. at Sprewsel, in the parish of Wycliffe, near Old Richmond, Yorkshire, England, about 1324; was one of the original students of Queen's College, Oxford, upon its foundation by Queen Philippa in 1340; soon removed to Merton College, then the leading one at Oxford, and resided there many years; took orders as a priest; is supposed to have published in 1356 his first work, *The Last Age of the Church*, in which he argued that the millennium was past, that the world was then under the reign of Satan and of Antichrist, and that the day of judgment was near at hand; was soon led to identify the papacy with Antichrist; maintained about 1360 a vigorous polemic against the mendicant orders of preachers, who had begun to abound in England, and whom he accused of profligacy, of false doctrine, and of undermining the influence of the regular clergy; was chosen warden or master of Baliol Hall (now College) 1361; was in May of the same year presented by his college to the rectory of Fylingham (or Fillingham), Lincolnshire, which he subsequently (Nov., 1368) exchanged for that of Ludgershall, Buckinghamshire; took his degree of D. D., and began to read lectures on divinity at Oxford about 1363; was appointed warden of Canterbury Hall by its founder, Archbishop Islip, 1365, under a new arrangement which excluded monks from membership; was soon unseated by Archbishop Langham, the successor

of Islip; appealed to the pope, by whom an adverse decision was rendered seven years later; was appointed chaplain to King Edward III., and wrote against the papal demand for arrears of tribute from the English Crown 1365; was one of six commissioners sent in Aug., 1374, by Edward III. to Bruges to confer with the papal delegates upon questions of ecclesiastical authority in England; remained abroad nearly two years; was during his absence presented by the king with a prebend in the collegiate church of Westbury, Gloucestershire (Nov., 1375), and with the rectory of Lutterworth, Leicestershire (1376), probably through the influence of John of Gaunt, duke of Lancaster, whose acquaintance he seems to have made at Bruges; began to attack the pretensions of the papacy with great vigor; was accused of heresy by Archbishop Courtney, and summoned before a convocation of the clergy at St. Paul's, London; was attended thither (Feb. 19, 1377) by the two most powerful subjects of the kingdom, John of Gaunt and Henry Percy, the earl-marshal, whose defence of Wycliffe gave rise to a popular tumult in which the Savoy palace, the residence of the former prince, was attacked; was directly accused of heresy in four bulls issued by Pope Gregory VI. May, 1377, by virtue of which he was cited before a clerical synod at Lambeth early in 1378; was saved from active persecution by the intervention in his behalf of the queen-mother, and especially by the breaking out in that year of the great papal schism; was consequently allowed to depart with an admonition to refrain from preaching the obnoxious doctrines; was supported by the chancellor and many of the officers of Oxford University, and by a great part of the nation; began about this time to send out many disciples, who under the name of "poor priests" preached his doctrines in all parts of the kingdom; prepared with the assistance of his pupils a version of the entire Bible into English, which was rapidly disseminated among the people; lectured at Oxford against transubstantiation 1381, and was condemned by a synod of twelve doctors; was summoned before a clerical convocation at Oxford 1382, when he defended his opinions, presenting two confessions of faith in which they were reaffirmed, but in a conciliatory manner; was debarred by royal command from lecturing further at Oxford; retired to his living at Lutterworth, where he continued preaching and writing controversial and expository treatises until his death, which ensued two days after suffering a stroke of paralysis (Dec. 29) while celebrating mass. D. Dec. 31, 1384. His doctrines had many supporters in England (known as Wycliffites) for two generations, and being carried to Bohemia by the members of the suite of Queen Anne, gave rise there to the formidable Hussite movement. His opinions coincided in great part with those of Luther and Calvin, and he is justly called "the morning-star of the Reformation." The Council of Constance, as a preliminary to the martyrdom of John Huss and Jerome of Prague, examined and condemned forty-five articles of the doctrines of Wycliffe (May 5, 1415), formally declared him a heretic, and ordered his bones to be removed from consecrated ground and cast upon a dunghill. This sentence was not executed until thirteen years later, when, on the demand of the anti-pope Clement VIII., his remains were burned and the ashes thrown into the Swift, a tributary of the Avon. Wycliffe's writings were very numerous, more than 200 pieces being ascribed to him, chiefly brief tracts. Few of them were printed until recently, and many are still unpublished. His translation of the Bible was first edited by Rev. Josiah Forshall and Sir Frederick Madden for the University of Oxford (4 vols., 1850). His *Last Age of the Church* (Dublin, 1840) was edited by James Henthorne Todd, D. D., who also issued his *Apology for Lollard Doctrines* (1842) and his *Three Treatises* (1851). A collection of his English *Tracts and Treatises*, with *Selections and Translations from his Latin Works* (1845), was edited for the Wycliffe Society by Robert Vaughan, D. D., who was the author of the best biography of the Reformer (2 vols., 1828; new ed. 1853). His *Select English Works* (3 vols., 1871) have been edited by T. Arnold, and a *Life* by Lechler has recently appeared in Germany (Leipsic, 1873). (See also Rev. W. W. Shirley's *Catalogue of the Original Works of John Wiclif*, Oxford, 1865.) PORTER C. BLISS.

Wycliffites. See WYCLIFFE.

Wycon'dah, tp., Davis co., Ia. P. 1641.

Wydeville, or **Woodville.** See RIVERS, EARL OF.

Wye River, in Maryland, is an arm of Chesapeake Bay, extending for some distance between Queen Anne and Talbot cos. It divides into two navigable branches, the Front Wye and the Back Wye, which include Wye Island and the peninsula called Wye Neck.

Wyke'ham, William of, b. at Wykeham or Wickham, Hampshire, England, in 1324, of poor parents; was educated at Winchester School through the care of Nicholas Uvedale, governor of Winchester Castle; became private secretary to his patron, by whom he was recommended to the notice of Edward III., who received him into his service as clerk of the royal works then being carried on at Henley and at Yethampstead May, 1356; became "chief keeper and surveyor of the castles of the king at Windsor, Leeds, Dover, and Hadlee" Oct. 30, 1356; was virtually the architect of Windsor Castle, which was built under his eye, as also of Queensborough Castle in the Isle of Sheppey; took holy orders; became rector of Pulham, Norfolk, 1357, prebendary of Lichfield 1359, of London and Southwell 1361, of Lincoln 1362, of York Mar., 1363, and archdeacon of Northampton and of Lincoln the same year; was appointed keeper of the privy seal 1364, secretary of state 1366, bishop of Winchester 1367; was lord chancellor 1367–71; founded St. Mary's College at Winchester and New College, Oxford, 1373; was deprived of the temporalities of his see and excluded from Parliament 1376, but restored on the accession of Richard II. (1379); completed his munificent foundation at Oxford 1386; was again chancellor 1389–91, and rebuilt Winchester cathedral 1395–1405. D. at South Waltham Sept. 24, 1404. A splendid monument was erected to his memory in Winchester cathedral. (See *Three Chancellors—Lives of Wykeham, Waynflete, and Sir Thomas More* (1860), an interesting work by an anonymous writer.)

Wy'lie (ANDREW), D. D., b. in Washington co., Pa., Apr. 12, 1789; graduated at Jefferson College 1810; was licensed as a Presbyterian preacher 1812; was president of Jefferson College 1812–16, of Washington College 1817–28, and of Indiana University from 1828 to his death, at Bloomington, Ind., Nov. 11, 1851. In 1841 he took orders in the Episcopal Church. Author of an *English Grammar* (1822) and other publications.

Wylie (JAMES AITKEN), LL.D., b. in Scotland about 1810; received a classical education; became a distinguished minister of the Scottish Church; travelled or resided a considerable time in Italy, Spain, and the East, and is author, among other works, of *Modern Judea* (1841), *Ruins of Bible Lands* (1845), *A Pilgrimage from the Alps to the Tiber* (2d ed. 1855), *Wanderings and Musings in the Valleys of the Waldenses* (1858), *The Ter-Centenary of the Scottish Reformation* (1860), *The Awakening of Italy and the Crisis of Rome* (1866), *The Road to Rome viâ Oxford* (1868), and *Daybreak in Spain, a Sketch of Spain and its New Reformation* (1870).

Wylie (SAMUEL), D. D., b. in Ireland about 1792; came to the U. S. when a lad; was educated under the supervision of his uncle, Rev. Dr. D. B. Wylie of Philadelphia; graduated at the University of Pennsylvania and at the theological seminary of the Reformed Presbyterian Church; was ordained 1818; and acted as a home missionary until 1820, when he was settled as pastor of a church at Sparta, Randolph co., Ill., where he remained fifty-two years, until his death Mar. 20, 1872. He was an able and eloquent preacher, and wielded great influence in his denomination, above a dozen churches having been formed from the nucleus of his original congregation.

Wylie (SAMUEL BROWN), D. D., b. at Moylarg, near Ballymena, Ireland, May 21, 1773; graduated at the University of Glasgow 1797; came to Philadelphia, Pa., the same year; became tutor in the University of Pennsylvania 1798, and in 1801 pastor of the First Reformed Presbyterian church in that city, filling that post fifty-one years; conducted a private academy for many years; was a professor in the theological seminary of the Reformed Presbyterian Church 1809–51; professor of ancient languages in the University of Pennsylvania 1838–45, and vice-provost of that institution 1838–45; was an eminent classical and Oriental scholar, and co-editor of the *Presbyterian Magazine* 1821–22. D. at Philadelphia Oct. 11, 1852. Author of *The Faithful Witness for Magistracy and Ministry upon a Scriptural Basis* (1801), a *Greek Grammar* (1838), a *Life of Rev. Alexander Macleod, D. D.* (1855), and other publications.

Wylie (THEODORE W. J.), D. D., son of Dr. Samuel Brown, b. at Philadelphia in 1818; graduated at the University of Pennsylvania 1836; became associate pastor with his father over the First Reformed Presbyterian church 1843, and has been pastor since 1852; was at several periods professor in the theological seminary of his Church; has edited the *Missionary Advocate* 1838–41 and the *Banner of the Covenant* 1845–55, and is author of an *English, Latin, and Greek Vocabulary* (1839) and other publications.

Wylie's, tp., Marion co., Ala. P. 400.

Wyl'lys (GEORGE), b. at Fenny Compton, Warwickshire, England, about 1590; settled at Hartford, Conn., 1638; was an assistant 1639, deputy governor 1641, and

governor 1642. D. at Hartford Mar. 9, 1645.—His son SAMUEL, b. in England in 1632, graduated at Harvard 1653; was an assistant governor 1654–84. D. at Hartford May 30, 1709.

Wyllys (SAMUEL), a descendant of Gov. George, b. at Hartford, Conn., Jan. 15, 1739; graduated at Yale College 1758; was lieutenant-colonel of Spencer's regiment, and colonel of a regiment at the siege of Boston 1775; served through the war as colonel in the Connecticut line; became afterward general of militia, and was secretary of state 1795–1809. D. at Hartford June 9, 1823.—His grandfather, HEZEKIAH (d. 1641), became secretary of Connecticut colony in 1712, and transmitted it in 1734 to his father, GEORGE (1710–96), who held it until 1795. The three generations thus held that office for ninety-eight consecutive years.

Wy'man (JEFFRIES), M. D., b. at Chelmsford, Mass., Aug. 11, 1814; graduated at Harvard 1833, and at the Harvard Medical School 1837; became demonstrator of anatomy and curator of the Lowell Institute 1839, before which he delivered a course of lectures 1840; spent two years in Europe, studying medicine in the hospitals of Paris and natural history in the Jardin des Plantes; was professor of anatomy in the Hampden-Sidney Medical College at Richmond, Va., 1843–47, and from the latter date until his death Hersey professor of anatomy in Harvard University. He soon began the formation of the Museum of Comparative Anatomy, to the increase of which he devoted most of his energies for many years, making extensive journeys; delivered before the Lowell Institute in 1849 a second course of *Lectures on Comparative Anatomy and Physiology* (1849); became professor of comparative anatomy in the Lawrence Scientific School at Cambridge; was successively secretary of the Boston Society of Natural History, its curator in different departments, and its president 1856–70; was president of the American Association for the Advancement of Science 1857; became curator of the Peabody Museum of Archæology at Cambridge 1866, and laid the foundation of its remarkable collections; published over 60 papers in the scientific journals and in the *Transactions* or *Proceedings* of the numerous societies to which he belonged; made the first anatomical investigation of the gorilla, and gave it its scientific name; in conjunction with Dr. Savage investigated the question of spontaneous generation with remarkable carefulness and impartiality; made curious researches in regard to the action of light and polar force in embryology, and especially in teratology; exposed the spuriousness of the famous skeleton called the *Hydrarchus Sillimani*, alleged to be that of an extinct sea-serpent, and discovered in Florida and elsewhere pre-historic human remains in fresh water shell-heaps. He was regarded as among the first of American comparative anatomists. D. at Bethlehem, N. H., Sept. 4, 1874. Among his more important scientific monographs are—*The Osteology of Troglodytes gorilla* (1847), *The Anatomy of the Nervous System of Rana pipiens*, in the *Smithsonian Contributions* (vol. v., 1853), *On the Skeleton of a Hottentot* (1865), *An Unnoticed Fracture of the two Lower Lumbar Vertebræ*, *On the Changes of Bones subjected to Great Heat*, *On the Embryology of Raia batis*, and *Notes on the Cells of the Bee*.

Wyman (MORRILL), M. D., brother of Jeffries, b. at Chelmsford, Mass., about 1815; graduated at Harvard 1833, at Cambridge Medical College 1837, and was adjunct Hersey professor of the theory and practice of medicine there 1853–56. Author of *A Practical Treatise on Ventilation* (1846) and other publications.

Wyman (R. H.), U. S. N., b. July 18, 1822, in New Hampshire; became lieutenant in 1850, commander in 1862, captain in 1866, commodore in 1872; served on the W. coast of Mexico during our war with that country, and participated in the capture of Vera Cruz. In 1861 commanded the Pawnee at the battle of Port Royal, and in 1862 was many times engaged with the batteries and sharpshooters on the Potomac and Rappahannock rivers while commanding the Potomac flotilla. Highly commended in official despatches. Com. Wyman has been for several years in charge of the hydrographic office, Washington, where he has attained an enviable reputation by his valuable and thorough work. FOXHALL A. PARKER.

Wynd'ham (Sir WILLIAM), BART., b. at Orchard Wyndham, Somersetshire, England, in 1687; educated at Eton and at Christ Church, Oxford; made the tour of Europe, and on his return entered Parliament for Somersetshire 1710, which county he represented thirty years; married a daughter of the duke of Somerset; became secretary at war June 18, 1711, chancellor of the exchequer Aug., 1713, and privy councillor Nov., 1713; was dismissed from office on the accession of George I., Oct., 1714; was suspected of treasonable intrigues with Bolingbroke, and charged with supporting the rebellion of the earl of Mar, and committed to the Tower 1715, but never brought to trial, and soon liberated; became the leader of the parliamentary opposition, defending the duke of Ormond and the earls of Oxford and Strafford when impeached by the House of Commons. He was noted for his eloquence. D. at Wells July 17, 1740.—His eldest son, CHARLES, became first earl of Egremont, inheriting that title from a maternal uncle, and became secretary of state 1761. D. in 1763.

Wynkin de Worde. See WORDE.

Wynn (CHARLES WATKYN WILLIAMS), D. C. L., b. in Montgomeryshire, Wales, about 1770, grandson of George Grenville; was a member of Parliament for that county for the unprecedented term of fifty-three years from 1797; was president of the board of control 1822–28, secretary at war in the Grey administration 1830–31, and subsequently chancellor of the duchy of Lancaster 1834–35. He was an authority upon parliamentary precedents, and was a friend and correspondent of Southey. D. in London Sept. 2, 1850.—His sister FRANCES (1780–1857) kept a voluminous journal, from which was edited by A. Hayward, Esq., an entertaining volume, *Diaries of a Lady of Quality from 1797 to 1844* (1864).

Wynne (EDWARD), b. in England in 1734; became an eminent lawyer, and was author of several professional treatises, among which was *Eunomus, or Dialogues concerning the Law and Constitution of England* (4 vols., 1767; 5th ed., 2 vols., 1822), which has been recommended as an introduction to Blackstone's *Commentaries*. D. at Chelsea, near London, in 1784.

Wynne (JAMES), M. D., LL.D., b. at Utica, N. Y., in 1814; graduated at the University of New York both in arts and in medicine (1835); practised for some years in Baltimore, and afterward in New York, where he gave special attention to the subject of life insurance, and was lecturer on medical jurisprudence to the New York Medical College. Author of numerous professional and literary essays, of some poems, of an elaborate *Report on the Vital Statistics of the United States* (1857), and of *The Private Libraries of New York*, a magnificently printed monograph.

Wyn'ter (ANDREW), M. D., b. at Bristol, England, in 1819; educated at a private school; became a physician; has especially devoted himself to the study of mental diseases; edited the *British Medical Journal* 1845–60, and has contributed to the quarterly reviews and other periodicals, from the pages of which he has collected several volumes of essays—*Curiosities of Civilization* (1860; 8th ed. 1868), *Our Social Bees, Pictures of Town and Country and other Papers* (2 series, 1861–66), *Subtle Brains and Lissom Fingers, being some of the Chisel-Marks of our Industrial and Scientific Progress* (1863; 3d ed. 1868), and *Curiosities of Toil* (2 vols., 1870).

Wyn'toun (ANDREW), b. in Scotland about the middle of the fourteenth century; became a canon regular of the priory of St. Andrew's, and was chosen prior of St. Serf's Inch (or Island), Lochleven, before 1395. D. after 1420. Author of *De Oryginale Cronykil of Scotland*, in rhyme, first edited, with notes and a glossary, by David Macpherson (London, 2 vols., 1795).

Wyoce'na, p.-v. and tp., Columbia co., Wis. P. of v. 270; of tp. 1281.

Wyo'ming, one of the Territories of the Rocky Mountain region, lying between the 41st and 45th parallels of N. lat., and between the 104th and 111th meridians of lon. W. from Greenwich, is bounded N. by Montana, E. by Dakota and Nebraska, S. by Colorado and Utah, W. by Utah, Idaho, and Montana. Its length from E. to W. is 355 miles, its width from N. to S. 276 miles. Its area is 97,883 sq. m., or 62,645,120 acres.

Topography.—The main range of the Rocky Mountains, which to the N. constitutes the eastern boundary of the Territory of Idaho, enters Wyoming at the N. W., extending in a south-easterly direction through the Territory into Colorado. The Wind River Mountains are the culminating crests of the main range of the Rocky Mountains in the north-western part of Wyoming, like the Bitter Root Mountains between Idaho and Montana, and the Sierra Madre in Colorado, which form the main continental divides. The Snow Mountains lie E. of the Wind River Range, being a prolongation S. from Montana. This range has the valley of the Yellowstone on the W. and that of the Big Horn on the E. The Big Horn Mountains lie still farther E., also in the northern part of the Territory, between the valley of Big Horn and Powder rivers. The Rattlesnake Mountains are S. of the Big Horn Mountains, near the geographical centre of the Territory. The Black Hills, which constitute the eastern foot-hills of the Rocky Mountains, and which have of late become so famous for Indian battles

and the explorations for gold and for fossils there, occupy part of the eastern section of the Territory, extending from Dakota in a south-westerly direction. Medicine Bow Mountains are in the southern part of Wyoming, between Laramie River and the N. fork of the Platte. The Red Buttes are N. of Medicine Bow Mountains and the Laramie Plains. Independence Rock, near the eastern terminus of the Granite Ridge, is situated between the Rattlesnake and Medicine Bow Mountains, at the confluence of Sweetwater River with the N. fork of the Platte. The Sweetwater Range lies W. of Independence Rock, on the S. side of Sweetwater River; Bishop, Queen, and Horned Mountains, E. of Green River, near the southern boundary of the Territory, being spurs of the Sierra Escalante in Colorado. The highest peak in the Territory is Fremont's Peak in the Wind River Range, near lon. 110° W. and lat. 43° 30′ N. The sources of Lewis or Snake River, one of the branches of Columbia River, of the Madison and Big Horn, affluents of Missouri River, and of Green River, one of the largest tributaries of the Colorado of the West, are all about the base of this peak, so that the waters from its slopes fall into the Pacific, the Gulf of Mexico, and the Gulf of California. The Great South Pass over the Wind River Range, which was used by the express lines before the railroad was completed, is 7489 feet above the sea. The Pacific R. R. crosses at Creston, a pass farther S. The whole Territory has an elevation of from 3000 to 8000 feet above the sea; the Laramie Plains, an excellent grazing region of great extent, are from 5000 to 6000 feet above the sea.

Rivers, Lakes, etc.—The N. fork of the Platte, with its tributaries, and a few of the smaller affluents of the S. fork of the Platte, drain nearly one-third of the Territory, the central, S. E., and S. S. E. portions; Green River and its tributaries traverse the S. W. section, W. of the Wind River Range; the affluents of Lewis or Snake River are formed in the N. W.; while the tributaries of the Yellowstone, the Big Horn, the Tongue, Powder, Little Missouri, and Shyenne drain the N. and N. E. of the Territory. Most of these rivers and streams flow through deeply-eroded beds or cañons. In the Yellowstone National Park (see YELLOWSTONE NATIONAL PARK), of which the greater part is in this Territory, there are several lakes of considerable size; there are also smaller lakes on the head-waters of Snake and Green rivers.

Geology and Mineralogy.—The crests, and indeed the bulk, of the mountain-masses of all the ranges of the Territory are Eozoic, being composed mainly of red feldspathic granite and syenite and gneiss, while the lower slopes are Silurian, forming narrow belts around the higher mountain-slopes. To these succeed the more distinctly fossiliferous formations, Devonian, Carboniferous, Triassic, Jurassic, and Cretaceous rocks succeeding each other in regular order. Between the Big Horn and Wind River ranges the plateau is mainly Carboniferous, Triassic, and Jurassic, with a small tract of Cretaceous groups in the centre. The elevated plains are mostly Cretaceous, but overlaid with Tertiary sands, gravel, and drift, with occasionally extensive deposits of lignite or brown coal. The coal-beds along and near Union Pacific Railway, near Evanston and at Rock-spring and Carbon stations, are probably lignite, as they occur apparently in Tertiary deposits: but they differ in appearance and quality from the European lignites, and are equal to most of the better bituminous coals for all purposes of combustion. They contain from 50 to 54 per cent. of fixed carbon. They are extensively worked, and furnish most of the coal used not only on the Union and Central Pacific railways, but in the villages and towns on the line of those roads between Omaha and San Francisco. There are geological indications of the possibility of available coal-mines in the true coal-measures in the plateau between the Big Horn and Wind River ranges. Gold is found and mined in the Sweetwater region and in places on the slopes of Medicine Bow Mountains, and the indications of gold in the Black Hills are such as to warrant an expectation of profitable mining there. In the Seminoe Mountains and in the Ferris Mineral district, as well as at Crow Creek, 20 miles W. of Cheyenne, deposits of both silver and gold have been found and worked. In other localities, especially around Laramie Peak, gold has been discovered. Iron-mines have been opened at Rawlin's Springs, and are yielding large quantities of excellent ore. Other extensive iron deposits are known to exist, but have not yet been developed. Copper, lead, and gypsum are found in paying quantities, but await development.

Soil and Vegetation.—Notwithstanding the mountainous character of much of the Territory, which renders it better adapted to grazing than to cultivation, there is a large amount of arable land, which with irrigation will amply repay the toils of the husbandman. The explorations of Prof. Hayden and his party justify the estimate that about 5,000,000 acres are arable land, and that not far from 35,000,000 are available for grazing purposes. The mountains are clothed with a thick growth of pine, spruce, and hemlock trees of large size; the foot hills have some pine, spruce, aspen, walnut, elm, ash, box elder, hackberry, and red cedar of smaller growth, while the river bottoms are abundantly supplied with two species of cotton wood and thickets of willows. As a considerable portion of this Territory is included in the Great American Desert, the sagebush (*Artemisia*) and the buffalo grass are of course very abundant, especially on the Laramie Plains, some of which are alkaline. But these alkaline lands when irrigated, as most of them can be, yield most bountiful crops. The U. S. exploring expedition under Prof. Hayden described and named 195 species of plants, many of them peculiar to the Territory.

Zoology.—The wild animals of the Territory are principally the grizzly bear, black bear, wolf, prairie wolf, badger, wolverine, otter, fisher, porcupine, mink, skunk, little ermine, buffalo, elk, mule or black-tailed deer, big horn or mountain-sheep, prong-horn antelope, 4 species of hare or rabbits, 4 of squirrels, 2 of prairie-dogs, gopher, mu krat, 2 species of mouse, etc.; in all, about 30 species of mammals have been described in the Territory, and 121 species of birds, including 12 birds of prey; many gamebirds, including a dozen or more of the duck and teal family; 6 species of grouse, etc., and a large number of song birds; there are more than 80 species of mollusks. Reptiles are not numerous. Many of the streams swarm with mountain-trout, and other fresh-water fish are abundant.

Climate.—The average mean temperature of the year is for the whole Territory about 44° F. In the mountains it is in some years as low as 36°, while on the plains in the E. it averages 45° to 46°, and in the Green River region (S. W.) it is about 42°. The summer is for the most part cool, though sometimes the temperature rises for a day or two to 103° at the hottest part of the day. The nights are cool. The cold of winter is at times intense, the winds and snow sweeping over the great plains with almost irresistible fury. In the winter of 1873–74, an exceptionally mild one, the lowest temperature at Cheyenne was −21°. Stock requires to be sheltered for two or three months, though stock-raisers too often neglect this, to their great loss. The small amount of rainfall is an objection to the settlement of the Territory, though not an insuperable one. The annual rainfall varies from 8 to 13 inches, but in all the arable portion there are streams flowing at such an elevation as permits ample irrigation, and under its influence would yield abundant crops.

Agricultural Productions.—These, except live-stock, are not of large amount. In 1870 there were but 338 acres of land reported as under cultivation, and but 4341 acres taken up in farms. The value of the farms was but $18,187, and the value of all farm-products but $42,760. There has been a very great advance in these particulars since that time, but the farming as distinct from the grazing interest is still small. The value of all live-stock in the Territory in 1870 was $141,795. In 1874 the cattle alone shipped from Eastern Wyoming to Chicago brought over $500,000. The number of horses and of sheep in the Territory is increasing with great rapidity.

Manufactures are in their infancy in the Territory, the total production of 1870 being but $765,424, employing but 502 hands. The exigencies of the Union and Central Pacific railways have increased the amount of manufacturing in certain directions, but the population is not yet sufficient to induce a very general interest in manufactures. The mining interests are also rapidly developing themselves; the coal product is large, and the production of gold and silver in 1875 is said to have reached $5,000,000, and is fast increasing. The iron of the Territory is likely soon to be in demand for railway purposes.

Railroads.—The only railways in the Territory as yet are the Union and Central Pacific, which together traverse the southern part of the Territory, having a length of 470 miles within it; and the Denver Pacific, extending from Cheyenne to Denver, 106 miles in length, but only 5 or 6 miles of it within the Territory. A railway is projected from Bryan or Point of Rocks on the Union Pacific to the Yellowstone National Park, but is not yet in progress.

Finances.—The assessed valuation of real and personal estate in 1870 was $5,516,748; the true valuation, $7,016,748. The total taxes, Territorial and county, were $34,471; there was no Territorial debt. The *commerce* of the Territory passes over Union Pacific Railway, but its amount cannot be determined.

Banks, etc.—There are 2 national banks in the Territory, having an aggregate capital of $125,000, and 3 or 4 private banking-houses.

Population.—The population of Wyoming in 1870 was 9118, of whom 7219 were males and 1899 females; 8726 white, 183 colored, 143 Chinese, 66 Indians; 5605 natives

of U. S., 3513 foreign born. The density of the population was 0.09 to the sq. m. There were 2248 families, of 4.06 to a family; 2379 dwellings, with 3.83 persons to a dwelling; 856 persons were of school age (5–18), 6056 of military age (18–45), 7156 of voting age (21 years old and upward: women are allowed to vote in Wyoming); the number of male citizens 5297. The surveyor-general estimated the population at the close of 1874 at 25,000.

Education.—At the close of 1874 there were 14 school districts in the Territory, and 10 school-houses, valued at $31,600 with their furniture. The whole number of teachers employed was 20—5 males and 15 females. The average wages of the teachers were $85 per month. The whole amount of wages paid to teachers, $14,200. Number of scholars enrolled, 1000. There are some private schools at Cheyenne, Laramie, and Evanston, mostly under the care of missionaries of the different denominations, but no institutions of higher education. There are no charitable educational institutions and no insane hospital in the Territory. There is a Territorial prison at Cheyenne, and a rude jail in each county.

Newspapers.—There were 6 newspapers in the Territory in 1870, with 1950 circulation, and an annual issue of 243,300; 2 were dailies and 4 weeklies. There were in 1875, 3 dailies and 7 weeklies.

Churches.—In 1870 there were 12 churches of all denominations, with 12 church edifices, 3500 sittings, and $46,000 of church property. Of these, 1 was Baptist, with 300 sittings and $4000 church property; 1 Congregational, with the same number of sittings and amount of church property; 3 Episcopal, with 750 sittings and $10,000 church property; 2 Methodist, with 600 sittings and $8000 church property; 3 Presbyterian, with 750 sittings and $12,000 church property; and 2 Roman Catholic, with 800 sittings and $8000 church property. In 1875 there were 2 Baptist churches, 1 ordained minister, 50 members, about 300 adherent population, and $7000 church property; 2 Congregational churches, 42 members, about 260 adherent population, and $6500 church property; 4 Episcopal churches, with 3 church edifices, 2 ministers, 116 communicants, 696 adherent population, and $12,000 church property; the Methodists had 3 churches, 3 ministers, 115 members, with 690 adherent population, and church property valued at $9000; the Presbyterians had 3 churches, 3 ministers, 104 members, 624 adherent population, and $12,000 church property; the Roman Catholics, 3 churches and 10 stations, 2 priests, about 1000 adherent population, and $10,000 church property. In all, 17 church edifices, 11 clergymen, 427 members, 3570 adherent population, $56,500 of church property.

The governor and secretary are appointed by the President of the U. S., usually for four years. The legislative assembly consists of a council of 13 members and a house of representatives of 27 members, each elected for two years. The judicial power is vested in a supreme court of 3 justices—1 chief and 2 associate, appointed by the President for four years; 3 district courts, presided over by the judges of the supreme court; probate courts and justices of the peace.

Counties.—There are five counties, as follows:

Counties.	Pop. in 1870.	Males in 1870.	Females in 1870.	White in 1870.	Colored, including Chinese and Indians, 1870.
Albany	2021	1635	386	1971	50
Carbon	1368	1193	175	1360	8
Laramie	2957	2240	717	2822	135
Sweetwater	1916	1492	424	1777	139
Uintah	856	659	197	796	60
Totals	9118	7219	1899	8726	392

The valuation was not given by counties for this Territory in 1870, and no later valuation is accessible.

Principal Towns.—Cheyenne, the capital, in 1870 had 1450 inhabitants; it is now said to have 2500. Laramie City and Evanston, both on Union Pacific Railway, have from 1500 to 2000 inhabitants each; South Pass City, Atlantic City, and Miners' Delight, all in the Sweetwater mining region, are growing towns, and Rawlin's Springs and Fort D. A. Russell are towns of some importance.

History.—The oldest white settlement is probably that at Fort Laramie, where a fur-trading post was established in 1834, rebuilt by the American Fur Company in 1836, and sold to the U. S. in 1849, since which time it has been garrisoned by white troops. Old Fort Bridger, 2 miles above the present site of the fort, was built and occupied by traders in 1841; removed to its present site in consequence of an Indian raid upon it. It was owned by Messrs. Bridger & Vasquez till 1854, then sold to the Mormons and burnt by them in 1857, but rebuilt by the U. S. in 1858. Forts D. A. Russell, Sanders, Fred. Steele, and Fetterman, and Camps Stambaugh and Brown, are of later date. They have been established for the protection of the Union Pacific Railway and the mining settlements. The Territory was organized by act of Congress approved July 25, 1868. Its growth has not been rapid, as the Indians have been somewhat troublesome and the land was not as easily cultivated as in some other of the Territories. There had been no serious fighting with the Indians until 1876, when the Sioux in the Black Hills in the extreme N. E. of the Territory attacked Gen. Custer's command and totally destroyed it. Changes now in progress in regard to the future location of the Indian tribes will probably lead to the more rapid development of this Territory in the near future.

Governors of the Territory.—John A. Campbell, 1869–75; John M. Thayer, 1875–77. The Territory has no vote for President. A. G. Brackett. Revised by L. P. Brockett.

Wyoming, county of W. New York, drained by Genesee, Buffalo, and Tonewanda rivers, and traversed by Erie R. R.; surface hilly and broken, but tolerably fertile, and well adapted for grazing. There are flour-mills, saw-mills, tanneries, and manufactures of agricultural implements, brick, carriages, paper, and woollen goods. Horses, cattle, and sheep are numerous. Staples, oats, wheat, Indian corn, potatoes, hay, wool, and dairy products. Cap. Warsaw. Area, 590 sq. m. P. 29,164.

Wyoming, county of N. E. Pennsylvania, intersected by the N. branch of Susquehanna River, drained by several large creeks, and traversed by the North Branch Canal and Delaware Lackawanna and Western and Lehigh Valley R. Rs.; the surface is hilly, and in some portions mountainous, abounding in timber, coal, and iron. There are saw-mills, flour-mills, tanneries, and manufactories of iron castings and carriages. Cattle and sheep are the chief live-stock. Staples, Indian corn, oats, buckwheat, wheat, potatoes, wool, hay, and dairy products. Cap. Tunkhannock. Area, 345 sq. m. P. 14,585.

Wyoming, county of S. West Virginia, bordering on Virginia, and drained by affluents of Guyandotte and Sandy rivers. The surface is mountainous, much of it being heavily timbered. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, wool, and hay. Cap. Oceana. Area, about 500 sq. m. P. 3171.

Wyoming, p.-v., North Murderkill hundred, Kent co., Del. P. 280.

Wyoming, tp., Lee co., Ill. P. 1280.

Wyoming, p.-v., Stark co., Ill., at the junction of Chicago Burlington and Quincy and Peoria and Rock Island R. Rs., has 4 churches, 2 large school buildings, containing 4 departments each, 2 exchange banks, 2 large hotels, 1 newspaper, and 3 flouring-mills. P. 640.
E. H. Phelps, Ed. "Post."

Wyoming, p.-v. and tp., Jones co., Ia., on Davenport and St. Paul R. R., 51 miles N. of Davenport, contains 3 churches, a library, a graded school, 1 bank, 1 newspaper, and a steam flouring-mill. Principal business, stock-raising. P. 1733. P. D. Swigart, Ed. "Journal."

Wyoming, p.-v., Bath co., Ky. P. 120.

Wyoming, tp., Kent co., Mich. P. 1786.

Wyoming, p.-v. and tp., Chisago co., Minn. P. 522.

Wyoming, p.-v. and tp., Otoe co., Neb. P. 911.

Wyoming, p.-v., Middlebury tp., Wyoming co., N. Y. P. 338.

Wyoming, p.-v., Luzerne co., Pa.

Wyoming, p.-v. and tp., Iowa co., Wis. P. 735.

Wyoming Valley, in Luzerne co., Pa., was called *Wyoming* ("great plains") by the Delaware Indians, who, with the Shawnees and the Wyomings (Iroquois), inhabited this beautiful region, rich in agricultural resources, and in later days remarkably productive of anthracite coal of excellent quality. It is traversed by the N. branch of Susquehanna River. It was settled in 1762 by people from Connecticut, which colony claimed this region by virtue of its ancient charter, notwithstanding the protest of the government of Pennsylvania. In the following year the settlers were either driven away or slain by the Delawares, but the colonists soon returned, bought the claims of the Six Nations to the valley, and for several years were embroiled in a contest with other citizens, who recognized the government of Pennsylvania. In 1771, the British government having confirmed the Connecticut claim, peace was restored, but in 1775 a force of Pennsylvanians attacked the settlements without success.

During the Revolutionary war a large number of Tories from New York settled in the valley, which, from its seclusion, could not well be protected from hostile arms. The greater proportion of the able-bodied men were on duty

with Gen. Washington when on June 30, 1778, a body of 400 British troops and 700 Seneca Indians, with some Tories, invaded the valley. On July 3 the battle of Wyoming was fought between this force and a body of some 300 settlers, chiefly boys and old men, who were utterly defeated and driven into a fort, the Tories and Indians murdering all the prisoners. On the next day the fort capitulated, but the terms of the capitulation were not observed, and the greater part of the inhabitants were soon compelled to flee from the valley by the Indians. In 1782, Congress decided the dispute as to jurisdiction in favor of Pennsylvania; but when authorities attempted to eject the Connecticut people from the property they had acquired in the valley, they again took up arms, and the contest lasted until 1788, when the Pennsylvania legislature confirmed the titles of the residents; but for some twenty-five years there was much litigation in regard to the conflicting claims of those holding lands under the Connecticut and the Pennsylvania grants. This long series of contests was known as the "Pennymite wars," the settlers calling their opponents "Pennymites." The valley includes parts of the townships of Pittston, Jenkins, Plains, Wilkesbarre, Hanover, Plymouth, Kingston, and Exeter, but the Connecticut colony occupied a large tract in Luzerne and several other counties. The picture of the massacre of Wyoming given by Campbell in his *Gertrude of Wyoming* is greatly exaggerated in respect to the cruelties practised by the Indians. Above Kingston, opposite Wilkesbarre, stands a granite obelisk which commemorates the slain in the contest of July 3, 1778. (See Charles Miner's *Hist. of Wyoming*, 1845; George Peck, D. D., *Wyoming, its History and Incidents*, etc., 1858.)

Wy'on (William), R. A., b. at Birmingham, England, in 1795, son of a die-sinker of German descent; was apprenticed to his father; became extremely skilful in his art; was appointed in 1816 second engraver in the royal mint, the chief engraver being his cousin, Thomas Wyon (b. 1792), on whose death in 1817 he succeeded to that post, which he retained until his death, at Brighton in 1851. Besides the current British coins, Mr. Wyon executed most of the war-medals awarded during his time, as those of the Peninsula, Trafalgar, Jellalabad, and Cabool, also the civic medals of the Royal Academy, the Royal Society, the Geographical, Geological, Asiatic, and other learned societies. His heads have great force and delicacy, and are always fine likenesses. A *Memoir of his Life and Works* (1837) was published during his lifetime by Nicholas Carlisle.

Wyrar'disbury, or Wraysbury, village of England, county of Bucks, on the Thames, 12 miles S. E. of Eton. In the park of Ankerwyke House, close by, stands, still living and powerful, an oak tree, of which it is known from authentic documents that it was an old and mighty tree when in 1215 King John signed the Magna Charta on Runnymede meadow.

Wyse (Thomas), K. C. B., b. at the manor of St. John, near Waterford, Ireland, in 1791; educated at Stonyhurst and at Trinity College, Dublin; studied law at Lincoln's Inn; married in 1821 a daughter of Lucien Bonaparte, prince of Canino; was separated from her 1828; was a member of Parliament 1830–49, a lord of the treasury 1839–41, joint secretary to the board of control 1846–49, and minister plenipotentiary at Athens from 1849 until his death, Apr. 15, 1862. Author of *An Historical Sketch of the Late Catholic Association of Ireland* (2 vols., 1829), *Education Reform, or the Necessity of a National System of Education* (1837), and *An Excursion in the Peloponnesus* (2 vols., 1865), and published some poetical translations from the German.

Wy'sox, tp., Carroll co., Ill. P. 1331.

Wysox, p.-v. and tp., Bradford co., Pa. P. 1290.

Wyss (Johann Rudolf), b. at Berne, Switzerland, Mar. 13, 1781; studied philosophy at various German universities; was appointed professor in the academy of his native city. D. there Mar. 30, 1830. He published *Vorlesungen über das höchste Gut* (2 vols., 1811), *Idyllen, Volksagen, Legenden und Erzählungen aus der Schweiz* (3 vols., 1815–22), and *Reise im Berner Oberland* (1808); but his most celebrated work is *Der Schweizerische Robinson* (1813), an educational treatise, which was translated into many languages.

Wythe, county of S. W. Virginia, intersected by the Great Kanawha (here called New River), and traversed by Atlantic Mississippi and Ohio R. R. The surface is mostly an elevated plateau, containing large quantities of iron ore, lead, bituminous coal, and gypsum. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, wheat, oats, hay, and wool. Cap. Wytheville. Area, about 600 sq. m. P. 11,611.

Wythe, tp., Hancock co., Ill. P. 1219.

Wythe, tp., Elizabeth City co., Va. P. 2932.

Wythe (George), b. at Elizabeth City, Va., in 1726; educated at William and Mary College; inherited a large fortune by the death of both of his parents before reaching mature age, and led for some a life of extravagance, but when thirty years of age devoted himself to legal studies; was admitted to the bar 1757; soon became eminent as a lawyer; was chosen to the house of burgesses as the representative of William and Mary College 1758; drew up in 1764 a remonstrance addressed to the British Parliament against the Stamp act; was elected to the Continental Congress Aug., 1775; signed the Declaration of Independence; was appointed Nov., 1776, along with Jefferson (who had been his pupil), to revise the laws of Virginia; was chosen Speaker of the house of delegates and appointed judge of the high court of chancery 1777; became sole chancellor on the reorganization of that court 1786, filling that post twenty years; was professor of law at William and Mary College 1779–89; was a member of the Virginia convention which ratified the Federal Constitution, of which he was a strenuous advocate, 1788; emancipated his slaves toward the close of his life, and furnished them with the means of subsistence. D. by accidental poisoning at Richmond June 8, 1806. Author of *Decisions of Cases in Virginia by the High Court of Chancery* (1795; 2d ed., with *Memoir*, by B. B. Miner, 1852).

Wythe'ville, p.-v., cap. of Wythe co., Va., on Atlantic Mississippi and Ohio R. R., has good schools, a court-house, excellent water-supply, wide streets regularly laid out, 2 newspapers, and is a favorite summer resort for tourists. P. 1671. John H. Caldwell, Ed. "Enterprise."

Wyt'tenbach (Daniel), b. at Berne, Switzerland, Aug. 7, 1746; studied 1760–64 at the University of Marburg, where his father had been appointed professor of theology; went thence in 1768 to Göttingen to enjoy the instruction of Heyne. Before this he had begun to read through the Greek authors in chronological order, bestowing especial attention on the later philosophers and rhetoricians. In 1769 he attracted the attention of Ruhnken by his *Epistola Critica super Nonnullis locis Juliani Imperatoris ad Dav. Ruhnkenium*; in 1770 visited Leyden to attend the lectures of Ruhnken and Valckenaer. Through the influence of these scholars he obtained the chair of philosophy and literature at the college of the Remonstrants in Amsterdam; in 1775 made a journey to Paris, where he became intimate with Larcher, Sainte-Croix, and Villoison; was appointed in 1779 professor of philosophy at the Athenæum of Amsterdam, and in 1799 was invited to succeed Ruhnken in Leyden as professor of Greek literature and librarian of the university. Wyttenbach was thoroughly imbued with the love and spirit of the Platonic philosophy, his acquaintance with which he used in illustrating the later philosophers. His principal writings are—*Præcepta Philosophiæ Logicæ* (Amst., 1781), *Plutarchi de Sera Numinis Vindicta* (Leyden, 1772), *Selecta principum Græciæ Historicorum* (Amst., 1793), *Platonis Phædon* (Leyden, 1810), various writings collected in *Opuscula* (2 vols., Leyden, 1821). In 1777, Wyttenbach, with Ruhnken, established the *Bibliotheca Critica*, a critical journal in Latin, of which 3 vols. appeared 1777–1808. His most important work was his edition of Plutarch's *Moralia*, on which the labor of nearly thirty years was bestowed, undertaken at the request of the delegates of the Oxford University press, but never completed. It appeared at intervals from 1795 to 1821 in 8 vols. 4to and 15 vols. 8vo. D. Jan. 17, 1820. From his papers was issued an *Index Græcitatis* (2 vols. 8vo, Oxf., 1830).—Madame Wyttenbach (Johanna Gallien), his niece, whom he married in 1817, when past seventy, was a learned woman, distinguished in philosophy and literature. In 1827 she received the title of doctor of philosophy from the University of Marburg. Though German by birth, she wrote in French. Her principal writings are—*Théagène* (Paris, 1815), *Alexis* (ib., 1823), *Symposiaques, ou Propos de Table* (ib., 1823). (See Malne, *Vita Wyttenbachii*, 1823; Dezobry, *Dict. Biog.*; *Biog. Univ.*; B. B. Edwards on "School of Philology in Holland" in *Classical Studies*.)

H. Drisler.

Wyttenbach (Thomas), b. in 1472 at Bienne, canton of Berne, Switzerland; studied theology at Tübingen and Bâle, and was appointed preacher in his native city in 1507. In 1519 he began to preach against the sale of indulgences, the mass, and the celibacy of the priests, and in 1524 he, together with seven other priests from the vicinity, married. Although he had gained many adherents among the citizens, the Roman Catholic party, the council of Berne, and the bishop of Bâle were nevertheless powerful enough to drive him from his office and expose him to poverty and many persecutions. He continued, however, to preach according to his convictions, and two years after his death, which took place in 1526, Bienne became reformed.

X.

X, a letter which represents in English the sound of *ks*. In Spanish it has the sound of the Spanish *j*, a rough aspirate. In French it has the sound of our *x*, *s*, or *z*. In Portuguese it commonly sounds like our *sh*. X stands for the numeral ten; *x* in mathematics is the most frequent symbol for the unknown quantity. X takes its form, but not its power, from the Greek aspirate χ (*chi*).

Xabaten'ses [from the French *sabot*], one of the names given to the Waldenses, from the wooden shoes they wore, which were distinguished in some way by the sign of the cross upon them. R. D. HITCHCOCK.

Xalapa. See JALAPA.

Xalisco. See JALISCO.

Xan'thine [Gr. ξανθός, "yellow"], a name given to the yellow principle contained in flowers, to a yellow coloring-matter found in madder, and to a gas formed by the decomposition of xanthates. J. P. BATTERSHALL.

Xanthine, or **Xanthic Oxide** [Gr. ξανθός, "yellow;" Ger. *Xanthin* or *harnige Säure*], the principal constituent of a rare form of URINARY CALCULI (which see), was discovered by Marcet. It also occurs in human urine, in the spleen and liver, in the muscular flesh of the horse and ox, and in the variety of guano found in the island of Jarvis. It is artificially produced by the reduction of URIC ACID (which see) with sodium amalgam, and by treating *guanine* ($C_5H_5N_5O$) with nitrous acid. It can also be obtained from xanthic calculi or Jarvis guano, but it is most often prepared from the muscular organs of the horse or ox. Xanthine has the composition $C_5H_4N_4O_2$. It separates from its solutions either in white flocks or in minute scales, which are sparingly soluble in water and are insoluble in alcohol and in ether. When distilled, it yields ammonic carbonate and cyanide, and when strongly heated in contact with the air, it burns, emitting an odor resembling that of burning hair. If reduced by means of sodium amalgam, it yields *sarcine* ($C_5H_4N_4O$). Xanthine unites with acids and bases, forming soluble crystalline compounds; the compound with nitric acid possesses a bright yellow color, whence the name of the base. Upon heating the silver compound of xanthine with methylic iodide, *dimethylxanthine* is formed; this is isomeric, but not identical, with THEOBROMINE (which see). J. P. BATTERSHALL.

Xanthippe. See SOCRATES.

Xan'thophyl [Gr. ξανθός, "yellow," and φύλλον, "leaf"], a modified form or product of transformation of *chlorophyl*, the green coloring-matter of leaves. Little is known about it chemically as yet, more than the fact that by some chemical change in the leaf, generally before separation from the tree, the green matter is changed into other compounds, sometimes yellow and sometimes red, this being the first stage of decay, the final product being brown. HENRY WURTZ.

Xanthoprote'ic Acid [Gr. ξανθός, "yellow," and προτεῖον, "chief rank"]. When the fingers are wetted with nitric acid, they become stained of a deep and indelible yellow, which becomes orange-red on the subsequent application of an alkali. This phenomenon was investigated by Mülder, who found that the action of the nitric acid was upon the *albuminoid* matter of the skin, and he isolated the yellow substance, to which he gave the above name. He attributed to it the composition $C_{34}H_{26}N_4O_{14}$. White of egg and other albuminoid matters give the same compound. The stain produced upon wood by nitric acid is due to a similar compound formed with albuminoid matter in the wood. The indelibility of the stain on the fingers is due to the fact that this substance is soluble only in acids and alkalies so concentrated as to destroy all organized substances, and which hence cannot be applied to the skin with safety. Boiling potash solution dissolves xanthoproteic acid with a deep red color; hence the darkening of the stain by alkalies. From this solution xanthoproteates of other bases may be precipitated. The writer, having experimented extensively with these bodies, believes that xanthoproteic acid and its compounds may be made very useful substances in the arts. HENRY WURTZ.

Xanthorham'nine [Gr. ξανθός, "yellow," and *rhamnus*, a plant], a yellow coloring-matter, contained in the ripe Persian or Turkey berries and in Avignon grains. It appears to be formed by the decomposition of *chrysorhamnine* ($C_{23}H_{22}O_{11}$), which is present in the unripe berries. Its extraction is effected by boiling the ground berries with alcohol, allowing the decoction to stand until the various impurities present settle, then allowing the xanthorhamnine to crystallize, and afterward purifying it by recrystallization from alcohol. It is also obtained upon boiling chrysorhamnine with water. It forms yellow crystals, which are easily soluble in water and in alcohol, but do not dissolve in ether. It probably has the composition $C_{23}H_{28}O_{14}$, although, according to some authorities, it is identical with *quercitrine*, $C_{33}H_{30}O_{17}$. Xanthorhamnine is a glycoside, yielding, when treated with dilute acids, glucose ($C_6H_{12}O_6$) and *rhamnetine* ($C_{11}H_{10}O_5$). It forms precipitates with several metallic salts, and imparts a yellow color to fabrics mordanted with alumina, and a black color to those mordanted with iron salts. J. P. BATTERSHALL.

Xanthoxylum. See PRICKLY ASH.

Xanthus, city of Lycia. See LYCIA.

Xavier, de (FRANCISCO). See FRANCIS XAVIER (SAINT).

Xavierian Brothers, a Roman Catholic community of instructors, founded in 1839 at Bruges by T. J. Ryken (1797–1871). They have several houses in the U. S.

Xe'bec, or **Chebeque,** a three-masted Barbary vessel, formerly much used by pirates, and now used to a small extent in Mediterranean commerce. The xebec is sharp fore and aft, carries both square and lateen sails, according to the wind, has low sides, and a deck with so great a camber that the crew walk on gratings over the deck. Xebecs ship much water, but are rapid sailers. The name probably comes from the Turkish.

Xe'nia [Gr. ξένια], those gifts, honors, provisions, and securities which in ancient Greece, where hospitality was a religious duty, and often formed the foundation of important political relations, the host offered the guest. The 13th book of the Epigrams of Martial, which treats of subjects relating to this peculiar social feature, is inscribed *Xenia*, and hence Goethe and Schiller took the title under which, in 1797, they published in the *Musenalmanach* about 400 epigrams, which made an enormous sensation in Germany on account of their sharp criticism of authors, books, and literary affairs in general. (See the works on the subject by Boas (1851) and Saupe (1852).)

Xe'nia, p.-v. and tp., Clay co., Ill., on Ohio and Mississippi R. R., 87 miles E. of St. Louis, Mo., contains 3 handsome churches, an academy, 2 flouring-mills, 2 carriage and wagon manufactories, woollen-mills, 1 plough-factory, 1 newspaper, and 2 hotels. P. of v. 916; of tp. 2479. W. W. MCLIN.

Xenia, p.-v. and tp., cap. of Greene co., O., located in the midst of a highly-cultivated agricultural region, 3 miles from Little Miami River, on Shawnee Creek, 65 miles N. E. of Cincinnati and 52 miles S. W. of Columbus. The town was laid out in the year 1803 by John Vance, on the lands of John Paul, who donated the square now bounded by Main, Market, and Greene streets for the public buildings. The first cabin was erected in Apr., 1804, by John Marshall. Xenia is noted for the breadth and cleanliness of its streets, its broad and finely-shaded sidewalks, its numerous church edifices, and its excellent educational facilities. It was the original terminus of Little Miami R. R., the first of any considerable length constructed in the State, connecting the place with Cincinnati at an early period. This road was subsequently continued to Springfield, and the Columbus and Xenia and Dayton and Xenia constructed. Besides these, the Dayton and South-eastern, a narrow-gauge railroad, passes through the place, connecting it with the coal and iron fields of Jackson co. The Miami Valley is another narrow-gauge railroad, now under contract, forming still another connection with Cincinnati *viâ* Lebanon. Xenia contains 13 churches, 5 public-school buildings, 1 female college, 1 theological seminary, 3 newspaper-offices, 2 banks, 3 weekly newspapers, and numerous mercantile and manufacturing establishments. The court-house is a handsome and commodious structure, with fire-proof vaults and other modern improvements, located upon the public square above referred to, which is surrounded by a beautiful stone and iron fence, and is devoted to the purpose of a public park. Opposite the park is the city building, containing a large and elegant hall, the city council chamber, and offices for the mayor and other city officers. The city has an efficient fire department, with 2 steam fire-engines. Located near Xenia are the Ohio Soldiers' and Sailors' Orphans' Home, the Greene county in-

firmary, and Wilberforce University. P. of v. 6377; of tp. 2251. STINE & MARSHALL, PROPS. "XENIA TORCHLIGHT."

Xenoc'rates, b. at Chalcedon in 396 B. C.; became a pupil of Plato, and gained his favor by his earnestness and energy, though the master was well aware of his slowness of comprehension and lack of elegance in manners. He accompanied Plato to Syracuse, and went after his death, together with Aristotle, to Asia Minor. Afterward he returned to Athens, and succeeded Speusippus as chief of the Academy, which position he occupied till his death, 314 B. C. He was highly respected by the Athenians for the integrity of his character, and was repeatedly sent as an ambassador to foreign princes—Philip of Macedon, Antipater, etc. Aristotle respected him for his insight and knowledge, but of his works none has come down to us. —To be distinguished from him is XENOCRATES the physician, a native of Aphrodisias in Cilicia, who flourished during the reign of Nero. A little essay by him, Περὶ τῆς ἀπὸ τῶν Ἐνύδρων Τροφῆς (*De Alimento ex Aquatilibus*), is still extant, and is very interesting on account of the picture it gives of the state of natural history at that time. It has been edited by Franz (1771) and by Corny (1791).

Xenoph'anes, b. at Colophon, Ionia, about 570 B. C.; went as an exile to Sicily, thence to Magna Græcia, and settled in 536 B. C. at Elea, where he d. about 480 B. C. He is the founder of the Eleatic school of philosophy. He attacked Homer and Hesiod, whose polytheism and theogonies were diametrically opposed to the necessary idea of the unity and oneness of the Divine Being; and he protested that the universe was one, and the one universe God; that is, he taught a decided pantheism. Of his philosophical poems only a few fragments have been preserved by Athenæus and Plutarch, and have been collected by Karsten in his *Philosophorum Græcorum veterum Reliquiæ* (Brussels, 1830, vol. i.).

Xen'ophon, b. in Athens about 444 B. C.; became a disciple of Socrates, who saved his life in the battle of Delium, 424 B. C., when he was thrown from his horse during the flight. In 401 B. C. he went to Sardis at the invitation of Proxenus, a friend of his, and he followed the younger Cyrus on his expedition against his brother, Artaxerxes Mnemon, as a sort of volunteer in the corps of 10,000 Greek auxiliaries. After the battle of Cunaxa, when Cyrus had fallen and the most prominent Greek chiefs had been treacherously murdered in the Persian camp, Xenophon led the Greek troops from the Mesopotamian plains, across the mountain-ranges and plateaus of Asia Minor, to Trapezus on the southern shore of Pontus Euxinus, thence to Chrysopolis, opposite Byzantium, and finally to the camp of Thimbron, the Lacedæmonian general who commanded against Tissaphernes and Pharnabazus. In 396 he stayed in the Lacedæmonian camp in Asia under Agesilaus, and all his life through, in his actions and in his writings, he showed a great partiality for Sparta. He accompanied Agesilaus to Greece, and fought on the Lacedæmonian side in the battle of Coronea, 394 B. C. He was then banished from Athens, and settled at Scillus, near Olympia in Elis; thence he was expelled in 371 B. C., after the battle of Leuctra, and took up his residence in Corinth, where he remained till his death, about 354 B. C., though in the mean time the decree of banishment from Athens had been reversed. His literary activity falls, no doubt, in the latter part of his life, during his residence at Scillus and Corinth, and comprises history, philosophy, and social and moral science. Of his historical writings the most remarkable is the *Anabasis*, which in a simple but fluent and agreeable style gives much curious information of the nations at that time inhabiting the interior of Asia Minor. It was the first work of its kind in Greece; it gave the Greeks for the first time an idea of the true composition of the Persian empire and the internal working of its government; and it exercised, no doubt, a considerable influence on Alexander the Great. Of his philosophical writings the most widely known is his *Apomnemoneumata* or *Memorabilia Socratis*, which gives a portrait of Socrates, not very elevated, but very vivid, and of the greatest interest as forming a complement to that drawn by Plato. He also wrote *Hellenica*, a history of Greece from the end of Thucydides' history to the battle of Mantinea; *Cyropædia*, a sort of political romance; and minor treatises on hunting, finances, etc. There is a valuable edition of his collected works by L. Dindorf (5 vols., Oxford, 1831–66), and another by Schneider and Bornemann (6 vols., Leipsic, 1821–38).

Xen'otime [Gr. ξένος, "strange," and τιμή, "honor:" the name having been given by Beudant, and having no distinct meaning, unless, as suggested by Dana, intended as a sneer at Berzelius, who announced it to contain a new metal, then held in doubt or disbelief], a beautiful and interesting mineral, essentially *phosphate of yttria*, but sometimes containing *zirconia* (then called *castelnaudate*), and sometimes *cerium oxide*. In crystallization dimetric; hardness between fluor spar and apatite; density about 4.5 (4.54, Lawrence Smith, from Clarksville, Ga.). Its color varies much. In the Georgian mineral Dr. Lawrence Smith found 11 per cent. of cerous oxide. Berzelius's mineral, from Hitteröe, which appears to have contained yttria only, with density 4.557, appears to give yttrium the molecular diameter 17, that of alumina in corundums, and of magnesium in brucite. HENRY WURTZ.

Xeres. See JEREZ DE LA FRONTERA.

Xe'res (ha'res), **de** (FRANCISCO), b. at Seville, Spain, about 1500; was secretary to Pizarro during his conquest of Peru, of which he wrote from Caxamarca a narrative addressed to Charles V., *Verdadera Relacion de la Conquista del Perú y de la Provincia del Cuzco llamada la Nueva Castilla, etc.* (Salamanca, 1547), which is sometimes appended to Oviedo's *Natural History of the Indies*. An Italian translation was given by Ramusio, and a French one by Ternaux-Compans.

Xe'res-de-los-Caballe'ros, or **Jeres-de-los-Caballeros**, town of Spain, province of Badajoz, is picturesquely situated at the foot of Sierra Morena, surrounded by an old Moorish wall and well built. P. 8295.

Xerx'es, king of Persia 486–465 B. C., b. about 519, the oldest son of Darius Hystaspis and Atossa, the daughter of Cyrus; succeeded to the throne on the death of his father in preference to his three elder brothers, sons of Darius by his first wife, a daughter of Gobryas. Herodotus calls him cowardly, cruel, and incompetent, but the facts related of him do not seem to warrant this judgment. In the picture which Herodotus gives of the war between the Greeks and the Persians, and which is in every respect one of the grandest pictures history contains, the part Xerxes plays is by no means a very prominent one. The war was not a contest between a regular social order on the one side and a single person, possessed of a tremendous ambition, and wielding, by his talents, his position, his good fortune, an enormous power, on the other. There is nothing in this war reminding the reader of the career of Tamerlane or Gengis Khan. The contest was one between two different phases of civilization—the one vague and fantastic in its purposes, loose and unjust in its organization, awkward and cruel in its working, but developed to the highest degree of splendor and power which it was capable of; the other perfectly clear and definite in all its aspirations, firm and nimble in its organization, shrewd and generous, full of tricks and full of reverence in all its devices, but very young yet, hardly more than a boy in its plays and in its passions. In this contest much cowardice, cruelty, and incompetence became apparent on the Persian side, but they characterize the Eastern civilization rather than the person of Xerxes. Immediately after his accession to the throne an insurrection took place in Egypt, but with one rapid campaign he suppressed it, and he then commenced his preparations for the war against the Greeks. They lasted for four years, and resulted in the largest military armament the world ever saw. The Egyptians and Phœnicians furnished the fleet, 1207 triremes and 3000 smaller vessels, manned with about 500,000 men; and in order to preserve this fleet from the fate which overtook Mardonius's in 492 B. C. at Mount Athos, a canal was dug from Strymonic to the Singitic Gulf—a work which cost the labor of several thousand workmen for nearly three years. The army was composed of contingents from all the countries between China and Sahara, and between the Black and the Arabian sea; forty-six nations were represented in the camp of Xerxes at Cratilla in Cappadocia, each with its own peculiar equipment and method of war. Immense stores of provision were accumulated at regular stations along the whole line of march from Cratilla to Athens, and a bridge was thrown across the Hellespont from Abydos to Sestos. A storm destroyed the bridge, and Xerxes ordered the engineers who had built it to be put to death. This was certainly very cruel, according to Greek views, but when we remember that at the same time he ordered the waters of the strait to be scourged as a kind of punishment, and a set of fetters to be cast into them as a means of handcuffing their waves, we feel that we are in another world, in which Greek views of morality cannot be used as measurement of personal character. A new bridge was constructed, and for seven days and nights one continuous line of soldiery marched across it. At Doriscus in Thrace, in the plains on the Hebrus, the gigantic army halted, and the great king, the tallest and handsomest man of the whole host, inspected and numbered it: 10,000 soldiers were packed as closely as possible in a square, and a wall raised around them. The whole army was then poured, portion after portion, into this square, which was filled 170 times, equalling 1,700,000 men. When to these are added

80,000 horse, 20,000 men employed with the war-chariots and camels, the naval force, the European reinforcement, and a proportionate number of women, children, slaves, and other attendants, the whole army led by Xerxes against Greece must have comprised about 5,000,000 persons. The figure is appalling, and has been rejected as fabulous. The only reason, however, which has been given for thus impeaching the trustworthiness of Herodotus is that it would have been a stupidity to attack Greece with such an army. For the very same reason Herodotus's report of the Mount Athos canal has been denied. Juvenal considered the canal a good specimen of Greek lies, and Niebuhr positively rejected the story as incredible. Nevertheless, recent researches have discovered undeniable traces of the canal. It must be remembered that Xerxes knew much less of the resources of the Greek nation than we do. He had heard from the Carthaginians that they inhabited the northern shores of a sea which it took as long a time to cross on a vessel as it took to traverse his own realm on a camel; and what other means than the number had he of asserting his power over this unknown nation? The account of Herodotus is somewhat loose, and the figures which result from it may be somewhat exaggerated, but the more we learn of the actual state of affairs at that time, the less incredible do they appear. Like an avalanche this host rolled down over Greece. There was some impediment at Thermopylæ, Artemisium, etc., but Xerxes barely heard of it. Athens was burnt, and on Sept. 23, 480 B. C., he sat on his throne of gold, raised on a promontory of Mount Ægaleos, to witness the battle of Salamis, looking at the spectacle as the day-dreamer looks at his own dreams. But the battle was lost, and the great king fled, panic-stricken, first to Sardis, and thence to Susa, where he buried himself in dissipations, sensualities, voluptuousness, and court intrigues. In 465 he was assassinated by Artabanus. CLEMENS PETERSEN.

Xime'nes de Cisne'ros (FRANCISCO), b. at Torre Laguna, New Castile, Spain, in 1436 or 1437; educated at the universities of Alcalá de Henares and Salamanca, where he graduated in both civil and canon law 1456; became a priest; went to Rome, where he practised as an advocate in the consistorial courts 1459–65, acquiring a great reputation for political ability; obtained from the pope a bull nominating him to the first benefice of a specified value which should become vacant in the archbishopric of Toledo; took possession in 1473 of the living of Uzeda, near his native village, against the will of the archbishop of Toledo, who regarded the papal bull as a violation of his rights, and on declining to surrender the living was imprisoned six years in the tower of Santoreaz; was released and given possession of his benefice 1480; exchanged it for a chaplainship near Siguenza, where he studied Hebrew and Chaldee, and acted as vicar to the bishop of the diocese; resigned his preferments in the Church and entered the Franciscan convent of San Juan de los Reyes in Toledo 1482; distinguished himself by his austerity in self-mortification; acquired a great reputation for sanctity, and was in great request at the confessional; retired to the secluded mountain-convent of Our Lady of Castañar, where he built with his own hands a cell in which he passed his time in prayer and meditation; was appointed superior of the convent of Salzeda; was appointed confessor to Queen Isabella 1492, retaining his monastic habits and residence, and soon acquired a national reputation for sanctity; was appointed provincial of his order in Castile 1494, and made his visits of inspection on foot, subsisting on alms; was nominated high chancellor of Castile, archbishop of Toledo, and primate of Spain 1495; refused for six months to accept that dignity, yielding only to the express commands of the pope; retained the austere simplicity of his former mode of life, dispensing the vast revenues of his see chiefly in charities; effected a vigorous reform among the Spanish clergy; founded the University of Alcalá 1498; insisted upon the conquered Moors of Granada receiving Christian baptism during the residence of the court at Granada 1499, thus giving rise to the rebellion in the Alpujarras 1500; is said to have ordered the destruction of many thousands of Arabic MSS.; commenced in 1502 the printing at his own expense, at Alcalá de Henares, of the famous Complutensian Polyglot Bible (from *Complutum*, the Latin name of Alcalá); displayed an enlightened zeal and munificence in providing for all the details of his new university; was the director of most of the public acts of Isabella up to her death in 1501; was mediator between Ferdinand and the archduke Philip in their rival claims upon the regency of Castile; became president of the Castilian council of regency on the death of Philip 1506; was appointed by Pope Julius cardinal and inquisitor-general of Castile 1507; led an expedition against the pirates of Oran on the Barbary coast 1509, securing thereby to Spain an important territorial acquisition; lived in comparative retirement several years on account of the jealousy of Ferdinand, but became again regent of the kingdom on the latter's death, 1516; effected the proclamation of Charles V. against the rival pretensions of the partisans of the insane queen Joanna; enlisted a national guard: quelled domestic disturbances; reduced the little kingdom of Navarre to quietude by dismantling its forces; made preparation against the Barbary corsairs; extended the Inquisition throughout the Spanish dominions; took measures for the protection of the rights of the American Indians and to check the growth of African slavery; introduced reforms into the revenue system; surrendered the regency on the arrival of the young king in Spain in September, and was allowed to retire to his diocese. D. at Roa, on the Douro, Nov. 18, 1517. (See his biographies by Gomez de Castro, and by Hefele, *Der Cardinal Ximenes* (Tübingen, 1844).) PORTER C. BLISS.

Xime'nes de Quesa'da (GONZALO), b. in Granada, Spain, about 1500; went to Santa Marta in a judicial capacity 1535; took command of an expedition against the Chibcha Indians; penetrated with 800 men into the heart of New Granada, experiencing great sufferings; conquered the rich cities of Tunja and Iraca; gained great victories over the Chibchas, and accumulated vast quantities of gold; founded the city of Bogota Aug. 6, 1538; had disputes about boundaries with Frederman, who came thither from Venezuela, and Benalcazar, who arrived from Quito; went to Spain 1539; returned with the title of marshal 1551; led an expedition in search of El Dorado, and founded the city of Santa Agueda 1572. D. of leprosy at Mariquita Feb. 16, 1579.

Xisuthrus. See XYSYTHRUS.

Xorullo. See JORULLO.

Xy'lene, or **Xy'lol** [Gr. ξύλον, "wood"], one of the series of coal-tar hydrocarbons, a homologue of benzole or benzene; composition C_8H_{10}. It has been called *dimethylbenzene*, from the notion that it was formed by the substitution of H_2 in benzene, C_6H_6, by two of methyl, CH_3, making it $C_6H_4(CH_3)_2$. The view of the present writer is that it is $C_6.10H_2C$, being formed by the further association of $4H_2C$ with benzene, which is $C_6.6H_2C$. This latter view is founded on the fact (set forth already under VOLUMES, MOLECULAR) that the difference in equivalent volume, between the dominant form of benzene and xylene, is closely four times the cube of 26, the latter being regarded as the molecular diameter of the radical molecule homologen, H_2C, in this case. Xylene is a colorless liquid of little odor, boiling, according to Warren, at 139.8°. Longuinine gives its density, at melting ice, as .877; the computed density, according to the new view of its constitution, is .8712 at −2° C. HENRY WURTZ.

Xylographic Books. See BLOCK-BOOKS, in PRINTING, by W. S. PATERSON.

Xylography. See ENGRAVING.

Xyloid'ine [Gr. ξύλον, "wood"], an explosive substance discovered by Braconnet in 1832, prepared by dissolving starch in nitric acid; by the addition of water a white explosive compound is precipitated. (See EXPLOSIVES.)

Xylol. See XYLENE.

Xyris. See YELLOW-EYED GRASS.

Xysythrus, king of Babylon at the time when the Deluge occurred. The Chaldæan historian Berosus, of whose work some fragments have been preserved by Eusebius, tells how in the plain of Shinar many people of various descent dwelt together without laws, after the fashion of animals; how Oannes, a monster-god with the head of a man, the body of a fish, and the legs of a woman, arose from the Persian Gulf, sat down among the men of Shinar, and taught them all the arts of civilization—how to erect temples and build cities, how to make laws and maintain order, how to cultivate the soil and establish industry, etc. Thus Babylon was built, and Alorus became the first king of the new empire. He was followed by nine others, which together reigned for 100 *saros*, or 432,000 years. The last was Xysythrus. Warned of the coming of the Flood, he built a ship and was saved from the Deluge. When the waters subsided, the ship landed on the mountains of Koordistan. Xysythrus went out of the ship, built an altar, offered up a great sacrifice, and then disappeared among the clouds. But those who had been with him in the ship returned to Babylon, rebuilt the city, unearthed the sacred books, which had been deposited at Sippara when the Flood came, and formed a new empire, which stood for 33,000 years, ruled over by 86 kings, until it was conquered by the Medes. There is a striking resemblance in all the principal traits between this narrative of the Deluge and that contained in the Bible, and also between these two and that lately published by George Smith from the cuneiform inscriptions.

Y.

Y, as an English vowel, represents our *i*, and has both its sounds, as seen in *by, lovely*. As a consonant in English it has a sound analogous to the vowel-sound of long e (English), but almost suppressed by the closure of the palatal passage by the tongue. Its consonantal power is that of the Latin, Polish, and German *J*. Properly, as derived from the Greek Υ or Y, it should have its power in Danish and Anglo Saxon (Ger. *ü*; Fr. *u*). In pure English words it was intended for the long vowel of *machine*, and was formed from *ii*, written *ij*—a combination still used (but with the perverted power of *y* in *by*) in Dutch, where *ijs* is the word spelled *eis* in German and *ice* in English. In chemistry, Y is the symbol of yttrium.

Yacht, a name of Dutch origin which became common in the English language in the latter part of the seventeenth century. In 1661 the Dutch East India Company presented Charles II. with a yacht, and the speed and buoyancy of this kind of vessel soon brought all other pleasure-vessels into disuse, even those gorgeous ones which were built "frigate-like." In 1720 the first yachting club was formed at Cork in Ireland, under the name of the Cork Harbor Water Club, now the Royal Cork Yacht Club. In 1815 the Yacht Club was founded, which took up its head-quarters at Cowes in the Isle of Wight, and used the Solent as its chief arena. It afterward changed its name to the Royal Yacht Club in 1817, and in 1833 to the Royal Yacht Squadron. According to its rules of organization, each member must be the owner of a vessel not smaller than ten tons, and it was said that William IV. wished to give its commodore the title of admiral, but dared not, lest he should thereby arouse the jealousy of the navy. In 1824 the Thames Yacht Club was founded; in 1844, the Royal Mersey Yacht Club; in 1845, the Royal Victoria Yacht Club, etc.; and in 1875 the number of British yachts was 1764, of which 610 measured 10 tons or less; 913 between 10 and 100 tons; 147 between 100 and 200; 51 between 200 and 300; 19 between 300 and 400; 3 between 500 and 600; 1 of 600, and 1 of 730 tons. The last is a steamer, and the number of steam yachts has greatly increased since 1870.

The first yachting club in the U. S. was formed at New York in 1844, comprising 9 members and as many yachts. In 1845 the number of yachts was 17 and of members 171; and in 1875 the club registered 38 schooners of 5566 tons, 27 sloops of 924 tons, and 13 steamers of 1000 tons. In the same year there were in all 31 regular yachting clubs organized in the U. S., registering 692 vessels—namely, 116 schooners, 391 sloops, 3 cutters, 145 cat-rigged, and 34 steamers. Some of the most prominent events in the rapid development of this kind of sport were—the first regular regatta, which took place in New York harbor July 17, 1845, from Robbin's Reef around the S. W. Spit buoy to the lightship and return, and in which 7 schooners and 3 sloops took part, the Cygnet being the winner; the first race-match between yachts, which took place on Oct. 10, 1846, between the sloop Maria, 154 tons, and the schooner Coquette, 74 tons, the course being 25 miles to the windward and return, from the lightship off Sandy Hook. The most exciting match-race took place in 1866, between the Henrietta, Fleetwing, and Vesta, from Sandy Hook to Cowes, for a sweepstakes of $90,000; the Henrietta made the run in 13 days 21 hours 55 minutes, and won. The first yacht which crossed the Atlantic was the America in 1851. Her arrival in the Thames made an immense sensation, and produced a revolution in English yacht-building. The oldest English yachts were built after the "cod's-head and mackerel-tail" model. Then followed the so-called "wave-line" type, which was a much-improved development of the former. But the America had, against all good rules, the mackerel tail in front and the cod's head in rear; and still more astonishing was the manner in which the sails were set, presenting flat surfaces to the wind, and practically reducing *in absurdum* the old conviction that sails should be able to "hold the wind." On Aug. 8, 1870, the American sloop Magic won the first race for the queen's cup in New York harbor, making a run of about 43 miles, from an anchorage off Stapleton, Staten Island, around the S. W. Spit to Sandy Hook lightship and return, in 4 hours 7 minutes 51 seconds.

By acts of Congress Aug. 7, 1848, and June 29, 1870, yachts have the privilege of going from port to port of the U. S., and by sea to foreign ports, without entering or clearing at the custom-house, and this privilege also extends to yachts belonging to a regularly-organized yacht club of any foreign nation which grants like privileges to the yachts of the U. S. A regulation with respect to the lights to be carried by yachts is given by a circular of Dec. 5, 1874, and an elaborate *Sailing Regulation* for yachts has been issued by the Royal Alfred Yacht Club of England.

Yad'kin, county of N. W. North Carolina, drained by Yadkin River; surface diversified, containing considerable iron ore; soil fairly productive. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, oats, tobacco, and wool. Cap. Yadkinville. Area, 310 sq. m. P. 10,697.

Yadkin, tp., Davison co., N. C. P. 954.

Yadkin, tp., Stokes co., N. C. P. 1758.

Yadkin River, rises in Caldwell co., N. C., near the Blue Ridge. After passing into South Carolina it is called the GREAT PEDEE (which see). In North Carolina it is a swift, turbulent, and unnavigable stream. Its valley is fertile and abounds in mineral wealth.

Yad'kinville, p.-v., Liberty tp., cap. of Yadkin co., N. C. P. 133.

Yak. The yak (*Bos grunniens*) is the ox of Thibet, but is widely known, chiefly because of the beauty of its tail and the extensive use to which it is everywhere put in the East. It is a huge animal, as tall as one of our largest oxen, very hairy, and like a bison in appearance. However, the long sweeping tail marks it out as a distinct species. It is generally black or white, or black and white, the latter most commonly. Its hair is not coarse, though long and thick; and though the creature, when wild and disturbed and wounded in its native haunts, can prove terribly fierce, yet it can be easily tamed and domesticated. Its hair protects it from the cold of the great mountain-heights which it loves to frequent. It is a most sure-footed animal, climbing over rocks with the agility of a chamois. The Thibetans frequently keep large domesticated flocks of yaks, and the milk of the female yak is much prized. It is very rich and in color yellow, and has a strong but pleasant odor. Herds of wild yaks have been met with on the Himalayas as high as 20,000 feet above the sea level; they are, however, rarely seen above 16,000 feet. It has a small head, and horns half covered by a mass of hair, but its eyes are very large, soft, and brilliant. The legs and the neck are short. The yak has over the shoulders an immense mass of hair, resembling a hump. It does not low like an ox, but has a peculiar sharp, quick, deep voice, very much similar to the grunt of a boar. The yak is sometimes hunted by large dogs. Sportsmen declare that its flesh is superior to venison. The Thibetans frequently use its skin for their clothing. Some Thibetans ride long journeys on yaks, which, being so sure-footed, can be trusted to cross dangerous passes and to wend their way safely by the brink of precipices. The prince of Wales, during his recent tour through India, secured several splendid specimens of yak-tails. Those ordinarily purchased in India, generally cheaply, are very poor specimens of the perfect yak-tail, than which a finer mass of flowing hair can scarcely be conceived. Yak-horns are by no means so fine as those of the wild buffaloes of Indian hills. Rugs of yak-skin are much sought after, and a fine strong cloth is made out of the soft hair above the hump. R. C. CALDWELL.

Yaki'ma, county of S. Washington Territory, lying on the E. slope of the Cascade Mountains, reaching to the valley of the Columbia, and containing some fertile soil and valuable grazing and timber land. Cattle are the chief live-stock. Cap. Yakima. Area, about 5000 sq. m. P. 432.

Yakima, p.-v., cap. of Yakima co., Wash. Ter.

Yakutsk', or **Jakutsk',** province of Siberia, bounded E. by the province of Irkutsk, W. by Okotsk, S. by the Jablonvoy Mountains, and N. by the Arctic Ocean. Most of this province is a low, level plain whose northern part is frozen 100 feet deep, but which presents good pasturage in the southern part. Its inhabitants, numbering 228,363, consist mostly of tribes of Yakuts and Buriats, the former of which live as nomads with large herds of cattle, the latter as hunters and fishers, the country abounding in sables, martens, squirrels, foxes, and bears, and the rivers in fish, especially salmon.

Yakutsk, or **Jakutsk,** town of Siberia, capital of the province of Yakutsk, on the Lena, in lat. 62° 1′ N. It has hardly 4000 inhabitants, and is poorly built. The houses

of the native Yakuts have doors of hides and windows of ice. But it is the seat of the provincial government, and in June it has a large fair, where butter, furs, tallow, fish, and mammoth-tusks to the value of $300,000 are exchanged for European merchandise.

Yâl, the Indian lute, of a varying number of strings. It is esteemed as equalling the flute, and excelling all other instruments of music in sweetness. Wandering minstrels in India to the present day patronize this instrument in a marked degree. Tiruvalluvar, the greatest of Tamil poets, says, "The flute is sweet, the *lute* is sweet."

R. C. CALDWELL.

Yalabu'sha, county of N. Mississippi, drained by tributaries of Tallahatchie and Yalabusha rivers, and traversed by Mississippi Central and Mississippi and Tennessee R. Rs.; surface generally level, soil fertile. Mules, cattle, and swine are the chief live-stock. Staples, cotton and corn. Cap. Coffeeville. Area, 450 sq. m. P. 13,254.

Yalabu'sha River, one of the principal eastern affluents of the Yazoo River, entirely in the State of Mississippi, is navigable 90 miles to Grenada by steamboats.

Yale (ELIHU), F. R. S., b. at New Haven, Conn., Apr. 5, 1648; went to England with his parents when ten years of age, and never returned to Connecticut; went to the East Indies 1678; was governor of Fort St. George, Madras, 1687–92; gained a large fortune, and was afterward in England a governor of the East India Company. He made various gifts in books and money to the newly-established college at his birthplace, amounting between 1714 and 1721 to some £500, in consequence of which his name was in 1718 given to the collegiate building, and applied in the charter of 1745 to the whole institution. D. in London July 22, 1721, and was buried at Wrexham, North Wales, the ancient seat of his family.

Yale College, "the collegiate school of Connecticut," was chartered by the general assembly of the colony of Connecticut in Oct., 1701. From the first settlement of New Haven (1638) it had been intended to set up a college there, and it was in execution of this design that the minister of New Haven, James Pierpont, in concert with other Congregational ministers of the Connecticut seaboard, effected in 1701 the foundation of the collegiate school. The ten ministers made trustees by the charter were empowered to set up and carry on the school where they should see fit, and to perpetuate their own body. By an additional act (1723) the rector or head-master of the school was made a trustee *ex officio*. The school was formally established at Saybrook in Nov., 1701, though the classes until 1707 were taught at Killingworth (now Clinton), an adjoining town, where Abraham Pierson, the first rector, was pastor. After long dissatisfaction and amid much opposition the school was permanently settled in New Haven in 1716, and in 1718 its name was changed to Yale College, in recognition of a gift (in goods valued at £200) from Elihu Yale of London, a native of New Haven, who had amassed a fortune in India, where he had been (1687–92) governor of Fort St. George, one of the settlements of the East India Company. In 1745 the present charter was granted by the general assembly, confirming the trustees in all their powers under the title of "the president and fellows of Yale College in New Haven." Down to the period of the Revolution the college received from the colonial government stated or occasional grants of funds, without which it could hardly have survived. In 1792 the governor, lieutenant-governor, and six senior senators of the State were made, *ex officiis*, members of the corporation, the State making at the same time a grant valued at $30,000 to the college funds. In 1871 the assembly, with the assent of the corporation, substituted for the six senators six graduates of the college, who were chosen, as their successors (one vacancy occurring annually) are also chosen, by the votes of a plurality of graduates of the first degree of five years' standing. For the first 100 years instruction was chiefly given by the rector or president, assisted by two or three tutors chosen from among the recent graduates and serving for a brief period. A professor of divinity (or college pastor) was appointed in 1755, and in 1770 a professor of mathematics, though the chair was not permanently occupied till 1794. It was not until the present century that the system of permanent professors, assisted still by temporary instructors, was fully established. The instructors now number about 90, four-fifths of whom are permanent officers. The presidents for the last century have been—Ezra Stiles (1777–95), Timothy Dwight (1795–1817), Jeremiah Day (1817–46), Theodore D. Woolsey (1846–71), Noah Porter (since 1871). The president is the presiding officer of the board of trustees and of every board of instruction; he also takes an active part in teaching, mainly in the academical department. As at present constituted, there are four departments of instruction grouped under the name of Yale College—viz. the departments of philosophy and the arts, of theology, of law, and of medicine, the first of these including the academical department (the original Yale College, around which all the others have been developed), the Sheffield Scientific School, the School of the Fine Arts, and the school of graduate (or advanced non-professional) instruction. The degrees given in the department of philosophy and the arts are—bachelor of arts, bachelor of philosophy, master of arts, doctor of philosophy, civil engineer, and dynamic engineer. The degrees given in the other departments are—bachelor of divinity, bachelor of laws, master of laws, doctor of civil law, and doctor of medicine. Degrees in arts were first given in 1702, in medicine in 1814, in law in 1843, in philosophy in 1852, in theology in 1867. The whole number of graduates is over 11,000, of whom more than half are deceased. The annual commencement is held on the Thursday after the last Wednesday in June, and the college year begins eleven weeks later. The number of students enrolled on the annual catalogue for 1875–76 was 1051, of whom 769 were undergraduates, or candidates for the first degree in arts or philosophy (582 in the academical department and 187 in the Sheffield Scientific School), and of these, 171 received their degrees in 1876. The average age at graduation in the academical department is 22½ years.

The course of study in the academical department extends through four years. The requirements for admission are mainly in Greek, Latin, and mathematics, and the first two years of the course are given largely to further drill in these branches; while the studies of the last two years take a wider range, and about one-fourth of the time in these two years is given to advanced courses in subjects in which the student has already made some progress, and which he chooses from among a larger number offered to his option. The annual charge for tuition and incidental expenses is $140. Beneficiary funds help to meet this charge for those who need such relief, to the extent of over $15,000 yearly. About $3000 is also disbursed yearly to graduate and undergraduate students in premiums for the encouragement of scholarship. The permanent funds of the department (exclusive of real estate, buildings, and apparatus devoted to academical uses) are about $700,000. The college buildings occupy a square (about 850 feet by 400) in the centre of the city, adjoining the public green. There are six dormitories, built from 1752 to 1871, and accommodating over 400 persons. There are also on this square a chapel, a library, an art-school, and seven other buildings used as halls, recitation-rooms, and offices. The more recent buildings are placed with the intention of forming ultimately a quadrangle enclosing an open space. The rent of lodging-rooms varies, according to location, from $25 to $140 a year, the annual rent of a half-room averaging about $35. The buildings of the other departments are all in the neighborhood of the college square.

The Sheffield Scientific School, begun in 1847 as a school of applied chemistry, was gradually expanded until in 1860 it received its first considerable endowment from Mr. Joseph E. Sheffield of New Haven, who has since largely added to his original gift. The school provides for advanced and special students in the mathematical, physical, and natural sciences, and also for undergraduates who wish a training leading chiefly in this direction. The State legislature appropriated to the school in 1863 the national grant of 1862 for the benefit of agriculture and the mechanic arts, the income from which amounts to $8100 annually. The course of instruction leading to the degree of bachelor of philosophy occupies three years. The degrees of civil and dynamic engineer are given to bachelors of philosophy after a higher course of two years, and the degree of doctor of philosophy after a three years' course. The charge for tuition is $150 a year. The degree of Ph. D. is also given to bachelors of arts who have pursued advanced studies at the college for two years, and the degree of M. A. is given for one year's similar study.

The School of the Fine Arts was founded in 1861 by Mr. Augustus R. Street of New Haven, who erected a building for its use and otherwise endowed it. At present instruction is provided in drawing and painting only.

The theological department was founded in 1822 in connection with the Congregational denomination, and provides a three years' course of study. There is no charge for instruction or for room-rent in the buildings belonging to the school.

The law department, begun as a private school soon after 1800, was not recognized as part of the college until 1824. It now offers a three-years' course for the degree of LL.B., and also advanced courses with appropriate degrees at the end of one and two years. The annual tuition fees are $90.

The medical department was organized in 1813, and in 1814 received a grant of $30,000 from the State. The

requirements for a degree include attendance on two yearly courses of lectures. The annual lecture fee is $105.

The college library, which is open to students in all departments, contains upward of 80,000 volumes. In the same building is a separate library of about 20,000 volumes, supported by the undergraduates and devoted to general literature. There are also special libraries belonging to the theological, law, medical, and scientific schools.

The Peabody Museum of Natural History, devoted chiefly to zoology, geology, and mineralogy, was established by a gift of $150,000 from the late Mr. George Peabody of London in 1866. At present only one wing of the proposed museum has been erected. FRANKLIN B. DEXTER.

Yam, the tuberous root of *Dioscorea sativa*, a climbing woody vine of the order Dioscoreaceæ. Many other species of yam are described, but they may be only very strongly-marked varieties, since the yam vine has a tendency to assume various forms. Yams are extensively grown in all warm countries as food. The great tubers are cooked after the manner of potatoes, and most kinds are very palatable. Some of the wild sorts are mawkish, and even poisonous. Yams are successfully grown in the Southern States, and the Chinese yam (*D. batatas*) thrives in our Northern States, but its great roots, though often of excellent quality, have a tendency to bury themselves so deeply in the earth that they can only be reached at considerable trouble.

Yam'a, a god of the Hindu Pantheon. In the case of this deity, as in the case of many others worshipped from the earliest times by the inhabitants of Hindustan, we are obliged to separate between the idea of him primarily entertained and expressed and the latter-day idea, which has quite rehabilitated the divinity. The Yama of the Vedic hymns is quite a different being from the Yama of the *Purânas*. To the mind of the modern Hindu, Yama is an Oriental Pluto, the judge of the dead, the luminous lord of the manes, and the monarch of hell. Yama, as he appeared to the imagination of the primitive Aryans who first crossed the Indus, was simply an aërial phenomenon, a vague potency, worshipped vaguely. In the *Rig-Veda*, for instance, Yama is represented as being the son of Vivasvat and Saranyû, and the twin-brother of the lustful Yami. Yami tries to entice Yama to become her husband, but he resists resolutely. Whatever the emblematic significance of this may be—and this must be carefully inquired into hereafter—the episode is a strange one, yet quite in keeping with the early legends of the patriarchal times of the first Aryans in India. It recalls the lines from Milton's *Il Penseroso*:

> "Thee, bright-haired Vesta, long of yore
> To solitary Saturn bore:
> His daughter she; in Saturn's reign
> Such mixture was not held a stain.
> Oft in glimmering bowers and glades
> He met her, and in secret shades
> Of woody Ida's inmost grove,
> While yet there was no fear of Jove."

As a parallel in Hindu mythology to the legend of Yama and Yami it may be observed that Brahma himself is mentioned as having conceived a passion for his own daughter Tilôtumei. She fled from his incestuous embrace, and hid herself, whereupon Brahma assumed four visages, pointing to each of the four quarters of the globe, so that the maiden might not escape his observation. And, according to the same *Purâna*, from the four visages, thus assumed with a guilty purpose, the four pure and holy Vedas proceeded!

The reader, to have a clear conception of Yama as he was regarded in the Vedic period, should consult *Rig-Veda*, x. 17, 1. Dr. Muir thus translates a portion of the text: "Tvashtri makes a marriage for his daughter. Hearing this, the whole world assembles. The mother of Yama, becoming wedded, the wife of the great Vivasvat disappeared. They concealed the immortal bride from mortals. Making another of similar form, they gave her to Vivasvat. She bore the Asvins when that happened. Saranyû abandoned the two pairs of twins." Dr. Muir also gives a translation of the dialogue between Yami and Yama (*Rig-Veda*, x. 10, 1), in which she entices her twin-brother to take her to him as wife. Prof. Roth considers that Yami urges the union between herself and her twin-brother, as Yama and Yami are intended to represent the earliest pair of the human species, which she desires to propagate. Scholars have justly regarded Yama as intimately connected in the Hindu mind with belief in a future state of existence. In the *Rig-Veda* this is made abundantly plain. (See Muir's *Sanskrit Texts*, vol. v. p. 292.) In that veda he is thus apostrophized: "Worship with an oblation King Yama, son of Vivasvat, the assembler of men, who departed to the mighty streams and spied out the road for many." The meaning of this passage as referring to a future life for mortals is plainly exemplified in a paraphrase in the *Atharva Veda* (xviii. 3, 13), which runs as follows: "Reverence ye with an oblation Yama, the son of Vivasvat, the assembler of men, *who was the first of men who died, and the first who departed to the celestial world*." The *Rig Veda* also says: "Yama was the first who found for us the way: this home is not to be taken from us; those who are now born follow by their own paths to the place whither our ancient fathers have departed. . . . Meet ye with the fathers, meet with Yama, meet in highest heaven with the recompense of the sacrifices you have (on earth) offered. Throwing off all imperfections, again go to your home. Become united to a body, and be clothed in a shining form;" and so on. It is almost impossible to resist the conclusion from the above and similar passages that Yama was regarded as the pioneer and patron of an after life to mortals. He is represented as having two four-eyed, brindled dogs that call up the idea of Cerberus. They are termed "watch-dogs, observant guardians of the pathway;" "brown messengers of Yama, broad of nostril, and insatiable." In painting and sculpture we do not see these dogs about Yama. The god is generally represented as seated on a buffalo. He is four-armed and of austere aspect. In one hand he holds a mace, in another a noose. He guides the animal on which he is seated by the horns. His garments are of the color of fire, whilst the complexion of his skin is of a bluish-green. He is crowned, and demons of a dwarfed size are frequently represented as worshipping him at his feet. His eyes are inflamed and bloodshot, and his teeth are like those of a tiger. It is only as *Dharmarâja*, or king of virtue or justice, that Yama is ever represented as a benign divinity. Then he is placid of countenance, with a look of mild serenity, but this is only as he appears, so Hindus say, to those who, fortified by a life of purity and good actions, have no need to fear the lord of hell. In the later phases of Hindu mythology all kinds of attributes are applied to Yama, and innumerable legends are current concerning him. We need not even refer to these, but confine our attention to the important question—a question which has provoked much discussion—viz. What was the central idea which gave rise in primal Vedic times to the personifications of Yama and Yami? Prof. Max Müller understands *Vivasvat* to mean the sky, *Saranyû*, the dawn, *Yama* the day, *Yami* the night. Prof. Roth believes that *Vivasvat* is the representation of the light of heaven, *Saranyû*, the dark storm-cloud, and *Yama* and *Yami* the first human pair. Serious objections may be found to both of these interpretations. As for the latter, it is sufficient to remark that the *Vedas* represent Yama as *resisting* Yami's importunity, and not as cohabiting with her so to upraise a race of mortals. As for Prof. Max Müller's theory, it is, though ingenious, unsatisfactory. It is difficult to understand how *Vivasvat* can be considered as satisfactorily representing the sky, or *Saranyû*, "the moving one," the dawn. That wonderfully deep and able Sanskrit scholar, the late Prof. Goldstücker, furnishes an explanation which is the most satisfactory one yet published. He says: "Vivasvat, 'the expanding,' probably implies the firmament 'expanding' to the sight through the approaching light; *Gandharva*, as usual, the solar fire, and *Saranyû*, the dark and cool 'air' (the moving element); Yama and Yami seem to represent the current of air produced by the effect of the solar heat emanating from the firmament on the cool air of the night, when the antagonism between the warm and cold air, of which this current consists, would be Yama repelling his union with his sister Yami, though, at the same time, they are 'husband and wife while yet in the womb' (of the night air). And since this phenomenon extends over the whole atmosphere, the two four-eyed watch-dogs of Yama are probably the eight, or twice four, regions of the compass, either each couple of them taken together with their intermediate regions—whence both dogs are called spotted—or the four regions, or the intermediate four, taken separately, whence one dog is called dark, the other spotted." A part of this explanation may be deemed fanciful, but as a whole it appears to be more worthy of credit than any other. In the later phases of Hindu mythology Yama becomes more and more exclusively considered as the dire god of hell, the judge of all, and the relentless punisher of the unjust. His messengers use his mystic noose to draw out of the bodies of men the souls which are doomed to appear before his judgment-seat. To the modern Hindu, Yama is the embodiment of power without pity, and stern, unbending Fate. R. C. CALDWELL.

Yamagata Aritomo, b. in the province of Chosiu, Japan, and is about thirty-five years of age; was educated for the military profession; at the commencement of the late revolution was appointed an aide-de-camp to the general of the imperial army; in 1871 went to Europe with Gen. Saigo to obtain military information for the government; on his return to Japan was appointed vice-minister

of war, and in 1874 was called to hold the three high positions of *sangi* or privy councillor, minister of war, and lieutenant-general of the imperial army. F. A. P. BARNARD.

Yamas'ka, county of Quebec, Canada, bounded N. W. by the St. Lawrence and Lake St. Peter, and traversed by the river St. Francis. Much of it is fertile. Lumber is the leading manufacture. Cap. St. François du Lac. P. 16,317.

Yamachiche, p.-v., St. Maurice co., Quebec, Canada, on Yamachiche River, near the St. Lawrence, 75 miles N. W. of Montreal. It has an academy, a convent, trade in grain and lumber, and some manufactures. P. about 1300.

Yam'bu, or **Yembo,** town of Arabia, in a hot and arid plain between a chain of barren and steep mountains and an inlet of the Red Sea. It is well built, has a good harbor, and is of great importance as the port of Medina and one of the principal stations for the pilgrims who visit the holy cities of Arabia. P. between 6000 and 7000.

Yam Hill, county of N. W. Oregon, bordering on the Coast Mountains, bounded E. by Willamette River, intersected by Yam Hill River, and traversed by Oregon Central R. R.; surface generally undulating, soil in the E. part fertile. Horses, cattle, sheep, and swine are numerous. Staples, wheat, oats, and wool. Cap. Lafayette. Area, 750 sq. m. Pop. 5012.

Yan'cey, county of N. W. North Carolina, bordering on Tennessee. The surface is mountainous, Mount Mitchell in the S. E. part being about 6500 feet above the level of the sea. Cattle, sheep, and swine are the chief live-stock. Staples, Indian corn, wool, and tobacco. Cap. Burnsville. Area, about 600 sq. m. P. 5909.

Yancey (WILLIAM LOWNDES), b. at Ogeechee Shoals, Ga., Aug. 10, 1814; his father, Hon. Benjamin C. Yancey, was a distinguished lawyer of Abbeville, S. C.; the son was well educated at the North, and admitted to the bar in Abbeville, S. C.; moved to Alabama in 1836; edited the Cahawba *Democrat* and the Wetumpka *Argus*; served in both branches of the legislature; was a member of Congress 1844–47 and of the national Democratic convention of 1848; an ardent opponent of the Compromise measures of 1850, and a leader of the secession party of the South; advocated in 1858 the formation of committees of safety in the cotton States "to fire the Southern heart;" seceded from the national Democratic convention at Charleston on the nomination of Douglas; advocated the election of Breckenridge; was the reporter of the ordinance of secession in the Alabama convention Jan., 1861; went to Europe as a Confederate agent, and was subsequently a member of the Confederate Congress. D. near Montgomery July 28, 1863.

Yan'ceyville, p.-v. and tp., cap. of Caswell co., N. C. P. 2203.

Yan'dell (DAVID WENDEL), M. D., b. at Murfreesboro', Tenn., Sept. 4, 1826; graduated M. D. at Louisville University 1846; was in Europe 1846–47; practised and taught medicine at Louisville, Ky., 1848; was professor of various departments of medicine in the Louisville University from 1859; medical director in the Confederate army 1861–66; president of the American Medical Association 1871; professor of surgery in the Indiana Medical College 1874; has contributed valuable articles to the profession, and established the *American Practitioner* 1870. PAUL F. EVE.

Yandell (LUNSFORD P.), M. D., b. in Tennessee July 4, 1805; graduated in medicine at Maryland University; professor of chemistry in Lexington Medical School 1831, and afterward a professor in a Louisville college; edited medical journals in both the latter cities, and wrote several medical works and addresses. D. at Louisville, Ky., Feb. 4, 1878. PAUL F. EVE.

Yang-tse-Kiang' (the "son of the great water"), the principal river of China, rises in Eastern Thibet from two streams which unite in lat. 26° 30′ N., lon. 102° E.; flows with a very winding and tortuous course, first S. E., then N., and at last N. E., and enters the Yellow Sea in lat. 32° N., lon. 121° E., through a vast estuary several miles broad. Its entire length is probably more than 3000 miles, and it receives from both sides numerous and powerful affluents. The largest vessels can ascend it as far as Hang-Kow, 700 miles from its mouth, and it is navigable to within a few miles of its sources. As it runs through one of the most fertile and most densely-peopled regions on the globe, and is possessed of a tremendous draining and carrying power, it is, or will be, one of the most important rivers on earth. But as it was opened to foreign commerce only a few years ago, and only as far up as Hang-Kow, it has as yet seen only the beginning of its history. By the Imperial Canal it communicates with the Hoang-Ho.

Yanina. See JANINA.

Yan'kee, a term originally employed familiarly to denote natives of the New England States, was applied during the American Revolution to the insurgents generally, and during the civil war was the usual designation given in the "Confederate States" to the Union soldiers. In Europe, especially in England, it is generally synonymous with Anglo-American. The etymology is uncertain, but the most probable explanation is that given by Heckewelder, who considers it a corruption of the word "English" by the Indian tribes.

Yankee Doodle, a popular air, considered, especially in parts of the Northern States, as one of the national airs. It is reported to have been a popular tune in England during the Commonwealth, at which time its doggerel words originated, Oliver Cromwell being designated as *Yankee Doodle*. Others say that it was the tune originally set to the well-known old English song, "Lydia Locket lost her pocket," and that the present words were composed in 1775 by a British sergeant in Boston. Still other accounts of its origin are given.

Yankee Springs, p.-v. and tp., Barry co., Mich. P. 1023.

Yank'ton, county of S. E. Dakota, separated from Nebraska by Missouri River, intersected by Dakota River, and partly traversed by Dakota Southern R. R., which terminates at the county-seat. Surface irregular, with fertile soil on the river-bottoms. Cattle are the principal live-stock. Staples, wheat, oats, and hay. Cap. Yankton, also the capital of the Territory. Area, 520 sq. m. P. 2097.

Yankton, city, cap. of Dakota, and seat of justice of Yankton co., on Missouri River, is the terminus of the Dakota Southern R. R., and is connected by steamers with the principal ports on the Missouri; has 1 daily and 3 weekly newspapers. P. 737.

Yankton Indians. See DAKOTA INDIANS.

Yan'tic River, a stream which unites with the Shetucket and Quinebaug at Norwich, Conn., to form the Thames. It affords large and well-utilized water-power.

Yaphank', p.-v., Suffolk co., N. Y.

Yapock. See CHEIRONECTES.

Ya'quis, or **Hiaquis,** a tribe of Indians in Sonora, Mexico, on the river of the same name, allied to the Pimas and Cahitas, number some 20,000, are semi-civilized, having had Roman Catholic missions among them since 1590, and are usually peaceful, but have maintained several wars with the white settlers, the latest having been in 1825, 1832, and 1841. They practise agriculture and possess numerous domestic animals.

Yard [*yeard*, "hedge," or *gyrdan*, "to gird." Old Saxon], the statutory unit of length in England, declared by the act of 5 Geo. IV. 1824, to be "to the pendulum beating seconds in a vacuum at the level of the sea in the latitude of London in the proportion of 36 to 39.1393." The same act declared the standard measure then in custody of the clerk of the House of Commons, bearing the engraved legend, "Standard Yard, 1760," to be "the original and genuine standard." This standard was constructed by Bird by direction of a parliamentary committee appointed in 1758, and was a copy of one prepared in 1742 by the eminent horologist and mechanician George Graham, after a careful comparison of the various yards and ells of Henry VII. and Elizabeth, kept in the Exchequer. In the earlier periods of British history the standards of weight and measure were very inexact. Before the Conquest, according to Prof. Wackerbarth of the University of Upsala, Sweden (*Tidskrift for Matematik och Fysik*, Stockholm, 1870), the length of this measure was about 39.6 inches. It was, as its name imports, the assumed length of the girdle of a man of ordinary size; but in 1101 it was adjusted to the length of the arm of Henry I., and it still measures the average length of the human arm with the fingers extended. As a cloth-measure, the yard is divided into 4 quarters = 16 nails. For other purposes it is divided into 3 feet = 36 inches, the foot being in general made practically the unit.

The yard is also the unit-base of the measures of length in the U. S., though not made so by any direct act of Federal legislation. The standards authorized by Congress to be constructed at the bureau of weights and measures in Washington, and presented to the executive authorities of the several State governments, were for many years adjusted from a scale of eighty-two inches length divided on brass by Troughton of London for Mr. Hassler, the first chief of the U. S. Coast Survey, the length being taken between the twenty-seventh and sixty-third divisions of the scale; but in 1856 an officially-certified copy of the imperial standard yard was obtained, and the recently-constructed American standards have been copies of this. (See WEIGHTS AND MEASURES.) F. A. P. BARNARD.

Yard'leyville, v., Bucks co., Pa.

Yarkand', city of East Toorkistan, in lat. 38° 20′ N., lon. 77° 30′ E., about 105 miles S. E. of Kashgar, on the left bank of the river Yarkand, is surrounded by an earthen wall and defended by two citadels, one within the walls and one on the southern side. As a fortress, however, the place is not of very great importance, but since the expulsion of the Chinese and the establishment of an independent East Toorkistan empire at Kashgar, Yarkand has become the centre of a very important trade. Caravans from India arrive here, carrying with them the manufactures of Manchester, and through Russian Toorkistan lines of commerce connect it with the Caspian Sea and Moscow. Its manufactures of silks, cottons, linen, and woollens are important. The city is well built; the houses are mostly of stone; the streets are frequently intersected by canals; the bazaars, caravanserais, and mosques are numerous. The population is variously estimated at from 30,000 to 100,000.

Yar'mouth, town of England, county of Norfolk, on a slip of land between the North Sea and the Yare, along the bank of which runs a quay nearly two miles long; the harbor is accessible for vessels of 200 tons burden. It is the principal seat of the English herring fisheries, and a considerable deep-sea fishing is also carried on, the produce of which is daily carried to London. Crape and silk goods are manufactured, and a great number of coasting vessels are built here. P. 41,819.

Yarmouth, county of S. W. Nova Scotia, bounded S. W. by the Atlantic Ocean. Its coast-line is deeply indented and its surface is broken, but portions are very fertile. Shipbuilding, the fisheries, and other marine pursuits are the leading industries. Cap. Yarmouth, but a part of the courts are held at Tusket. P. 18,550.

Yarmouth, port of entry, cap. of Yarmouth co., N. S. Cape Fourchu light, near the entrance to the harbor, is in lat. 43° 50′ N., lon. 66° 7′ W. It is a wealthy town, fishing, commerce, and shipbuilding being largely carried on. Yarmouth has 2 weekly newspapers, 3 seminaries and several other schools, 3 banks, gasworks, and some fine public buildings. P. of sub-district, 5335.

Yarmouth, p.-v. and tp., Cumberland co., Me. P. 1872.

Yarmouth, p.-v. and tp., Barnstable co., Mass. P. 2423.

Yarmouth Port, p.-v., Barnstable co., Mass.

Yar'muk [from the Talmudic *Jarmoch*], a permanent river in Eastern Palestine, which the Greeks called *Hieromax* or *Hieromiax* (Pliny, *Nat. Hist.*, v. 16), and which is now called *Sheriat el-Mandhur*, from a Bedouin tribe dwelling on its banks (Ritter, *Erdkunde*, xv. 372). It is not mentioned in the Bible, nor by Josephus, although now considered the southern boundary of ancient Bashan. Its principal tributaries drain the Hauran and Jolan. It traverses a limestone region overlaid here and there by basalt. In the latter part of its course it plunges down a wild gorge and empties into the Jordan, with a strong current 130 feet wide, about 5 miles S. of the Sea of Galilee. It is full of fish, and lined with oleanders. On its banks near Gadara, about 8 miles from the Jordan, are hot sulphur springs, mentioned by Eusebius (Ἐμμαθά) and Jerome (*Amatha*) in their *Onomasticon*. Tristram (*The Land of Israel*, pp. 457, 458) reports nine of these springs, chiefly on the N. side of the stream. R. D. Hitchcock.

Yaroslav', government of European Russia, in the central part of the country, traversed by the Volga. Area, 14,120 sq. m. P. 1,000,748. The ground is low and level, and the soil not very fertile. Rye, oats, hemp, and flax are raised, but not in great quantities; timber is scarce. The inhabitants of this government are described as the most intelligent and handsome race of the whole Russian people, and they know how to make up for an inferior soil by industry. Their manufactures of linen and hardware enjoy a great reputation, and smiths, masons, carpenters, and artisans of every description emigrate from this government to all parts of the country.

Yaroslav, town of European Russia, capital of the government of Yaroslav, on the Volga at the influx of the Kotorost, in lat. 57° 37′ N. It is a handsome, enterprising, and prosperous town, the seat of the governor and of a Greek archbishop. It has large manufactures of linen and hardware, and an extensive trade. P. 37,275.

Yar'ra-Yar'ra, river of Australia, in the colony of Victoria, passes Melbourne and enters Port Philip, 8 miles below. On account of a bar at its mouth, with but 9 feet of water at high tide, the Yarra-Yarra is navigable only for vessels of 60 tons burden; larger vessels unload at Williamstown, near its mouth. Above Melbourne it is not navigable.

Yar'ranton (Andrew), b. at Ashley, Worcestershire, England, about 1615; became a linen draper; was a soldier in the civil wars; was subsequently engaged in ironworks and as a surveyor, engineer, and agriculturist. Author of various treatises on agriculture, credit and labor, etc., by which he earned the title of "founder of English political economy," given him by a modern economist, Patrick E. Dove, who has written a biographical sketch (Edinburgh, 1855). His principal work was entitled *England's Improvement by Sea and Land, to Outdo the Dutch without Fighting, etc.* (2 parts, 1677–81).

Yar'rell (William), F. L. S., b. at Westminster, England, in June, 1784; became a wealthy newspaper agent, an enthusiastic sportsman, and an eminent zoologist, forming an important collection of British fishes; was one of the originators, and long a vice president, of the Zoological Society, and communicated above 80 papers to various societies with which he was connected. D. at Yarmouth Sept. 6, 1856. He published *A History of British Fishes, illustrated by 400 Woodcuts* (2 vols., 1835–36), of which the 3d edition was accompanied by a *Memoir of the Author* by Sir John Richardson (2 vols., 1859; *Supplement*, 1860), and *A History of British Birds, with 520 Wood Engravings* (3 vols., 1839–43; 3d ed. 1856). A new and thoroughly revised edition of the last is now (1876) being published under the supervision of Prof. Alfred Newton.

Yarriba. See Yoruba.

Yar'row, or **Milfoil** (*Achillea millefolium*), a European plant of the Compositæ family, nearly allied to camomile, wormwood, and tansy, is found as a common weed in England and the U. S., produces leaves and flowers which have a bitter, astringent taste and an aromatic odor, and yields a blue volatile oil. It was formerly much used as a vulnerary, and in Sweden is employed by brewers as a substitute for hops.

Yarrow, a river of Selkirkshire, Scotland, rises at Yarrow Cleugh, near Loch Skene, flows N. E. 25 miles through Lochs Lowes and St. Mary, and falls near Selkirk into the Ettrick, a tributary of the Tweed. On its banks are the ruins of the famous castle of Newark, and Bowhill, the family-seat of the dukes of Buccleuch. Its current is rapid, and it affords many picturesque views, which are commemorated in three well-known poems of Wordsworth.

Yassy. See Jassy.

Yates, county of W. New York, lying on Seneca, Canandaigua, and Crooked or Keuka lakes, the latter of which penetrates halfway across the county, and traversed by Crooked Lake Canal and by Northern Central R. R. The surface is undulating or hilly, and contains considerable iron ore; soil a sandy loam. There are saw-mills, planing-mills, flour-mills, distilleries, and manufactures of agricultural implements, carriages, saddlery, and brick. Horses, cattle, and sheep are the chief live-stock. Staples, wheat, Indian corn, oats, barley, hay, wool, dairy products. Cap. Penn Yan. Area, about 500 sq. m. P. 19,595.

Yates, tp., McLean co., Ill. P. 1048.

Yates, p.-v. and tp., Orleans co., N. Y. P. 2014.

Yates (A. R.), U. S. N., b. Oct. 28, 1838, in New York; graduated at the Naval Academy in 1857; became lieutenant in 1861, commander in 1872; served on board the Hartford at the battle of Mobile Bay, and is thus mentioned in Rear-Admiral Farragut's report of Aug. 12: "Lieut. A. R. Yates of the Augusta acted as an additional aid to me on board the Hartford, and was very efficient in the transmission of orders. I have given him command of the captured steamer Selma." Foxhall A. Parker.

Yates (Edmund Hodgson), b. in London, England, in July, 1831; became a professional man of letters; wrote for many periodicals; was a dramatic author and theatrical critic; edited *Our Miscellany*, *Temple Bar*, and *Tinsley's Magazine*, and held for some years a high position in the London general post-office. Author of numerous successful works of fiction, and now (1876) editor of the *World* newspaper.

Yates (James), b. at Highgate, near London, in 1789; educated at the universities of Glasgow and Edinburgh; studied theology at Berlin, and was pastor of Unitarian churches in Glasgow, Birmingham, and London; was an active member of several scientific societies, to which he communicated memoirs on antiquities, philology, botany, and geology. Author of *A Vindication of Unitarianism* (1815), in reply to Dr. Wardlaw; *Textrinum Antiquorum, an Account of the Art of Weaving among the Ancients* (1843); *Descriptive Catalogue of a Collection of Current Coins of all Countries in the International Exhibition* (1862), and other pamphlets on education, religion, and the decimal system, and was a contributor to Dr. William Smith's *Classical Dictionaries*.

Yates (John V. N.) was for many years secretary of the State of New York; edited a volume of *Select Cases Adjudged in the Courts of the State of New York* (1811), *A Collection of Pleadings and Practical Precedents* (2d ed., 1837); wrote a *Continuation* to Chief-Justice Smith's *History of the Province of New York* (Albany, 1814); was joint author with Joseph W. Moulton of a *History of the State of New York* (2 parts, 1824–26), and with John L. Tillinghast of a *Treatise on the Principles and Practice, Process, Pleadings, and Entries in Cases of Writs of Error, etc.* (Albany, 2 vols., 1840).

Yates (Joseph C.), b. at Schenectady, N. Y., Nov. 9, 1768; became a lawyer there; was one of the founders of Union College; served as mayor 1798–1808, as State senator 1806–07, as judge of the supreme court 1808–22, and governor of New York 1823–25. D. at Schenectady Mar. 19, 1837. A county in New York commemorates his name.

Yates (Richard), b. at Warsaw, Ky., Jan. 18, 1818; graduated at Illinois College, and studied law; served several terms in the Illinois legislature, and in 1850 was elected to Congress on the Whig ticket; in 1861 was elected governor of Illinois, and took an active part in raising troops for the Union army; served as U. S. Senator from Illinois from 1865 to 1871. D. in St. Louis Nov. 27, 1873. J. B. Bishop.

Yates (Robert), b. at Schenectady, N. Y., Jan. 27, 1738; educated in New York City, where he was admitted to the bar 1760; settled at Albany; was a member of the committee of public safety 1775, of the provincial congress, and chairman of committee of military operations 1776, of the constitutional convention 1777; was appointed a judge of the supreme court of New York the same year; became chief-justice 1779; was a member of the national convention which formed the Federal Constitution of 1787; took notes of its proceedings, which were printed by his widow (1839); retired from the bench 1798, and was appointed a commissioner to settle disputed land-titles in the "Military Tract" with the states of Massachusetts and Connecticut, and also to settle claims of New York against Vermont. D. at Albany Sept. 9, 1801.

Yates (William), D. D., b. at Loughborough, Leicestershire, England, Dec. 15, 1792; educated at Bristol College; went to Calcutta as a Baptist missionary 1815; settled at Serampore; devoted himself chiefly to the task of translating and of preparing textbooks; visited England and the U. S. 1827–29, and was on his way to England when he d. in the Red Sea, July 3, 1845. Author of *A Grammar of the Sanscrit Language* (1820), *A Sanscrit Vocabulary* (1820), *Introduction to the Hindostanee Language* (1827), *Dictionary of Hindostani and English* (1836), and a posthumous work, *An Introduction to the Bengali Language* (2 vols., 1847; new ed. 1864). He translated the whole Bible into Bengali, and the New Testament into Hindi, Hindostani, and Sanskrit. A *Memoir* (1847) was written by Dr. James Hoby.

Yates City, p.-v., Knox co., Ill.

Yates'ville, tp., Morgan co., Ill. P. 1440.

Yaupon. See Holly.

Yav'apai, county of N. E. Arizona, bordering on Utah and New Mexico. Only a small portion of its area has been explored. The greater part of it is 5000 or 6000 feet above the sea, and portions are considerably more elevated. Colorado River crosses the N. W. corner through precipitous cañons; as does also the Colorado Chiquito, which flows through the centre of the county. Among the other streams are tributaries of San Juan and the Gila. The mountain-chains are numerous, their general direction being N. and S. There are some mining districts in the county, and the Moqui Indians inhabit the north-eastern part. Cap. Prescott. Area fully 50,000 sq. m. P. 2142.

Yawn'ing. Yawning is in some respects analogous in its action on the respiratory process to sighing. It consists of a deep inspiration, accompanied by an involuntary opening of the jaws to their fullest extent. But it differs from sighing in these points—that it is entirely automatic; that is, not performed by the action of the will; that it is evidence of mental weariness, or rather of the existence of the state which the French call *ennui*—a word which has not its exact synonym in the English language; and that it is contagious. Its exciting cause is imperfect aëration of the blood, and it is sometimes a symptom of certain brain diseases, in which the encephalon is weakened in its functions of carrying on the operations of the organism. Yawning is performed by certain animals, as the dog, and in them, as in man, has a like cause, and is succeeded, so far as we can determine from observation, by a feeling of relief from sensations not altogether agreeable. W. A. Hammond.

Yaws (*Framboesia*), a contagious disease of Africa, Malaisia, the Feejee Islands, the West Indies, etc. It has several varieties. It closely resembles the *Sibbens* of Scotland and the *Scherliero* of Illyria. Some have considered it a form of leprosy, but it is more probably syphilis.

Yazoo', county of W. Mississippi, lying on Black River, intersected by the Yazoo, and skirted in the E. part by Mississippi Central R. R.; surface level, soil very fertile. Horses, mules, cattle, and swine are the chief livestock. Staples, cotton and Indian corn. Cap. Yazoo City. Area, 650 sq. m. P. 17,279.

Yazoo City, p.-v., cap. of Yazoo co., Miss., in Yazoo Valley, one of the richest corn and cotton growing districts of the South, and 60 miles from Vicksburg, has 8 churches (3 colored), 4 good schools, 2 weekly newspapers, 1 bank, 2 mills, several manufactories, and an efficient fire department. Yazoo River is navigable for over 200 miles above the city. Drummond Burch, Ed. "Democrat."

Yazoo Fraud, The. This was the name popularly applied to the sale by Georgia in 1795 of the greater portion of her western territory. The treaty of peace of 1783 having made the Mississippi the western boundary of the U. S., and the treaty of Beaufort of 1787, between the States of Georgia and Mississippi, having settled the questions of boundary between these States, the State of Georgia was possessed of a vast and valuable western territory, extending to the Mississippi and lying between the parallel lines drawn from the head-waters of the Savannah River on the N. and the head-waters of the St. Mary on the S., including what afterward became the States of Alabama and Mississippi. In 1789 the State of Georgia sold to the South Carolina Yazoo Co., the Virginia Yazoo Co., and the Tennessee Co. lands in this territory estimated at 10,000,000 to 12,000,000 acres for about $140,000. Certain difficulties both as to the Indian title and the currency in which the purchasers were entitled to pay having arisen, suits were commenced in the Federal courts, which were abruptly terminated by the amendment to the U. S. Constitution declaring that such courts should have no jurisdiction to entertain suits brought against a State. These sales, therefore, seem to have been practically inoperative. But in 1795, under a reorganization of the purchasers, the State of Georgia sold to four companies—the Georgia Co., the Georgia-Mississippi Co., the Upper Mississippi Co., and the Tennessee Co.—for $500,000 an immense body of Western lands, the exact extent of which perhaps could scarcely be estimated, but which it was alleged extended from the Alabama and Coosa on the E. to the Mississippi on the W., and from the northern boundary of Georgia along the 35th nearly to her southern limit on the 31st degree of latitude. This sale naturally attracted the attention and excited the apprehension of the Federal government, to whose notice it was specially brought by a message of Pres. Washington. But it created an indignant excitement in the State of Georgia. It was charged, with apparent truth, that the legislation necessary for the sale had been obtained by the corruptest influences and by the wholesale bribery of the members of the legislature. Gov. James Jackson, then U. S. Senator from Georgia, resigned his seat, became a candidate for the State legislature, and the leader of the people in their determination to overturn the whole transaction. He succeeded, and in 1796 all acts authorizing the sale were repealed, the purchase-money paid was ordered to be returned, and every vestige of the transaction was obliterated from the records; which latter part of the sentence was executed in the presence of the governor, the legislature, and a vast assembly of citizens by burning the act itself, the fire being kindled by the use of a lens, so as to make it, in the words of one who has described the scene, "a consuming fire from heaven." Having thus cancelled the legislative sale, the State of Georgia, after a negotiation with the general government, ceded all this western territory to the U. S. in 1802, and the rights of the purchasers thus became a question for the Federal government. In 1803, Mr. Madison, secretary of state, Mr. Gallatin, secretary of the treasury, and Mr. Lincoln, attorney-general, appointed by Mr. Jefferson under an act of Congress to report on the Yazoo claims, made a very full examination of the history of the sale, and, while not positively confirming what had been done, expressed their belief that "the interest of the U. S., the tranquillity of those who may hereafter inhabit that territory, and various equitable considerations which may be urged in favor of most of the present claimants, render it expedient to enter into a compromise on reasonable terms;" and they recommended compensation in land or money. The popular feeling, however, against the transaction, partly on account of the alleged corruption of the State legislature, partly on account of the unwillingness to see this great territory monopolized by the combination of a few capitalists, prevented any action by Congress. The claimants finally sought their remedy in the U. S.

courts, and the case was carried by appeal to the Supreme Court of the U. S. In Fletcher *vs.* Peck, Chief Justice Marshall in 1810 held that the original sale by the State of Georgia must be sustained; that the allegation of corruption on the part of the legislature could not be entertained by the court; that purchasers from the land companies were innocent holders without notice; that the repealing act of the Georgia legislature could not divest the rights thus acquired. Consequently, in 1814 Congress appropriated $5,000,000 to be raised by the sales of the lands to quiet and extinguish all the Yazoo claims.—Such is a brief outline of what was once a very famous and violent controversy, the crimination and recrimination of which are scarcely worthy of historical perpetuation. Those who may desire to examine it more closely will find material in the acts of the Georgia legislature; the debates in Congress; *Amer. Arch. Pub. Lands*, vol. i.; Fletcher *vs.* Peck, 6 Cranch & Chappells; *Georgia Miscellanies*.

L. Q. C. Lamar.

Yazoo River (the name signifies "River of death" in the Choctaw language, alluding to the malarial diseases which prevailed upon its shores), a navigable stream of Mississippi, originates in the Yazoo Pass, Coldwater River, Beaver Dam River, and other bayous and sloughs springing from the E. bank of Mississippi River. These join the Tallahatchie, a navigable stream from the N. E., at Polkville, Miss., where the Yockeney also comes in from the E., but the united stream is generally called the Tallahatchie down to the junction with the Yalabusha, which is also navigable. The Yazoo proper below this point is 290 miles long, deep, serpentine, and sluggish, and navigable the year round. It joins the Mississippi 12 miles above Vicksburg. At high water steamboats might pass, but for the levee at Moon Lake, from the Mississippi, through Yazoo Pass and the Coldwater River, throughout the whole length of the Yazoo system of bayous and streams. On the W. side the Sunflower River and other navigable channels pass from the Mississippi to the Yazoo. The region adjacent to the Yazoo is very fertile; on the W. side it is flat and often swampy, but on the E. more often bluffy or rolling.

Yberville. See Iberville, D'.

Yea'mans (Sir John), b. at Bristol, England, early in the seventeenth century; resided many years in Barbadoes; settled in South Carolina 1665, at which time he was the introducer of African slaves into the colony; was governor of South Carolina 1671–71; was removed from office for arbitrary conduct, and went to Barbadoes, where he d. soon afterward.

Yeames (William Frederick), b. at Taganrog, Russia, in 1835, son of the British consul at that place; studied art in London and Italy; acquired reputation as a painter of historical and genre pictures, and was chosen an associate of the Royal Academy 1866.

Year [Aug.-Sax. *gear*; Ger. *Jahr*], the time of one complete revolution of the earth round the sun, or of the apparent revolution of the sun in the celestial sphere. This is the sidereal year, so called because it is the interval between two consecutive returns of the sun to the same point among the stars; the sensible or natural year, called in astronomy the tropical or equinoctial year, is the period within which the cycle of the seasons is fully completed. The seasons are dependent on the progressive and periodical changes of the sun's place in declination. (See Climate.) The declination is maximum at the tropics and zero at the equinoxes. Hence, the tropical or equinoctial year is the interval between two successive arrivals of the sun at the same tropic or at the same equinox. The equinoxes have a very slow and not entirely uniform retrograde motion upon the earth's orbit, called precession, amounting in the mean to 50.2″ of arc per annum: and hence the tropical year is shorter than the sidereal by the amount of time occupied by the earth in passing over this small arc—an amount equal in the mean to 20*m.* 19.9*s.* of mean solar time. The mean annual arc of precession is at present undergoing an excessively slow increase, the effect of which is to diminish the length of the mean solar year at the rate of 0.595*s.* per century—a process which will at length be reversed.

If the earth's orbit were perfectly circular, or if it were a perfectly true ellipse, the major axis maintaining an invariable position in space, the length of the sidereal year would be absolutely, as it is very nearly, constant. The orbit is elliptical, but is somewhat distorted in figure by the disturbing attractions of other bodies, and its axis has an exceedingly slow direct angular motion, turning around the sun as a pivot. The annual increase in longitude of its extremities or apsides is 11.778″ of arc; and consequently, when the earth has completed a sidereal revolution, it is less advanced in the ellipse than it was at the beginning of the same revolution by this small space. If, therefore, there be drawn from the sun, in the plane of the earth's orbit, a straight line fixed in space, and if the beginning of the sidereal year be taken at the moment in which the earth's centre passes this line, the length of the sidereal year will slightly diminish as, in the revolution of the line of the apsides, the aphelion approaches this line, and will similarly increase after the aphelion has passed the line, and until the perihelion shall make the same passage; but the entire amount of variation will be so exceedingly minute that, as above stated, the length of the year will be very nearly constant.

The interval which elapses between the moment of the earth's departure from any given point in the ellipse till its return to the same point again is called an anomalistic year, and is greater than the length of the sidereal year by the time necessary to traverse the minute arc 11.8″, which time in the mean is 4*m.* 39.7*s.* The anomalistic year is usually reckoned from the aphelion or from the perihelion passage, but, whatever is the point of departure, the length is the same. The mean lengths of the several years above defined may be stated as follows:

The mean solar or tropical year.....365*d.* 5*h.* 48*m.* 46.054*s.*
The mean sidereal year.....365*d.* 6*h.* 9*m.* 5.95*s.*
The anomalistic year.....365*d.* 6*h.* 13*m.* 45.65*s.*

The length of the tropical year was approximately ascertained by the ancient Egyptians by measuring, from day to day at noon, the shadow of a vertical gnomon erected for the purpose upon a horizontal plane. The shadow is necessarily minimum on the day of the summer solstice, and the interval between two such minima is the number of entire days in the solar year. A calendar year of 365 days would, however, go backward, in reference to the natural year, about twenty-five days in a century, and the fact, if not the amount, of its error would soon become perceptible. The Thebans are said to have first discovered that six hours must be added to the length of the calendar year to prevent this displacement. Hipparchus, in the second century B. C., found six hours too great by 4*m.* 48*s.*, making the year 365*d.* 5*h.* 55*m.* 12*s.* Near the end of the ninth century of our era, the Arabian astronomer and prince, Albategnius, reduced the year of Hipparchus by 8*m.* 48*s.*; giving 46*m.* 24*s.*, instead of 55*m.* 12*s.* The Alphonsine Tables (1252) gave 49*m.* 16*s.*; Copernicus (1543), 49*m.* 6*s.*; Tycho Brahe (1602), 48*m.* 45½*s.* All these determinations having been made before the invention of the telescope, their near approximation to the truth is remarkable, especially that of the last.

As, in the practical affairs of life, convenience requires that the year should be composed of a definite number of entire days, the fractional excess of about a quarter of a day above 365 is allowed to go on accumulating for four years, and the fourth year is increased by the addition of another day, making it 366. But as the fractional excess is not quite a quarter of a day, falling short that amount by 11*m.* 13.95*s.*—a quantity sufficient to amount to eighteen hours in a century, or three days in four hundred years—allowance is made for this by omitting the intercalary day in three out of every four centurial years. This is the Gregorian correction, for a fuller explanation of which, and for the subdivisions of the year among different peoples, see Calendar, and on the latter point see also Month.

The epoch of the reformed Julian calendar (see Calendar) is Jan. 1, B. C. 45, as reckoned by the chronologists; or Jan. 1, B. C. 41, according to the reckoning of the astronomers.* The intercalation was first applied in the year 42 B. C., chronological reckoning, and subsequently every third year, instead of every fourth, as intended (the pontiffs who regulated the calendar forming the quadrennium, in accordance with the usage of the time, by counting the leap-year both at the beginning and at the end), until the 37th year of the era, which was the 9th B. C., by chronological reckoning, and was the final leap-year of this irregular series. Then, by order of Augustus, for the purpose of correcting the irregularity, the intercalary day was suppressed for three successive quadriennia: that is, in the 41st, 45th, and 49th of the era, being the fourth year before the birth of our Saviour, the year of that event, and the fourth year after. The birth of Jesus Christ is assumed, for chronological purposes, to have occurred on the 25th of December in the 45th year of the Julian era; and as, by the Julian calendar, Jan. 1 was made the beginning of the year, the first calendar year of the Christian era com-

* The astronomers, for convenience of calculation, make the supposed year of our Saviour's birth the year zero, the years following being accounted positive, and the years preceding negative. Thus, in comparing dates B. C. in the works of such writers as Delambre with those given for the same events by professed chronologists, like the authors of *L'Art de Vérifier les Dates*, etc. etc., it is necessary to bear in mind that the excess of a unit in the statements of the latter authorities, instead of being evidence of disagreement, implies practical identity.

menced seven days after the event from which it nominally dates, or on Jan. 1 of the 46th Julian year. The first century of the era terminated, therefore, Dec. 31 A. D. 100, and the eighteenth century Dec. 31, A. D. 1800. It would hardly be worth while to make so obvious a remark, if the question had not occasionally been gravely raised, whether the year 1800 belongs to the eighteenth or to the nineteenth century. The popular error on the subject has probably arisen from the fact that, in the ecclesiastical calendar, printed in all the prayer-books of the Roman and Protestant Episcopal churches, the centennial corrections are made on the centurial years, and each corrected century commences with the hundredth year of the century preceding, and ends with the ninety-ninth year of the century current. The reason for this practice is that the solar correction, being the omission of an intercalary day, must be made on a year which is regularly a leap-year; and in order to avoid complication the lunar correction when made is made synchronously with it. The centurial year is chosen as the year for applying the correction for the sake of simplicity and facility of recollection. Another fixed leap-year might be selected, as, for instance, the year 4 or the year 96 in each century; in which case the calendar centuries would end with the year 3 or the year 95. On this subject the following mode of reasoning is sometimes used; it is mentioned here because it has been seriously entertained, and not because it appears to the writer to be ingenious or even plausible: "A year is not counted in chronology until it is completed. Hence, the first year of the era was zero, and the count 'one' ran through the second year, which was not counted till after its close. In like manner, the count 'ninety-nine' ran through the hundredth year, the count 'one hundred' ran through the first year of the second century," and so on. The question, therefore, according to this reasoning, is not a question of opinion, but a question of fact.

The fact, nevertheless, is, that the count in chronology is not made as above asserted. The Christian era was only first used for the purposes of chronological reckoning some time in the sixth century, when it was adopted in Italy on the recommendation of Dionysius Exiguus, a Latin monk. It did not become well established in France and Germany until the time of Charlemagne (A. D. 742–814). The year of the Nativity was not then well known, and has never, in fact, been positively ascertained to this day. It was assumed, as above stated, for the purpose of establishing the era, that this year was identical with the 45th of the Julian era, and the 46th of that era was made the first of the Christian, the count applying equally to the first day and the last day of that year. The 145th Julian year was, therefore, the 100th Christian year, and the first Christian century ended with its hundredth year, so named. It is a little curious that those who employ the mode of reasoning above given do not apply it as well to the century as to the year. According to them, the first century should be called zero, and the present the eighteenth.

Different peoples have differed widely as to the place among the seasons of the beginning of the year. The Roman year, before the time of Julius Cæsar, began on the 1st of March. The civil year of the Jews began at the autumnal equinox, though their sacred year began at the vernal. The Greek year, before the time of Meton, began at the winter solstice; afterward at the summer solstice. The Egyptians, Persians, and other Eastern peoples began, like the Jews, at the autumnal equinox. The Mohammedan year, being a lunar year, has no determinate epoch, but continually goes backward among the seasons. The first of September was the beginning of the year in the Eastern Empire, and the same was true in Russia before the time of Peter the Great. In France, under the Merovingian kings, the year began March 1; under the Carlovingians, March 25; under the Capetians, at Easter; and from 1564 onward, Jan. 1. The ancient Northern nations of Europe placed the beginning of the year at the winter solstice. In England the year began on the 25th of March previously to the adoption of the Gregorian calendar, which took place in 1752. The same usage prevailed in the British American colonies from Nova Scotia to Georgia, and was abandoned at the same time. F. A. P. BARNARD.

Year and a Day (in law). This space of time was constantly employed by the common law and by ancient statutes to designate the period by the full completion of which, after the happening of some specified event, a legal right connected with such event would be either gained or lost. The following examples will sufficiently illustrate its use and effect: A person feloniously assaulted and wounded by another must die within a year and a day from the infliction of the wound in order that the crime should be murder. Animals taken estray belonged to the lord of the manor unless claimed within a year and a day from their seizure. Wreck found and taken into possession by the proper officer fell to the Crown or its grantee unless an owner appeared within a year and a day from the finding. Certain actions and proceedings must be commenced within that time after the right accrued. Thus, an execution could not be issued on a judgment after a year and a day from its entry unless the judgment itself was revived by *scire facias*. It is useless to multiply examples, since the only matter of interest connected with this particular limit of time consists in the reasons for its choice and its actual meaning. A year and a day was not literally one year and one day in addition, or 366 days. It was simply a complete year, or 365 days, and the term was selected in order that, by taking into account another rule of the common law, the period of time which must elapse before the right was gained or lost might be *one full year*. This resulted from the established doctrine of the common law that in reckoning the continuous lapse of time each day was regarded as a single, indivisible, and instantaneous point of time, and was therefore condensed into its first moment, or, in other words, was legally ended as soon as begun. By virtue of this principle a minor attained his majority at the instant after midnight of the 364th day of his twenty-first year. He became of age when he was 20 years 364 days and a moment old. During the entire 365th day, although he had not completed his twenty-first year by perhaps twenty-four hours according to our popular computation, he was fully competent to perform all the acts belonging to the age of manhood. The same principle was applied to every lesser specified space of time, as, for example, a year. If a rule of the common law or of a statute should declare that some act could be done or some right acquired or lost after the expiration of a year from a given time, the act would be lawful, the right would be gained or lost, after the expiration of 364 full days—that is, immediately after the beginning of the 365th day at midnight—for that day being legally regarded as existing and finished in its first moment, the year would have been fully accomplished, although there might be twenty-four hours longer before the succeeding day would commence. In consideration of this well-known rule, and to furnish a complete year of 365 full days before the probationary period should end, the time "a year and a day" was invented. The result is, that a "year and a day" was exactly one complete year according to the modern popular computation of time.

JOHN NORTON POMEROY.

Year Books, early reports of cases decided in the English courts of law. (See REPORTS.) They are mainly interesting in an antiquarian and historical point of view, and are seldom resorted to as guides for modern decisions. Instances, however, may be found in which they are consulted. (See the cases of *Lumley* vs. *Gye*, 2 Ellis & Blackburn, 216; *Curtis* vs. *Hubbard*, 4 Hill (New York), 437; *Althorf* vs. *Wolfe*, 22 New York Reports, 366, 367.) The *Year Books*, as generally known to the legal profession, consist of an edition published by Sergeant Maynard (1678–80), beginning with the reign of Edward I. and coming down to the time of Henry VIII. The collection was an imperfect one, a number of the early reports still remaining in a manuscript form. Some of these have been published within a few years. The usually-received edition is in the form of thick and unwieldy folios, in black-letter type, in an obsolete language (Norman French), and with many abbreviations at the present time difficult to decipher. Few lawyers of our day could succeed in reading and understanding them. The volumes which have been recently published are in portable form, with excellent paper and clear type, and an English version is given in parallel columns with the Norman French. It is greatly to be hoped that the reports in Sergeant Maynard's work may go through the same process of republication, as the cases there collected, if presented in a readable form, would undoubtedly supply much curious and valuable information as to the manners and customs of the times when they were decided. (Consult Wallace on *Reporters*; Foss's *Judges of England*.) T. W. DWIGHT.

Yeard'ley (Sir GEORGE), b. in England about 1580; was governor of Virginia 1616, 1619–21, and 1625; was a member of the council, and promoted many important improvements in Virginia. D. in 1627.

Yeast, Yeast-Plant, and **Yeast-Powders.** See BREAD and FERMENTATION, by PROF. C. F. CHANDLER.

Ye'cla, town of Spain, province of Murcia, on the Jumilla, has a trade in wine, brandy, and fruit. P. 11,669.

Yeddo or **Yedo,** now **Tokio** or **Tokei.** See JAPAN.

Yeisk. See JEISK.

Yekaterinboorg', town of European Russia, government of Perm, on the Isset, is the centre of a large mining district on the eastern side of the Ural Mountains in lat. 56° 50′ N. Cutting and engraving of precious stones and manufactures of marble, etc., are carried on. P. 24,500.

Yekaterinodar', town of Russian Caucasia, government of Stavropol, in the midst of a swamp which serves as fortifications, is most wretchedly built, consisting for the greatest part of mud huts thatched with straw. P. 8765.

Yekaterinograd', town of European Russia, in the Ciscaucasian territory of the Terek, on the left bank of the Terek, was founded in 1777 by Potemkin, is fortified, and forms a military Cossack station. P. about 5000.

Yekaterinoslav', town of Russia, capital of the government of the same name. It was founded by Potemkin in 1784, is the seat of the governor and of a Greek bishop, and has several important manufactures. P. 22,548.

Yelatom', town of Russia, government of Tambov, on the Oka, has 12 churches. P. 5983.

Yêl-elei-kilangu, the true Indian name for the tapioca. This plant is rapidly becoming the Hindû's potato. The crown prince of Travancore has been recently paying great attention to its proper cultivation. In India a method has frequently been adopted to cook the root of the tapioca-plant and serve it up to table in such a form that it is almost if not wholly impossible to recognize the difference between it and the "mealiest" and largest of potatoes. The tapioca-plant, having a sevenfold leaf, is thus called the *yêl elei-kilangu*, or, literally, "root with seven leaves." In many parts of India it grows wild. R. C. CALDWELL.

Yeletz', town of Russia, government of Orel, on the Sosna, is old, but neatly built. It is celebrated for its manufactures of wheat flour, has trade in buckwheat and cattle, and iron-mines in the vicinity. P. 30,182.

Yeli'ta, tp., El Paso co., Tex. P. 799.

Yelk [sometimes called **Yolk**, which is considered incorrect by Noah Webster; derived, doubtless, from the Ang.-Sax. *geolew* and the German *gelb*, "yellow," the German *gelt*, "gold," being a kindred word]. The yelk of eggs is composed chiefly of an oily matter, forming a sort of emulsion with a solution which contains albumen and caseine, somewhat similar to white of egg. The albuminoid matters were formerly called *vitelline*, and supposed to be peculiar, but the contrary is now held. HENRY WURTZ.

Yell, county of W. Arkansas, lying on Arkansas River, and intersected by Fourche, La Fave, and Petit Jean rivers; surface diversified, soil fertile. Cattle and swine are the chief live-stock. Staples, cotton and Indian corn. Cap. Danville. Area, 936 sq. m. P. 8018.

Yell, tp., Boone co., Ia. P. 1399.

Yell, tp., Webster co., Ia. P. 349.

Yell (ARCHIBALD), b. in Kentucky in 1797; settled in Arkansas; was appointed judge of the Territory; was a member of Congress 1837–39, and again 1845–46; was governor of Arkansas 1840–44; took part in the Mexican war, and was killed at the battle of Buena Vista, Feb. 23, 1847.

Yellow Berries. See FRENCH BERRIES.

Yel'low-Bird, the common name given to two varieties of birds, the American goldfinch (*Chrysomitris tristis*) and the yellow-poll warbler (*Dendroica æstiva*).

Yellow Creek, tp., Chariton co., Mo. P. 1016.

Yellow Creek, tp., Linn co., Mo. P. 3126.

Yellow Creek, tp., Columbiana co., O. P. 3088.

Yellow-eyed Grass, the common name of the Xyridaceæ, an order of endogens chiefly consisting of the *Xyris*, a genus of biennial or perennial rush-like plants with two-edged, sword-shaped leaves. More than 50 species have been described, and 15 are found in the Northern U. S., chiefly in sandy swamps and pine-barrens.

Yellow Fever, so called because of the peculiar yellow tinge of the skin characterizing it, and for the same reason technically designated *typhus icterode*, *icterus* being the classical name of "yellow jaundice." It is not a form of typhus fever, but resembles it in the prostration, blood-disorganization, and softening of internal organs which are features in both. Yellow fever prevails chiefly in tropical and warm climates. When occurring in temperate or cold zones, it has been imported in the course of commercial travel. It is indigenous chiefly in the West Indies, upper coasts of South America, the borders of the Gulf of Mexico, and the Southern U. S. It occurs in isolated, sporadic cases at all seasons in seaports, to which it has been transported in ships. Rigid quarantine of all ships coming from yellow-fever localities, and their fumigation before disembarking passengers and cargo, have averted the epidemics formerly so frequent. It is generally conceded that there is a specific morbific element, a portable *fomites* or fermentative substance, which propagates this disease. This *materies morbi*, when imported and let loose, will prove innocuous unless the weather be warm or mild and the air moist. It rarely develops when the mercury is below 70° F., and frost or freezing weather effectually terminates its career. Insalubrious, damp, low, and filthy localities are more likely to be its points of successful lodgment, as when emigrants from yellow fever ports, on landing, go to the dense and uncleanly tenement districts of the larger cities. But in the same way it may be carried into the healthiest residences. It is thus the poison is imported and carried directly to certain points which become *foci* of the disease, from which, unless brought under immediate and rigid sanitary surveillance, it radiates with more or less havoc. By the intercourse of business and personal visits it may be carried from the infected localities to other points, which in turn become foci of contagion. But there is no general atmospheric contamination, no infection, no contagion necessarily, except as the air vitiated by the breath, vomit, and stools of the patient is inspired. Yellow fever is not now regarded, as formerly, a fever of malarial origin, allied to intermittent and remittent. It prevails on the coasts and in large cities, sparing the contiguous country, which is often swampy and afflicted severely by malaria. The negroes of the South, although susceptible to malaria, enjoy a relative immunity from yellow fever. Yellow fever has no periodicity—that is, alternations of febrile periods and remissions; from the onset of the attack to its termination it is a continuous fever. Quinine and other anti-malarial remedies do not control it, or especially relieve it beyond their general tonic effect. Yellow fever has no definite duration of its period of incubation or formation. In some cases, for two or three days or more, there will be general lassitude, loss of appetite, and sense of debility. In graver cases the attack may be precipitate and speedily fatal; reversely, there are "walking cases," in which, with jaundice and even mental disturbance, the muscular power is retained. There is usually an initial chill, some headache, and slight increase of temperature. Exceptionally, the thermometer in the mouth or axilla will register a high degree, as in other fevers—103°, 104°, 105° F.—but more often the body-heat is but little elevated, and in some cases is lowered. The pulse is but little accelerated. The stomach is irritable at an early date, due to the poisonous influence of bile in the blood upon the origin of the pneumogastric nerve, as well as by sympathy with the congested liver. The mind may be mildly or actively delirious. The skin grows yellow, and, when vomiting causes exhaustion and wasting, is often shrivelled. The blood has become seriously impaired by the morbific poison, and its decomposed and watery elements tend to transude the coats of the vessels. Hence, with the effects of vomiting, vessels in the congested stomach are unloaded, and the already disorganized blood, being further perverted by the action of gastric juice, presents a coffee-ground, or again a tar-like, appearance, known as "black vomit." This is regarded as a critical or even fatal sign: and with reason, since it is an evidence of serious destruction of red blood-cells. Exhaustion and collapse are the result of such conditions unless stimulating and sustaining treatment is assiduously adhered to. The average duration is a week, and cases vary in character from a mild fever, with gastric disorder, to a malignant and incurable typhus icterode. There is no specific treatment. No depressing remedies should be employed. Cold and evaporating lotions to the head may prevent brain symptoms; ice, effervescing waters or champagne in small quantity, and other remedies for composing the stomach, are valuable. Carbonate of ammonia may help to oxygenate the blood. But quiet, discreet nursing, warm drinks, and blanketing, and, later, abundant nutrition, are found to be the most successful means of cure. The mortality varies with the character of the epidemic, the class of persons it has attacked, their hygienic surroundings, and the discretion with which cases are treated; it may be as low as 5 or as high as 75 per cent. E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

Yel'low-Hammer [Ger. *Ammer* or *Goldammer*], the *Emberiza citrinella*, a very common and quite handsome European bunting. In Great Britain it is looked upon with a superstitious dislike, and its nests and eggs are destroyed by the rustics. In Italy it is fattened and eaten.

Yel'lowhead, tp., Kankakee co., Ill. P. 1492.

Yel'lowlegs, the *Gambetta flavipes*, a North American snipe, found all along our Atlantic coast. It is a fine game-bird, and is esteemed by epicures.

Yel'low Med'icine, county of S. W. Minnesota, formed since the census of 1870. The surface is an uneven table-land, watered by Lac qui Parle and Yellow Medicine rivers. Cap. Granite Falls. Area, 792 sq. m. P. 2184.

Yellow Medicine, tp., Redwood co., Minn. P. 385.

Yellow Medicine River flows from Lake Hendricks, on the line between Minnesota and Dakota, and flows E. by N. to Minnesota River.

Yellow River. See HOANG-HO.

Yellow-Root, a name given in the U. S. indifferently to several plants, most of which have been described under other names. (See CELASTRACEÆ, PUCCOON, RANUNCULACEÆ, and VIRGILIA.)

Yellow Sea [Chinese, *Whang-Hai* or *Hoang-Hai*], large inlet of the Pacific Ocean on N. E. coast of China, between China proper and the peninsula of Corea, and extending between lat. 33° and 41° N. It is rather shallow, and its depth is steadily diminished by the large amount of yellowish mud which the Hoang-Ho and Yang-tse-Kiang carry along with them, and which has given it its name.

Yellow Springs, tp., Des Moines co., Ia. P. 1743.

Yellow Springs, p.-v., Miami tp., Greene co., O., on the Little Miami division of Pittsburg Cincinnati and St. Louis R. R., has a mineral spring of considerable celebrity, was incorporated in 1854, has 7 churches, a graded school and an ungraded school for colored children, and is the seat of ANTIOCH COLLEGE (which see). P. 1435.

Yellowstone Lake and **River.** See YELLOWSTONE NATIONAL PARK.

Yellowstone National Park. Located in the north-western corner of Wyoming Territory is a tract of country more remarkable for the wonderful curiosities of nature than any other region on the globe. It may very properly be called the "Northern Wonderland," in contradistinction to a similar region in New Zealand, which is now known as the "Southern Wonderland." It is a singular fact that it is only within about six years that this marvellous region has been made known to the world. Vague rumors of great volcanoes, spouting hot springs, mud springs, etc. had reached the civilized world from time to time, but they were supposed to be the wild vagaries of the wandering mountaineer, and produced no lasting impression. In 1869 a small party of surveyors from Helena, Mon., penetrated a portion of this country, and the information thus obtained induced the organization in 1870 of an expedition under the direction of Gen. Washburne, surveyor-general of the Territory. To this expedition was attached Mr. N. P. Langford and Lieut. Doane, both of whom excited much interest among our people by their reports. In 1871, Prof. Hayden visited this region with a well-organized scientific corps, made a careful exploration of the most remarkable features, and on the return of the expedition to Washington the reports excited very general interest both at home and abroad. In Feb., 1872, the Congress of the U. S. passed an act reserving an area of about 3575 sq. m. in the north-western corner of Wyoming Territory, withdrawing it from settlement, occupancy, or sale under the laws of the U. S., dedicating and setting it apart as a public park or pleasuring-ground for the benefit and enjoyment of the people. (See act at the end of this article.)

It extends from the 44th to the 45th parallel of latitude, and from the 110th meridian to a short distance beyond the 111th. Its general elevation is high, averaging about 6000 feet, or nearly the height of Mount Washington in the White Mountains. The mountain-ranges have a general elevation of from 9000 to 10,000 feet above the sea-level, although many sharp and rugged peaks rise considerably above this. The country is so elevated that it could scarcely ever be available for agricultural purposes. The winter extends far into the spring, and it is no unusual thing to find snow covering September's flowers. During July and August the weather is delightful, the thermometer rarely if ever rising higher than 70° F. In the early morning, however, it often records 26°, and sometimes falls as low as 10° and 12°. The air is so dry and invigorating that the cold is not felt as much as higher temperatures are in the moister Eastern climate. Near the N. E. corner of the park heads Clarke's Fork of the Yellowstone. From the S. W. Snake River, or Lewis's Fork of the Columbia, starts toward the Pacific, while on the western side Madison and Gallatin rivers, two of the three branches that unite to form the Missouri, have their origin. The largest mass of water in the park is Yellowstone Lake, which lies near the south-eastern corner of the park, from the upper part of which Yellowstone River flows in a northerly direction, and after a course of 1300 miles reaches the Missouri, having descended about 7000 feet. Thus are found here the heads or sources of two of the largest rivers of the continent, rising in close proximity to each other. The divides or watersheds between them are comparatively low, and sometimes it is difficult to say in which direction the water flows, whether to the Pacific or to the Atlantic.

At the present time the traveller on his route to the Yellowstone National Park will find his best outfitting point at Bozeman or Fort Ellis as he takes his leave of the confines of civilization. Fort Ellis is located on the E. bank of Mill Creek, one of the sources of the E. Fork of the Gallatin, and from its position overlooks one of the most beautiful valleys in Montana. It is surrounded on the E. and N. sides by ranges of hills and mountains, which form the divide between the waters of Yellowstone and Missouri rivers. Fort Ellis, although considered one of the extreme frontier posts, and supposed to be located among hostile tribes of Indians, really commands the valleys of the Yellowstone and the three forks of the Missouri, the finest and most productive portion of Montana. It is a very pleasant station, surrounded with beautiful scenery, with a climate that can hardly be surpassed in any country. Streams of pure water flow down the mountain-sides, cutting their channels through the plains everywhere. The vegetation is most abundant. Bozeman is a pretty town, with about 500 inhabitants, situated 3 miles below, surrounded on every side with well-cultivated and productive farms. It is most probable that within a short period the Northern Pacific R. R. will pass down this valley, and then its beauty and resources will become apparent. Here guides, transportation, and all the necessary outfit for a tour of a few weeks or months may be secured. Leaving Bozeman, the tourist takes a slightly S. E. course, passing over the beautiful divide which separates the sources of the Missouri from the Yellowstone Valley. From the summit of this divide he begins to catch glimpses of the beautiful scenery which awaits him in the promised land. On the E. side of the Yellowstone Valley lies spread out before his vision one of the most remarkable ranges of mountains in the West. Persons who have visited Europe have spoken of this range as in no way inferior in beauty to any in that far-famed country. A series of cone-shaped peaks, looking like gigantic pyramids, are grouped along the E. side of the valley for 30 or 40 miles, with their bald, dark summits covered with perpetual snow, the vegetation growing thinner and smaller as the almost vertical sides are ascended, until long before reaching the summits it has entirely disappeared. On all sides deep gorges have been gashed out by aqueous forces, cutting through the very core of the mountains, and forming those wonderful gulches which only the hardy and daring miner has ventured to explore. This range, which is called on the map Snowy Mountains, forms the great watershed between two portions of Yellowstone River, above and below the first cañon, and gives origin to some of the most important branches of that river. Large numbers of springs and small streams flow down from the mountains into the Yellowstone on the S. W. side. Below the first cañon, but from the N. E. side, flow the Big Boulder, Rosebud, Clarke's Fork, and Pryor's Fork, with their numerous branches. This range continues on in a more or less broken condition to the S. E., until it connects with the Big Horn Range. From the summit of Emigrant Peak, one of the highest of these volcanic cones, one great mass of these basaltic peaks can be seen as far as the eye can reach, rising to the height of 10,000 to 11,000 feet above the sea. Emigrant Peak, the base of which is cut by Yellowstone River, is 10,629 feet above tide-water, while the valley-plain near Boteler's Ranch, on the opposite side of the river, is 5925 feet. This splendid group of peaks rises 5000 feet and upward above the valley of the Yellowstone.

Crossing the divide, the traveller descends the valley of Trail Creek into the valley of the Yellowstone, amid some of the wildest and most charming scenery in the W. On every hand he observes increasing proofs of modern volcanic action. In many places broad sheets of basalt have been poured out over the valley, forming mésas or broad table-lands. On the surrounding hills volcanic breccias are weathered into singularly fantastic forms, and present a great variety of sombre colors. Near the head of the valley two enterprising young men have established a ranch for the purpose of supplying travellers and miners with such accommodations as the scanty means of pioneers can afford. For many years the farm of Boteler Brothers formed the extreme western limit of settlement, but since the discovery of hot springs other settlers have advanced up the river to the borders of the park.

In the absence of a chart, the following tables of distance, compiled mostly from the reports of the U. S. geological survey of the Territories, will be of value:

Ogden, Ut., to Franklin, Id., by rail	80½	miles.
Franklin to Virginia City, Mon., by stage	317	"
Virginia City to Bozeman, by stage	66	"
Franklin to Market Lake, Snake River Valley	152	"
Point of Rocks Station, Union Pacific R. R., to Yellowstone Lake, by Capt. Jones's route	289	"

Bozeman to Geyser Basins, viâ Yellowstone River.

Bozeman	0	miles.
Fort Ellis	3	"
Divide between Spring and Trail creeks	16	"
Boteler's Ranch on Yellowstone River	39	"
Foot of second cañon of the Yellowstone	52	"
Devil's Slide at Cinnabar Mountain	60	"
Bridge near mouth of Gardiner's River	68	"
Cache Valley, the mouth of East Fork of Yellowstone	84	"
Crossing of Tower Creek	88	"

Divide on spur from Mount Washburne	94 miles.
Crossing of Cascade Creek	108 "
Mud Volcanoes	117 "
Yellowstone Lake, at head of river	124 "
Head of Yellowstone River to Hot Springs on S. W. arm of lake	15 "
Hot Springs to Upper Geyser Basin	15 "
Mud Volcanoes to Lower Geyser Basin	24 "
Bridge near mouth of Gardiner's River to Mammoth Hot Springs	4 "

Market Lake to Yellowstone Lake.

Market Lake	0 miles.
Henry's Lake	100 "
Tyghee Pass	110 "
Gibbon's Fork	133 "
Lower Geyser Basin	140 "
Upper Geyser Basin	148 "
Divide	158 "
Shoshone Geyser Basin	162 "
Lewis Lake	172 "
Hot Springs, Yellowstone Lake	180 "

Virginia City to Yellowstone Lake, viâ Wagon-road to Geyser Basins.

Virginia City	0 miles.
Madison River, ¼ mile from Wigwam Creek	14 "
Driftwood, or Big Bend of Madison	42 "
Henry's Lake	60 "
Tyghee Pass	63 "
Gibbon's Fork	86 "
Lower Geyser Basin	93 "
Upper Geyser Basin	101 "
Yellowstone Lake	116 "

The Mammoth White Mountain Hot Springs.—This group of springs is one of the most remarkable within the limits of the National Park, and, as far as is known, has not its equal in grandeur in the world. The Te Tarata Spring of New Zealand is the nearest approach to it in appearance, but the formation is of a different character, the Gardiner's River springs depositing calcareous material, while that in New Zealand is silicious, like the deposits in the geyser region of Iceland and in our own geyser basins at the head of the Madison. The exploring party of 1870 did not discover these springs, and the Hayden exploring expedition of 1871 was the first organized party that ever visited them. The springs in action at the present time are not very numerous, or even so wonderful as some of those higher up in the Yellowstone Valley or in the Fire-Hole Basin; but it is in the remains that so instructive records of their past history were found. The calcareous deposits from these springs cover an area of about 2 sq. m. The active springs extend from the margin of the river, which is at an elevation of 5845 feet, to a height of 6522 feet, or nearly 1000 feet above. The entire side of the mountain presents a view of one of the finest displays of nature's architectural skill the world can produce. The snowy whiteness of the deposit at once suggested the name of White Mountain Hot Springs. The scene had the appearance of a frozen cascade. If a group of springs near the summit of a mountain were to distribute their waters down the irregular declivities, and they were slowly congealed, the picture would bear some resemblance in form. The steep sides of the hill are ornamented with a series of semicircular basins, with margins varying in height from a few inches to 6 or 8 feet, and so beautifully scalloped and adorned with a kind of bead-work that the beholder stands amazed at this marvel of nature's handiwork. Add to this a snow-white ground; there is every variety of shade of scarlet, green, and yellow as brilliant as the brightest of our aniline dyes. The pools or basins are of all sizes, from a few inches to 6 or 8 feet in diameter, and from 2 inches to 2 feet in depth. As the water flows from the spring over the mountain-side from one basin to another, it loses continually a portion of its heat, and the bather can find any desirable temperature. At the top of the hill there is a broad flat terrace covered more or less with these basins 150 to 200 yards in diameter, and many of them going to decay. Here we find the largest, finest, and most active spring of the group at the present time. The largest spring is very near the outer margin of the terrace, and is 25 by 40 feet in diameter, the water so perfectly transparent that one can look down into the beautiful ultramarine depth to the bottom of the basin. The sides of the basin are ornamented with coral-like forms, with a great variety of shades, from pure white to a bright cream-yellow; and the blue sky reflected in the transparent waters gives an azure tint to the whole which surpasses all art. The calcareous deposit around the rim is also most elegantly ornamented, but, like the icy covering of a pool, extends from the edge toward the centre, and this projects over the basin until it is not more than a fourth of an inch thick. These springs have one or more centres of ebullition, and in this group it is constant, seldom rising more than 2 to 4 inches above the surface. From various portions of the rim the water flows out in moderate quantities over the sides of the hill. Whenever it gathers into a channel and flows quite swiftly, basins with sides from 2 to 8 feet high are formed, with the ornamental designs proportionately coarse; but when the water flows slowly, myriads of the little basins are formed, one below the other, with a kind of irregular system, as it might be called, which constitutes the difference between the works of nature and the works of art. The water holds a great amount of lime in solution. It also contains some soda, alumina, and magnesia. The ebullition is largely due to the emission of large quantities of carbonic acid gas. As these waters flow down the sides of the mountains, they constantly deposit more or less of this calcareous sediment in almost every possible variety of form. Underneath the sides of many of these pools are rows of stalactites of all sizes, many of them exquisitely ornamented, formed by the dripping of the water over the margins of the basins. One of the most attractive features of this remarkable scene are the old ruins, which indicate the former existence of a far greater number of hot springs than are found at the present time, with here and there a dead geyser-mound. A high cone, which received the name of the "Liberty Cap" from its peculiar form, is 42 feet high and perhaps 20 or 30 feet in diameter at its base. These springs are also constantly changing their places. Some die, while others burst out in new places.

About 20 miles above the Mammoth Hot Springs is the lower end of the Grand Cañon and Tower Falls. Layers of basalt have been poured out over the basic rocks, of whatever age they may be, at different periods, and at the same time vast quantities of fragments of rocks which were cemented together with a kind of volcanic dust and tufa, forming thick beds of breccia. In the process of erosion by water, hundreds of curious pinnacles and columns, resembling groups of Gothic spires, were carved out of the solid beds of basalt and breccia. Tower Creek, which flows into Yellowstone River at the lower end of the Grand Cañon, has received its name from these remarkable columns. About 200 yards above its entrance into the Yellowstone the stream pours over an abrupt descent of 156 feet, forming one of the most beautiful and picturesque views to be found in any country. It is surrounded with pinnacle-like columns composed of volcanic breccia, rising 50 feet above the falls and extending down to the foot, standing like gloomy sentinels or like the gigantic pillars at the entrance of some grand temple. One could almost imagine that the idea of the Gothic style of architecture had been caught from such carvings of nature. In the walls of the lower end of the Grand Cañon are several rows of five-sided basaltic columns arranged in a vertical position, and so regular that they appear to have been carried and placed in the sides of the gorge by human hands.

The Grand Cañon is about 30 miles in length, carved out of the igneous rocks, with walls varying from 1500 to 2000 feet in vertical height. The sides of the walls incline from 45° to 80°, and in many places are vertical and worn into an almost unlimited variety of forms, as pinnacles, towers, spires, etc. But the most striking features are the great variety and brilliancy of the coloring. The pure whites of the decomposed feldspar are mingled with the sulphur-yellows and streaked with bands of bright red, colored with iron.

Besides the Grand Cañon, the objects of the deepest interest to the traveller are the Upper and Lower falls of the Yellowstone. No language can do justice to the wonderful grandeur and beauty of these scenes, and it is only through the eye that the mind can gather anything like an adequate description of them. The two falls are not more than one-fourth of a mile apart. Above the Upper Falls the Yellowstone flows through a grassy meadow-like valley with a calm, steady current, giving no warning until very near the falls that it is about to rush over a precipice 140 feet, and then, within a quarter of a mile, again to leap down a distance of 350 feet or more. After the waters of the Yellowstone roll over the upper descent they flow with great rapidity along the apparently flat, rocky bottom, which spreads out to nearly double its width above the falls, and continues thus until near the lower falls, where the channel again contracts, and the waters seem, as it were, to gather into a compact mass and plunge over the descent of 350 feet in detached drops of foam as white as snow. It is a sight far more beautiful than, though not as grand or impressive as, that of Niagara Falls. A heavy mist always arises from the water at the foot of the falls, so dense that one cannot approach within several hundred yards without being drenched. The yellow, nearly vertical wall on the W. side is covered, for 300 feet or more in height from the bottom, with a dense matting of mosses, sedges, grasses, and other vegetation of the most vivid green, which have sent their small roots into the softened rocks, and are nourished by the ever-ascending spray. From any point of view, these falls, as well as the cañon,

will strike the beholder as among the unique phenomena of the natural world.

At the very source of Yellowstone River is one of the most beautiful sheets of water in the West—Yellowstone Lake. It is about 22 miles in length and from 12 to 15 in breadth. Its shape is peculiar, and has not inaptly been compared to that of the human hand, the various bays or promontories representing the thumb and fingers. Its greatest depth was found, by a series of careful soundings, to be 300 feet. The elevation of the lake above sea-level is 7788 feet. Only four lakes are known to have so great an elevation in any part of the world up to this time—namely, Lakes Titicaca in Peru and Uros in Bolivia, which are respectively 12,874 and 12,359 feet above sea-level: and Lakes Manasasarowak and Rakastal in Thibet, Asia, both of which lie at the great height of 15,000 feet. The shore-line of Yellowstone Lake measures over 300 miles, and it presents some very beautiful curves or indentations in its shores, which have received a variety of names. The western side of the lake is covered with pine forests, as in the southern end, where also there are many lakelets and considerable marshy ground. There are no high mountains in this direction, low, broad hills forming the watershed between the lake and the sources of Snake River. One can cross almost anywhere to the Shoshone Geyser Basin. The eastern side of the lake is also well wooded, but more broken by small open prairies. The country on this side soon rises into a grand mountain-range, from which numerous volcanic peaks rise; prominent among them are Mounts Stevenson and Doane. The interesting localities of the lake on the eastern side are Brimstone Basin, Steam Point, and Steamboat Springs, Turbid Lake, and the springs of Pelican Creek and Sulphur Hills. On the south-western arm also is an interesting group of springs. Brimstone Basin is S. E. of Steam Point, and marks the seat of once active springs, evidenced by the deposits. The stream flowing through them is strongly impregnated with alum. At Steam Point, besides the springs, are several steam-jets. From one the steam escapes with a noise resembling that made by the escape-pipes of a large steamboat. Others resemble the escape of steam from the cylinders of a locomotive. Springs are found on the shore of the lake between Steam Point and Pelican Creek, and along the course of the latter stream. At Turbid Lake, 2 miles E. of the lake and back of Steam Point, the springs are mud-springs and sulphur-vents. The water of the lake itself is made turbid by the springs in its midst and on the shores. Sulphur Hills are between Pelican Creek and the Yellowstone. Sulphur is not characteristic, notwithstanding the name. The period of greatest activity of all the springs here is past, and they are gradually dying out.

The springs on the shore of the south-western arm of the lake occupy an area of about 3 miles in length and half a mile in width. There are no geysers. Some of the springs are found in conical silicious mounds, rising from the water of the lakes near the shore. One of these is named the "Fish Pot," from the fact that while standing on its crater one may extend his fishing-rod, catch trout, and, turning, may cook them in the spring. About 400 yards from the shore is a basin of boiling, pink-colored mud, with conical mud-craters, from which the mud is ejected. There are also a number of clear, flowing springs of hot water, and numerous springs of boiling, muddy water varying in color from white to dark yellow.

Geyser Basins of Fire-Hole River.—The geyser basins of the Upper Madison include, altogether, about 75 sq. m. In this area are thousands of springs and geysers, ranging in temperature from the boiling-point to cold. Their description would occupy the space of a volume. Only the salient features can be given here. The springs are divisible into three classes: (1) True geysers, which are agitated at stated intervals, and from which the water is projected. (2) Those which are constantly agitated or always boiling. They rarely have eruptions; most of the mud-springs can also be included under this division. (3) Those which are always tranquil. In the latter the water is generally of a lower temperature, and has a beautiful blue color or often a green tint like that of the beryl. In springs of the very lowest temperature there is often a low form of gelatinous vegetable growth. Some of the springs of the Lower Basin merit the title of small lakes. They are divided on the maps into eight groups. The first is on the East Fork; the second is about a mile farther to the S., and the third, fourth, and fifth groups still farther S., on the E. side of the basin. In the third group are the Fountain Geyser and the Mud Puffs, both worthy a visit. In the fifth group is the Architectural Geyser, probably the most powerful in the Lower Basin. The sixth group is on the main river, above the mouth of Fairy Fall Creek, the seventh is on the latter stream, and the eighth on Sentinel Creek, a stream joining the Fire-Hole below Fairy Fall Creek. There are but about half a dozen real geysers in the Lower Basin, but craters are seen which must once have been active spouters. The deposits are silicious, as is the case with the Upper Basin. There are many places where the springs are extinct, nothing remaining save the glaring white sediment. The scalloped rims, extending out over the water like cakes of ice, and the corrugated sides of the basin, are exceedingly beautiful. Before leaving the Lower Basin we must visit Fairy Falls, a very pretty miniature cascade at the head of Fairy Fall Creek. From the mouth of the latter creek to the mouth of Iron Spring Creek, which marks the lower boundary of the Upper Basin, the distance is 5 miles in an air line. About midway are the Halfway Springs. The principal one is a huge caldron 250 feet in diameter, with walls about 20 feet high. It is in constant agitation, giving off clouds of steam. On one side the wall is broken down, and thence the surplus water flows into the river through numerous channels, whose beds are lined with scarlet, yellow, and green, which contrast boldly with the white silicious sinter surrounding the spring. Farther back from the river, on a slight eminence, is an almost circular spring 150 feet in diameter.

Upper Geyser Basin.—The Upper Geyser Basin has been called the Great Basin, because it contains the principal geysers. It is about 2 miles long, and will probably average half a mile in width. The best view is obtained from the crater of "Old Faithful," at the upper end. Through the Lower Basin the course of the river is almost due N., while in the upper it flows W. of N. Its banks are made of geyserite, the silicious deposit of the springs, which is literally honeycombed with springs, pools, and geysers that are constantly gurgling, spitting, steaming, roaring, and exploding.

To describe all the remarkable hot springs and geysers of this interesting region would require a volume instead of a brief article, and only a few of the more conspicuous can be noticed. Entering the Upper Basin from the N., the traveller passes a series of rapids, at the upper end of which he enters the gateway, as it were, guarded by two sentinel geysers, one on either side of the river, that on the left being the most active. Following the river for about 250 yards, he reaches the "Fan Geyser," where there are several orifices from which the water radiates, the streams crossing each other and producing a fan-shaped eruption. A short distance above, on the opposite side of the river, is the "Grotto Geyser," which is easily recognized by the peculiar form of its crater, from which it takes its name. There are two orifices, the principal one being in the larger and more irregular mound, which is 8 feet high, while the smaller one is only 4 feet high. The interval between its eruptions is unknown. It throws a column of water and steam from 40 to 60 feet above its crater. Several hundred yards farther back from the river, S. W. from the Grotto, are the "Pyramid," "Punch-Bowl," "Bath-Tub," and "Black Sand" geysers. The "Giant" is about 400 feet S. E. of the Grotto. It has a rough, cone-like crater 10 feet high, with one side broken down. The orifice from which the water is expelled is about 5 feet in diameter. This curious crater is near the river's edge, on a platform of deposit measuring 342 yards in circumference. It has seldom been seen in eruption. Langford gives the height as 140 feet in 1870. It was also in action in 1874, but the height was not measured. Following up the river on the S. W. side, the next geyser observed is the "Castle." It is a cone rising a little over 11 feet above an irregular platform of sinter that measures 75 by 100 feet and is 3 feet high. The orifice of the geyser-tube is 3 feet in diameter and circular, and its throat is lined with large orange-colored globular masses. In 1870 its eruption threw a column of water 140 feet above its crater, continuing three hours. In 1872 the maximum height observed was 93 feet, and the duration fifteen minutes, after which steam escaped with a pulsating movement, the whole display lasting about an hour and twenty minutes. In 1874 the same succession of water and steam was noticed, the former lasting twenty minutes, and attaining an estimated height of 250 feet, and the latter lasting about forty minutes longer. The noise of the eruption is indescribable. After the eruption the exhausted geyser sinks into complete repose. Near the "Castle" is a beautiful blue hot spring, which has been given the fanciful name of "Circe's Boudoir." The water is perfectly transparent, and so intensely blue that one involuntarily plunges his hand in to see if it is water. The basin is of pure white silica, looking like marble. It is about 20 feet in diameter, and has a beautiful and regular scalloped margin. The white basin slopes to a funnel-shaped opening which is 40 feet deep, and here the water is intensely blue, its temperature 180° F.

"Old Faithful," standing at the head of the valley, is so named from the regularity of its spouting. Its mouth is 6

feet by 2, in a silicious mound that rises 11 feet above the general level. On this mound are small basins whose edges are ornamented with bead-like silica. The eruptions commence with a few abortive attempts, followed by a rapid succession of jets, which soon reach the maximum and then subside, only steam escaping from the orifice. The average interval between the eruptions observed in 1872 was one hour two and three-quarter minutes, and the average duration four minutes fifty-three seconds. As observed in 1873, the interval was fifty-six minutes and forty seconds, and the duration four minutes and thirty-three and one-half seconds. The height of the column was estimated at nearly 150 feet. The greatest height measured in 1872, out of seventeen eruptions, was 130 feet. The "Beehive" is on the opposite side of the river, nearly due N. of "Old Faithful," and about 300 yards distant. It is near the river, and readily recognized by its cone, 3 feet high and about 3 feet in diameter. From this cone the water is projected with great force in a steady stream. The column is fan-shaped. No water falls back, but it seems to be all resolved into vapor. The length of the eruptions is from four to fifteen minutes, and the interval unknown. The column rises from 100 to 250 feet. Two hundred yards back of the "Beehive" is the "Giantess," which has a large basin, 23 by 32 feet. It is on the summit of a gently-sloping silicious mound. Its eruptions are very irregular. They last from eight to eighteen minutes. The only eruption measured in 1872 was 69 feet; an immense mass of water was thrown up. Other estimates have given the height as 60, 200, and 250 feet.

Farther down the river and opposite the "Castle," from which it is distant 160 yards, is the "Grand Geyser." One would scarcely take it for an important geyser unless he witnessed one of its spoutings; for, unlike the others, it has no raised crater. Its basin, which is 52 feet in diameter, is depressed a foot below the general level. The mouth of the geyser-tube in the centre measures 4 by 2 feet, and from this, about once in twenty-four hours, a column is thrown to the height of from 175 to 250 feet. The eruption generally consists of three periods, after each of which the water sinks completely out of sight. Near the "Grand" are the "Saw-mill" and the "Turban." The latter is only a few feet from the "Grand," and will be known by the globular masses that look like huge squashes, and are easily seen, lining the sides and bottom of the crater when the water has disappeared from the basin. The eruptions are unimportant. Near the mouth of Iron Spring Creek, on the N. side, is the "Soda Geysers" group.

In the Shoshone Basin, on the W. side of the Great Divide, there is a group of geyser and hot springs not surpassed in beauty and hardly less active than those already noticed in the Fire-Hole. They are located at the extreme western end of the western arm of Shoshone Lake, on Shoshone Creek, up which they extend on either side for about half a mile.

Hot springs are also found on Lewis's Lake and Heart Lake, S. E. of Shoshone Lake, and doubtless they occur in many other localities yet undiscovered.

The probable origin of thermal springs is well known. The hot springs and geysers of Iceland have been studied with very great care by some of the ablest scientific men in Europe, as Bunsen, Bischoff, and Tyndall, and their conclusions have been accepted. The same phenomena as those of Iceland are repeated in New Zealand and the Yellowstone National Park, only on a much more extensive scale. That all thermal springs are remnants of former volcanic action, there can be no doubt. Geysers, or intermittent springs, may be regarded as volcanoes, except that the former throw out heated waters, while the latter eject melted materials, etc. We may take it for granted that the hot springs derive their temperature from heated aqueous vapors rising from below; and the only question which remains to be settled regards the actual sources of these vapors. Shall we adopt the theory that the interior of our globe is in an incandescent state, and that the origin of the heat is deep-seated below the earth's crust, rising from the melted nucleus? or shall we look to a far more superficial source? In the first place, the water of the hot springs is derived from the surface. Passing down through fissures in the earth's crust, it meets the heated vapors from below, and portions being expanded into steam, a force is produced the same as in a steam-engine. If this force can rise freely in a continual column, a simple boiling spring is produced. If the channel or passage upward is complicated, we have the phenomena of the spouting spring. According to Bischoff, the intermittent springs are caused by the existence of caverns in which the heated vapors are retained by the pressure of the column of water from above. The violent escape of the vapor produces the thunder-like, subterranean sound and the tremblings of the earth that precede the eruption. When so much vapor has escaped that the expansive force of that which remains has become less than the pressure of the confining column of water, tranquillity is restored, and this lasts until a quantity of vapor is again collected which is sufficient to produce a fresh eruption. The spouting of the spring is therefore repeated at intervals, depending upon the capacity of the cavern, the height of the column of water, and the heat generated below.

Heights attained by the Eruptions of the Principal Geysers in Fire-Hole Basins, Yellowstone National Park.

Name of geyser.	Authority	Height in feet.
Fountain, in Lower Basin	Hayden, 1871	30 to 60
Architectural, in Lower Basin	Hayden, 1871	60 to 80
Old Faithful, Upper Basin	Hayden, 1871	100 to 150
Old Faithful, Upper Basin	Hayden, 1872	* 132
Old Faithful, Upper Basin	Norton, 1872	150
Old Faithful, Upper Basin	Comstock, 1873	150
Old Faithful, Upper Basin	Dunraven, 1874	100 to 150
Giantess, Upper Basin	Langford, 1870	250
Giantess, Upper Basin	Hayden, 1872	* 39
Giantess, Upper Basin	Norton, 1872	100
Beehive, Upper Basin	Langford, 1870	* 219
Beehive, Upper Basin	Hayden, 1872	100 to 150
Beehive, Upper Basin	Norton, 1872	100
Castle, Upper Basin	Langford, 1870	50
Castle, Upper Basin	Hayden, 1871	10 to 15
Castle, Upper Basin	Hayden, 1872	* 93
Castle, Upper Basin	Comstock, 1873	30
Castle, Upper Basin	Dunraven, 1874	250
Grand, Upper Basin	Hayden, 1871	200
Grand, Upper Basin	Hayden, 1872	* 173
Grand, Upper Basin	Comstock, 1873	200
Turban, Upper Basin	Hayden, 1872	* 25
Turban, Upper Basin	Comstock, 1873	30
Giant, Upper Basin	Langford, 1870	140
Grotto, Upper Basin	Langford, 1870	60
Grotto, Upper Basin	Hayden, 1872	* 41
Grotto, Upper Basin	Comstock, 1873	25

Elevations in the Yellowstone National Park.

	Feet above sea-level.
Mammoth White Mountain Hot Springs	6278 to 7035
Mud Volcanoes	7756 to 7800
Crater Hills Springs	7828 to 7979
Sulphur Springs, on divide between Yellowstone and E. Fork of Fire-Hole River	8246
Lower Geyser Basin	7250 to 7350
Upper Geyser Basin	7300 to 7400
Third Geyser Basin	7772
Shoshone Lake, Geyser Basin	7900

Lakes.

Yellowstone Lake	7788
Shoshone Lake	7870
Lewis Lake	7750
Madison Lake	8301
Henry's Lake	6443

Mountain-Peaks.

	Feet above sea-level.
Mount Hayden	13,833
Mount Washburne	10,388
Mount Sheridan	10,343
Mount Blackmore	10,134
Mount Delano (Yellowstone Valley)	10,200
Mount Doane	10,118
Electric Peak	10,992
Emigrant Peak	10,629
Red Mountain, S. of Yellowstone Lake	9,806
Lookout Hill, N. of Shoshone Lake	8,257
Old Baldy, near Virginia City	9,711

Passes and Divides.

Teton Pass	8,464
Tyghee Pass	7,063
Reynolds's Pass, Henry's Lake, N. to Madison River	6,911
Divide, Yellowstone and Gallatin, on road from Fort Ellis to Boteler's Ranch	5,721
Divide on Mount Washburne where trail crosses	9,155
Divide between Yellowstone and Madison, on trail from Mud Volcanoes and Geyser Basins	8,164
Divide between Madison and Shoshone lakes	8,717
Divide between Yellowstone and Lewis lakes	8,024
Togwater Pass (Upper Yellowstone to Wind River)	9,621

Analysis of Deposit from the Hot Springs of Gardiner's River.

Water and volatile matters	32.10 per cent.
Lime	57.70 "
Silica	3.32 "
Ferric oxide	3.62 "
Alumina	3.31 "
Soda and magnesia	traces.
	105.05 per cent.

Analysis of Geyserite from Lower Geyser Basin.

Water, etc.	9.00 per cent.
Silica	88.60 "
Alumina and iron	1.60 "
Lime	0.95 "
Magnesia, soda, potash, and lithia	traces.
	100.15 per cent.

* Measured by triangulation; the others are estimated.

Analysis of Pink Mud from Mud-Puffs in Lower Geyser Basin.

Water	8.65 per cent.
Silica	44.61 "
Alumina	45.09 "
Magnesia	2.66 "
Iron	1.86 "
Lime and soda	traces.
	102.87 per cent.

Analysis of Geyserite from Upper Geyser Basin.

Water	13.42 per cent.
Silica	79.56 "
Lime	1.54 "
Alumina	0.46 "
Magnesia	1.78 "
Iron, chlorine, and soda	traces.
	96.76 per cent.

Analysis of Geyserite from Shoshone Lake, Geyser Basin.

Water	13.00 per cent.
Silica	76.80 "
Alumina	9.46 "
Lime	1.80 "
Iron, magnesia, and soda	traces.
	101.06 per cent.

As has been previously stated, during the session of 1871–72 a bill was introduced into both houses of Congress to set apart the area about the sources of the Yellowstone and Missouri rivers, embracing these wonderful curiosities, as a public park for the benefit and instruction of the people. The bill was referred to the committee on public lands. At their request the writer prepared the following report, which explains the object of the bill, and on the strength of the information therein contained the bill became a law: "The committee on the public lands, having under consideration bill H. R. 764, would report as follows: The bill now before Congress has for its object the withdrawal from settlement, occupancy, or sale, under the laws of the U. S., a tract of land 55 by 65 miles about the sources of the Yellowstone and Missouri rivers, and dedicates and sets it apart as a great national park or pleasure-ground for the benefit and enjoyment of the people. The entire area comprised within the limits of the reservation contemplated in this bill is not susceptible of cultivation with any degree of certainty, and the winters would be too severe for stock-raising. Whenever the altitude of the mountain districts exceeds 6000 feet above tide-water, their settlement becomes problematical unless there are valuable mines to attract people. The entire area within the limits of the proposed reservation is over 6000 feet in altitude, and the Yellowstone Lake, which occupies an area 15 by 22 miles, or 330 sq. m., is 7427 feet. The ranges of mountains that hem the valleys in on every side rise to the height of 10,000 and 12,000 feet, and are covered with snow all the year. These mountains are all of volcanic origin, and it is not probable that any mines or minerals of value will ever be found there. During the months of June, July, and August the climate is pure and most invigorating, with scarcely any rain or storms of any kind, but the thermometer frequently sinks as low as 26°. There is frost every month of the year. This whole region was in comparatively modern geological times the scene of the most wonderful volcanic activity of any portion of our country. The hot springs and the geysers represent the last stages—the vents or escape-pipes—of these remarkable volcanic manifestations of the internal forces. All these springs are adorned with decorations more beautiful than human art ever conceived, and which have required thousands of years for the cunning hand of nature to form. Persons are now waiting for the spring to open to enter in and take possession of these remarkable curiosities, to make merchandise of these beautiful specimens, to fence in these rare wonders so as to charge visitors a fee, as is now done at Niagara Falls, for the sight of that which ought to be as free as the air or water. In a few years this region will be a place of resort for all classes of people from all portions of the world. The geysers of Iceland, which have been objects of interest for the scientific men and travellers of the entire world, sink into insignificance in comparison with the hot springs of the Yellowstone and Fire-Hole basins. As a place of resort for invalids it will not be excelled by any portion of the world. If this bill fails to become a law this session, the vandals who are now waiting to enter into this Wonderland will in a single season despoil, beyond recovery, these remarkable curiosities which have required all the cunning skill of nature thousands of years to prepare. We have already shown that no portion of this tract can ever be made available for agricultural or mining purposes. Even if the altitude and the climate would permit the country to be made available, not over 50 sq. m. of the entire area could ever be settled. The valleys are all narrow, hemmed in by high volcanic mountains like gigantic walls. The withdrawal of this tract, therefore, from sale or settlement takes nothing from the value of the public domain, and is no pecuniary loss to the government, but will be regarded by the entire civilized world as a step of progress and an honor to Congress and the nation.

'DEPARTMENT OF THE INTERIOR,
'WASHINGTON, D. C., January 29, 1872.

'SIR: I have the honor to acknowledge the receipt of your communication of the 27th instant, relative to the bill now pending in the House of Representatives dedicating that tract of country known as the Yellowstone Valley as a national park. I hand you herewith the report of Dr. F. V. Hayden, U. S. geologist, relative to said proposed reservation, and have only to add that I fully concur in his recommendations, and trust that the bill referred to may speedily become a law.

'Very respectfully, your obedient servant,
'C. DELANO, *Secretary.*

'Hon. M. H. DUNNELL, *House of Representatives.*'

The committee therefore recommend the passage of the bill without amendment."

The law which was passed by Congress in relation to the Yellowstone National Park reads as follows: "*An Act to set apart a certain tract of land lying near the head-waters of Yellowstone River as a public park. Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled,* That the tract of land in the Territories of Montana and Wyoming, lying near the head-waters of Yellowstone River, and described as follows—to wit, commencing at the junction of Gardiner's River with Yellowstone River, and running E. to the meridian passing 10 miles to the eastward of the most eastern point of Yellowstone Lake; thence S. along said meridian to the parallel of latitude passing 10 miles S. of the most southern point of Yellowstone Lake; thence W. along said parallel to the meridian passing 15 miles W. of the most western point of Madison Lake; thence N. along said meridian to the latitude of the junction of Yellowstone and Gardiner's rivers; thence E. to the place of beginning—is hereby reserved and withdrawn from settlement, occupancy, or sale under the laws of the U. S., and dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people; and all persons who shall locate or settle upon or occupy the same, or any part thereof, except as hereinafter provided, shall be considered trespassers and removed therefrom. *Sec. 2.* That said public park shall be under the exclusive control of the secretary of the interior, whose duty it shall be, as soon as practicable, to make and publish such rules and regulations as he may deem necessary or proper for the care and management of the same. Such regulations shall provide for the preservation, from injury or spoliation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition. The secretary may, in his discretion, grant leases for building purposes, for terms not exceeding ten years, of small parcels of ground, at such places in said park as shall require the erection of buildings for the accommodation of visitors; all of the proceeds of said leases, and all other revenues that may be derived from any source connected with said park, to be expended under his direction in the management of the same and the construction of roads and bridle-paths therein. He shall provide against the wanton destruction of the fish and game found within said park, and against their capture or destruction for the purposes of merchandise or profit. He shall also cause all persons trespassing upon the same after the passage of this act to be removed therefrom, and generally shall be authorized to take all such measures as shall be necessary or proper to fully carry out the objects and purposes of this act. Approved Mar. 1, 1872." F. V. HAYDEN.

Yellowstone Valley. See YELLOWSTONE NATIONAL PARK.

Yel'lowthroat, the *Geothlypis trichas*, a very common warbler of the family Sylvicolidæ. This familiar little bird is found in nearly every part of North America. Its throat and breast are yellow, and its song is quite pleasant.

Yellow Water River rises in the S. E. of Alabama, and after a S. W. course reaches Pensacola Bay in Santa Rosa co., Fla.

Yellow-Wood, the valuable yellow timber of *Oxleya xanthoxyla*, a noble cedrelaceous tree of Eastern Australia. Also the wood of *Cladrastis tinctoria* (*Olim Virgilia*), a beautiful leguminous tree, a native of Tennessee and Kentucky.

Yell'ville, p.-v., Union tp., cap. of Marion co., Ark. P. 96.

Yemassee', p.-v. and tp., Beaufort co., S. C. P. 2778.

Yemassees, or **Savannahs.** See SHAWNEES.

Yem'en [Arab. *Yaman*, signifying (1) "the right hand or side;" (2) "the south," to one looking E.; (3) "fortunate, happy," corresponding to the Gr. Εὐδαίμων, and the

Lat. *Felix*], the south-western province of the Arabian peninsula, bounded N. by Hedjaz (including Mecca and Medinah), E. by Hadramaut and the great central desert, S. by the Indian Ocean, and W. by the Red Sea. It consists in part of a maritime belt of lowland from 10 to 30 miles in breadth, mostly sandy and sterile, but in some places tropically fertile; in part of high table-land some 4000 feet above the sea; and between these two, running N. and S., a chain of heavily-wooded mountains, some of whose peaks are said to be from 6000 to 8000 feet high. Amongst these mountains are well-watered valleys and terraced slopes of marvellous fertility. With no definite eastern boundary, the area can be only roughly estimated. Between Hali and Bab el-Mandeb there is a coast-line of about 500 miles, and, allowing a breadth of 150 miles, there would be in all not far from 70,000 sq. m. of territory. As to population, the Turkish (governmental) estimate for Hedjaz and Yemen together is 1,134,375, more than half belonging probably to Yemen. The nominal capital, formerly Hodeida on the Red Sea, is now Sanaa (100 miles inland), whose hereditary imam, subject to Turkey, shares dominion with numerous chieftains more or less independent and powerful. The principal port is Aden (ancient *Adane*), seized by Great Britain Jan. 11, 1839, and now her Asiatic Gibraltar. Other ports are Mocha, famous for the coffee which it exports, Loheia, and Aboo-Arish. Zobid, a place of some 7000 inhabitants, the seat of a Sunnite college, is on the plain (Tehama), 15 miles from the mouth of one of the very few permanent rivers of the country. Beit el-Fakih, with a population of some 8000, is also on the plain. Of highland towns, besides Sanaa, the capital, the most important are Taiz, Dhamar, the seat of a Saydi college, Marib, Khamir, and Saadeh. The principal exports are coffee, gums, wax, dates, senna, tamarinds, ivory, morocco, and some grain. The history of Yemen reaches back into a remote antiquity. The earliest inhabitants are supposed to have been of the Hamitic race, descended perhaps from Seba and Sheba, son and grandson of Cush (Gen. x. 7). Descendants of the Semitic Sheba (Gen. x. 28) came in afterward; and out of the amalgamation of these two peoples grew up the famous Himyarite kingdom, which dates probably from about 700 B. C. The high civilization of this ancient kingdom is attested by hundreds of inscriptions just beginning to be translated, by coins, and works of art. The bursting of a cyclopean dike near Marib about 120 A. D. led to important changes, great masses of people moving northward toward Syria. About 275 A. D. the king, Abd Kelal, became a Christian, but apparently without effecting the conversion of his people. In 356 A. D. an embassy was sent by Constantius, which resulted in the mission of Theophilus, the conversion of the king, and the building of three churches (Philostorgius, *H. E.* iii. 4). The kingdom was conquered by the Abyssinians 525 A. D., by the Persians 575–97 A. D., and in 628 A. D. submitted to Mohammed. The Turks have been there with but little interruption since 1538 A. D. R. D. HITCHCOCK.

Yenika'le, or **Jenikale,** the ancient *Cimmerius Bosporus*, is the strait connecting the Sea of Azof with the Black Sea. It is 20 miles long, in some places only 2 miles broad, and very shallow.

Yenise'i, or **Jenisei,** the principal river of Northern Asia, rises in Mongolia in lat. 51° N., lon. 98° E., flows northward through Siberia, and enters the Arctic Ocean in lat. 72° 30′ N., lon. 85° E. Its length is about 2500 miles.

Yeniseisk', or **Jeniseisk,** government of Asiatic Russia, extending on both sides of the Yenisei, between lon. 80° and 107° E., comprises an area of about 958,012 sq. m., with 350,848 inhabitants. The southern part is mountainous, rich in precious metals and forests: almost all the settled tracts of the government are situated here. The northern part is a frozen swamp, and the vast plain, sloping down from the mountains to the ocean, is inhabited only by a few tribes of Toongooses, Yakoots, and Samoyeds, who live as hunters or by their herds of reindeer. Cap. Yeniseisk.

Yeniseisk, or **Jeniseisk,** town of Asiatic Russia, government of the same name, on the Yenisei, in lat. 58° 27′ N., has important gold-washings, and in August a fair at which the larger part of the Siberian fur-trade is concentrated. P. about 6000.

Yeo (Sir JAMES LUCAS), b. at Southampton, England, in 1782; entered the British navy at an early age; distinguished himself in various engagements, especially by the capture of Cayenne, and commanded the British fleet on the lakes during the war of 1812–15. D. in 1819.

Yeo'manry Cav'alry, a body of British volunteers, not reckoned as militia, and liable to duty only in Great Britain. They can be called out to assist the civil power or to serve against an invader. There was formerly a body of yeomanry infantry. The yeomanry were first organized in 1797.

Yeo'men of the Guard, properly "His (or Her) Majesty's Body guard of the Yeomen of the Guard," popularly called "Beefeaters" (*buffetiers*, "sideboard-men," since they serve at some state dinners at the sideboard), a body of 100 veteran soldiers, commanded by a captain (a nobleman), a lieutenant, an ensign, an adjutant, and four exons, all old soldiers. They were instituted in 1485 by Henry VII., are quartered in the Tower, armed with partisans, and wear the quaint garb of the fifteenth century.

Yeo'vil, town of England, county of Somerset, on the Yeo, carries on extensive glove manufactures, engaging over 2000 men, besides women and children. P. 7957.

Yes'digerd III., the last king of Persia of the dynasty of the SASSANIDÆ (which see), b. in 617 A. D., and ascended the throne in 632. In 636 he fought the great battle of Cadesia with the Mohammedan invaders. It lasted four days, but Yesdigerd was defeated, and in 637 his capital, Ctesiphon, was taken by the Arabs. A new Persian army was organized, but in 641 it was almost completely dispersed at Nehavend, and all Persia was conquered by the caliph. Yesdigerd fled, and lived for ten years as a fugitive, but in 651 was assassinated by one of his own attendants.

Yes'so, an island of Japan, between lat. 41° 24′ and 45° 31′ N., and between lon. 139° 40′ and 146° 7′ E., separated N. from Saghalien by La Pérouse Strait, and S. from the main island by the Strait of Tsugaru. Its area is estimated at 30,000 sq. m.; its pop. at 125,000. Before the establishment of the present Japanese government the whole interior part of the island was unknown and uninhabited. On the southern coast some Japanese colonies were fixed, and the northern part was occupied by the Ainos, a peculiar race, probably of Tungusian descent, numbering about 20,000, who have domesticated the bear, and show considerable shrewdness and flexibility of mind in their dealings with the Russians and the Japanese. Roads have since been opened through the interior; Japanese, Chinese, European, and American colonies have been established, and the rich resources of the island have begun to be developed. The surface is mountainous and the soil volcanic. Active volcanoes, solfataras, and hot springs are frequent; coal, petroleum, salt, sulphur, etc. abound. The mountains are covered with forests containing excellent timber and swarming with bears, wolves, and deer. The principal towns are Matsmai, the capital, and Hakodadi.

Yew [Ang.-Sax. *eow*], the common name of evergreen coniferous trees of the genus *Taxus*, and sometimes extended to others of the family Taxeæ. Thus, TORREYA (which see) is called stinking yew, etc. The common yew tree (*T. baccata*) of Europe and N. W. America is often planted in churchyards, and, like the cypress and willow, has a funereal character, well supported by its gloomy appearance. Its leaves and seeds are poisonous. Its tough wood was once in great repute for bows: it is very hard, elastic, and durable. The tree is famous for its longevity. Of its varieties, the Irish yew is the finest. Among our American yews, *T. Floridana* considerably resembles the foregoing. It grows wild in W. Florida. *T. Canadensis* is a prostrate sort, very common northward.

Yezd, or **Jesd,** town of Western Persia, in lat. 32° 10′ N., lon. 56° E., in a small oasis watered by the river Mehris, and producing excellent grapes, figs, and melons; grain has to be brought from Ispahan. It has manufactures of velvet and silk stuffs, and its extensive bazaars are well stocked, as it is a gathering-place for many caravans. Among its inhabitants are several Parsees (fire-worshippers), and many Jews who live in the most abject condition, hated, despised, and persecuted by the Mohammedans. P. about 40,000.

Yezidees. See DEVIL-WORSHIPPERS.

Ygdrasil, in Scandinavian mythology, the name of a wonderful world-tree, an ash, whose roots were fastened in the deepest bottom-ground of the universe, while its branches spread far above the highest heavens. Under its three roots sprang three sacred fountains, the sources of all virtues, and from its leaves fell drops of honey-dew, the sweetest of all blessings. In its top sat an eagle; at its foot lay a serpent; up and down its trunk ran a squirrel trying to make strife between the eagle and the serpent. What was meant nobody knows, or probably ever knew. The whole myth, as related in the old Icelandic poems, is wild, vague, and formless—like many other elements of the Scandinavian mythology, the unfinished product of an imagination which overreached itself in attempting to give definite form to what was only a dumb feeling; and the manifold speculations which N. F. S. Grundtvig, N. M. Petersen, Jacob Grimm, and others have attached to it are no doubt more interesting than true. C. PETERSEN.

Y'lang-Y'lang. See IHLANG-IHLANG.

Yoa'kum (HENDERSON K.), b. in Claiborne co., Tenn., in 1810; graduated at West Point 1832; entered the 3d Artillery; resigned 1833; was a lawyer in Tennessee 1835–45; was a member of the State senate 1839; settled at Huntsville, Tex., 1845; was lieutenant of Texan Rangers in the Mexican war; contributed to periodicals, and wrote *History of Texas* (2 vols., 1855). D. at Houston Nov. 29, 1856.

Yo'der, tp., Cambria co., Pa. P. 1632.

Yo'ga, the name of one of the two divisions of the Sânkhya philosophy of the Hindoos, of which the first, the *Sânkhya* proper, teaches the principles and successive development of the creation, while the second, the *Yoga*, contains the doctrines of the Supreme Being, and explains the means by which the human soul may enter into union with him.

Yokohama. See JAPAN.

Yo'kum Sta'tion, tp., Lee co., Va. P. 1822.

Yolk of Egg. See YELK.

Yol'land (WILLIAM), R. E., b. in England in 1810; educated at the Royal Military Academy, Woolwich; was commissioned second lieutenant of royal engineers 1828; served in Canada 1830–35; was employed at the Tower of London in the map-office of the ordnance survey of Great Britain and Ireland 1838–52, being executive officer at the Tower and at Southampton from 1840; was transferred on the same service to Phœnix Park, Dublin, 1852, and to Enniskillen 1853; became one of the inspectors of railways under the board of trade 1854, and was engineer member of the commission appointed in 1856 by the secretary at war to consider the best mode of reorganizing the system for training officers for the scientific corps, "in order that patronage should be altogether abolished, and that admission to those corps should be obtained only by an open competing examination;" visited France, Prussia, Austria, and Italy with that commission, which prepared an elaborate *Report* published by Parliament; became lieutenant-colonel of engineers 1855, and was brevetted colonel 1858. He published the *Astronomical Observations* made with Ramsden's zenith sector, and subsequently those made with Airy's sector, from 1842 to 1850, for the determination of the latitudes of various trigonometrical stations in Great Britain and Ireland, and wrote the *Treatise on Geodesy* in the *Course of Mathematics for the Royal Military Academy.*

Yo'lo, county of W. California, bordering on the N. W. on the Coast Range, and on the E. on Sacramento River, by whose affluents it is watered, and traversed by California Pacific R. R. The surface is level in the E., undulating in the centre, rising in the W. to the lower slopes of the Coast Range; soil remarkably productive. Horses, mules, cattle, sheep, and swine are numerous. Staples, wheat, barley, hay, and wool. Cay. Woodland. Area, 1150 sq. m. P. 9899.

Yolo, p.-v., Yolo co., Cal.

Yonge (CHARLES DUKE), b. at Eton, England, in Nov., 1812; educated at Eton College, where his father was one of the masters; graduated at Oxford 1835; became professor of history and English literature in Queen's College, Belfast; compiled several classical textbooks, including a valuable *English-Greek Lexicon* (1849), edited in the U. S. by Profs. Charles Short and Henry Drisler (New York, 1870), a *Phraseological Dictionary* (1855–56), a *Dictionary of Latin Epithets* (1856), and an edition of *Virgil* (1862); translated for "Bohn's Classical Library" the works of Diogenes Laertius, Athenæus, Ammianus Marcellinus, and 6 vols. of Cicero; also for the "Ecclesiastical Library" the *Works* of Philo Judæus (4 vols., 1854–55), and is author of a *History of England* (1857), *Parallel Lives of Ancient and Modern Heroes* (1858), a *Life of Wellington* (2 vols., 1860), a *History of the British Navy* (2 vols., 1863), a *History of France under the Bourbons* (4 vols., 1866–67), a *Life of the Earl of Liverpool* (3 vols., 1868), *Three Centuries of Modern History* (1872), a *History of the English Revolution of 1688* (1874), a *Life of Marie Antoinette* (3 vols., 1876), and other works. He enjoys since 1859 a pension of £70 per annum for valuable literary services.

Yonge (CHARLOTTE MARY), b. at Otterbourne, Hampshire, England, in 1823; has published more than thirty novels, usually characterized by "High-Church" religious tendencies, several works of history and biography, chiefly for the young, and some miscellaneous works. The most popular of her novels were *The Heir of Redclyffe* (2 vols., 1853; 17th ed., illustrated, 1868) and *Daisy Chain, or Aspirations* (2 vols., 1856; 9th ed., illustrated, 1868). The profits of the former were largely devoted to fitting out for Bishop Selwyn of New Zealand the missionary schooner Southern Cross, and those of the latter work, amounting to £2000, were devoted to the erection of a missionary college at Auckland, New Zealand. Among her historical and miscellaneous books are *The Kings of England* (1848; 7th ed. 1862), *Landmarks of History, Ancient, Middle Ages, and Modern* (3 vols., 1852–57), *Cameos from English History* (1868), *Stories of English History* (1874), *The Book of Golden Deeds* (1864), *The Book of Worthies* (1869), *The History of Christian Names* (2 vols., 1863), *The Story of English Missionary Workers* (1871), and *The Life of John Coleridge Patteson, Missionary Bishop of the Melanesian Islands* (2 vols., 1873). She was joint author, with Miss Elizabeth M. Sewell, of *Historical Extracts* (1868).

Yon'kers, city and tp., Westchester co., N. Y., located on the E. bank of Hudson River, 17 miles from New York. Hudson River R. R. passes through Yonkers on the bank of the river, and has 18 trains each way stopping daily; 4 steamboats also land each way daily. It is built on a series of hills, the principal one being on the northern side. Between that and the southern and eastern elevations there is a small river called the Nepperhan, which gives eight valuable water-powers within a distance of 1 mile, on the banks of which are located 3 wool hat factories, 4 large buildings devoted to carpet-making, 1 brewery, the Eagle Pencil Co.'s works, and 3 silk-factories. The other manufacturing establishments are the Clipper Mower and Reaper Co.'s works, elevator-works, where is also made the new Haymaker mowing-machine, a machine tool-factory, the Yonkers Barrel Co., and 2 gas companies. Yonkers has 14 churches, 2 missions, 2 national banks, 2 savings banks, a large number of public and private schools, a public reading-room, and 3 weekly newspapers. An excellent supply of pure water has been introduced at an expense of about $600,000. The assessed valuation of the real estate in 1875 was $20,906,904. The city proper is mainly occupied with first-class residences, and private residences crown the heights on the N. side of the city. Many of these residences are owned and occupied by merchants doing business in New York. The prosperity of the city arises from its large manufacturing interests. The police department is most efficient, and consists of some 30 men, 8 of whom are mounted. A thorough patrol is maintained day and night. Numerous street stations, as well as a large number of private houses, the banks, and many offices, are in telegraphic communication with police headquarters, which in turn is in full communication with the New York City police telegraph. The venerable building, the property of the Phillipse family prior to the Revolution, built in 1752 (the bricks were imported from Holland), and still in a fine state of preservation, was a few years ago purchased for public use, and has been judiciously altered in the interior to accommodate a number of the public officers. Care has been taken to preserve the old style of ornamentation, and one of the ancient tiled fireplaces is in a good state of preservation. P. 18,357.

M. F. ROWE, ED. "YONKERS STATESMAN."

Yonne, department of North-eastern France, is situated on both sides of the river Yonne, and comprises an area of 2781 sq. m., with 363,608 inhabitants. The surface is undulating and the soil very fertile, producing wheat and vegetables in large quantities, excellent wine, and fine forests and pastures. Iron, ochre, marble, and lithographic stones are produced, and different kinds of manufactures carried on. Of 42,234 children of school age, 4672 remained without any school education in 1857. Cap. Auxerre.

York, or **Yorkshire,** county of England, extending along the North Sea from the mouth of the Tees in the N. to the estuary of the Humber in the S., comprises an area of 5710 sq. m., with 2,436,113 inhabitants, and is divided into three ridings—North, East, and West Riding—each with its own military and civil jurisdiction, lord lieutenant, and public buildings. The surface is greatly diversified, but the soil is everywhere fertile, and has been rendered still more productive by a most careful cultivation. The northern part is mountainous, and contains the highest mountains of England. Here are excellent pastures, rich mines of alum and lead, and extensive quarries of marble. The central part is a broad valley stretching from N. to S. and well suited for agriculture; wheat of superior quality is raised here. Extensive coal-beds are found in several places, and a manufacturing industry of the greatest importance is carried on in Leeds, Sheffield, and other large towns of the county.

York [Lat. *Eboracum*], capital of Yorkshire, at the confluence of the Ouse and the Foss, is one of the oldest and—on account of its monuments—most interesting cities of England. It is surrounded with walls, and generally closely built, with narrow streets and curious, old-fashioned houses. Its cathedral, built from the eleventh to the fourteenth century, is one of the finest specimens of Gothic architecture in the world. It is built in the form of a cross, 524 feet long, 250 feet broad across the transepts, with a square,

massive tower, 235 feet high, rising over the crossing, and two elegant towers, 196 feet high, flanking the western front. Many of its other churches and public buildings are also fine edifices, and it has good educational, scientific, and literary institutions. Its manufactures and trade are not important. It is the seat of the archbishop of York, whose residence is at Bishopthorpe, a short distance from the city, while the old archiepiscopal palace, N. of the cathedral and built in the twelfth century, is used as a library. In the time of the Romans, York was the seat of the general government for the whole province of Britannia; Septimius Severus and Constantius Chlorus died here, and here Constantine the Great was proclaimed emperor. In the Saxon period it was the capital of Northumbria, and afterward of Deira, and in connection with the Scots and the Danes it offered a fierce resistance to William the Conqueror, who after taking it razed it to the ground. It was only partially rebuilt, and suffered much by fire in 1137. In 1644 it was captured by Fairfax, and in 1688, James II. took away its charter to compel it to yield to his arbitrary measures. P. 43,796.

York, county of New Brunswick, traversed by the navigable river St. John, and in part bounded on the S. W. by Maine. Its central portion is very fertile, but large tracts are barren, except of timber. It is traversed by Fredericton Railway. Cap. Fredericton. P. 27,140.

York, county of Ontario, Canada, extending N. from Lake Ontario to Lake Simcoe. It is fertile, especially in the southern and central parts, and has large lumber interests. It is traversed by various railroads, centring at Toronto, the county-seat. P., inclusive of Toronto, 115,974.

York, county of S. W. Maine, lying on the Atlantic Ocean, bordering on New Hampshire, drained by Salmon Falls, Piscataqua, Saco, and other streams, and traversed by several railroads. The surface is very uneven—rugged and sterile near the sea-coast, and only moderately fertile in the interior. There are more than 400 manufacturing establishments, among which are boots and shoes, boxes, brick, carriages, clothing, cotton goods, flour-mills, furniture, leather, machinery, prints, saw-mills, shipyards, woollens, and worsted goods. Cattle, horses, and sheep are the chief live-stock. Staples, manufactured articles, wool, lumber, hay, Indian corn, potatoes, and dairy products. Cap. Alfred. Area, 878 sq. m. P. 60,174.

York, county of S. E. Nebraska, intersected by the Middle and W. forks of Big Blue River; surface undulating, soil productive. There is very little live-stock. Staples, wheat, Indian corn, and potatoes. Cap. York. Area, 576 sq. m. P. 604.

York, county of S. E. Pennsylvania, bordering on Maryland, bounded N. E. by Susquehanna River, and traversed by Northern Central R. R. and its branches, and along its E. border by Susquehanna Canal. The surface is generally hilly, and in the W. part mountainous, with extensive quarries of limestone, sandstone, and slate. There are more than 1000 manufacturing establishments, among which are agricultural implements, bricks, carriages, cigars, flour-mills, furniture, iron, lime, leather, paper, machinery, rag carpets, railway cars, saw-mills, stone and earthen ware, whips, and woollen goods. Horses, cattle, and swine are numerous. Staples, manufactured articles, wheat, Indian corn, oats, tobacco, hay, and dairy products. Cap. York. Area, 864 sq. m. P. 76,131.

York, county of N. South Carolina, bordering on North Carolina, drained by Catawba and Broad Rivers, and traversed by Charlotte Columbia and Augusta, King's Mountain, and Atlanta and Richmond Air-line R. Rs. The surface is hilly, in parts mountainous, abounding in iron ore and manganese; gold has been found in considerable quantities. There are flour-mills and manufactories of carriages and forged and rolled iron. Live-stock not numerous. Staples, cotton and Indian corn. Cap. Yorkville. Area, about 800 sq. m. P. 24,286.

York, county of S. E. Virginia, lying on the peninsula formed by James and York rivers, and bounded E. by Chesapeake Bay; surface undulating, soil originally fertile. Swine and cattle are the chief live-stock. Staples, corn and potatoes. Cap. Yorktown. Area, 150 sq. m. P. 7198.

York, tp., Carroll co., Ill. P. 1490.

York, p.-v. and tp., Clark co., Ill. P. 1090.

York, tp., Du Page co., Ill. P. 1799.

York, tp., Benton co., Ind. P. 433.

York, tp., Dearborn co., Ind. P. 986.

York, tp., Elkhart co., Ind. P. 906.

York, tp., Noble co., Ind. P. 1041.

York, tp., Steuben co., Ind. P. 857.

York, tp., Switzerland co., Ind. P. 995.

York, tp., Iowa co., Ia. P. 554.

York, tp., Pottawattomie co., Ia. P. 226.

York, tp., Tama co., Ia. P. 1000.

York, p.-v. and tp., York co., Me. P. 2654.

York, p.-v. and tp., Washtenaw co., Mich. P. 1575.

York, tp., Fillmore co., Minn. P. 819.

York, tp., Putnam co., Mo. P. 1481.

York, p.-v., cap. of York co., Neb.

York, p.-v. and tp., Livingston co., N. Y. P. 2561.

York, tp., Athens co., O. P. 2652.

York, tp., Belmont co., O. P. 1508.

York, tp., Darke co., O. P. 797.

York, tp., Fulton co., O. P. 2229.

York, tp., Medina co., O. P. 886.

York, tp., Morgan co., O. P. 916.

York, tp., Sandusky co., O. P. 2091.

York, tp., Tuscarawas co., O. P. 1041.

York, p.-v. and tp., Union co., O. P. 1361.

York, tp., Van Wert co., O. P. 983.

York, city and tp., cap. of York co., Pa., on both sides of Codorus Creek, and on Northern Central and the Frederick division of Pennsylvania R. Rs., 100 miles W. of Philadelphia, contains 21 churches, a public library, an academy, collegiate institute, and excellent public schools, 6 banks, an orphan asylum, 2 daily, 8 weekly, and 2 monthly newspapers, several foundries, car and coach manufactories, agricultural works, match, shoe, and whip factories, excellent water-supply, an efficient volunteer fire department, and several minor manufacturing interests. It is the W. terminus of Peachbottom R. R. P. of city, 11,003; of tp. exclusive of city, 2591.

JOHN B. WELSH, ED. "YORK DAILY."

York, tp., York co., S. C. P. 3200.

York, tp., Dane co., Wis. P. 1068.

York, tp., Green co., Wis. P. 1088.

York, Cardinal. See STUART (HENRY BENEDICT).

York (DUKES OF), a title formerly conferred upon younger sons of the kings of England, some of whom have come to the throne through the decease of their elder brothers. The first duke was Edmund Plantagenet, fifth son of Edward III., and from him were descended the princes who after the many vicissitudes of the wars of the Roses became kings under the titles of Edward IV., Edward V., and Richard III. The title was held by Charles I. and James II. before their accession to the throne, was bestowed by the latter upon his second son, Henry Benedict, known as Cardinal York, the last of his family, and was last held by Frederick, second son of George III. (b. Aug. 16, 1763; d. Jan. 5, 1827), who became distinguished as a general in the wars against Napoleon.

York and Lancaster, Wars of. See ROSES, WARS OF THE.

Yorke. See HARDWICKE, EARLS OF.

Yorke (CHARLES), brother of Philip, second earl of Hardwicke, b. in England Dec. 30, 1722; became a lawyer; sat in Parliament for the University of Cambridge; was appointed solicitor-general 1756; was attorney-general 1762–63 and 1765–70, and was elevated to the dignity of lord high chancellor, by the title of Baron Morden, Jan. 17, 1770, but d. by suicide three days later, Jan. 20, 1770. He was one of the authors of the celebrated *Athenian Letters* (1741–43), and wrote some legal treatises.

Yorke (Sir CHARLES), b. Dec., 1790; educated at Winchester; entered the British army as ensign Jan. 22, 1807, and served with the 52d regiment in the Peninsula, and was present at the battles of Vimiera, Fuentes d'Onor, Salamanca, Vittoria, Pyrenees, Nivelle (wounded), Nives, and Orthes (severely wounded); participated in the sieges of Ciudad Rodrigo and Badajoz, and wounded at the latter; also served in the campaign and battle of Waterloo. In the Kaffir war (1852–53) he served at the Cape of Good Hope. For Badajoz he has received the war-medal with ten clasps. In 1863 he was transferred from the colonelcy of the 33d Foot to be colonel-commandant of the rifle brigade. In 1871 he became a general in the British army.

York River, the noble tidal estuary of Mattapony and Pamunkey rivers, which unite at West Point, Va., whence it extends eastward 40 miles to Chesapeake Bay. On York Spit, at its entrance, stands an iron screw-pile lighthouse in water 12½ feet deep at low tide, and built on fourteen piles, showing a fixed red light; lat. 37° 12′ 31″ N., lon. 76° 14′ 57″ W.

York'shire, p.-v. and tp., Cattaraugus co., N. Y. P. 1575.

York Springs, b., Adams co., Pa. P. 356.

York'town, tp., Henry co., Ill. P. 659.

Yorktown, p.-v. and tp., Westchester co., N. Y. P. 2625.

Yorktown, p.-v. and cap. of York co., Va., on York River, notable from the two sieges which it has sustained. P. about 1000. On Aug. 1, 1781, Lord Cornwallis posted himself here with a force of something more than 8000 men, supported by several frigates and other vessels which were anchored in York River, fortifying his position by strong redoubts and batteries on the land-side, and by a line of batteries along the river; also strongly fortifying Gloucester Point on the opposite side of the stream. In the latter part of September the combined American and French forces under Washington and La Fayette, numbering about 16,000 men, invested Yorktown. On Oct. 9 the first parallel was established, and fire was opened, by which several of the British guns were dismounted, and on the following evening a frigate and three large transports were destroyed. On the 11th the second parallel was opened, and as the besiegers were annoyed by an enfilading fire from two redoubts, a successful attack was made upon them on the night of the 14th, and the captured works were included in the parallel. A large French fleet under Count de Grasse in the mean while prevented Cornwallis from receiving the reinforcements which were sent to him by Sir Henry Clinton from New York. On the 16th he made an ineffectual sortie, and on the next day offered to capitulate. The terms having been agreed upon, on the 19th he surrendered his whole force, consisting of 7247 regular troops, 840 sailors, with 235 guns; the entire British loss in killed, wounded, and missing was about 550; that of the Americans and French, about 300. This surrender virtually brought the war of the Revolution to a close.—The second siege of Yorktown was during the civil war. Gen. Magruder, with about 15,000 Confederates, had taken possession of the place early in the spring of 1862, and Gen. McClellan, who had about 112,000, opened a siege commencing Apr. 5. The Confederates were soon largely reinforced by Gen. Johnston, who took the command, having in all about 53,000 men. The besieging works were completed, and fire was to have been opened May 6, but two days previously Johnston secretly evacuated the works, carrying away everything worth taking.

York'ville, a thriving suburb of Toronto (which see), in York co., Ontario, Canada. It is connected with Toronto by street railway, and has many fine residences and important manufactures. P. 2203.

Yorkville, tp., Pickens co., Ala. P. 1593.

Yorkville, p.-v., cap. of Kendall co., Ill., on Fox River Valley R. R., 51 miles W. of Chicago, has 1 church, good schools, 2 newspapers, 1 bank, 1 paper-mill, an elevator, a tannery, 2 hotels, and 4 large ice-houses. It is the centre for a large trading community. P. including Bristol, 1200. J. R. Marshall, Ed. "Record."

Yorkville, v., Whitestown tp., Oneida co., N. Y. P. 213.

Yorkville, b., Schuylkill co., Pa. P. 553.

Yorkville, p.-v., cap. of York co., S. C., on King's Mountain R. R., 22½ miles N. of Chester, has 7 churches, military and female schools, a banking-house, 1 hotel, 2 newspapers, 1 carriage manufactory, 3 shoe-factories, a marble-yard, 1 tannery, and harness and saddle establishment. P. 1364. L. M. Grist, Prop. "Enquirer."

Yorkville, p.-v. and tp., Racine co., Wis. P. 1587.

York von War'tenburg (Hans Davin Ludwig), Count, b. at Potsdam, Prussia, Sept. 26, 1759; entered the army in 1772; was cashiered in 1780 for insubordination; served in the Dutch army in India 1783–84; re-entered the Prussian service as a captain, and was made a major-general in 1807, and governor of the province of Prussia in 1811. During the Russian campaign of 1812 he commanded the Prussian auxiliary corps in the grand army, and concluded (Dec. 30, 1812) a convention with the Russians, according to which his corps remained neutral during the retreat. The Prussian king was compelled to denounce this convention for some time, but when Prussia soon after declared war against Napoleon, York's conduct was highly praised. He fought with great distinction in the campaigns of 1813–14, was made a count and field-marshal, and d. at Klein-Oels, Siberia, Oct. 4, 1830.

Yor'uba, or **Yarriba,** country of Western Africa, in Upper Guinea, between lat. 6° and 9° N., and between lon. 2° and 6° E., bounded W. by Dahomey, and comprising an area of 70,000 sq. m., with about 3,000,000 inhabitants. The surface is an undulating plain, elevated 1000 feet above the sea, broken in some places by ranges of low rocky hills, and traversed by several short but copious and rapid streams. Extensive forests are found of teak, sassa-wood, ebony, figs, and different kinds of palms, such as the oil, wine, cocoanut, and fan palm. Elephants, rhinoceroses, lions, panthers, buffaloes, wild-hogs, monkeys, numerous kinds of birds, but only few fish, and serpents of huge size abound. European animals, cereals, and vegetables have been introduced, but most of them undergo changes when acclimatized; thus, the sheep becomes covered with hair instead of wool. The country contains many large cities, such as Katunga, Adu, Larro, and Janna, and its trade and manufacturing industry are considerable.

Yosem'ite Val'ley is a region of remarkable scenic attraction, situated in the Sierra Nevada of California, about 150 miles in a direct line a little S. of E. from the city of San Francisco. It was discovered in 1851, having been first visited by a party of settlers in the vicinity of the mining-camp of Mariposa while in pursuit of a band of Indians who had made themselves troublesome to the whites, and who were ascertained to have a stronghold in the mountains, where they imagined that they were safe from any attack, and in which they sought refuge when obliged to retreat from the neighborhood of the settlements. The Indian residents in and about the Yosemite Valley are said to have been a mixed race, made up of the disaffected of the various tribes from the Tuolumne to King's River. The word *Yosemite* means "a full-grown grizzly bear," and was not the aboriginal name of the valley itself, but that of a noted chief of the tribe. The present Indian name of the Yosemite is said to be *Ah-wah-nee*. That this was a favorite locality with the Indians is quite certain, and they have names for each and every important feature of the valley; which names, however, are not now in use among the whites, having been replaced by others which are partly Spanish and partly English.

The Yosemite Valley is nearly in the centre of the State of California, N. and S., and about midway between the E. and W. bases of the Sierra, which is here not far from 70 miles in width. It is a level area, about 6 miles in length, and from half a mile to a mile in width, and is sunk nearly a mile in depth below the general level of the adjacent region. It has very much the character of a gorge or trough hollowed in the mountains in a direction nearly at right angles to their general trend. This gorge has not a regular form, but while its general direction remains nearly the same, its sides advance and retreat, with angular projections and recesses, thus giving a great variety of outline to the enclosing masses. The river Merced, which heads in the Sierra some 15 miles higher up than the head of the valley, in the group of mountains of which Mount Lyell is the dominating peak, runs through the Yosemite with many graceful windings, and gives rise at the head of the valley to the remarkable waterfalls which will be noticed farther on. Two branches of the main Merced also enter the valley near its head: one, the Tenaya Fork, which rises in a beautiful mountain-lake of the same name, comes in from the N. E.; the other, the Illilouette, enters from the S. These tributaries join the Merced through deep cañons, as the mountain-gorges in the Sierra are always called; but there are several other smaller streams which also enter the valley, leaping over its walls, and giving rise in almost every instance to interesting falls; which, however, are not in general of any great size, except during the early part of the season, when the snow upon the adjacent mountains is melting.

The pleasure-traveller who visits the Yosemite does not confine his explorations to the valley proper, but from various commanding points adjacent to it obtains a great variety of views of the groups of peaks which form the crest of the Sierra in that region, as well as of the spurs which extend down from the main range or stretch along parallel with it. Thus, a journey to the Yosemite properly also includes a tour around its exterior, or at least one or more visits to prominent points of view above it, from which the observer cannot only look directly down into the depths of the valley below him, but also command a variety of views of lofty and in part snow-clad ranges, which offer among themselves most remarkable contrasts of form and structure.

In noticing the details of the scenery of the Yosemite the valley proper may first be considered. The prominent features here are—the great elevation of the walls which enclose it; the remarkable approach to verticality in these walls; their great height and their wonderful variety and beauty of form. To these features may also be added the attractions of the magnificent waterfalls which occur at various points on both sides of the valley, although these, as already noticed, must be seen early in the season in order that the traveller may be greatly impressed by them. In entering the Yosemite by the roads which approach it from the lower end, the visitor notices that he has before him a valley of a different type of form from those he has before been accustomed to see. He passes from a V-shaped

gorge or cañon into one which may be fairly called U-shaped, since its walls rise almost vertically from its floor. This change of form is strikingly impressed on the visitor as he approaches what may be called the gateway of the Yosemite. Here he sees before him, on the N. side of the valley, the mass of rock called El Capitan, and, exactly opposite, the Bridal Veil and Cathedral Rocks. At this point the distance across the valley is only a mile, measured from the summit of the Bridal Veil Rock to that of El Capitan, and at the base of these cliffs there is only just room for the river to pass. El Capitan is an immense block of granite projecting squarely out into the valley, and presenting two almost vertical faces, which meet in a sharp edge 3300 feet in perpendicular elevation. The sides or walls of this mass are bare, smooth, and entirely destitute of vegetation. It is doubtful if anywhere in the world there is presented so squarely-cut, so lofty, and so imposing a face of rock. On the opposite side of the valley is the grand mass of the Cathedral Rocks, divided into two parts by a deep notch between them. The most striking face of the larger Cathedral Rock is turned up the valley, but on the side facing the entrance there is a feature of great beauty — namely, the Bridal Veil Falls, made by the creek of the same name, which, as it enters the valley, descends in a vertical sheet of 630 feet perpendicular, striking there a pile of *débris*, down which it rushes in a series of cascades, with a vertical descent of nearly 300 feet more, the total height of the fall being 900 feet. This creek runs during the entire year, but the fall is only great when the amount of water is near its maximum. When the stream is neither too full nor too low, the mass of water in its fall vibrates with the varying pressure of the wind, blowing in the daytime up the valley in the most beautiful and remarkable manner. It is this fluttering and waving of the sheet of water which has given it the poetic but somewhat fanciful name it now bears, that of the Indians having been *Pohono*, a term having reference, it is said, to the chilliness of the air under the high cliff and near the falling water. There is also a charming fall in a deep square recess of the rocks opposite the Bridal Veil, and just below El Capitan. This fall, which is over 1000 feet high, is called the Virgin's Tears. It runs, however, but a short time during the early summer months.

Passing up the valley after entering between the Cathedral Rocks and El Capitan, the level area or river-bottom increases to nearly half a mile in width. This area is broken up into small meadows, gay with flowers in the early summer, and sandier regions on which grow numerous pitch-pines (*P. ponderosa*) and some oaks, cedar, and firs. The walls of the valley continue lofty and broken into the most picturesque forms. Of these the Three Brothers and the Sentinel Rock are the most conspicuous. Nearly opposite the Sentinel Rock is one of the most attractive features of the Yosemite—namely, the fall made by the descent of Yosemite Creek down the wall on the N. side of the valley. The vertical elevation of the edge of this fall is 2600 feet, but the descent is not in one unbroken sheet. There is first a vertical fall of 1500 feet, then a descent of 626 feet in a series of cascades, and finally one plunge of 400 feet on to a low talus of rocks at the foot of the precipice. The body of water is not large, and it decreases considerably as the season advances, becoming very small in ordinary years by the end of August. The width of the stream above the fall is usually, in June and July, about 20 feet, and its depth perhaps 2 feet. The beauty and grandeur of this fall, however, taken in connection with the majesty of its surroundings, give it a claim to be ranked among the most remarkable natural objects in the world. There are certainly very few waterfalls which can compete with it.

At the head of the valley the falls of the Merced River are of great interest. There are two of them, with beautiful intervening rapids. The lower one is called the Vernal Fall, and is about 400 feet in vertical height. The upper, the Nevada Fall, is about 600 feet in elevation. The body of water in these falls is large and the effect very grand. As the Merced River is fed by melting snows high up in the Sierra, the amount of water is not so much diminished toward the end of the season as it is in the case of the smaller creeks heading at an inferior elevation; thus, the falls of the Merced usually remain extremely picturesque and attractive objects during the whole summer.

The dome-shaped masses of granite which characterize the vicinity of the Yosemite are also extremely grand. The North Dome, on the N. side of the valley, lends itself to beautiful combinations of scenery, as seen from various points a little above the Yosemite Falls. The Sentinel Dome, on the opposite side, is not visible from the valley itself, but it affords a magnificent view from its summit of the valley and its surroundings, and especially of the high Sierras. A projecting cliff, called Glacier Point, a little lower than this, and just on the edge of the valley, is also much visited for the sake of the grand view which it offers of the whole region, but especially on account of its favorable situation with reference to the Half Dome, of which it commands a most wonderful view. The rock thus named is the highest point in the immediate vicinity of the Yosemite, rising to an elevation of 4737 feet above the general level of the valley. The Half Dome has the appearance of having been originally a dome-shaped mass which has been split into two parts, one of which has sunk down and disappeared; hence the name. It fronts the valley of the Tenaya Fork of the Merced with a very steep slope, crowned by a vertical wall of fully 4600 feet in elevation, forming together a mass of rock of the most astonishing form and imposing magnitude.

The Yosemite Valley was given by Congress to the State of California in 1864, to be "held for public use, resort, and recreation," to be also "inalienable for all time," with the condition that portions of the valley might be leased, the income arising from such leases to be expended "in the preservation and improvement of the property or the roads leading thereto." The grant is managed by commissioners appointed by the governor of the State. Great difficulty has been experienced in getting possession of the premises, which were held by squatters, and these difficulties have not yet been fully overcome. Wagon-roads have been made into the valley, leading into it from its lower end up the Merced River. These, however, have been built and are owned by private parties, and the same is true of the various excellent trails which have been built to afford access to Glacier Point, Union Point, and other elevations commanding remarkable views of the valley and its surroundings.

J. D. WHITNEY.

Yoshida Kiyonari, b. in the province of Satsuma, Japan, about 1845; educated in the Chinese classics and the history of his own country at the government college of his province, as well as by private tutors; visited Europe in 1865, where he spent more than two years, going through a course of studies at University College, London; subsequently spent three years engaged in study in New Jersey and Massachusetts; on his return to Japan was made one of the chief clerks of the finance department by cabinet appointment; was next made commissioner of internal revenue by imperial appointment, in which position, although then in his twenty-sixth year, he originated some measures of importance for the public weal; in 1871 was appointed assistant minister of finance, in which capacity he visited England and negotiated a loan of more than $12,000,000 under circumstances of special advantage; returned to Japan, still connected with the finance department, and in the latter part of 1874 was appointed the first envoy extraordinary and minister plenipotentiary to the U. S. He is the youngest Japanese who ever received an imperial appointment.

F. A. P. BARNARD.

You'att (WILLIAM), b. in England in 1777; was for many years professor in the Royal Veterinarian College, and proprietor and co-editor of *The Veterinarian*, established in 1828. D. in London Jan. 9, 1847. Author of *The Horse* (1831), a standard work, of which two American eds. have been published; *Sheep, their Breeds, Management, and Diseases* (1832), *Cattle, etc.* (1834), *The Dog* (1842), *The Pig* (1860), and *The Complete Grazier* (1846). Prof. Youatt's works are high authority for stock-raisers in England and America.

Youghal, town of Ireland, county of Cork, Munster, on the estuary of the Blackwater, has a good harbor, admitting vessels of 400 to 500 tons, extensive and valuable fisheries, and a large export-trade in agricultural produce. Here the first potatoes were planted by Sir Walter Raleigh, whose house is still preserved. P. 6039.

You'mans (EDWARD LIVINGSTON), M. D., b. at Coeymans, N. Y., June 3, 1821; studied chemistry, physics, and medicine, although, on account of an attack of ophthalmia which made him blind for several years, he could pursue his studies only by the aid of his sister, ELIZA ANNE YOUMANS, known by her educational publications. Besides delivering a number of lectures, he published *Chemical Chart of Colored Diagrams* (1851), *Classbook of Chemistry* (1852), *Atlas of Chemistry* (1854), *Alcohol and the Constitution of Man* (1855), *Handbook of Household Science* (1857), *Correlation and Conservation of Forces* (1864), *Observations on the Scientific Study of Human Nature* (1866), *The Culture demanded by Modern Life* (1867). In 1871 he founded the "International Scientific Series" (New York, London, Paris, Leipsic, St. Petersburg, and Milan), of which 20 vols., have appeared, and in 1872 he founded the *Popular Science Monthly*.

Young, county of N. W. Texas, intersected by Brazos River; surface undulating, with much woodland; soil fertile. Cattle are very numerous, and grazing is the chief

indostry, although a little Indian corn is produced. Cap. Graham. Area, about 900 sq. m. P. 135.

Young, tp., Indiana co., Pa. P. 1650.

Young, tp., Jefferson co., Pa. P. 954.

Young (Alexander), D. D., b. at Boston, Mass., Sept. 22, 1800; graduated at Harvard 1820; taught in the Boston Latin School 1821–24; studied theology at Cambridge Divinity School, and was pastor of a Unitarian church at Boston from 1825 to his death, Mar. 16, 1854. He edited the *Library of Old English Prose-Writers* (9 vols., 1831–34), the *Chronicles of the Pilgrim Fathers of the Colony of Plymouth* (1841), and the *Chronicles of the First Planters of the Colony of Massachusetts Bay* (1846).

Young (Andrew W.), b. at Carlisle, N. Y., in 1802; became editor of the *Warsaw Sentinel* 1830–31, the *Republican Advocate* 1832–35, and the *American Citizen* 1836. Author of a widely-circulated *Introduction to the Science of Government* (1839), *The American Statesman* (1855), *National Economy* (1860), and other political works.

Young (Arthur), b. at Bradfield, Suffolk, England, Sept. 7, 1741; was in early life engaged in mercantile business at Lynn, which he abandoned for the pursoit of scientific agriculture; managed a large farm at Samford Hall, Essex, 1765–70; travelled through most of the counties of England and Ireland in quest of information on the enrrent methods of farming; made a careful tour through France for a similar purpose; wrote for the *Museum Rusticum* and for William Nicholson's *Journal of Natural Philosophy* (1792 *seq.*); edited the *Universal Museum;* was for some time parliamentary reporter for the *Morning Post* (1765 *seq.*); was engaged in practical husbandry from 1779; conducted through 45 volumes the *Annals of Agriculture*, established by him in 1784 at Bury St. Edmund's, and issued at London after 1808, a publication to which George III. sometimes contributed under the name of Ralph Robinson; corresponded with Washington on agriculture, and was secretary to the board of agriculture from 1789 to his death, at Bradfield Apr. 12, 1820. Among his many works may be specified *The Farmer's Letters to the People of England* (1767), *A Six Weeks' Tour through the Southern Counties of England and Wales* (1768), *A Six Months' Tour through the North of England* (4 vols., 1770), *The Farmers' Guide* (2 vols., 1770), *Rural Economy* (1770), *A Course of Experimental Agriculture* (2 vols., 1770), *The Farmer's Tour through the East of England* (4 vols., 1771), *The Farmer's Kalendar* (1771; 215th ed., revised by J. C. Morton, 1862), *Political Arithmetic* (2 parts, 1774–79), *A Tour in Ireland* (2 vols., 1780), *Travels, etc., with a View of Ascertaining the Cultivation, Wealth, Resources, and National Prosperity of the Kingdom of France* (Bury St. Edmund's, 2 vols., 1792–94; in French, Paris, 3 vols., 1794), *The Example of France a Warning to Great Britain* (1793), *An Essay on Manures* (1804), *The Progressive Value of Money as marked by the Price of Agricultural Products* (1812), and *The Rise of Prices in Europe, etc.* (1815). By order of the French Directory a collective edition of his agricultural works was published in French under the title *Le Cultivateur Anglais*, etc. (18 vols., 1800–01). Arthur Young was perhaps the most eminent of writers on agriculture, and his fame may be expected to increase for centuries to come. (See Allibone's *Dictionary of Authors*, McCulloch's *Literature of Political Economy*, and Donaldson's *Agricultural Biography*.)

Young (Brigham), b. at Whitingham, Vt., June 1, 1801, the son of a farmer; was educated in the Baptist Church, and trained as a painter and glazier, but joined in 1832 the Mormons at Kirtland, O., and started in 1835 on his first missionary journey. He was very successful as a preacher, and made many converts, being possessed of a peculiar but very impressive eloquence, and at the same time rose to the highest dignities and acquired an almost boundless influence within the sect by his energy and shrewdness, and by the power of his personality. After the death of Joseph Smith in 1844, he was chosen president of the Church by the apostles, and from 1846 to 1848 he led the host of the Mormons from Nauvoo across the prairies to Great Salt Lake Valley, where he founded Salt Lake City. In Mar., 1849, a convention was held in that city, a constitution was framed, and a State was organized under the name of *Deseret*, which in the "reformed Egyptian" language is said to mean the "Land of the Honey-Bee." Congress, however, refused to admit the new State, but the Territory of Utah was organized, and Brigham Young was appointed governor for four years. Conflicts soon arose with the Federal government (see Salt Lake City and Utah), but the U. S. officers were expelled from the Territory, and Brigham Young declared, "I am and will be governor until the Lord Almighty says, 'Brigham, you need not be governor any more.'" In spite of the forcible measures which the government took from time to time, he continued to wield an almost unlimited power as president of the Church. On Aug. 29, 1852, he introduced polygamy as an institution, as the celestial law of marriage, and he carried it through in spite of considerable resistance from a division of the Church itself. Soon, however, the development of the mining interests of the Territory and of the commercial interests of Salt Lake City brought a great number of people to the Territory and the city who were not Mormons, and the control of the legislation and administration of the State is now rapidly passing out of the hands of Brigham Young and the Mormons. D. at Salt Lake City Aug. 29, 1877.

Young (Charles Augustus), Ph. D., LL.D., b. at Hanover, N. H., Dec. 15, 1834; graduated at Dartmouth College 1853; was assistant teacher in Phillips Academy, Andover, Mass., 1854–55; studied theology in Andover Seminary 1855–56; was professor of mathematics and natural philosophy in Western Reserve College, O., 1856–66; was called in the latter year to the professorship of natural philosophy and astronomy at Dartmouth, a chair which had been filled by both his father and his grandfather, Prof. Ebenezer Adams. Prof. Young was the discoverer, associated with Harkness, of the spectrum of the corona in 1869, in 1870 of the reversal of the solar spectrum by the lower strata of the sun's atmosphere, and in 1872 of the presence of sulphur, cerium, and strontium in the sun by observations upon the spectrum of the chromosphere, made at Sherman at an elevation of 8000 feet. He was chosen an associate fellow of the American Academy of Arts and Sciences at Boston in 1871, a member of the National Academy of Sciences in 1872, and in that year was also elected a foreign associate of the Royal Astronomical Society of Great Britain. Prof. Young is the author of numerous published papers on science.

Young (Sir Charles George), D. C. L., b. in England in 1795; educated at the Charter-house; entered the College of Arms as a pursuivant 1813; became York Herald May, 1820, register of the college July, 1822, and Garter King-at-arms Aug., 1842, on which occasion he was knighted. D. in London Sept. 1, 1869. Author of *A Catalogue of Works on the Peerage and Baronetage of England, Scotland, and Ireland* (1827), *A Catalogue of the Arundel MSS. in the Library of the College of Arms* (1829), *The Order of Precedence, with Authorities and Remarks* (1851), and other professional treatises.

Young (Edward), LL.D., b. at Upham, Hampshire, England, in 1684; educated at Winchester School and at Corpus Christi College, Oxford; obtained a law fellowship at All Souls' College, Oxford; took there the degree of doctor of laws 1719; was defeated as a candidate for Parliament at Cirencester; was tutor to Lord Burleigh, son of the earl of Exeter; took orders in the Church of England 1727; was appointed a royal chaplain 1728; became rector of Welwyn, Hertfordshire, 1730; married a daughter of the earl of Lichfield 1731; lost his wife 1741, and was appointed clerk of the closet to the princess-dowager of Wales 1761. D. at Welwyn Apr. 12, 1765. Author of several successful satires and dramas, of some volumes of political essays, and of a celebrated religious poem, *Night Thoughts* (1742–46), once very popular.

Young (J. R.), U. S. N., b. Nov. 27, 1826, in Ohio; entered the navy as a midshipman Oct. 18, 1841; became lieutenant in 1855, captain in 1873; served in the Susquehanna at the taking of Forts Hatteras and Clark, in the battle of Port Royal, and in command of the iron-clad Sangamon took part in all the engagements with the defences of Charleston from July, 1864, to the close of the civil war. Highly commended for "gallantry and good service."

Foxhall A. Parker.

Young (James), b. at Glasgow, Scotland, in July, 1811; was in early life a joiner; attended the chemical lectures of Prof. Thomas Graham at the Andersonian Institution; was assistant to that gentleman, first in Glasgow and afterward at University College, London, 1832–38; was employed in a scientific capacity in Muspratt's chemical works at Newton 1838–42, and in Tennant's works at Manchester 1842–46; analyzed about 1847 the petroleum found in a spring in a coal-mine in Derbyshire; obtained from it a lubricating oil for machinery and a lighter oil for burning in lamps; was led thereby to undertake the slow distillation of coal by a process for which he took out a patent, thus created a new and important industry, permanently cheapening the price of light; established coal-oil works at Bathgate, and subsequently at Addiewell, Scotland; acquired a large fortune, and contributed indirectly to the rise of the vast petroleum industry in America; gave £10,000 for the endowment of the chair of chemistry in the Andersonian Institution, Glasgow; erected a bronze statue to Prof. Graham at Glasgow, and sent out at his own expense in 1872 an expedition to Central Africa in search of his early and intimate friend, Dr. Livingstone. Mr. Young

lives at Kelly, on the Clyde, and spends much of his time on his yacht Nyanza.

Young (James Hamilton), b. at Newton-upon-Ayr, Scotland, in 1793; came to Philadelphia, Pa., 1801; became an expert engraver and a writer upon statistical subjects, and was the author of the famous series of geographies published by Samuel Augustus Mitchell, of which several millions of copies have been circulated, the maps as well as the text being from his hand.

Young (John), b. at Chelsea, Vt., in 1802; removed in childhood to Livingston co., N. Y.; became a lawyer; sat in the legislature 1831 and 1844–45; was a Whig member of Congress 1841–43; governor of New York 1847–49, and U. S. assistant treasurer at New York City 1849–52. D. in New York City Apr. 23, 1852.

Young (John), G. C. B., Baron Lisgar, b. at Bailieborough, county Cavan, Ireland, Apr. 30, 1807, son of Sir William, a director of the East India Company; graduated at Corpus Christi College, Oxford, 1829; entered Parliament as a Conservative member for the county of Cavan 1831; was called to the bar at Lincoln's Inn 1834, but never practised the legal profession; was a lord of the treasury under Sir Robert Peel 1841–44, and secretary of the treasury 1844–46; became a privy councillor 1852; was chief secretary to the lord lieutenant of Ireland 1852–55, lord high commissioner of the Ionian Islands 1855–59, governor of New South Wales 1861–67; was governor-general of Canada from Sept. 18, 1868, to June, 1872, and was created Baron Lisgar Oct. 8, 1870.

Young (John), LL.D., b. in Scotland about 1810; became pastor of Albion chapel, Moorfields, and subsequently of a church at Edinburgh. Author, among other works, of *The Christ of History, an Argument grounded on the Facts of his Life on Earth* (1855; 6th ed. 1870), the later editions of which included an *Appendix containing a Brief Criticism of M. Renan's Vie de Jésus; Evil and God, the Mystery* (1856); *The Province of Reason* (1860), being a criticism of Dean Mansel's *Bampton Lectures; The Life and Light of Men* (1866), and *The Creator and the Creation, how Related* (1870).

Young (John Clarke), D. D., b. at Greencastle, Pa., Aug. 12, 1803; graduated at Dickinson College 1823; studied theology at Princeton Seminary 1824–26; was a tutor in the College of New Jersey at Princeton 1826–28; became pastor of a Presbyterian church at Lexington, Ky., 1828, and was president of Centre College, Danville, Ky., from 1830 until his death, June 23, 1857. Author of *An Address to the Presbyterians of Kentucky, proposing a Plan for the Instruction and Emancipation of their Slaves* (1835), of which 100,000 copies were circulated; *Universal Education a Pecuniary Gain to a Nation*, and of several published sermons and addresses.

Young (John Radford), b. in London, England, in Apr., 1799; was almost entirely self-educated; became a distinguished mathematician, and was for many years a professor in Belfast College. Author of many mathematical and mechanical textbooks and memoirs, of *The Mosaic Cosmogony not adverse to Modern Science* (1861), *Science Elucidative of Scripture, and not Antagonistic to it, a Series of Essays* (1863), *Modern Skepticism viewed in Relation to Science* (1865), of a paper *On the Origin of Speech* (1866), and other works.

Young (Josie Marie), b. at Sanford, Me., in Aug., 1808; became a printer at Portland, Me., and at Cincinnati, O.; was converted to Roman Catholicism 1827; studied for the ministry at Mount St. Mary's College, Emmittsburg, Md.; was ordained 1837; labored many years near Cincinnati; declined the bishopric of Pittsburg 1853, and was consecrated Apr. 23, 1854, bishop of Erie, Pa., where he d. Sept. 18, 1866.

Young (Matthew), D. D., b. in Roscommon co., Ireland, in 1750; educated at Trinity College, Dublin, where he obtained a fellowship 1775; took orders in the Church of England; became professor of philosophy in Trinity College 1786, and subsequently bishop of Clonfert and Kilmacduach; was a distinguished mathematician, one of the earliest members of the Royal Irish Academy, and a liberal contributor to its volumes. D. at Whitworth, Lancashire, Nov. 28, 1800. Author of *An Inquiry into the Principal Phenomena of Sounds and Musical Strings* (1784), *On the Number of Primitive Colors in Solar Light, etc.* (1800), *An Analysis of the Principles of Natural Philosophy* (1803), and other works, and left in MS. *The Method of Prime and Ultimate Ratios*, still unpublished.

Young (Pierce), M. B., b. in Spartanburg, S. C., in 1838; removed to Georgia; graduated at the military institute of that State 1857; cadet at West Point 1858; resigned in 1861, and entered the Confederate military service; for gallant and distinguished services rose by successive promotions to the rank of major general; in 1868 was elected to Congress from Georgia, and re-elected 1870 and 1872. Alexander H. Stephens.

Young (Thomas), b. at Milverton, Somersetshire, England, June 13, 1773; acquired early a comprehensive knowledge of history and languages, of natural science and mathematics; studied medicine at London, Edinburgh, and Göttingen; was appointed professor of natural philosophy at the Royal Institution in 1801; became a fellow of the College of Physicians in 1808, physician to St. George's Hospital in 1810, secretary to the board of longitude and conductor of the *Nautical Almanac* in 1818. D. in London May 10, 1829. His principal works are—*Syllabus of a Course of Lectures on Natural and Experimental Philosophy* (1802), in which he established the law of interference of light; *A Course of Lectures on Natural Philosophy and the Mechanical Arts* (2 vols., 1807), *Elementary Illustrations of the Celestial Mechanics of Laplace* (1821), the article "Egypt" in the *Encyclopædia Britannica, Rudiments of an Egyptian Dictionary* (1830), etc. His miscellaneous works were collected in 4 vols. (1855) by Dean Peacock and John Leitch, and his *Life* was written by the former.

Young Amer'ica, tp., Edgar co., Ill. P. 687.

Young America, v., Tompkins tp., Warren co., Ill. P. 1115.

Young America, p.-v. and tp., Carver co., Minn. P. 823.

Young Hick'ory, tp., Fulton co., Ill. P. 792.

Young Men's Christian Associations originated in 1844 in London, where George Williams invited his fellow-clerks to a meeting and organized the first association. The example was soon imitated in other cities of the country, and at present Great Britain and Ireland number about 300 associations; Germany has 200, Holland 200, France 40, Switzerland 30, Belgium 18, etc. In 1851 the first Young Men's Christian Association was formed in Montreal, and the growth of these institutions was still more rapid on this continent. In 1875 the U. S. and Canada numbered 519 associations, with 69,011 members; 337 reported their annual expenses at $360,365; 198 owned libraries containing 181,310 vols.; 56 had their own buildings, valued at $2,434,900, and 46 had building funds amounting to $108,756. The associations in the U. S. and Canada form an international convention, organized in 1854, and State and provincial conventions. Seven conferences of associations of all lands have been held: that of Paris in 1855 limited active membership to "young men who, regarding Jesus Christ as their God and Saviour according to the Holy Scriptures, desire to be his disciples in their doctrine and in their life." The last general conference was held at Hamburg in 1875. The practical test for admission to the American associations is membership of some evangelical church, a rule adopted in 1869 by the international convention of Portland. Young men of good moral conduct may be admitted, though not members of any church, but only as associate members—that is, they enjoy all the privileges of active members, but have no influence on the business of the society. Older church members are admitted as counselling members. The aim of the associations is to be intermediate agents between the churches and the young men, and, besides maintaining libraries, reading-rooms, lectures, classes of secular instruction, gymnasiums, they hold prayer-meetings, Bible-classes, and other religious meetings, and maintain an inner mission in various forms; in which latter respect they have worked with signal success. In 1857 the Ladies' Christian Union of New York was formed, and in 1866 the Young Women's Christian Association of Boston. There are now 47 women's Christian associations in the U. S. and Canada, with about 10,000 members. Of these, 19 have boarding-houses for young women, 19 industrial schools, 16 libraries, 17 assist in finding employment, 12 conduct Bible-classes, etc.

Young's, tp., Laurens co., S. C. P. 1961.

Youngs'town, p.-v., Porter tp., Niagara co., N. Y. P. 476.

Youngstown, city and tp., cap. of Mahoning co., O., on Mahoning River and on Atlantic and Great Western, Ashtabula Youngstown and Pittsburg, and Lake Shore and Michigan Southern R. Rs., 65 miles S. E. of Cleveland, and the same distance N. W. of Pittsburg, contains 11 churches, an endowed academy, 1 daily and 4 weekly newspapers, a handsome opera-house, court-house and jail, 4 rolling-mills, 7 blast furnaces, 2 foundries, 1 street-railway, a nut and bolt factory, and several minor manufacturing interests. There are 30 coal-mining companies, and the prosperity of the city depends largely upon its coal and iron industries. P. of city, 8075; of tp. exclusive of city, 2762.

A. R. Seagrove, Ed. "Register and Tribune."

Youngstown, b., Westmoreland co., Pa. P. 301.

Youngs'ville, p.-v., Warren co., Pa., on Brokenstraw Creek and on Dunkirk Allegheny Valley and Pittsburg and Pennsylvania R. Rs., 3 miles from Allegheny River, has a large school building, 2 extensive pump manufactories, several mills, and 1 newspaper.

E. W. Hoag, Ed. "Warren County Press."

Young'ville, tp., Tallapoosa co., Ala. P. 1680.

Yount, tp., Napa co., Cal. P. 1252.

Ypres, town of Belgium, province of West Flanders, on the Yperlee, was in the fourteenth century one of the leading manufacturing centres of Europe, and had about 200,000 inhabitants. A splendid monument of that time is the cloth-hall, a large structure in Gothic style, built in the thirteenth and fourteenth centuries, and now occupied by different public establishments. In the sixteenth century Ypres began to decline, and its present manufactures, though very varied, comprising linen, woollen, cotton, and silk, lace, and ribbons, oil, soap, salt, and leather, are comparatively of little consequence. It is fortified, and contains large barracks, hospitals, and many educational institutions. P. 17,190.

Ypsilan'ti, city and tp., Washtenaw co., Mich., on Michigan Central R. R., 30 miles from Detroit, on both banks of the Huron River. In 1807 the first trading-post was established here for the purpose of bartering with the Indians. It contains 6 churches and 1 chapel (Baptist), 1 high, the State normal school, and several excellent public schools, 3 newspapers, planing-mills, a carriage-factory, 2 whip-socket manufactories, an efficient fire department, and several capacious public halls. Two fine iron bridges span the Huron River at this place. P. of city, 5471; of tp. exclusive of city, 1561.

C. R. Pattison, Ed. "Commercial."

Ypsilanti, the name of a wealthy Greek family of princely rank, several members of which have become very prominent as enthusiastic champions of the emancipation of the Greek nation. Constantine Ypsilanti (b. at Constantinople in 1760) was appointed hospodar of Moldavia in 1799 and of Wallachia in 1802, but was dismissed in 1806 on account of his sympathy with Russia. Reinstated in 1807 by Russian influence, he incited the Servians to revolt, but, unable to carry through the revolution, fled to Russia, and d. at Kiev July 28, 1816.—His eldest son, Alexander Ypsilanti (b. at Constantinople in 1783), served in the Russian army, lost his right hand in the battle of Dresden, 1813, and was made adjutant to Alexander I., and major-general in 1817. As chief of the *Hetæria*, a secret association for the liberation of the Greek Christians in Turkey, he raised a revolution in Moldavia in 1821, and invaded the country with a considerable force of Russian and Greek volunteers, but was entirely defeated at Dragashan June 19, 1821; fled to Transylvania; was kept for several years in an Austrian dungeon, and d. at Vienna Jan. 31, 1828.—A younger brother of his, Demetrius Ypsilanti (b. at Constantinople Dec. 25, 1793), served also in the Russian army, joined the revolution in the Morea in 1821, and distinguished himself greatly at the capture of Tripolitza, the defence of Argos, and the encounter with Ibrahim Pasha at the mills of Lerna. In 1827 he was made commander-in-chief of the whole Greek army, but some disagreement between him and the president, Capo d'Istria, caused him to resign his command in 1830. D. at Napoli di Romania Aug. 16, 1832.

Yre'ka, city and tp., cap. of Siskiyou co., Cal. P. of city, 1063; of tp. 1816.

Yriar'te, de (Juan), b. at Orotava, Teneriffe, Canary Islands, Dec. 15, 1702; educated in Paris and London; became secretary to the royal printing-office at Madrid, librarian of the royal library, and translator to the secretary of state 1740; was elected to the Royal Academy 1713; prepared a system of orthography, punctuation, and accentuation for the Spanish language, which has since been generally adopted; published a Latin grammar in Spanish verse (1771), and collected 24,000 proverbs. D. at Madrid Aug. 23, 1771. His *Works* (2 vols., 1773) in prose and verse were posthumously published.

Yriarte, de (Tomas), nephew of Juan, b. at Orotava, Teneriffe, in 1750; educated by his uncle at Madrid; held during most of his life a post in the department of state; published translations from the French and many original dramas and poems, the most celebrated of which are his *Fábulas Literarias*, of which there are several English and French translations. He had many literary quarrels, and was accused before the Inquisition in 1786 of being addicted to "French philosophy," but escaped punishment. D. at Madrid in 1791.

Ysle'ta, p.-v., cap. of El Paso co., Tex.

Y'ssel, or **Ijssel,** a branch of the Rhine, separates from it near Arnhem in the Netherlands, receives the Old Yssel, which comes from Rhenish Prussia, and enters the Zuyder-Zee after a course of 80 miles.

Yssingeaux', town of France, department of Haute-Loire, manufactures blondes, laces, ribbons, and leather, and trades in grain, cattle, agricultural produce. P. 7971.

Ys'tad, town of Southern Sweden, on the Baltic, has a good harbor, some manufactures and trade, and regular steam-communication with Stralsund. P. 5234.

Yt'trium and **Yttria.** The words are derived from the locality, Ytterby in Sweden, of the mineral *gadolinite*, in which *yttria* was discovered in 1794 by the Russian chemist Gadolin. Yttria is a peculiar earthy oxide, contained in this and some other minerals, as Xenotime (which see), *yttrocerite, yttrotantalite, keilhauite, samarskite, euxenite, aschynite, polymignite, fergusonite.* They are all rare minerals. *Yttrocerite,* which is a fluoride of calcium, cerium, and yttrium, is found in several American localities, as at Amity, Orange co., N. Y., and at Paris, Me. The yttria obtained by the earlier investigators was found by Mosander in 1843 to contain another earth, which he called *erbia*, a third one, called by him *terbia*, not having been since found, so that its existence is deemed improbable. As obtained by igniting its oxalate, yttria is a soft white powder, infusible, and does not slake with water like lime, though it may be obtained as a hydrate by precipitation of its saline solutions. The metal yttrium is little known. Berzelius obtained it, by means of potassium, from its chloride, and describes it as metallic scales of blackish-gray color, not malleable. This, however, contained erbium. Yttrium forms a chloride, bromide, fluoride and iodide, selenide and sulphide. Its equivalent is uncertain; Cleve and Hoeglund, the latest experimenters, obtained 59.7; Bahr and Bunsen, 61.7; but Delafontaine obtained 74.5.

Henry Wurtz.

Yu'ba, county of N. E. California, bounded W. by Feather River, S. by Bear River, intersected by Yuba River, and traversed by the Oregon division of Central Pacific and by California Northern R. Rs. A portion of the county lies along the lower slopes of the Sierra Nevada, and the remainder is made up of large and fertile valleys. There is a little mining. Horses, cattle, sheep, and swine are numerous. Staples, wheat, barley, wool, hops, hay, and dairy products. Cap. Marysville. Area, about 600 sq. m. P. 10,851.

Yuba, city and tp., cap. of Sutter co., Cal. P. 998.

Yuba River, in California, rises by three forks (the N., Middle, and S.), which flow through deep, cañon-like gorges in the Sierra Nevada. The united stream joins Feather River at a point just below Yuba City.

Yucatan', a peninsula of Mexico, extending between lat. 17° 20′ and 21° 30′ N., and between lon. 87° and 92° 30′ W., bounded W. and N. by the Gulf of Mexico, E. by the Caribbean Sea, and S. and S. E. by Guatemala, the state of Tabasco, and British Honduras, comprises an area of 58,748 sq. m., with a pop. of 502,731 in 1869, mostly Indians. The eastern coast, along the Caribbean Sea, is rocky, bold, much indented, and presenting several good harbors, but both the northern and southern coasts are generally low, sandy, swampy, destitute of harbors, and frequently visited by yellow fever. The interior is hilly and high, gradually sloping down to the coasts, but here the soil is very productive, and the climate, although hot, is salubrious. The rivers are insignificant with the exception of the Usumasinta, which rises in Guatemala, forms part of the southern boundary, and sends one branch to the Laguna de Terminos. Immense forests cover a large part of the country, and excellent timber, fine cabinet-woods, dyewoods, and gums form the principal items of export. The chief occupation, however, is agriculture, and maize, rice, cotton, indigo, tobacco, hemp, etc., are raised, besides all kinds of tropical fruits. The manufacturing industry is confined to some coarse cotton stuffs. The country was discovered in 1517 by Fernandez de Cordova, and finally conquered in 1541 by Francisco de Montejo. It belonged to Spain until 1821; subsequently it has twice been independent, but belongs now to Mexico, forming the two states of Yucatan and Campeachy. (For the interesting ruins at Uxmal, Chichen, and Izamal, see articles under these names, and Architecture of the American Aborigines.)

Yucatan, p.-v. and tp., Houston co., Minn. P. 610.

Yuc'ca, the aboriginal and also the botanical name of a peculiar genus of liliaceous plants, species of which have the English names of bear-grass, Spanish bayonet, etc., natives of North America from New Jersey and from Iowa to Yucatan, but most abundant between the 25th and

35th degrees of N. lat. About a dozen species are well characterized (by Dr. Engelmann), with many varieties, and various doubtful forms are in cultivation. The stems of the more northern species are subterranean, so that the tuft of bayonet or dagger shaped leaves is next the ground; of the more southern, arborescent and palm like in some species, forming a trunk ten to twenty feet high, crowned by a dense tuft of prickly pointed leaves. In *Y. filamentosa* and some other species delicate threads separate from the edges of the needle pointed leaf, whence the popular appellation, "Adam's needle and thread." The root-stocks are replete with mucilaginous and saponaceous matter, which, under the name of "amole," serves as a substitute for soap in many a Mexican household, is also used by the negroes of the Southern U. S., and gives the common name of soap plant to *Y. angustifolia*, which abounds between the Mississippi and the Rocky Mountains. A stalk rising from the centre of the crown of foliage bears an ample panicle of large and white lily like blossoms, showy at all hours, but most so at evening, when the blossoms fully spread. The fruit is dry and capsular in some species, fleshy and baccate in others. The latter are edible and savory. That of *Y. aloifolia*, the "Spanish bayonet," is eaten by the negroes of the coast of South Carolina and Georgia under the name of banana, which it somewhat resembles in appearance; that of *Y. baccata* of Arizona, etc., is largely consumed when fresh by whites and Indians, and is cured by the latter for winter provisions. Several species are planted for ornament, and are much prized in landscape gardening. A. GRAY.

Yu'kon River, the largest and longest stream emptying on the western coast of North America, supposed to rise about 58° 31′ N. lat. and 131° 50′ W. lon. At its head-waters it is known as the *Tahco*. The general direction of the river from its head-waters to Fort Yukon, the northernmost point of the river, is supposed to be about N. W. From Lake Labarge to Fort Yukon it is called the *Lewis River*. It drains a vast area, and flows 2000 miles in its course to the sea, at Norton Sound.

Yule, a name sometimes given to Christmas. It was originally the name of a heathen festival celebrated at the winter solstice. The burning of the Christmas log, or Yule clog, and the decoration of churches and firesides with green branches, are parts of the old Yule ceremony.

Yule (HENRY), b. in 1820; served in the British army in India; became minister of Indian public works; retired as colonel; settled in London, and published *Fortification* (1851); *A Narrative of the Mission sent by the Governor-General of India to the Court of Ava* (1858), *Cathay and the Way Thither* (2 vols., 1866), *The Book of Ser Marco Polo, a new translation*, 2d ed. (2 vols. 8vo, 1875), besides minor translations, essays, and memoirs; was made C. B.

Yu'ma, county of S. W. Arizona, bounded S. by Mexico, separated by Colorado River from California and Lower California, and intersected by the Gila. The valleys of the Colorado and Gila are very productive when irrigated; the remainder of the area consists of high table-lands nearly destitute of water, but during a part of the year covered with grass. The mineral wealth, in gold, silver, copper, and lead, is apparently considerable. Cap. Yuma. Area, about 10,000 sq. m. P. 1621.

Yuma, p.-v., cap. of Yuma co., Ara. Ter., on the E. shore of Colorado River, contains a fine court-house and jail, 1 church, an excellent public school, 1 newspaper, 2 hotels, and several large mercantile houses. Principal business, trade with the interior, mining, and navigation. P. 1300. W. J. BERRY, ED. "ARIZONA SENTINEL."

Yumas, a tribe of American Indians settled on both sides of the Colorado, near its junction with the Gila; they call themselves the "Sons of the River," and are also known under the name of Cuchans. They were visited in 1701 by Father Kühn, 1744 and 1748 by Sedelmayr, and in 1780 Spanish settlements were established among them; but in 1781 they fell upon their white neighbors and massacred them. Since they came within the dominion of the U. S. they have been faithful to the Americans with the exception of a short rising in 1853; but they are rapidly dying out. Their number was 3000 in 1791, but only 930 in 1876. Their language is allied to those of the Mohaves, Cocopas, and Yavapai.

Yunnan', province of China, bounded S. and W. by Thibet, comprises an area of 107,983 sq. m., with 5,561,320 inhabitants. It is a wild mountain-land whose peaks rise considerably over the line of perpetual snow, and through whose gorges powerful streams break into the low plain. Large parts of the country are covered with forests. The fauna and flora of the valleys are tropical. Metals and precious stones abound. A peculiar feature of this province is its suspension bridges thrown across its gorges, and consisting of two lines on which slides a wooden box containing the traveller. Only parts of the population are Chinese, and the aboriginal inhabitants live almost independently, ruled over by native chiefs, whose acknowledgment of the supremacy of the Chinese emperor is merely formal.

Yunnan, town of China, capital of the province of the same name, is situated on the N. shore of Lake Chin, and is famous for its manufactures of silk stuffs, carpets, and tapestries.

Yus'sef ben Abd'el-Rah'man Al-Fehr'i, the last emir of Spain for the caliphs of Bagdad; was appointed to this office in 746, and ruled both with wisdom and energy. But in 753 the Ommyiade dynasty was overthrown in the East by an extensive insurrection, and shortly after a revolution also broke out in Spain. In 755, however, the Arab chieftains assembled at Cordova, and agreed to put an end to the anarchy by electing Abdel-Rahman ben Moawiyah, the last Ommeyiade, who had escaped the massacre and lived in Egypt, as king. Yussef took arms against this decision, but was twice defeated, and finally killed in the battle of Loxa, in 759.

Yus'sef ben Tuxfyn', the second prince of the dynasty of the Almoravides in Africa, and the founder of Morocco, was b. at Velad Sahara in 1006, and gained great fame as a military leader. In 1086 he was invited to Spain by the Moorish king to aid him against Alfonso VI. of Castile, and he contributed much to the victory of Zalaca, near Badajoz. But after the defeat of Alfonso, Yussef began to turn his arms against his own countrymen, and by degrees came into possession of the kingdoms of Malaga, Granada, Murcia, Cordova, Seville, Almeria, Badajoz, and Valencia, and in 1103 his son, Aly, was acknowledged as his successor both in Africa and in Spain. D. in 1106, one hundred years old.

Yus'te, a monastery of Spain, province of Caceres, situated in a wild and lonely but romantic mountain-region, filled by the spurs of the Sierra de Gredos and cut up by numerous torrents which flow to the Rio de las Battuecas. A narrow mule-path leads across the main ridge, through the Puerto del Emperador, into the valley of the Ierte. Here the emperor Charles V. spent the last years of his life, from his abdication in 1555 to his death in 1558.

Yu'thia, city of Siam, Farther India, on the Menam, 40 miles N. of Bangkok, in lat. 14° 40′ N. It was formerly the capital of the empire and the residence of the king, and contained several structures of immense dimensions and gorgeous ornamentation; but in 1766 the king of Ava invaded Siam, besieged Yuthia for two years, and finally razed it to the ground; which event gave occasion to the building of Bangkok. A new town, however, soon arose on the ruins of the old, and the present Yuthia has between 30,000 and 40,000 inhabitants, among whom are many Chinese and Burmese. The river, which entirely encircles the city, is here exceedingly rich in fish, and fishing is one of the principal occupations of the inhabitants. Another circumstance which gives Yuthia some importance is its fine and salubrious climate, on account of which many of the merchants of Bangkok remove hither during summer. Close by is the famous Golden Mountain, a pyramid 400 feet high and rising in sections, of which the third contains a huge vault, 150 feet high, in which is placed a golden or gilded statue of Booddha of colossal size.

Yut'ta, town of Palestine, 4 miles S. of Hebron, is the *Juttah* of Scripture, situated in the mountain-region of Judah, in the neighborhood of Maon and Carmel (Josh. xv. 55), and allotted to the priests (Josh. xxi. 16). It has been conjectured by Reland that Yutta (*Juttah*) is the πόλις Ἰούδα, "city of Juda," in the hill-country, in which Zacharias, the father of John the Baptist, resided.

Yverdun' (ancient *Ebrodunum*), town of Switzerland, canton of Vaud, at the mouth of the Thiele in Lake Neufchâtel, was the seat of the celebrated institute of Pestalozzi (1805–25); has a library with Roman antiquities, a school for deaf mutes, and a gymnasium. P. 5889.

Yvetot', town of France, department of Seine-Inférieure, manufactures cotton and linen fabrics, silk, and velvet, and trades in corn and wine. P. 8092.

Yvon' (ADOLPHE), b. at Eschweiler, Lorraine, in 1817; studied painting under Paul Delaroche, and began to exhibit in 1842; went to Russia in 1843, from which he exhibited a great number of sketches and drawings in 1847–48, and achieved subsequently a great reputation as a painter both of portraits and historical pieces. Among his most celebrated pictures are—*The First Consul descending the Alps* (1853), *Capture of the Malakhoff* (1857), *The Battle of Solferino* (1861), *Magenta* (1863).

Z.

Z, the last letter in many alphabets, stands in English, French, and Polish for a vocalized sibilant *s*-sound. It is more frequently represented by *s*, as in Eng., Ger., and Fr. *rose*, It. *rosa*, a sound unknown to Latin, Spanish, and South German. Its original Greek power is *sd* (*zd*) in *wisdom*, whence the two spellings of *Ezra* and *Esdra*. In German its sound is our *ts*; in Italian *dz* and *ts*: the Scotch name *Dalzel* is pronounced *Dalyel*; in Spanish it usually sounds like our *th* in *thin*, but in Spanish America it has the sound of our *s*. In England it is named *zed*, in the U. S. *zed* and *zee*. In Scotland *z* was used for *y* up to 1543, as *ze*, *zow*, *zieres*, for *ye*, *you*, *yours*.

Zaandam', town of the Netherlands, province of North Holland, on the Zaan, an affluent of the Yssel, has numerous corn, oil, and saw-mills, extensive paper manufactures, and considerable shipbuilding. The house in which Peter the Great lived while he worked here as an artisan on the wharves is still preserved. P. 12,320.

Zabaka'no, city of Western Africa, in lat. 11° 20′ N., lon. 2° 5′ E., in the south-western part of the dominions of the Foolahs, is celebrated for its beautiful and picturesque situation, for its excellent dyeworks, and for its leather manufactures. P. about 9000.

Zabism. See SABAISM.

Zacapa. See SACAPA.

Zacate'cas, one of the central states of the Mexican confederation, bounded E. by San Luis Potosi, comprises an area of 26,833 sq. m., with 397,945 inhabitants. It forms part of the large Mexican plateau, and its surface is a vast arid plain, elevated 6000 feet above the sea, almost destitute of water, unfit for agriculture, but affording pastures for large herds of sheep and goats. This plain is traversed by the Sierra Madre Mountains, which are still more barren and inhospitable, but which contain perhaps the richest silver-mines in the world. Mining and rearing of sheep are the principal, almost the only, occupations of the inhabitants. All kinds of manufactured articles and grain have to be imported from the neighboring states; in many places even drinking water must be procured from long distances and at great cost.

Zacatecas, town of Mexico, capital of the state of the same name, in a narrow valley between steep precipices, at an elevation of 7746 feet above the level of the sea. It is generally poorly built, but it contains many elegant residences and several fine churches. In the vicinity are numerous silver-mines which seem to be very rich, but which are very slovenly worked, and in many cases even completely abandoned. It has a college and a fine bazaar. P. 35,000.

Zach, von (FRANZ), BARON, b. at Presburg June 4, 1754; received a military education, but left the Austrian service and became chamberlain to the dowager duchess of Saxe-Gotha, with whom he resided in Germany, France, and Italy till her death in 1827. He then settled in Paris, and d. there of cholera Sept. 2, 1832. He was a very zealous student of astronomy; was director of the observatory of Seeberg, near Gotha, 1787–1806; participated in the foundation and building of the observatories of Naples and Lucca, and published *Monatliche Correspondenz zur Beförderung der Erd- und Himmelkunde* (28 vols., Gotha, 1800–13), afterward continued in Italy under the title of *Correspondance astronomique*. He also wrote *L'Attraction des Montagnes et ses Effets sur les Fils à Plomb* (2 vols., 1814), *Tabulæ Motuum Solis novæ et correctæ* (1792), and *Supplementa ad Tabulas Motuum Solis* (1804), etc.

Zachari'æ (HEINRICH ALBERT), b. at Herbsleben, duchy of Saxe-Coburg-Gotha, Germany, Nov. 20, 1806; studied law at Göttingen; was appointed professor of jurisprudence there in 1830, and d. May 21, 1875. His principal works are—*Lehre vom Versuche der Verbrechen* (2 vols., 1836–39), *Deutsche Staats- und Bundesrecht* (3 vols., 1841–45), *Handbuch des deutschen Strafprocesses* (2 vols., 1861–68), besides a great number of monographs and essays referring to the juridical side of the political development of Germany, in which he took part as a member of the North German Diet, and subsequently of the upper house of the Prussian Diet.

Zachari'as, pope 741–752, increased the authority and power of the see of Rome very much by persuading Luitprand, king of the Longobards, to cede to him all that he had conquered of the exarchate; by consecrating Pepin le Bref king of the Franks; and by the manner in which he co-operated with Boniface in regulating and consolidating the Church in Germany. Personally, he was kind and possessed of literary taste. He bought multitudes of Christian slaves and liberated them, and translated the dialogues of Gregory the Great into Greek.

Zacynthus. See ZANTE.

Zad'kiel was the assumed name of a person not long since dead who believed, or pretended to believe, that events could be foretold through the aid of astrology. Stars at birth or at any critical period of the lifetime of an individual, or in the case of a community, city, or nation, were supposed to guide the course of events, so that an observation of them would lead the prophet to presage correctly all that which would subsequently happen. It is almost needless to say that this so-called science, believed in by millions, was, root and branch, merely audacious quackery. Such almanacs of astrological predictions have existed since the days of Confucius. The Latin poet Manilius wrote an astrological poem. There are many Arabian astrological almanacs extant. Cardinal d'Ailly calculated the horoscope of Jesus Christ. In Japan, India, Persia, and especially China, these pamphlets, containing wild, haphazard predictions, were known and proscribed before the first year of the Christian era. One great astrologer, *Vitsang-Ti-Hinghee*, is said to have been executed on account of publishing a prediction of the subversion of a provincial ruler. Yet such prophecies gain numerous readers to-day. Zadkiel is a name which of itself sufficiently savors of imposture. His almanac is in English, with utterances vaguer than those of a Delphic oracle; and yet there are men and women, reputed to be sane, who pin their faith to his vaticinations. (See ASTROLOGY.)

R. C. CALDWELL.

Zadonsk', town of European Russia, government of Voronezh, on the left bank of the Don, has several ecclesiastical, educational, and benevolent institutions, and some manufactures. P. 6897.

Zafaran'-Bo'li, town of Asiatic Turkey, in Asia Minor, on the Chatisoo, has a good bazaar, several fine mosques, and a large trade in saffron, which is extensively cultivated in the vicinity. P. about 15,000.

Zaf'fre, or **Zaffer** [Ger. *Zaffer*], a product obtained by roasting cobalt ores with sand. It is simply an impure oxide of cobalt, produced by the oxidation of the sulphides or arseniurets present, and the volatilization of the oxides of sulphur and arsenic. Zaffre is ground up with various compositions to be used for painting porcelain, in the decoration of the latter.

H. WURTZ.

Zagaro'lo, town of Italy, province of Rome, on a hill about 21 miles E. N. E. of the city of Rome, and commanding the magnificent scenery so peculiar to this region. Zagarolo contains some Roman antiquities of interest, and many of the houses, some of which are Saracenic, are as old as the thirteenth century. This town was a fief of the Colonna for a long period, though their possession of it was often fiercely contested by the popes. In the seventeenth century it passed to the Rospigliosi. In 1591, Gregory XIV. assembled here a theological council charged to correct the typographical errors which had crept into the Bible. P. 5463.

Zagoskin (MIKHAIL), b. at Penza, Russia, in 1789; fought in the campaigns of 1812; received afterward an appointment in the imperial library in St. Petersburg; became director of the theatre of Moscow in 1820, and keeper of the armory in the Kremlin in 1842. D. in Moscow in 1852. He wrote comedies which were brought on the stage with considerable success, and novels, of which one, *The Young Muscovite* (3 vols., Moscow, 1829), was translated into English (London, 1831).

Zagros Mountains. See ASSYRIA.

Zagazig, town of Lower Egypt, capital of the province of Sharkieh, is connected with Suez by rail, and with Ismailia and Suez by a canal; forms the chief dépôt for the cotton produced in the eastern part of the delta of the Nile; and is increasing in commercial importance. Close by are the ruins of the ancient city of *Bubastis*. P. about 40,000.

Zahn (JOHANN KARL WILHELM), b. at Rodenberg, Hesse, Germany; studied architecture and painting in Cassel 1817–23, Paris 1823–24, and Italy 1824–28; was up-

pointed professor at the academy of fine arts in Berlin in 1829; visited Italy again 1830–10. D. in Berlin Aug. 22, 1871. By the application of his invention of colored lithographs he published *Die schönsten Ornamente und merkwürdigsten Gemälde aus Pompeji, Herculanum und Stabiä*, 3 series, with 100 plates in each (1828–63), *Auserlesene Verzierungen aus dem Gesammtgebiet der bildenden Kunst*, 25 plates (1842–44), and *Ornamente aller classischen Kunstepochen*, 100 plates (1832–39).

Zaïre. See CONGO, and also CONGO, in APPENDIX.

Zakrzew'ska (MARIE ELIZABETH), b. in Berlin, Prussia, Sept. 6, 1829. Her father was of Polish descent and an officer in the army; owing to his liberal opinions he lost his salary. His wife, in order to educate her children, six in all, studied midwifery and achieved a large practice. Marie, in assisting her mother, became interested in medical affairs, and made the acquaintance of many able professors. Dr. Schmidt lent her important aid in securing every advantage in her medical education. He was determined to make her a German La Chapelle. She passed her examinations with great credit, became the assistant of her professor; at his death she filled his chair, which in Prussia was an offence to the male profession. Her persecutions were so great that she resigned her position and emigrated to America, and in 1853 landed in New York, without means and without a knowledge of the language. She was compelled to earn her bread by working for fancy stores, instead of founding a hospital as she had long desired. At length she made the acquaintance of Dr. Elizabeth Blackwell. As she could not be admitted to the profession in Prussia, she was compelled to get a diploma in this country. Accordingly, she entered Cleveland College in Ohio and graduated. She returned to New York, and in company with Drs. Elizabeth and Emily Blackwell established the New York Infirmary, which she superintended for two years as resident physician and manager. She removed to Boston, and in 1863, through her untiring efforts and energy, the New England Hospital for Women and Children was incorporated—an institution that fully realizes the expectations of its friends.

SUSAN B. ANTHONY.

Zaleu'cus, the lawgiver of the Epizephyrian Locrians in Magna Græcia, flourished in the middle of the seventh century B. C., and his code is said to have been the first collection of written laws which the Greeks ever possessed. Of his personal life and of his legislation nothing is known but loose tradition, but from this it would seem that his laws were pretty severe. Adultery was punished by the loss of both eyes; the use of unmixed wine and journeys to foreign countries were forbidden; any one who wished to propose a new law or the abolishment of an old was compelled to step forward in the assembly with a rope around his neck, and if his proposition was rejected he was immediately strangled.

Zalesczyk'y, town of Austria, in Galicia, is beautifully situated on the Dniester, contains a fine palace, and has several annual fairs and a considerable trade in grain. P. 5158.

Zale'ski, p.-v., Madison tp., Vinton co., O. P. 690.

Zalu'ski (JÓZEF ANDRZEJ), b. at Rawa, present government of Warsaw, Poland, in 1701, of an old and wealthy family; made comprehensive theological and philosophical studies in Germany, Holland, France, and Italy, and took holy orders: was a partisan of Stanislaus Leszczynski, who sent him as ambassador to Rome to Pope Clement XII.; lived for some time after the abdication of the king at his court in Lorraine, but returned subsequently to Poland, and was made bishop of Kiev by Augustus III.: spoke with great vehemence in the diet of 1766 against the Dissidents, and as Russia had espoused their cause simply as a means of interfering in the affairs of Poland, Zaluski was arrested at the instance of the Russian ambassador, Repnin, and banished to Kaluga, where he was kept in a sort of confinement till his death, Jan. 9, 1774. His whole fortune he had spent on the collection of an excellent library, comprising over 230,000 volumes, which was placed in a separate building in Warsaw and opened to the public. On his death he bequeathed the library to the Polish people, but in 1795 Russia preferred to consider it state property, and carried it to St. Petersburg, where it was incorporated with the imperial library. Zaluski wrote several valuable bibliographical works.

Za'ma, town of Numidia, near the Carthaginian frontier, was a very strong place in the time of the Punic wars, and selected by King Juba as his residence and the depository of his treasures. Here was fought, on Oct. 19, 202 B. C., the famous battle in which Publius Cornelius Scipio defeated Hannibal, thereby bringing the second Punic war to an end. Strabo describes the city as lying in ruins, but it must subsequently have been restored, as Pliny speaks of it as a free city, and St. Augustine mentions a bishop of Zama. It was generally called *Zama Regia* by the ancients. At present there exist only a few insignificant remains of it.

Zam'acois (EDUARDO), b. at Bilbao, Spain, about 1837; studied art at the Madrid Academy, in Italy, and in Paris under Meissonier; alternated between Paris and Madrid for some years, and became eminent in the "new Spanish school" of genre painters, whose works have acquired great popularity, especially in the U. S., where some of his best works are owned. D. in Madrid in Jan., 1871.

Zambe'si, river of Eastern Africa, drains an immense territory extending between lat. 8° and 21° S., and between lon. 14° and 37° E., and enters into the Channel of Mozambique between lat. 18° and 19° S. through several mouths, of which, however, only the Quilimane is navigable.

Zambro'ta, tp., Goodhue co., Minn. P. 781.

Za'min, a genus of cycadaceous plants, partly tree-like and partly stemless. The genus has a wide geographic range. *Z. integrifolia*, the COONTIE (which see) of Florida, *Z. tenuis* and *Z. furfuracea* of the Bahamas, *Z. cycadis* of South Africa, *Z. pumila* in the West Indies, and other species furnish starchy food from their stems. This product enters into commerce as arrow-root and sago, though in strictness it is neither.

Zamoj'ski, the name of a celebrated Polish family of old nobility and immense wealth, of which many members have been prominent in the history of Poland since the beginning of the sixteenth century: (1) JAN ZAMOJSKI, b. Apr. 1, 1541, at Skoków, palatinate of Chelm; studied in Paris and Padua, and was appointed, immediately after his return in 1565, to important positions in the government. On the death of King Sigismund Augustus in 1572, he succeeded in extending the elective franchise so that every nobleman who was able to serve personally in the army, with his own equipment and at his own expense, was entitled to participate in the election of the king; and this manœuvre enabled him to carry the election of Henry of Anjou. The choice proved a very unfortunate one, but when Henry ran away from Poland, Zamojski succeeded a second time in controlling the election, and established Stephen Báthori, prince of Transylvania, on the throne in 1576. Between the new king and the proud king-maker there existed perfect harmony, and Zamojski was made commander-in-chief of the Polish army and grand chancellor of the Crown. He fought with brilliant success along the frontiers of the empire against the Tatars, Cossacks, etc., but his support of Báthori's internal reforms made him unpopular, and his unflinching vindications of the law against the arrogance of the nobility procured him many enemies. Nevertheless, on the death of Báthori in 1586, he could have taken the crown for himself. He preferred, however, to tender it to some scion of established royalty, and Sigismund III., son of Johann III. of Sweden and Catharina Jagellonica, was elected king. But Sigismund was weak and suspicious, and Zamojski was soon superseded by incompetent favorites. The rest of his life he spent away from the court, either on his estates, in literary occupation, or in warfare, defending the frontiers at the head of armies which he raised and maintained at his own expense. He d. June 3, 1605, at Zamosc, which he had founded. He wrote *De Senatu Romano* (1563), *Testamentum Joannis Zamori* (1606), etc.; and in Lünig's *Literæ Proceruum Europæ* are to be found several very interesting letters by him. His biography was written by Zorkowski (Lemberg, 1860).—(2) ANDRZEJ ZAMOJSKI, COUNT, b. in 1716 at Zdiezun, present government of Plock, received an excellent education, both scientific and military: was made a major-general in 1751, subsequently a senator, commander-in-chief, and finally, in 1764, grand-chancellor. But in 1767, when, at the instance of the Russian ambassador, Repnin, several senators had been banished to Kaluga, Zamojski resigned his offices and retired to his estates. Here he introduced many reforms, and even abolished serfdom, which raised a bitter enmity against him among other noblemen. On the invitation of the diet of 1776 he drew up a code of law, comprising an elaborate regulation of the rights and duties of the third estate, and in 1778 he published it—*Zbiór praw sadowych* (3 vols., Warsaw). It proved too liberal, however, for the moment. It was rejected by the diet of 1780, and not adopted until by the constitution of May 3, 1791. D. at Zamosc Feb. 10, 1792.—(3) His grandson, COUNT ANDRZEJ ZAMOJSKI, b. Apr. 2, 1800; was educated at Paris, Geneva, and Edinburgh; entered the civil service of the Polish government in 1823, and was minister of the interior during the revolution of 1830. After the fall of Warsaw he retired to his estates, where he abolished serfdom, founded schools, established the first

private bank, introduced steam navigation on the Vistula, issued a periodical, *Annals of Agriculture*, and formed a great agricultural association which held its meetings in Warsaw. In 1862 this beneficent activity was suddenly broken up. Zamojski was banished and settled in Paris.

Zamo'ra, town of Spain, capital of the province of Zamora, on the Douro, which here is crossed by a splendid bridge. It contains many fine churches, palaces, monasteries, hospitals, barracks, and other public buildings, but these edifices, like the dilapidated walls which surround the city, are now only monuments of a splendor long gone by. Its manufactures of serges, linens, leather, hats, brandy, and liqueurs are not important, but its trade in wine and grain is brisk. P. about 12,000.

Zamora, de (Antonio), b. in Spain about 1680; was a chamberlain of Philip V. and a popular dramatic author. D. after 1730. His best dramas were *Mazariegos y Monsalves*, *El Hechizado por Fuerza*, and *Don Juan*.

Za'mosc, town of Poland, government of Lublin, on the Wieprz, is well built, has a large, elegant palace and an arsenal, and is one of the strongest fortresses of the country. It was founded in 1588 by Jan Zamojski, who established here a scientific academy with a valuable library, which flourished for over two centuries, until it was closed by the Russians. The city, which was often besieged by the Cossacks, Swedes, Germans, and Russians, remained in the possession of the family of Zamojski until 1820, when it was bought by the Polish crown for an enormous sum. P. about 5000.

Zampieri. See Domenichino.

Zancle. See Messina.

Zane, tp., Logan co., O. P. 879.

Zane (Ebenezer), b. in Berkeley co., Va., Oct. 7, 1747, was of Danish descent; settled on the present site of Wheeling 1770, being the first permanent establishment on Ohio River; built there a blockhouse called Fort Henry, from which he repulsed several assaults made by the Indians during the Revolution; was a disbursing officer under Lord Dunmore; held several other civil and military posts, gaining the rank of colonel, and became owner of the land on which the city of Zanesville, O., now stands. D. at Wheeling in 1811.

Zanes'field, p.-v., Jefferson tp., Logan co., O. P. 282.

Zanes'ville, p.-v. and tp., Montgomery co., Ill. P. 1901.

Zanesville, city and cap. of Muskingum co., O., on the National Road, at the junction of Licking and Muskingum rivers, on the meridian of 40° N. lat. By rail it is 170 miles from Cincinnati, 137 from Cleveland, and 59 from Columbus. It is on the line of Baltimore and Ohio R. R., running E. and W., and Cincinnati and Muskingum Valley, extending from Cincinnati to Dresden Junction, where it connects with Pittsburg Cincinnati and St. Louis R. R. Muskingum River S. is navigable for steamboats of light draught to Ohio River the year round. Zanesville contains 22 churches, 19 public-school buildings (1 a high school in which the classics are taught), 2 benevolent institutions (1 for friendless women and the other for orphan children—the latter a private charity), 1 furnace, 2 large rolling-mills, 1 flooring tile and 1 roofing tile manufactory, 3 portable and stationary engine machine-shops, 2 wagon and carriage manufactories, 2 horse railroads, 1 public library, 1 national and 4 savings banks, 2 laundry-soap works, 1 cotton and 3 woollen mills, 4 glassworks (1 window and 3 bottle), and 1 file manufactory. It has 1 daily newspaper and 5 weeklies. Its waterworks are the second in extent in the State; the basins, three in number, are located on heights 183 feet above the level of the river, affording a pressure of 80 pounds to the square inch. A standpipe supplies residents on the high ground. The fire department is comparatively small, but efficient. The city is mainly built upon a level plain, and has beautiful surroundings and unsurpassed landscape. In the early history of Ohio (1810–12) Zanesville was its capital, and the first State-house was erected there. P. 10,011, now estimated at 20,000. T. J. Newman, Ed. "Daily Courier."

Zanguebar. See Zanzibar.

Zan'te [anc. *Zacynthus*], one of the largest of the Ionian Islands, comprises an area of 164 sq. m., with 39,367 inhabitants. It is of volcanic origin, and earthquakes are frequent, but the plain which occupies the greatest part of its surface is very fertile and produces currants in large quantities, wine of superior quality, citrons, pomegranates, and melons. A peculiar feature are the pitch-wells in the neighborhood of the capital, Zante, which has a good harbor protected by a mole, and carries on a considerable trade. P. 17,516.

Zanzibar', or **Zanguebar,** the name (1) of a large portion of the eastern coast of Africa; (2) of an island lying 25 miles off this coast; and (3) of a city, the capital of the island—all belonging to the dominions of the sultan of Zanzibar. The Zanzibar of the mainland extends along the Indian Ocean from lat. 2° N., where it is bounded by the territories of the Gallas tribes, to Cape Delgado, in lat. 10° 42′ S., where it is bounded by the Portuguese province of Mozambique; its western boundary, toward the interior, is entirely undefined. It is inhabited by heathen tribes of negroes, who in the interior live perfectly independent, while along the coast they acknowledge the authority of the sultan. The products are those common in the tropical zones, and they seem to be plentiful, but as yet they have not acquired any great importance in commerce. The heat is excessive, the climate very injurious to Europeans, and the country very seldom visited.—The island of Zanzibar, 48 miles long and 30 miles broad, is in lat. 6° S. It is of coral formation, low, flat, but exceedingly fertile, well watered by numerous rivulets, which are kept running during the whole year by the copious and steady rainfall, and with a healthy and equable climate, the thermometer never rising above 90° and never sinking below 70° F. The inhabitants, numbering about 250,000, consist partly of Arabs, who form the aristocracy, own the land, and cultivate it by slaves—partly of free negroes, who carry on its trade. The whole island is cultivated like a garden, and rice, sugar, cocoanuts, cloves, and fruit of the finest quality are raised in abundance.—The city of Zanzibar, the residence of the sultan, contains about 65,000 inhabitants, and carries on a considerable trade, exporting gum-copal, cloves, ivory, cocoanuts, and oil-seeds, and importing iron and cotton goods. Although it contains several fine, even magnificent, buildings, it is generally ill built, and it has a bad reputation on account of its extreme dirtiness. The natural drainage of the place is insufficient, and as nothing has been done by art, pestilential fevers are of frequent occurrence.

Zapa'ta, county of S. W. Texas, bounded W. by the Rio Grande, which separates it from Mexico; surface generally level, undulating, but hilly in the N. part. Horses, cattle, and sheep are numerous, stock-raising being the principal industry, although a little Indian corn is produced. Cap. Carrizo. Area, 1425 sq. m. P. 1488.

Zapol'ya, the name of a powerful Hungarian family which at one time maintained a protracted contest with the house of Hapsburg for the possession of the Hungarian crown: Johann Zapolya, b. in 1487; was proclaimed king of Hungary in 1526, and vindicated himself in Transylvania and Lower Hungary against Ferdinand of Austria by acknowledging himself a vassal of Solyman II. D. in 1540. —His son, Johann II. Zapolya, b. a short time before the death of the father; was recognized by Solyman II. as king of Hungary under the tutelage of his mother, Isabella. He married in 1560 a daughter of the emperor, but with his death in 1570 the male line of the family of Zapolya became extinct.

Za'ra, town of Austria, capital of Dalmatia, on a narrow peninsula in the Adriatic, strongly fortified and surrounded by bastions of Venetian construction which form beautiful public walks. It has a safe but somewhat shallow harbor, an arsenal, large barracks, a fine cathedral, and many other handsome public edifices and monuments, as it is the see of an archbishop and the seat of the provincial government. It manufactures silk fabrics, rosoglio, and maraschino; its trade is mostly coasting-trade, but its fisheries are extensive and valuable. P. 8014.

Zara'te, de (Agustin), b. in Spain about 1505; accompanied Blasco Nuñez de Vela, viceroy of Peru, to that country 1543 as treasurer of the Crown; became master-general of accounts in Peru and Terra Firma; took part in the civil wars of the Pizarros, and wrote *Historia del Descubrimiento y de la Conquista de Peru* (1555). D. about 1560.

Zarathustra. See Zoroaster.

Zaslav', town of Russian Poland, government of Volhynia, on the Gorin, has celebrated manufactures of cloth, and rich mineral springs in the vicinity. P. 8857.

Zauschue'ria, a beautiful flowering plant, a native of California, and named after M. Zauschner, a Bohemian botanist, who first brought it into general notice, is a perennial of the evening primrose family, with stem from one to two feet high and brilliant-colored flowers strongly resembling those of the fuchsia. It blooms late in the summer and during the fall, succeeds best in dry and sandy soil, and must in New York and New England be protected during winter.

Zava'la, county of S. W. Texas, drained by Nueces and Leona rivers; surface level, fairly adapted for grazing, though suffering from scarcity of water. P. 133.

Zaylah. See ZEILAH.

Zbo'rnz, town of Austria, in Galicia, on the Iwka, near the Russian frontier, has a trade in corn and pork. P. 6772.

Ze'a [anc. Κέως], one of the Cyclades Islands, in the Ægean Sea, is 13 miles long and 8 miles wide, fertile, with a healthy climate, and rich in cotton, wine, and figs. P. about 5000. Cap. Zea.

Zea (FRANCISCO ANTONIO), b. at Medellin, New Granada, Oct. 20, 1770; educated at Bogotá; took part in a revolutionary movement, for which he was imprisoned at Cadiz, Spain, 1797–99; became assistant director of the botanic garden at Madrid 1802; director-in-chief and professor of botany 1805; was a member of the junta of Bayonne 1808; was minister of the interior and governor of Malaga under Joseph Bonaparte; joined Bolivar in South America 1814; became intendant-general of the army; vice-president of Venezuela Feb., 1819; was accredited as minister plenipotentiary to all the European courts Sept. 21, 1819, and obtained in 1822 from English bankers a loan of £2,000,000. D. at Bath, England, Nov. 28, 1822.

Zealand. See ZEELAND.

Zeal'ots, a fanatical Jewish sect which struggled desperately against the Romans from about 6 A. D., when Judas the Gaulonite headed a revolt, till the fall of Jerusalem, in the year 70.

Zea mays. See INDIAN CORN.

Zebid', town of Yemen, Arabia, on the Zebid, 60 miles N. of Mocha, is surrounded with high walls surmounted by towers, and strongly fortified. Its harbor has been silted up, and it thus has lost much of its trade. P. about 7000.

Zebo'im [Heb., "gazelles" or "hyænas"], one of the five "cities of the plain" (Gen. xiv. 2), four of which were destroyed (Gen. xix. 28, 29). See ZOAR.

R. D. HITCHCOCK.

Ze'bra, the *Asinus zebra*, (1) a wild ass of the mountainous parts of South Africa, but now nearly extinct. It is of a creamy-white color, striped with a rich black on the head, trunk, and legs, except on the belly and inside of thighs; the nose is reddish; the tail blackish at end; the hoofs are narrow and deeply concave beneath. It is one of the handsomest, and also one of the wildest and least tractable, of animals. It hybridizes with the ass. (2) The name is also used as group-term for the *A. zebra* and related forms characterized by a similar style of ornamentation. Thus, the DAUW (which see) is sometimes called Burchell's zebra, but is a much less handsome beast than the true zebra. The quagga is another species. Only in a few instances has the zebra been domesticated and put to service, for it always retains its vicious nature.

Zebra-Wood, a beautiful striped wood used for veneering, is produced in Guiana by *Omphalobium Lamberti*, a large tree of the order Connaraceæ, and in the West Indies by *Eugenia fragrans* of the order Myrtaceæ.

Zebu', or **Brahman Bull,** the common domesticated ox of India, found also in China and East Africa. It differs from the common ox of Europe and America in having one, or more rarely two, humps of fat on the shoulders, and in having eighteen caudal vertebræ, while our cattle have twenty-one. The Brahman cow goes with young 300 days, the common cow 270. Hence, the zebu is assigned to another species, *Bos Indicus*. Nevertheless, it breeds freely with the common cattle. The zebu is of several breeds, varying much in size. The beef is of fair quality and the hump is prized. Zebus are trained to draw carriages, to plough, and to serve as beasts of burden. To this stock belong the sacred bulls of Siva.

Zebu, one of the Philippine Islands, in the Malay Archipelago, E. of Negros, in lat. 9° 20′ N., lon. 123° E., and forms, together with the islands of Matan and Bohol, a province with 389,073 inhabitants. The capital, Zebu, is a large and well-built town, with 8805 inhabitants, a fine cathedral, a handsome episcopal palace, and a good trade in the products of the islands.

Zeb'ulon, p.-v. and tp., cap. of Pike co., Ga. P. 745.

Zeb'ulun [Heb., "dwelling"], the tenth of the twelve sons of Jacob, the sixth and last by Leah. His personal history is a blank. In the exodus from Egypt the tribe of Zebulun marched in the van, next after Judah and Issachar, just ahead of the six wagons which carried the hangings, planks, and pillars of the tabernacle. The territory of the tribe in Palestine was bounded on the E. by the southern half of the Lake of Galilee, beginning just above the site of Tiberias, and included Nazareth and Rimmon, but especially the very fertile plain of *Battauf* (10 miles from E. to W. and 5 from N. to S.), on whose northern edge, according to Robinson, stood Cana of Galilee.

R. D. HITCHCOCK.

Zechari'ah, the eleventh in order of the twelve minor prophets of the Hebrew canon. Zechariah is mentioned in chap. i. 1, and chap. vii. 1, as having received the word of the Lord in the second and fourth years of Darius (521 and 519). He would therefore be one of those who returned with Zerubbabel, Joshua, and Haggai. The first eight chapters correspond fully with this statement. They consist of discourses in which the prophet seeks to impress on the people the lessons of the Captivity, and to warn them against the sins of idolatry, etc., which had brought this calamity on their fathers. But chs. ix.–xiv. present great difficulty if we have to interpret them as written at this time and under these circumstances. Assyria and Egypt are referred to as powerful and dangerous neighbors of Judah (x. 11), though Assyria and Egypt were both provinces of the Persian empire in 520. Israel and Judah are represented as independent and hostile (xi. 14). Idolatry is condemned as a prevalent vice (xiii. 2). Prophets are rebuked as by Jeremiah (xiii. 3, 4). These features lead us back to the time before the Captivity, and even before the fall of Samaria, for the date of these prophecies, and the critics are generally agreed that we have here the works of two or three prophets combined in one book. Zech. xi. 12 and 13 is quoted in Matt. xxvii. 9, 10, though not closely or accurately; but it is quoted as from *Jeremiah*. Furthermore, we find several prophets by the name of Zechariah mentioned in the Old Testament, and some confusion as to their identity. Zachariah, son of Jehoiada, was tutor to King Joash, and was put to death by him (2 Chron. xxiv. In Matt. xxiii. 35 he is called son of Barachias). Another prophet by this name in the time of Uzziah is mentioned in 2 Chron. xxvi. 5; another in the time of Ahaz (Isa. viii. 2; cf. ver. 16) was the son of Jeberechiah (= Berechiah). In the superscription (Zech. i. 1) the author is called "son of Berechiah, son of Iddo." In Ezra v. 1, vi. 14, Neh. xii. 16, he is called the son of Iddo. It is evident that there is confusion here, and it is probable that there are combined in this book the works of two or three prophets of the same name who lived at different times. Probably, the author of the first eight chapters was the son of Iddo, and the remainder was from the hand of the son of Berechiah, contemporary with Isaiah. Hence the confusion in the superscription.

Zedekiah. See JEWS, by PROF. FELIX ADLER, PH. D.

Zed'oary [Arab. *jadwar*], the warm aromatic root (rhizome) of certain East Indian plants of the order Zingiberaceæ. The best is long zedoary, from *Curcuma zedoaria*. Round zedoary is from *Curcuma zerumbet* and *Kæmferia rotunda*. Zedoary, like cassumuniar, galangale, and zerumbet, considerably resembles ginger, but the latter is so much superior to them all as to have crowded them entirely out of general commerce.

Zee'land, or **Zealand,** province of the Netherlands, bounded S. by Belgium and W. by the North Sea, consists of the islands of Walcheren, Beveland, Tholen, Duiveland, and Schouwen, between the mouths of the Maas and the Scheldt, and comprises an area of 665 sq. m., with 181,650 inhabitants, of whom 130,557 are Protestants and 46,018 Roman Catholics. The ground is very low, and must be protected against inundation by dikes, but the soil is very fertile and very well cultivated. Large crops of wheat, oats, potatoes, beans, madder, and tobacco are raised, and cattle, sheep, and pigs are extensively reared. The fisheries are valuable and the manufacturing industry considerable.

Zei'lah, or **Zay'lah,** town of Egypt, on the Gulf of Aden, about 100 miles S. of the Strait of Bab-el-Mandeb, in lat. 11° 17′ N., on a sandy promontory, is surrounded with mud walls, the whole in a decayed condition, but its harbor is safe and has 15 feet of water at low tide, and the surrounding country is rich and populous. A considerable trade is carried on with various Arabic ports, ivory, myrrh, ostrich-feathers, and gums being the principal articles of export. It was the last point held by the Turks on the African coast of the Red Sea: it was ceded to Egypt in 1875. P. about 5000.

Zei'lin (JACOB), U. S. M. C., b. July 16, 1806, in Pennsylvania; entered the marine corps as second lieutenant Oct. 1, 1831; became captain in 1847, major in 1861, colonel in 1864, brigadier-general in 1867; brevetted for gallantry during the Mexican war, and wounded at the battle of Bull Run; made commandant of the marine corps in 1864, and was retired in 1876.

FOXHALL A. PARKER.

Zeis'berger (DAVID), b. at Zauchtenthal, Moravia, Apr. 11, 1721; was educated in the Moravian settlements in Saxony and Holland, and joined then his parents, who some years previously had emigrated to Georgia. In 1740 he began his missionary work among the Indians, which he continued with unabated energy for more than sixty years. In 1781–82 his success received a severe check.

The settlements of Christian Indians which he had formed on the Tuscarawas, O., were in 1781 broken up by a body of Wyandot warriors at the instigation of the British commandant of Detroit, and the settlers were compelled to remove to Sandusky; and when, next year, some 96 of them returned to their former homes to gather their corn, they were murdered by the neighboring white settlers; which atrocity of course put a stop to further missionary progress among the Indians, at least for a long time. Zeisberger, however, did not lose courage, and when, in 1796, Congress granted to the Moravian Indians the tract of land in the valley of the Tuscarawas which they had formerly occupied, he was able to return to the place with a considerable number of converts and build the town of Goshen, where he d. Nov. 17, 1808. He published a spelling-book (1776), a collection of hymns (1803), *Sermons to Children* (1803), and a *Harmony of the Four Gospels* (1821), in Delaware, and a Delaware grammar and dictionary and an Iroquois dictionary by him exist in manuscript in the libraries of Harvard University and of the American Philosophical Society in Philadelphia.

Zeitz, town of Prussia, province of Saxony, on the White Elster, is surrounded with walls, and has breweries, distilleries, soapworks, and manufactures of cotton and linen fabrics, earthenware, leather. Large quantities of fruits and vegetables are raised in the vicinity. P. 15,417.

Zela'ya, town of the Mexican confederation, state of Guanajuato, consists of the town proper, which is handsome and well built, and a number of wretched suburbs inhabited by Indians. It has some cotton manufactures, and the surrounding districts are fertile and well cultivated. P. about 11,000.

Ze'le, town of Belgium, province of East Flanders, manufactures spirits and horse, sack, and sail cloth. P. 12,037.

Zelieno'ple, p.-b., Butler co., Pa. P. 387.

Zelle. See CELLE.

Zel'ler (EDUARD), b. at Kleinbattwar, a v. of Würtemberg, Jan. 22, 1814; studied theology and philosophy at Tübingen under Baur and Strauss; heard afterward Marheinecke, Neander, and Gans at Berlin; began to lecture on philosophy and theology at Tübingen in 1840; founded in 1842 the *Theologische Jahrbücher*, which was continued to 1857, and formed the principal organ of the new Tübingen school of theologians; was appointed professor of theology at Berne in 1847, of philosophy at Heidelberg in 1849, at Marburg in 1862, and at Berlin in 1872. Among his principal works are—*Die Philosophie der Griechen* (3 vols., 1844–52; translated into English by O. I. Reichel under the titles *Socrates and the Socratic Schools*, 1868, and *The Stoics, Epicureans, and Sceptics*, 1869), *Die Apostelgeschichte* (1854; translated into English by Joseph Dare, *The Acts of the Apostles*, 1875), *David Friedrich Strauss* (1874; translated into English in the same year). He also wrote *Platonische Studien* (1839), *Das theologische System Zwingli's* (1853), *Staat und Kirche* (1873).

Zeller (JULES SILVAIN), b. in Paris Apr. 23, 1820; studied in his native city, and subsequently in Germany; taught history in the lyceums of Bordeaux, Rennes, Strasbourg, and Aix, and was appointed professor of history at the Normal School of Paris in 1858, and of the École polytechnique in 1869. He wrote *Ulrich de Hutten* (1849), *Histoire de l'Italie* (1852), *Episodes dramatiques de l'Histoire d'Italie* (1855), *L'Année historique* (4 vols., 1860–63), *Les Empereurs romains* (1863), *Histoire d'Allemagne* (1872).

Zel'ter (KARL FRIEDRICH), b. in Berlin Dec. 11, 1758; was trained as a mason, and became a master in 1783, but, although he worked at his trade with great enterprise and success, he nevertheless found time to make a thorough study of music; became the leader of the Fasch Singing Academy in 1800 and professor of music at the Academy of Fine Arts in 1809. In the same year he founded the first Liedertafel, a singing society of male voices, for which he composed a great number of excellent songs. He also composed much church music. D. at Berlin May 15, 1832. His correspondence with Goethe was published in Berlin in 6 vols. (1833–34). His *Life* has been written by Dr. W. Rintel (1861).

Zena'na [Pers. *zen*, "woman;" *zenanah*, "belonging to women"], the name given to that portion of the house devoted entirely to the use of the females in a family of good caste in India. The house of a native gentleman of Bengal is always divided into two distinct parts—the outer portion, which belongs to the gentlemen, and the inner or zenana, which is appropriated to the women. Each of these buildings is in the shape of a hollow square, with an open court in the centre—the men's building toward the street, the women's back of it. The house is from two to three stories high, with verandas on each story running round the inner part opening on to the open courts in the centre. In the men's portion of the building there are doors and windows opening toward the street, and the rooms are large and lofty, with handsome furniture. In the zenana, however, everything exhibits a condition of the utmost squalor and wretchedness, though it may be in a very high-caste or wealthy family. There sometimes will be from 50 to 100 ladies, or even more, residing in one of these houses, all of them belonging to one family, yet all of them wives of different individuals; for, though polygamy is permitted by their *shastras* or holy books, it is very little practised in Bengal. These ladies have no common parlor or sitting-room elegantly furnished, like the ladies of the Turkish harem, but each one has her own little room, where she lives all her life and brings up her children, though she is permitted to go into any room to visit the other women in the zenana, and the work-rooms and open court in the centre of the building are free to them all. But she must never go out into the outer portion of the building, that which belongs to the gentlemen, as it is considered the greatest disgrace that could happen to a zenana lady to be seen by any other man besides her own husband. Therefore, too, no man can enter the zenana, until late at night he may go to his wife's room, after every woman has retired to her own apartment. The rooms of these ladies are simply prison-cells, with one door and one window, the window merely an opening without glass, but with bars up and down the opening; and both window and door open on to the veranda surrounding the inner court, so that nothing outward is visible. They can only see what takes place in the court. The room is from ten to twelve feet square, with a brick or tile floor, no carpet or matting, and the only furniture is a wooden bedstead, with a piece of matting in lieu of a bed, a wooden box for the lady to keep her clothes, and a brass drinking-vessel, and sometimes in the corner of the room a strip of matting about four feet long, which the lady spreads on the floor to sit upon; but this is only an occasional luxury. The walls are black with dirt, filth, and cobwebs, looking as if they had not been whitewashed for fifty years, and with never any other ornaments but the ugly painted daubs of their gods; and these only rarely. These rooms of the ladies are always on the second or third floor, and are approached by a flight of brick steps, generally winding, three-cornered, and almost always in a state of dilapidation and perfectly dark, so that you are in constant dread of falling and breaking your neck. The ladies who inhabit these holes are, when young, lovely and gentle, loving and tender, of the true Caucasian race, descended from the ancient Aryans. They have magnificent black eyes and hair, beautiful, graceful forms, small, tapering hands and feet, which are continually dyed with henna—the foot in such a way as to make it look somewhat like a red slipper, and the nails and inside of the palms of the hands with the same red dye. The only garment they wear all the year round is a *sarree*, a straight piece of cloth about a yard wide and from five to six yards long. This is put on widthwise from the waist down, and then is wound once round the body, and then one end brought up so as to cover the back, breast, and head—simply one thickness of the cloth, that of cotton, and frequently the very sheerest of muslin, so that the drapery is often nothing more than the thinnest veil. No shoes or stockings are ever worn, but often a great many jewels. These jewels are always the bride's dowry. The wedding-garment is a similar sarree, only of a very thin red silk made in the country.

The inner court in the centre of the men's court is generally flagged with stone or paved with brick. This is very seldom done in the women's court, but the floor is generally only mud beaten hard. All the rooms on the first floor surrounding this court are the same, or else the floor is made of a plaster composed of mud and cowdung mixed together. These lower rooms are used as cooking-rooms and cow-sheds. When the birth of a child is expected, the poor mother is not allowed even the poor comforts of her own room, but she is brought down and made to share the cow-shed with the cow, simply a strip of matting being placed between them, and here, with nothing but a piece of matting on the cold, damp floor, she has to remain for twenty-eight days. All this time she is considered polluted, and no one must speak to her but the low-caste coolie-woman who has acted as midwife. She must never have a doctor, no matter how great may be her sufferings. After the child is born, for two or three months it is rubbed all over every day with mustard oil and laid out in the sun to dry, and all through life, when they are cold, the women frequently do this. To this custom, doubtless, the present color of their skin is owing, for we are told when they came first into Bengal they were as white as we: they certainly are

of the same style of feature; but this practice, continued as it has been for probably thousands of years, would darken any nation. They are of all shades of color, from the Italian up to the darkest brown, but the skin always pure and spotless. The little girls are married when they are six or seven years old, and most generally are mothers before they are quite eleven years of age. The son *always* lives in his father's house, and his little bride is taken there, so that often there are five or six generations living in one house. If the quarters become too straitened, they will build on another hollow square back of the former, or put on another story to the building; some of the larger buildings have three or four of these inner courts, all belonging to the one zenana.

Till within the last fifteen years no Christian step had ever passed the doors of these houses, and the ladies were brought up in utter ignorance of the outside world, as a zenana lady was never allowed to go anywhere but from her husband's house to her father's. Then she was carried shut up tight in a palanquin, with a very thick cloth or comfortable thrown over it to prevent her seeing out. They were never taught to read or to write or sew; indeed, they were told that if a woman learnt to read, she was doing that which only a man should do, and therefore she would instantly become a widow—a fate more to be dreaded than anything else, as a widow, if she were not burnt on the funeral pile of her husband, was a disgraced being, and suffered a lifelong agony, subject to every privation, contemned and ill treated by all; and when she died, after suffering untold agonies for thousands of years in the other world, would be condemned to return to this world either in the form of a snake or some other vile animal. The only thing a zenana lady had to do was to pay her devotions to the gods, take care of her children, braid her hair, and cook for her husband. This latter every woman, from the highest to the lowest, must do. After the food is prepared, it is sent in on a large brass platter to the husband; he eats what he likes, and the remainder is sent back to the wife.

It is only in the province of Bengal that these rigid rules with regard to the zenana ladies are exacted; but in that province alone there are eighty millions of people. In other parts of India the women (though everywhere under some restrictions) are allowed much more liberty. The learned men of Bengal give this as a reason for the rigid seclusion of their women: Before the days of the Mohammedan invasion (about 800 years ago) their women were allowed as much liberty as English women in the matter of going out, etc., but their conquerors, the licentious Mohammedans, found the Bengal ladies so much more beautiful than their own that it did not matter, wife or maid, whoever they saw that struck their fancy, they would seize her and carry her off to their harems. To prevent this they were obliged to shut up their women. They of course greatly rebelled against this, so that the Brahman priests had to make it a part of their religion, and to write out some fresh shastras or holy books with very strict and rigid laws for the confinement of women: and they made them all the more strict because the women rebelled so much. The women could not read for themselves, and as the priests pretended to read these laws from the old shastras, they knew no better. Still, with that generation they had a great deal of trouble, but the priests so thoroughly instilled these laws into the minds of the rising generations that they became fixed; and now many a woman believes it to be such a great impropriety to be seen by any other man besides her own husband that she would rather die than submit to such disgrace. The Mohammedans did not so overrun the lower provinces, which sent their submission to the conquerors without their armies being marched thither; therefore there were few Mohammedans comparatively in those parts, so there was no need to enforce such very rigid seclusion on their women.

But Christian ladies are now permitted to visit these poor prisoners, and to carry to those who have so long sat in darkness the light of the glorious gospel of Jesus Christ; and with that and education, here and there a few little beginnings of comfort are being introduced into these squalid homes or abodes of misery. HARRIET G. BRITTAN.

Zend-Aves'ta, the collective name of the sacred books of the Parsees, contains the doctrines of the ancient Persian religion founded by Zoroaster. The collection consists of various parts, of which the most remarkable are—the *Vendidad*, or "Law-Book," giving the rules for avoiding and the means of expiating sin and impurity; the *Yaçna*, containing prayers and songs of praise; the *Yeshts*, the *Nyâyish*, etc. The first of these divisions is, generally speaking, the most interesting, and has been edited, translated, and annotated by Westergaard (Copenhagen, 1852) and by Spiegel (Leipsic, 1853–58); but the second, which has been edited, translated, and annotated by Haug (Leipsic, 1858–60) and by Kossowicz (1867–71), is the oldest. It is evident, however, not only that the writings comprised in the *Zend Avesta* belong to various periods, but also that they are only fragments of a rich sacred literature which has been lost. Pliny says that Zoroaster composed 2,000,000 verses, and Attavari, an Arabian author, says that his writings covered 12,000 cow skins. But from the conquest of Persia by Alexander the Great, in 330 B. C., to the accession of the dynasty of the Sassanidæ, in 235 A. D., the religion of Zoroaster and the wisdom of the Magi were not only thrown into the background by Greek ideas, but became nearly lost. The accession of the Sassanidæ indicates a revival of the ancient Persian religion, and it is to their zeal that we owe the *Zend-Avesta*. New troubles, however, overtook the book and the confessors of its doctrines. In 651, Persia was conquered by the caliph Omar, and the inhabitants were forced to embrace Mohammedanism. A small number, the Parsees, who refused to give up the religion of their ancestors, fled to India, and through them the *Zend-Avesta* became known to Europeans. A manuscript of the book was brought to England in the seventeenth century, but no one could read it. The first who succeeded in making it accessible to European readers was a Frenchman, Anquetil-Duperron, who spent several years in India, enjoyed the instruction of the priests of the Parsees, and in 1771 published a translation of the whole *Zend-Avesta* into French. The reception it received was very curious. The English simply repudiated it as a forgery, the Germans assigned it a vague place somewhere in space and time, and most people considered it a production of very doubtful origin. Thus stood the case until in 1826 the Dane Rasmus Rask, who had spent several years in India, established beyond doubt that the books of the *Zend-Avesta* were written in three different forms or developments of the same idiom—namely, the Zend, the Huzvaresh or literary Pehlevi, and the Parsi; that the Zend, in which the oldest parts of the book were written, was not a corrupted dialect of the Sanskrit, but an independent language closely allied to the oldest, the Vedic forms of the Sanskrit; and that, consequently, the *Zend-Avesta* contains documents of the oldest known tongue of the Aryan family. Soon after the Frenchman Eugène Burnouf took up the study of the Zend language, and it has subsequently been pursued vigorously by Bopp, Spiegel, Haug, Westergaard, and others, and throws much light on the most intricate philological questions.

Zend Language. See ZEND-AVESTA.

Zen'ger (JOHN PETER), b. in Germany about 1680; became a printer; settled in New York; established there a press in 1726, and founded (Nov. 5, 1733) the *Weekly Journal*; was imprisoned thirty-five weeks in 1734–35 for alleged libel upon Gov. Cosby and council, an offence of which he was acquitted on trial on the ground of the truth of his statements. D. in New York in 1746. The *Journal* was conducted by his widow and son John till about 1752.

Zengg, town of Austria, in Croatia, on the Adriatic, has a small and somewhat unsafe harbor, but carries on a very active trade in Hungarian produce, especially in grain and salt, with Italy and the Levant. P. about 5000.

Zenick. See SUBICATE.

Ze'nith [from the Arab., signifying "the line of the head"], the point in the celestial sphere directly over the head of the observer; the opposite of the *nadir*.

Zenith Telescope. See APPENDIX.

Zenjan', town of Persia, province of Irak-Ajemee, on the Zenjan, is surrounded with walls and has extensive manufactures of carpets, woollen cloths, and arms, and large, well-stocked bazaars. P. 15,000.

Ze'no, emperor of the Eastern empire (474–491), was an Isaurian by birth, but married in 469 Ariadne, a daughter of the emperor Leo I. As Leo I. had no male children, he proposed to leave the crown to Zeno, but Zeno, besides being a foreigner, was very unpopular in Constantinople on account of his ugly character, and the imperial proposition caused such a commotion that it had to be given up. The succession was then fixed on Leo II., a son of Zeno and Ariadne, but as Leo II. died in the same year as Leo I., in 474, Zeno actually came into possession of the crown. During his reign revolts within alternated with miserable wars without. The attacks of the Goths were bought off, time after time, with enormous sums, but the emperor finally got rid of them by commissioning their chief, Theodoric the Great, to conquer Italy and expel the usurper Odoacer. Basiliscus, who was proclaimed emperor in Constantinople in 475, was overthrown by buying his two generals, Illus and Harmatius, and the intrigues and rivalries of the two ministers were ended by the assassination of Harmatius. The insurrection of Marcian in 479 was suppressed by buying his soldiers, and that of Illus, which

lasted for several years, was baffled by intrigues and assassination. At last Zeno was buried alive by his own wife, who married his successor, Anastasius.

Zeno (Apostolo), b. at Venice Dec. 11, 1668; devoted himself to literature, and acquired great fame by his dramatic compositions; founded in 1710 the celebrated periodical, *Giornale de' Letterati d'Italia*; went in 1715 to Vienna as court-poet and historiographer; returned in 1729 to Venice, and d. there Nov. 11, 1750. His dramatic works were published in 10 vols. at Venice in 1744, but his historical works have more interest than his poetical—*Istorici delle cose Veneziane* (10 vols., 1718–22) and *Dissertazioni istorico-critiche* (2 vols., 1752–53), *Epistole* (6 vols., 1785).

Zeno of Elea, b. 490–485 B. C. at Elea, a friend and disciple of Parmenides, whose doctrines he supported by indirect demonstration (*reductio ad absurdum*), is reported to have been adopted as a son by Parmenides, who was twenty-five years his senior. Aristotle names him as the father of dialectics, from the circumstance that his arguments in favor of the Eleatic doctrine of Being were based upon the self-refutation of its opposite. This negative dialectic established the truth of Being as One, by showing the contradiction inherent in the hypotheses (*a*) of motion, (*b*) of multiplicity, (*c*) of sense-perception: "The flying arrow is at rest, because at every moment it is only in one place;" "Achilles cannot overtake the tortoise, because as often as he reaches the place occupied by the tortoise the previous moment, the latter has left it;" "Motion cannot begin, because a body cannot arrive at a given place before it has passed through an infinite number of intermediate spaces." Aristotle in his *Physics* (vi.) pointed out the fallacy in his arguments against the reality of motion. In Plato's *Parmenides* a writing of Zeno's is referred to as containing a prolix argument to prove that Being is One, but this writing has been lost. Strabo reports him to have participated in the ethico-political efforts of Parmenides, and we are told by Diogenes Laertius that, being unsuccessful in that, he was taken by Nearchus the tyrant and put to a cruel death. William T. Harris.

Zeno the Stoic, b. about 350 B. C., son of a Phœnician merchant residing in Cittium, a Greek city on the island of Cyprus; was occupied in commerce until near his thirtieth year, when a shipwreck caused him to visit Athens, where he read the works of Xenophon and Plato, and conceived a great admiration for their master, Socrates, and accordingly became a disciple of Crates the Cynic, who imitated the external peculiarities of Socrates. Becoming sated with this phase of the Socratic school, he resorted to Stilpo the Megarian, who initiated him into the dialectics by which the nugatoriness of sense-perception is exhibited. He afterward joined Xenocrates and Polemon of the first Academic school, and about the year 310 B. C. founded his own school in the Στοὰ ποικίλη (porch adorned with paintings by Polygnotus), whence the name "Stoic" arose. He taught fifty-eight years, according to Apollonius, dying about 258 B. C., by his own hand. Diogenes Laertius (vii.) mentions a number of works attributed to him, but none of them have been preserved. His doctrines were considered by the ancients to be not so much new in substance as new in terminology. He combined the ethics of the Cynic school with the physics of Pythagoras and Heraclitus, and introduced a modified logic. (See Stoics for details of his doctrines.) William T. Harris.

Zeno'bia, the daughter of a Syrian chieftain; married in a second wedlock Odenathus, prince of Palmyra, who after his brilliant campaigns against the Persians was declared augustus and coregent of the empire by Gallienus. In 267, Odenathus was murdered, and Zenobia ascended the throne, assumed the title of "queen of the East," declared herself independent of Rome, extended her authority over all Syria, parts of Asia Minor, Mesopotamia, and Egypt, and governed her realm with prudence and energy. But in 271, Aurelian marched against her. Her armies, commanded by herself, were defeated at Antioch and Emesa, and she was shut up in Palmyra. She attempted to escape, was captured, and with her hands in chains walked before the emperor's chariot on his triumphal entry into Rome in 274. She afterward lived in elegant style in a villa near Tibur. Her daughters married into the highest Roman families, and her son received an independent principality on the Armenian frontier. Her beauty was most extraordinary, and so were her accomplishments; she spoke Latin, Greek, Syriac, and Egyptian. She marched at the head of her armies, and in the council-chamber was shrewd and sagacious. It was generally believed that she had been privy to the assassination of her husband.

Zen'ta, town of Hungary, on the Theiss, has 16,808 inhabitants, mostly engaged in cattle-rearing and fishing.

Ze'olite [Gr. ζέειν, to "boil"], the name of a very large group of minerals which fuse under the blowpipe, whence the name. They are generally impure hydrated silicates, containing alkaline earths or alkalies, often alumina, and rarely magnesia. They are mostly crystalline or subcrystalline. They are often deposited in cavities in plutonic rocks, and have been found infiltrating ancient walls built by man. They are doubtless formed from watery solutions.

Zephani'ah [Heb. "watchman of the Lord"], one of the minor Hebrew prophets, was of noble birth. His ancestors for four generations are mentioned, ending with Hezekiah, probably the king of that name. He lived in the reign of Josiah (640–610 B. C.). His prophecy treats of idolatry and luxury, and is remarkable for its silence in regard to Josiah's reformation.

Zerafshan', the gold-bearing main stream of the Russian district of Zerafshan, which was formed in 1868, enlarged in 1870, and now comprises an area of 1756 sq. m., with 339,200 inhabitants, rises under the name of Musja at the foot of an immense glacier and passes through the Lake of Iskander. In its upper course it is a wild mountain-stream; during its middle course it provides for the irrigation of extensive and very fertile rice and cotton fields, orchards and mulberry plantations, for which purpose it is led into numerous canals above Samarkand. Below this city it disappears in a region of steppes whose sandy wastes are steadily extending their boundaries, so that since the transfer of the country to the Russian dominion about 100,000 Tadshiks and Usbeks have removed. The mountains among which the river has its sources rise about 19,000 feet. The inhabitants of the valleys of this mountain-region acknowledge only unwillingly the authority of the czar, and in the beginning of the winter of 1876 it was necessary for the Russians to make a difficult winter and mountain campaign hither. The Kiptshak Khokands made a vehement resistance, but in vain. E. Schlagintweit.

Zeram. See Ceram.

Zerbe, tp., Northumberland co., Pa. P. 1446.

Zerbst, town of Germany, duchy of Anhalt-Dessau, on the Nuthe, has large breweries, distilleries, foundries, and manufactures of velvet, plush, leather, gloves, earthenware, and vinegar. P. 11,957.

Ze'ro [It. *zero*], in common language, *nothing*; in arithmetical language, *no number*; and in the language of analysis, *a quantity less than any assignable quantity*. If we subtract a from a, the remainder is absolutely 0, and the result is purely *numerical*: the zero thus found is the *naught* of arithmetic. Again, if we take the fraction $\frac{a}{x}$, in which a has a constant value, x being arbitrary, it is obvious that the value of the fraction will diminish as the value of x increases; if x is made exceedingly great with respect to a, the value of the fraction will be exceedingly small; and finally, if x is made greater than any assignable quantity, the value of the fraction will be less than any assignable quantity, or *zero*. The zero thus found is the zero of analysis. In the analytical sense, zero may be regarded as a quantity; and as such it is said to be an *infinitesimal*. In this sense of the term two zeros are not necessarily equal, as may be shown by the following course of reasoning: Let us have the two fractions $\frac{a}{x}$ and $\frac{na}{x}$; now, if we suppose x to increase from any value, the value of the second fraction will always be n times that of the first, and in accordance with the principle that *what is true of a varying magnitude up to its limit is true at its limit*, the limiting value of the second fraction will be n times the limiting value of the first: that is, the zero in the second case is n times that in the first case. W. G. Peck.

Zero, a term that has been applied by thermometer-makers to several more or less arbitrary points of temperature. Fahrenheit, one of these, imagined that he had obtained an absolute zero, or non-existence of heat, by mixing snow and salt, and the point at which his thermometer happened to stand in the particular mixture which he happened to make he called the zero of temperature. It is, however, a fact that in any considerable *mass* of this particular freezing mixture a temperature is often found of 6 Fahrenheit degrees, or even more, below his zero. The so-called zero of the Centigrade thermometer has a much more rational basis, because, being the temperature of water formed by ice at the moment of its fusion, it is easy to find it and verify it; but the application of the term *zero* to this case is no less a scientific solecism. It is indeed not even the *melting-point of ice*, as it has been shown by a distinguished investigator, Person, that ice begins to absorb latent heat, and therefore begins to melt, at about 2° C., or say 4° F., below this point; and it is therefore

obvious that the true initial melting ice temperature is about 28° F., this being the point of temperature at which motion and change begin upon the solid earth, and therefore entitled to be regarded as an initial point or standard temperature in nature. The Centigrade zero is only the temperature of *melted ice*, that of *melting ice* having a range of 4° F. It is time these indisputable facts were recognized in science and stated in the textbooks.

Zero, Absolute.—This is another phrase in common use, which conveys what the writer believes to be an indubitable error. His reasons for this are stated under the head TEMPERATURE, NATURE OF, where it is shown that the so-called absolute zero of temperature is probably only that at which the most incondensable of our *gaseous* bodies—doubtless *hydrogen*—would lose its gaseous form and become a liquid. (See THERMOMETRY.) HENRY WURTZ.

Zerub'babel [Heb., "begotten in Babylon"], the prince of the tribe of Judah and civil (Joshua being the sacerdotal) head of the first Jewish colony returning from the captivity in Babylon by permission of Cyrus, 536 B. C. From his heathen name, *Sheshbazzar* (Chaldee or Persian, "fire-worshipper), it may be inferred that he had been in the service of the king of Babylon. His exact pedigree is uncertain. Called, in every place but one, the son of Salathiel, he may have been only his nephew, the son of Pedaiah, Salathiel's brother, according to 1 Chron. iii. 19, although Ewald supposes this to be a clerical error. In either case, he was descended from David in the line of Nathan. He lived to see the temple finished, 516 B. C., but when or where he died cannot now be determined. He had great energy as a ruler, but is most honored for the place he holds in the genealogy of Christ. R. D. HITCHCOCK.

Zerumbet, the rhizome of *Zingiber zerumbet*, an East Indian ginger-plant. By some it is considered identical with cassimuniar, the product of *Zingiber cassimuniar*, and by others it is erroneously confounded with round zedoary. It has quite disappeared from commerce, being inferior to true ginger.

Zetland. See SHETLAND ISLANDS.

Zet'terstedt (JOHAN WILHELM), b. in the circle of Östergotland, Sweden, May 20, 1785; studied natural history, especially botany, and subsequently also entomology, at the University of Lund; began to lecture there in 1810; was appointed professor in 1839; retired in 1853, and d. Dec. 23, 1874. He visited Öland in 1811 and 1817, Gotland in 1819 and 1841, and made extensive travels in Lappmark in 1821, 1832, and 1840. Besides reports of his travels and minor essays, he published *De Plantis cibariis Romanorum* (1808), *Dissertatio de Fecundatione Plantarum* (3 vols., 1810–12), *Orthoptera Sueciæ* (1821), *Fauna Insectorum Lapponica* (1828), *Monographia Scutophagarum Scandinaviæ* (1835), *Insecta Lapponica* (1838–40), *Diptera Scandinaviæ* (14 vols., 1842–60).

Zeltinic. See CETTIGNE.

Zeuglodon'tia [Gr. ζεύγλη, "yoke," and ὀδούς, "tooth," from the form of some of the teeth], an extinct group of mutilate mammals, generally regarded as a sub-order of the order Cete, but sometimes raised to independent ordinal rank. The distinctive characters were as follows: The skull was much more like the ordinary mammalian type than it is in either of the existing sub-orders; the intermaxillaries were expanded forward, normally interposed between the supramaxillaries, and formed the terminal as well as anterior portion of the lateral margins of the upper jaw: the nasal apertures opened more or less anteriorly, and never so far backward as in the Denticete or Mysticete; the olfactory organs must consequently have been moderately developed; the lower jaw had the rami connected by suture at the symphysis; the teeth approached to the normal mammalian type in that there were typically six (3 + 3) incisors in the intermaxillary bones, and those of the supramaxillary were mostly two- or three-rooted; the roots were so large and connected by the crowns in some of the species to such an extent as to have produced the resemblance to a yoke to which the ordinal name alludes. The representatives of the order existed during the Tertiary epoch, and ranged from the Eocene to the Pliocene, but are now entirely extinct. They were the least specialized of the cetaceans, and the older ones (those of the Eocene) had a skull comparatively little abnormal in comparison with terrestrial mammals. They were doubtless developed long before the Tertiary epoch, but no palæontological evidence thereof has yet been discovered. They are supposed to have been derived from the same common progenitors as the seals, but this supposition remains to be verified. Some of the species attained a gigantic size; *e. g. Basilosaurus cetoides* of the Jackson beds (Middle Eocene) of the U. S., of which remains found indicate a length of over seventy feet, while others were little larger than porpoises. They were prevalent in ancient times almost if not quite as extensively as the living cetacean types, remains having been found in North and South America, as well as Europe and Asia. They have been differentiated into two families—Basilosauridæ and Cynoceidæ. THEODORE GILL.

Zeulenro'da, town of Germany, principality of Reuss, has manufactures of stockings and hosiery and large trade in cattle. P. 6463.

Zeus. See JUPITER.

Zeux'is, b. about 450 B. C., was at the height of his reputation about 420 B. C.; lived to a great age, the latter part of his life in Ephesus; was celebrated for the grace, sweetness, and dignity of his feminine figures, for the skill of his technical drawing and color—as in the grapes the birds pecked at, and the face of the old woman whom the artist is said to have died of laughter on looking at—and for his lifelike delineation of men and animals, as in the picture of the Centaurs. To the genius of Zeuxis we have the testimony of Lucian, Cicero, Pliny. His greatest works were—*Helen, Penelope, The Infant Hercules strangling the Serpents, Jupiter, Menelaus, Marsyas, Cupid.* Of his personal life little is told, except that he was proud of his reputation and ostentatious of his wealth. The date of his death is unknown. O. B. FROTHINGHAM.

Zevely (ALEXANDER N.), LL.D., b. in Salem, N. C., Aug. 16, 1813; became the third assistant postmaster-general in 1859, filling this position until 1869, and inaugurating, while in the government service, many useful postal reforms, among them the money-order system and plans for the more prompt delivery of letters. His influence in all postal matters was very great.

Ze'vio, town of Italy, province of Verona, near the right bank of the Adige, about 11 miles S. E. of the city of Verona. Zevio is a well-built, prosperous town, and the adjacent country is very rich in agricultural products, especially rice and other grain. P. 6015.

Zeyst, village of the Netherlands, in the province of Utrecht, is situated in a beautiful district, and contains many fine villas and summer-residences, built by the wealthy citizens of Amsterdam. A colony of Moravian Brethren has settled here and established extensive manufactures of porcelain, soap, and candles. P. 5256.

Zhitomeer, or **Zytomiers.** See JITOMIR.

Zhiz'dra, or **Shisdra,** town of Russia, government of Kaluga, has large iron-works, smelting-furnaces, and cloth manufactures. P. 8890.

Zhukoff'ski (VASILI), b. in 1783; studied in Moscow, and devoted himself to literature; edited the *Viestnik Europi* (1808–09); served in the campaigns against Napoleon, and attracted great attention by his war-songs and patriotic hymns; was tutor to the present emperor, Alexander II., 1824–48; resided subsequently in Germany, and d. at Baden-Baden Apr. 24, 1852. His collected works were published at St. Petersburg (1849–50) in 10 vols., and translations into English of some of his poems are found in Sir John Bowring's *Specimens of the Russian Poets* (1824). He was himself a very successful translator of German and English poetry.

Zidon. See SIDON.

Ziem (FÉLIX), b. at Beaune, Côte d'Or, about 1822; studied painting in Paris; travelled in Italy and the East 1845–48; exhibited at the Salon in 1849. His excellence is in marine subjects and landscape. The Bosphorus, Constantinople, Tripoli, Marseilles, Venice, have furnished themes for his best paintings. His pictures of Venice are much admired. He has also painted fruit-pieces and decorative designs. Two third-class medals were awarded to him in 1850 and 1855, a first medal in 1852, and the decoration of Honor in 1857. O. B. FROTHINGHAM.

Zie'rikzee, town of the Netherlands, province of Zeeland, on the island of Schouwen, has a good harbor, extensive shipbuilding, shipping, and fishing, and a large trade in agricultural produce. Its walls, behind which its citizens made an obstinate resistance to the Spaniards in 1576, are now transformed into promenades. P. 7844.

Zie'then, von (HANS JOACHIM), b. on his paternal estate of Wustrau, Prussian province of Brandenburg, May 18, 1699; received a military education, and entered a regiment of dragoons as lieutenant in 1726, but became entangled in the difficulties of one of his comrades, and was cashiered. In 1730, however, he was reinstated in the army as lieutenant in a regiment of hussars just then forming, and during the first Silesian war he became its commander. During the second Silesian war he made his famous march to Jägerndorf through the Austrian lines; distinguished himself at Hohenfriedberg, June 4, 1745, and at Hennersdorf, Nov. 23, and was made a major-general. Shortly after the peace some disagreement arose between him and the king, and a reconciliation did not

take place until 1755, but in the Seven Years' war he took a most brilliant part, as commander of the cavalry, in the battles of Prague, Kollin, Leuthen, Liegnitz, and Torgau; and after the peace he retired to his estates as the most popular and one of the most celebrated of the generals of Frederick the Great. D. at Berlin Jan. 26, 1786. His *Life* has been written by Hahn.

Zif, p.-v. and tp., Wayne co., Ill. P. 480.

Zil'leh [anc. *Zela*], town of Asiatic Turkey, in Asia Minor, manufactures sailcloth and coarse cotton fabrics, and has an annual fair in the middle of November, which often is frequented by 50,000 persons. It contains 2150 families, most of which are Turks.

Zil'lerthal, one of the principal valleys of the Tyrol, 50 miles long, enclosed by lofty glaciers and opening N. into the valley of the Inn, contains about 14,000 inhabitants, who are reputed for their beauty, fine song, and industry. Rearing of cattle and manufactures of gloves and essences of herbs are the principal occupation. In 1837, 399 persons, men, women, and children, emigrated to Prussia. They had left the Roman Catholic Church, and the Austrian emperor, although he first promised them toleration, decided that they had either to return to the Roman Catholic Church or remove to Transylvania, where there were Protestant congregations. They refused both propositions, and left Austria altogether.

Zim'mermann, von (Johann Georg), b. at Brugg, canton of Berne, Switzerland, Dec. 8, 1728; studied medicine at Göttingen; began to practise at Brugg in 1751, and was appointed court-physician at Hanover in 1768. D. Oct. 7, 1795. He enjoyed a great reputation as a physician; was invited to the court of Catharine II.; attended Frederick the Great in his last illness; and published *Von der Erfahrung in der Arzneiwissenschaft* (2 vols., 1764), which was often republished and translated into several foreign languages. But still greater was his fame as a philosophical writer. His *Vom Nationalstolze* (1758) and *Ueber die Einsamkeit* (4 vols., 1784–85) made his name celebrated throughout the whole of Europe, especially the latter, which is still quoted now and then, though it is a very dull book, and caught the attention of its time chiefly through its sentimentality and affectation. In 1788 he published *Ueber Friedrich den Grossen und meine Unterredung mit ihm kurz vor seinem Tode*, and in 1790 *Fragmente über Friedrich den Grossen* (3 vols.) implicated him in some very bitter controversies, and his last days were darkened by melancholy, a sickly sensitiveness, and finally by mental exhaustion. A collection of some of his letters was published at Aarau in 1830. (See also *Zimmermann's Krankengeschichte* (1786), by Wichmann.)

Zinc [Ger., Sw., and Dan. *Zink*], sometimes called **Spelter,** one of the metallic elements, very abundantly distributed, comparable in this respect to lead. It was not known in metallic form to the ancients, though they knew how to make alloys of it with copper (common brass) by adding zinc ores to melted copper. Zinc, being one of those metals, however, which must be procured by a process of *distillation*, was doubtless beyond the skill of the metallurgists of old. It was first, and for a long time, brought into Europe from the East, and it is not much more than 100 years since zinc was first smelted in Europe. The ores of zinc are not numerous, there being only six mineral species which furnish all the zinc and zinc-white of commerce. These are *blende, calamine, willemite, smithsonite, franklinite*, and *zincite*, including sulphide, silicates, carbonate, and oxide. (See Zinc, Compounds of.) The sulphide and carbonate are first roasted to expel sulphur and carbonic acid. Calamine also contains water, which must be expelled by roasting. The ores, thus prepared, are distilled, in admixture with carbon, in retorts or furnaces of special construction, the zinc-vapor generally carrying with it some lead, sulphur, and arsenic. Most commercial zinc, when required pure, must be redistilled. That which is made from calamine, or from the willemite, franklinite, and red zincite of New Jersey, is free from arsenic, and generally quite pure. When made from blende it sometimes contains Cadmium (which see), and more rarely traces of Indium (which see).

The metal zinc is one of much hardness, with a bluish color, with a brilliant lustre when freshly cut, but soon taking a tarnish, from the formation of a film of suboxide or carbonate, which protects it quite strongly from further oxidation, so that it is an extremely durable metal, resisting both air and water very persistently. When cast it is highly crystalline in structure, and somewhat brittle, though at the same time sectile; but by heating to a temperature somewhat below 300° F., it may be rolled into very thin plates, passing into a modification which is quite malleable, so that sheets as thin as tin-foil may be obtained. The best way to obtain it pure is by electrolysis. At a temperature but little higher than that mentioned still another allotropic modification appears, which is very brittle and fragile, and in a mortar heated to 400° F., or a little higher, the metal may be crushed to powder. It melts at about 780° F., and boils at about 1900° F., yielding a vapor which takes fire in the air and burns with a dazzling light to zinc-oxide. (See Zinc-White.) The relations of zinc to acids and other solvent liquids are highly interesting. When chemically pure it dissolves readily in nitric acid, but not so in dilute sulphuric and hydrochloric. Even ordinary commercial zinc, containing lead, iron, etc., may be almost absolutely protected from the latter two acids by the thinnest film of *mercury*, which in voltaic batteries (see Electricity) is used, therefore, for this purpose. On contact, however, with most other metals, and other substances capable of conducting electricity, voltaic circuits are set up, and the zinc dissolves, hydrogen being evolved from the surface of the other metal. Hence, through the formation of such circuits with its metallic impurities, commercial zinc is readily soluble in acids, and even in solutions of neutral salts. These same relations explain the well-known *protective* action of zinc upon iron or copper, even in sea-water (as in the case of sheathing of ships). The film of hydrogen formed upon the surface of the other metal prevents all oxidating action thereon. Zinc is largely used for coating iron and copper, exerting a protecting influence, both as a mere coating or impervious varnish, and through its voltaic relations. (See Zincking of Metals.) Zinc dissolves also in *alkalies*, whose compounds with its oxide are soluble (see Zinc, Compounds of), in a manner similar to that above described, its relations to other metals in such alkaline liquids being altogether similar to those in acid and saline solutions.

The density and molecular volume of zinc have a much smaller range than is usual among the metals, so far as has been investigated, indicating less tendency—at normal temperatures, at least—to allotropic variations. Indeed, it is not impossible that of 14 density-determinations of pure zinc on record, 12 may belong to one allotrope, the lowest of these being by Brisson, 6.861, and the highest by Wertheim, 7.146, and the mean 6.952. A simple zinc-molecule, Zn_{21}, corresponds to 7.019 at 28° F. This is doubtless the constitution of ordinary cast zinc, and the same molecule is found in the dominant form of zinc-oxide in the "hydrate," the heaviest sulphates, the densest *willemite*, in *gahnite*, in blende, and in some other compounds. When rolled, 1 molecule in 4 undergoes condensation, and rolled zinc appears to be

$$Zn_{20} \cdot 3 Zn_{21} = 7.266 \left\{ \begin{matrix} \text{Boltey,} & 7.2 \\ \text{Daniell,} & 7.21 \end{matrix} \right\}.$$

When melted, zinc becomes $Zn_{21} Zn_{22} = 6.529$ (Playfair and Joule, 6.522). Henry Wurtz.

Zinc, Alloys of. Almost all the other common metals, except *lead* and *bismuth*, alloy readily with zinc, forming alloys that generally partake of the hardness of the zinc, and, when the latter is in excess, of its brittleness also. Under Brass will be found some mention of the highly-important alloys with *copper*, these being by far the most valuable of zinc alloys. In making brass and other zinc alloys care must be taken that the heat does not rise too high, to avoid volatilization of the zinc. With *lead*, zinc will not unite unless through intermediation of some other metal, such as *tin*, which alloys with both; with lead and bismuth also, equal quantities of each of the three metals, a *fusible alloy* is obtained which melts in boiling water. Bronze, which properly consists of tin and copper, is often alloyed with zinc, and triple alloys of these three metals are used for journal-boxes and some other purposes. An alloy with 11 times its weight of tin is beaten into leaves and used as a spurious substitute for silver-leaf. $ZnSn_6$ appears to form a definite compound, having the fixed fusing-point 500° F.; but in other proportions there is a separation during cooling into two distinct alloys. *Amalgams* of zinc have little interest except in connection with voltaic batteries. (See Zinc.) Henry Wurtz.

Zinc, Compounds of. Zinc forms a number of compounds which are useful in the arts, and several of its native mineral compounds are of much interest.

For the *oxide* see Zinc-White.

The *sulphide* of zinc is found constituting two mineral species, identical in composition, but differing in crystalline form—*blende* or *sphalerite*, which is of the regular system, and *wurtzite* (named after the French chemist, Adolphe Wurtz), which is hexagonal. Blende has a peculiar brilliant resinous lustre, sometimes black, but also sometimes transparent, brownish, yellowish, or even colorless. Hardness between calcite and fluor-spar. The localities are very numerous. A colorless variety is found at Franklin, N. J. (which was called by Nuttall *cleiophane*); handsome crys-

tals at the Wheatley and Perkiomen mines in Pennsylvania, also at Austin's lead-mines in Wythe co., Va., and in a multitude of other places. Blende appears to have the constitution—

$$_{2}\,{}^{S}_{24}.\left(\frac{Zn\ Zn}{21\ 22}\right) = 4.079 \left\{\begin{matrix}\text{Henry, white, from New Jersey,} & 4.063\\ \text{Kuhlmann,} & 4.07\end{matrix}\right\}$$

thus containing the *melted-zinc* molecule. (See ZINC.) Wurtzite, the hexagonal allotrope, is not much known. It was obtained from a Bolivian silver mine. Hexagonal sulphide of zinc may be obtained artificially by several methods. For the mineral the density 3.98 is given by the discoverer Friedel, which is lower than average blende densities. Considering that Friedel's specimen contained iron and lead, which would augment its density, it seems not improbable that wurtzite, when pure, may be $_{21}^{S}.^{Zn}_{22} = 3.961$, containing a zinc-molecule which occurs in some *willemite*, also in *calamine*.

WILLEMITE.—(See this head.)

Calamine.—This is one of the commonest ores of zinc. It is right-rhombic in crystallization, of the hardness of apatite, generally white in color, brilliant in lustre when crystalline, particularly on the cleavage surfaces. Its density varies from 3.164 to 3.871, and one modification may be regarded as a hydrated willemite, containing, like the latter, the same zinc-molecule as in *wurtzite*, above:

$$O_{4}.^{2Zn}_{22}.^{Si}_{21}.^{4H}_{24} = 3.528 \text{ (Monheim, from Altenburg, 3.19).}$$

This volumic formula may be noted for its *pleosymmetry*. (See under the head WATER OF CRYSTALLIZATION.) Calamine (*Galmei* in German) is said by Agricola to be derived from *calamus* (a "reed"), but the derivation is obscure and unlikely. This mineral constitutes an abundant ore of zinc in many countries. Enormous quantities have been mined at Friedensville, Pa., where, however, mining is stated to have been recently stopped by water, the cost of removing which exceeded the value of the ore. In Europe there are several rich mines.

Smithsonite, carbonate of zinc, named after the English chemist Smithson, the illustrious founder of the Smithsonian Institution at Washington.—Rhombohedral; hardness the same as calamine; white or light in color, and with vitreous lustre. The range of densities not so great as in the case of calamine. The zinc-molecule is enormously condensed, one whole type (4 diameters) below that in the oxide, hydrate, and cast metal (which is $\frac{Zn}{21}$), smithsonite being, in its medium densities—

$$O_{6}.^{2Zn}_{17}.^{2C}_{20} = 4.391 \text{ (Karsten, 4.3765).}$$

The maximum densities, however, appear to correspond to another form—

$$O_{6}.\left(\frac{Zn\ Zn}{16\ 17}\right).^{2C}_{20} = 4.455 \left\{\begin{matrix}\text{Neumann,} & 4.45\\ \text{Levy,} & 4.45\end{matrix}\right\}.$$

Franklinite.—This very interesting and valuable ore, which is found only sparingly in two or three European localities, occurs in New Jersey, at the Sussex zinc-mines, in immense quantities. It was named from Franklin Furnace, a place in this region near Hamburg, one of the localities. Franklinite is regular in crystallization, black and opaque, slightly magnetic, with metallic lustre, indistinct octahedral cleavage, of the hardness of feldspar, and a density somewhat over 5. Infusible before the blowpipe; contains about 20 per cent. of zinc-oxide, and 13–14 per cent. of manganic oxide, the rest being ferric oxide. It yields, when smelted, a species of *spiegel-iron*. (See IRON.)

Gahnite—Zinc-Spinel; also called *Automolite*.—Regular, like other spinels; hard as topaz; very variable in color, and generally opaque, but sometimes translucent. When pure composed of Al_2O_3, 61.3, and ZnO, 38.7, but always containing some Fe_2O_3, regarded as replacing the alumina. Densities from 4 to 4.91. Found also near Franklin Furnace, N. J., with the willemite and franklinite. Named after the Swedish chemist Gahn, who discovered it at Fahlun, Sweden. The name *automolite* is applied to varieties nearly free from iron.

Zinc-Vitriol, White Vitriol, Zinc-Sulphate, Goslarite.—This is a familiar commercial compound, also occurring in nature as *goslarite*. At the Rammelsberg mine, near Goslar, in the Hartz, it is abundant, but not common elsewhere. For commercial use it is prepared by roasting and then lixiviating blende, or by dissolving metallic zinc in dilute sulphuric acid, and crystallizing. Its composition is $O_4SZn.7H_2O$. Crystals right-rhombic, efflorescing in the air, with loss of part of their crystal-water. At 212° F. they lose $6H_2O$, the seventh equivalent requiring a much higher temperature. At bright redness the acid is decomposed into a mixture of oxygen and SO_2 gases, pure zinc-oxide remaining behind. This is a method of making *oxygen* proposed by Deville and Debray. (See OXYGEN, by HENRY WURTZ.) White vitriol dissolves in 2.33 times its weight of cold water, and less than its weight of boiling water. It has an acrid metallic taste, and is very powerfully emetic in its effect when swallowed in any quantity. It is used in medicine, both directly and as a material for preparation of other medicinal zinc-compounds. One (the heaviest) form of it contains the dominant cast-zinc molecule—

$$O_{4}.^{S}_{24}.^{7H}_{24}.^{Zn}_{21} = 2.011 \left\{\begin{matrix}\text{Filhol,} & 2.036\\ \text{Mohs,} & 2.036\end{matrix}\right\};$$

but in the commonest modification the zinc-molecule is one type (4 diameters) larger:

$$O_{4}.^{S}_{24}.^{7H}_{24}.^{Zn}_{25} = 1.953 \left\{\begin{matrix}\text{Schiff,} & 1.953\\ \text{Stolba,} & 1.9534\\ \text{Buignet,} & 1.957\end{matrix}\right\}.$$

There appear, however, to be other forms. Zinc sulphates are known with other proportions of crystal-water—with one, five, and six molecules.

Zinc-Chloride ($ZnCl_2$), *Butter of Zinc.*—Zinc combines powerfully with chlorine, thin foil taking fire therein spontaneously. The substance formed is whitish, translucent, of the consistence of wax, melts at a low temperature, and sublimes at a red heat, condensing in white needles. It is highly deliquescent, and soluble in water and alcohol. The aqueous solution of zinc-chloride has several uses in the arts. It is used for "burnettizing" wood (see PRESERVATION OF TIMBER, by HENRY WURTZ) and as a disinfecting agent. If boiled with zinc oxide, an oxychloride solution is formed, which Persoz found to have the power of *dissolving silk*, so that the latter may thus be separated from wool and from cotton. The writer has found that this may be accomplished, though special management is required.

Organic Compounds of Zinc, "Zinc Radicals."—By heating the compounds formed by the action of iodine on the marsh-gas homologues with zinc under pressure, a curious class of colorless liquid organic compounds, containing zinc in their constitution, is formed, called "methylide," "ethylide," "amylide," and so on, of zinc. Zinc "methylide" and "ethylide" take fire in the air spontaneously.

HENRY WURTZ.

Zinc-Green. See RINMANN'S GREEN.

Zincite, or Red Zinc Ore, a highly-interesting mineral species, very rare in Europe, but found in one district in the State of New Jersey in such profusion as to constitute an extremely valuable ore of zinc. Its range runs through Stirling Hill and Mine Hill in Sussex co., where it is found imbedded in calcite, associated largely also with *franklinite* and *willemite*. (See ZINC, COMPOUNDS OF.) The zincite of New Jersey, though essentially of the same composition as the pure white zinc-oxide of commerce (see ZINC-WHITE), is nevertheless very different therefrom in chemical and physical characters. Its color, in the mass, is a peculiar and beautiful deep orange-red, and in powder orange-yellow. Its density (see below) is also greater. In thin scales it is translucent and deep yellow, and Prof. Dana found it free from intermixed red oxide of iron or other matter, to which the color has been attributed by some. This color is therefore supposed by him—as well as by G. Rose and J. D. Whitney—to be due to the presence of some *oxide of manganese*, supposed to be Mn_2O_3, in unknown form of combination. This color being, however, a *constant* characteristic, and the proportion of manganese in the mineral exceedingly *variable*, and indeed sometimes almost if not altogether absent, the writer finds himself unable to accept this view, and is forced to put forth the belief that zincite is a special *allotropic form* of zinc-oxide. Under the head of ZINC it is shown that at least two allotropes of metallic zinc exist, the crystallized cast metal $\frac{Zn}{21}$, and the malleable denser wrought zinc, which is $\frac{Zn}{20}.^{3Zn}_{21}$. The density-figures given for red zincite are precisely in agreement with the view that this denser molecule of the metal is contained in it:

$$O_{4}.\left(\frac{Zn}{20}.^{3Zn}_{21}\right) = 5.732 \left\{\begin{matrix}\text{Wm. P. Blake,} & 5.684\\ \text{Dana, } \textit{maximum,} & 5.7\\ \text{Karsten,} & 5.7344\end{matrix}\right\}.$$

Blake's sample was composed of *orange-yellow crystals*, which contained, by his analysis, 99.5 per cent. of oxide of zinc, and but 0.68 of Mn_2O_3. When ordinary white zinc-oxide is heated, it turns yellow, but loses this color again on cooling. The suggestion occurs that if *crystallized* at the temperature at which this change of color occurs, it might remain permanently yellow on cooling, and turn out, in fact, to be the very modification found in nature as zincite. The higher density is in accordance with the fact of the generally higher densities of allotropes of metallic oxides formed by exposure to heat.

HENRY WURTZ.

Zincking of Metals, the plating of metals with a thin layer of zinc, by which they are protected from the oxidizing action of the air. Iron is the metal oftenest coated, but copper is also sometimes treated in the same manner. In the preparation of zincked iron (so-called "galvanized

iron") the metal is first cleansed by immersion in a warm bath of equal parts of sulphuric or hydrochloric acid and water, after which it is cleaned by rubbing with emery: it is next dipped in a bath of equal parts of saturated solutions of chloride of zinc and chloride of ammonium, then into a metallic bath consisting of 640 parts by weight of zinc, 106 parts of mercury, and about ⅓ part of sodium, where it is allowed to remain until it acquires the temperature of the melted metal (680° F.). In order to avoid the partial solution of the iron by the action of the molten zinc, it is advisable to add pieces of wrought iron to the bath, so that it may previously become partially saturated. Iron castings are treated by a somewhat similar process: they are first cleaned by rubbing with sand, then heated, and immersed while still hot in a concentrated solution of chloride of zinc containing sulphate or chloride of ammonium, after which they are dipped in a bath of molten zinc, the surface of which is kept free from oxide by means of a little sal-ammoniac. The protective action of the zinc coating obtained as above described is said to exceed that of the tin upon ordinary tinned iron; increased strength is also imparted to the iron by the zinc, and its welding properties are not impaired. Copper objects can be zincked by immersion in a concentrated and boiling solution of chloride of ammonium, in which granulated or powdered zinc has been placed, or by simply dipping them in a boiling solution of chloride of zinc. Zincked iron is extensively employed for telegraph wires, roofing purposes, water-coolers, etc. J. P. BATTERSHALL.

Zincog'raphy [*zinc*, and γράφειν, to "engrave"], the art of producing impressions of prints and other designs on zinc, from which a fac-simile on paper can be made, is very analogous to LITHOGRAPHY (which see). It embraces the processes of *anastatic printing* (*anastasis*, "resuscitation"), *zinc-printing*, *panicanography*, and *photo-zincography*. In anastatic printing (first used in Germany in 1840) a printed sheet is moistened with water containing nitric acid, which affects only the parts where there is no printing, being repelled from the letters by virtue of the oily matter in them. The sheet is then pressed on a prepared zinc plate, whereby a typographical surface is produced, from which impressions can be printed on paper. *Zinc-printing* consists in first etching designs in the metal with the needle, cleaning them with acid, and covering the entire plate with a layer of fusible metal, which is afterward removed by planing until the etched lines appear at the surface: the plate is then dipped in an acid bath, when the surface of the plate will be dissolved, but not the fusible metal which fills the lines; in this way a relief-drawing, suitable for the printing of maps, plans, etc., can be obtained. In the process of panicanography, by which crayon drawings, proofs of wood or copper plates, etc., are transferred to a zinc plate, a damp inked roller is passed over the drawing, and powdered rosin then spread on it, which adheres only to the parts that were moistened by the ink. Upon now placing the plate in a bath consisting of diluted nitric acid, the unprotected surface is etched, and a relief surface formed which can be used for printing. Photo-zincography is accomplished by first preparing a photograph, then transferring it to zinc, from which copies can be multiplied as from a lithographic stone; it is based upon the fact that bichromates render gelatine insoluble when a mixture of the two is exposed to the action of light. The paper used is prepared with a solution of bichromate of potash and gelatine, and exposed together with the negative of a drawing or other design to the light, the outline of the same being thus obtained in insoluble lines. On then covering it with printer's ink and wetting it at the back, the soluble portion swells up, and allows of the removal of the ink from this part, but not from the insoluble lines. A copy of the object photographed is thus produced in ink, which can be easily transferred to zinc. J. P. BATTERSHALL.

Zinc-White. This is the name of a very large commercial product used as a pigment, formerly made by the combustion of metallic zinc and collection of the fumes, but of late years obtained directly from zinc ores by a process which combines the reduction of the zinc from the ore to a metallic vapor, and the subsequent burning of this vapor in the same apparatus. This operation is conducted in several large establishments in this country on an immense scale, the commercial demand for this pigment having advanced very rapidly of late years. This advance has proceeded from its extensive substitution for *white-lead* in painting woodwork—a substitution due to an increasing appreciation among painters of the deleterious effects of handling the latter pigment. The general plan of the apparatus used consists in a perforated hearth, with a closed ash-pit below, upon which hearth is spread the charge of mixed ore and anthracite coal. The latter is kindled, and air blown in through the ash-pit. The products of combustion, containing an excess of air with vapor of metallic zinc, undergo another combustion after leaving the charge, forming fumes of zinc-oxide, which, after cooling, are caught by being forced through very long bags of some textile fabric, through which the gases gradually filter, leaving the finely-divided oxide within. HENRY WURTZ.

Zin'der, town of Central Africa, dominion of Bornoo, near the frontier of the country of the Tuariks, is surrounded with walls and ditches, which also enclose many gardens and orchards, and carries on a considerable trade. P. estimated at 10,000.

Zingarel'li (NICOLÒ ANTONIO), b. at Naples Apr. 4, 1752: was educated in the conservatory of his native city; brought out his first opera, *Montezuma*, in 1781; was appointed chapel-master at the cathedral of Milan in 1792, and at St. Peter's church in Rome in 1804, but was dismissed because he refused to celebrate the birth of the king of Rome with a *Te Deum*; was made director of the music school of San Sebastian in Naples in 1812, and chapel-master at the cathedral in 1816. D. at Naples May 5, 1837. He composed about 40 operas, among which was *Romeo e Giulietta* (1796), and a great amount of church music, but most of it has now fallen into oblivion.

Zing'el [Ger.], a name of *Aspro vulgaris* and *A. zingel*, two perch-like fishes of German and French rivers. Both are rather small, but are good food-fishes.

Zin'nia [named in honor of Dr. J. G. Zinn, a German savant (1727–59)], a genus of showy American herbs of the composite order, much cultivated in flower-borders. The finest are varieties of *Z. elegans*, a Mexican plant. *Z. multiflora* grows abundantly in parts of the Southern States, where it was doubtless introduced.

Zins'ser (FREDERICK), M. D., b. in the Palatinate, Germany, Sept. 22, 1837: studied medicine at the universities of Giessen and Wurzburg, where he graduated in 1861; came to New York in 1862; is a member of the College of Physicians and Surgeons, and of the German Hospital and Dispensary of the City of New York, department of skin and venereal diseases.

Zin'zendorf, von (NIKOLAUS LUDWIG), COUNT, b. in Dresden May 26, 1700; was educated at Hennersdorf in Lusatia by his grandmother, an intimate friend of Spener, and afterward (1710–16) in the pædagogium at Halle under the special supervision of Francke. From 1716 to 1719 he frequented the University of Wittenberg, where he studied law; undertook then a journey through Holland, France, and Switzerland, and received in 1721 an appointment in the civil service of the Saxon government, but resigned this office in 1727. In 1722 he bought the estate of Berthelsdorf, near Hennersdorf, and here founded a colony of Moravian Brethren who had emigrated from Bohemia on account of religious persecutions. New colonists of other Protestant denominations, especially Pietists, were added, and the place, which was called Herrnhut, prospered very much. A strong religious life developed, and as it was Zinzendorf's wish to give form and order to this movement, he went in 1734 to Stralsund, passed the theological examination, was ordained in the same year at Tübingen, and began to preach. Having been awakened himself by Spener, practical piety was much more important to him than theological discriminations, and he took pains to avoid conflicts with the established Church. Nevertheless, in 1736 he was banished from Saxony as a dangerous innovator, and was not allowed to return until 1747. In the mean time he visited Santa Cruz and St. Thomas 1740, North America 1741, Livonia and Esthonia 1743, Holland and England 1745, preaching, forming congregations, and founding missions in the various countries. (See MORAVIAN CHURCH.) In 1747 he returned to Herrnhut, and d. there May 9, 1760. Of his numerous works his hymns and *Das gute Wort des Herrn*, a kind of catechism (1739), are the most remarkable. Of the former there is a collected edition by Knapp, *Geistliche Gedichte* (1845). His *Life* has been written by Spangenberg (1772), Varnhagen von Ense (1830), Verbeek (1845), Schrantersbach (1857), Völbing (1850).

Zi'on, or **Sion,** a mountain of Palestine, rises 2537 feet above the level of the sea. W. and S. it faces the valley of Hinnom with a steep precipice 300 feet high. On the northern slope stands that part of Jerusalem which was called the "city of David" or the "upper city;" hence Jerusalem was often called the "daughter of Zion."

Zion, p.-v. and tp., Stearns co., Minn. P. 471.

Zion, tp., Greenville co., Va. P. 1186.

Zi'onsville, p.-v., Eagle tp., Boone co., Ind., on Indianapolis Cincinnati and Lafayette R. R., 15 miles N. W. of the former city, has 4 churches, an academy, 2 banks, 1

newspaper, stave and heading factory, 1 wagon manufactory, 1 woollen mill, 2 hotels, and 1 flouring mill. P. 956. THOMAS F. BRAGG, ED. "TIMES."

Zir'con [Cingalese], a silicate of zirconia, occurs in crystals, generally four-sided prisms terminated by four-sided pyramids, and also in grains of a white, red, brown, yellow, and green color, and is found in the sands of the rivers of Ceylon, in the sienite of Norway, at Strontian in Argyleshire, Scotland, and in the auriferous streams of the Croghan Kinshela Mountains in Ireland.

Zirco'nia, the earthy oxide contained in the mineral ZIRCON (which see), the dioxide of the metal ZIRCONIUM (which also see), ZrO_2.

Preparation.—Zircons are powdered—which may readily be accomplished after quenching in water while incandescent—fluxed with 4 parts of a mixture of carbonates of potash and soda with a little saltpetre. Berzelius added pieces of caustic soda during the fusion, using a platinum crucible, taking care to place the soda in the centre of the mass, to save the crucible. A silver crucible may be used, and caustic soda then altogether, for fluxing. Iron crucibles are objectionable, because iron oxides are the most difficult bases to separate from zirconia. The fluxed mass is dissolved in muriatic acid, and the silica separated by evaporation, as usual. From the aqueous solution of the residue ammonia precipitates the zirconia, with ferric oxide. One good method of obtaining the zirconia free from iron is to add tartaric acid before adding ammonia, which will hold the zirconia in solution, and then precipitate the iron with sulphide of ammonium. The filtrate, on evaporation, and ignition to burn off the carbon of the tartaric acid, leaves behind in pure form the *insoluble modification* of anhydrous zirconia. To obtain it in a form soluble in acids, the iron must be separated by another method, that of Hermann. This is by adding sodium hyposulphite and boiling, when zirconium hyposulphite is precipitated, leaving the iron in solution in ferrous condition. The precipitate, dissolved in hydrochloric acid and converted into chloride by continued boiling, is precipitated again with ammonia, which gives zirconia "hydrate" as a jelly. This, well washed with boiling water, dried and *gently* heated, is converted into amorphous zirconium-oxide, white and insoluble in water, but soluble in acids. Its molecular constitution (see VOLUMES, MOLECULAR) is—

$$O_4.2^{Zr}_{26} = 4.348 \left\{ \begin{array}{l} \text{Klaproth,} \\ \text{Watts's } \textit{Dictionary}, \end{array} \begin{array}{l} 4.3 \\ 4.35 \end{array} \right\}.$$

Heated to incipient redness, it glows brightly, undergoing a molecular change, indicated by an increase of density. It is now—

$$O_4.2^{Zr}_{24} = 5.022 \text{ (Berlin, 4.9).}$$

This is possibly the dominant form, or rather that corresponding to quartz, the insoluble modification of silicon-dioxide. There is, however, a *crystalline* form of zirconia, obtained by Nordenskjöld by fusing with borax, and dissolving out the latter with muriatic acid, which is in transparent, colorless, square prisms, and is—

$$O_4.2^{Zr}_{22} = 5.781 \text{ (Nordenskjöld, 5.712).}$$

This has the Zr condensed 4 diameters below that in the amorphous soluble allotrope, and may correspond to quartz, which latter, however, is $O_4.2^{Si}_{23}$.

Zirconia forms compounds with bases analogous to silicates, and zircofluorides analogous to silicofluorides. (See FLUO-SILICIC ACID; also under ZIRCONIUM.) Indeed, it is quite as well entitled to be called *zirconic acid* as silica to be called *silicic acid*.

Zirconic "Hydrates."—The gelatinous precipitate formed by ammonia (see above) dries to a yellowish gummy mass, which, like the "hydrates" of silica (see SILICA, HYDRATES OF), varies in composition. Berzelius found O_3H_2Zr. Hermann O_4H_4Zr. This is soluble in 5000 parts of water, and Prof. Brush of Yale College has made the remarkable observation that this solution reddens turmeric-paper like an alkali. HENRY WURTZ.

Zirconium, an element having characters approaching those of a metal, found principally in the mineral called ZIRCON (which see). Its chemical relations are very close and parallel to the great mineral element *silicon*, which gives to its study great interest. Like silicon—and carbon, which also belongs to the same natural group—it assumes different allotropic forms, widely varying in their physical characters. The amorphous allotrope of zirconium was obtained in 1824 by Berzelius by a method similar to that which yields amorphous silicon, by the action of an alkali-metal on the *zircofluoride of potassium*, F_6ZrK_2. It assumes a graphite-like lustre under the burnisher. It is unchanged by ignition apart from the air, but in air burns to zirconia. Its density has not been determined. *Adamantoid zirconium* was obtained by Troost by substituting for the alkali-metal above an excess of metallic *aluminum*, and dissolving out of the fused mass of aluminum the latter metal by muriatic acid. It resembles metallic antimony in appearance, and is very brittle and hard. It is incombustible except by Hare's blowpipe, and soluble with difficulty in acids, except hydrofluoric and *aqua regia*. Density = 4.15, which indicates an approximation to the 4th diametric type (see VOLUMES, MOLECULAR), $\frac{Zr}{28}$ 1.077, which is 4 diameters above that in zirconia which has been ignited. (See ZIRCONIA.) HENRY WURTZ.

Zirk'nitz (or **Czirkniez**), **Lake of,** in a deep valley in Carniola, Austria, between Laibach and Trieste, is famous on account of the occasional disappearance of its waters. It is 6 miles long, 3 miles broad, and 56 feet deep. At intervals—generally in August, though not regularly—its waters are entirely drawn off through a number of fissures in its bottom, and a harvest of hay, or even of buckwheat, is gathered in its bed. After the lapse of four or six weeks, or when the wet season sets in, the water begins to pour into the lake from a number of other fissures; but while it generally takes from twenty-two to twenty-five days to empty the lake, it takes often only twenty-four hours to fill it.

Zis'ka (JOHN), b. at Trocznow, Bohemia, in 1360; was educated at the court of Prague, and fought with the Teutonic Knights against the Lithuanians and Poles, in Hungary against the Turks, and on the English side in the wars between England and France. He had embraced the doctrines of Huss, and was conspicuous in the great commotion which was caused by the execution of Huss and Jerome. He was present on the famous 30th of July, 1419, when the commotion suddenly burst out into open violence. While a Hussite procession was passing by the town-house of Prague, a stone was thrown from the town-house and hit one of the ministers. In one moment the house was stormed, and the thirteen Roman Catholic magistrates were thrown out of the windows and massacred. The outburst spread rapidly over the whole country. Monasteries and convents were sacked and burnt, monks and priests were burnt at the stake or buried alive, negotiations from the side of Wenceslas and his successor, Sigismund, failed, and under the leadership of Ziska the Hussites formed a fortified camp on the top of Mount Tabor. They were in possession of the city of Prague, though not of the castle, and in order to defend it against the emperor Sigismund, who approached with an army of 30,000 men, Ziska took up a position on the hill of Witkow, just outside the city. He had only 4000 men, but such was the fanatical enthusiasm with which the Hussites fought that the emperor was unable to remove them, and had to retire with an immense loss after a most sanguinary struggle, July 14, 1420; the hill has since that day borne the name of Ziska Hill. In the autumn of the same year Ziska conquered the castle of Prague, but in the next year became blind. While a boy he had lost one eye, and now, while besieging the castle of Raby, also lost the other. But he continued, nevertheless, to command. Such was his knowledge of his country that from the descriptions of the terraine by his lieutenants he was able to make his dispositions and conduct the battle. In 1422 the emperor returned with another great army, and on Jan. 18 the battle took place at Deutschbrod. The emperor was completely routed, and, unable to raise a third army, he now began to negotiate. He was willing to grant liberty of conscience, to make Ziska governor of Bohemia, etc.; but before the negotiations could be brought to a close Ziska d. at Przibislaw Oct. 12, 1424. He was buried at Czaslau with his battle-axe suspended over his coffin, but in 1623 his tomb was disturbed and his bones removed on an imperial order from Vienna.

Zit'tau, town of Germany, kingdom of Saxony, at the confluence of the Mandau and Neisse, is surrounded with walls and well built. It contains many educational and benevolent institutions, and is the seat of the linen and damask manufactures of Saxony. Woollens, paper, oil, and iron goods are also manufactured. P. 17,869.

Zlatoosk', town of European Russia, government of Orenburg, on the Ai, an affluent of the Oofa, in the Ural Mountains, is the centre of a rich mining district, and manufactures sword-blades and different articles of steel which enjoy a great reputation. P. 9640.

Zmeinogorsk', town of Siberia, government of Tomsk, on the Smieyka, is situated at the richest silver-mines of the country. P. 6000.

Znaim, or **Znaym,** town of Austria, in Moravia, on the left bank of the Thaya, has large barracks and hospitals, and manufactures of mustard, chocolate, saltpetre, earthenware, leather, and cloth. P. 10,600.

Zo'an [Heb., "going out," indicating a frontier city; Coptic, *Gani* or *Dschane*; Arab. *Sân*], the *Tanis* of Manetho and the *Tanis* of the Greeks and Romans, an ancient

city of the Egyptian Delta, in N. lat. 31° and E. lon. 31° 55′, on the right bank of the Tanitic arm of the Nile, some 25 miles from the Mediterranean, and about 40 miles W. of Pelusium. Its high antiquity is incidentally recognized in Num. xiii. 22: "Now Hebron was built seven years before Zoan in Egypt," and perhaps by the same or a kindred people. But by whomsoever founded, it was probably rebuilt by the Hyksos, who made it their capital. The sanctuary of its great temple dates back, it is supposed, to the sixth dynasty (about 2200 B. C., according to Wilkinson, or about 3700 B. C., according to Mariette); and not till the twenty-sixth dynasty, in the seventh century B. C., did the city begin to decline. Strabo, who was in Egypt with his friend the Roman prefect, Ælius Gallus, 24 B. C., speaks of it as "a large city" (*Geog.*, xvii. 1. 20). Josephus, writing about 80 A. D., calls it "a small town" (*Jew. W.*, iv. 11. 5). It was probably the residence of the Pharaoh of the Exodus, and consequently the scene of the "marvellous things" that were done "in the field of Zoan" (Ps. lxxviii. 12), a geographical designation which corresponds exactly to a recently-discovered hieroglyphic inscription. (See Brugsch, *Zeitschr. f. Ægypt. Spr. und Alterthumsk.*, 1872.)—The desolation is now complete, fulfilling the prophetic threat to "set fire in Zoan" (Ezek. xxx. 14). "The field of Zoan" is described by Macgregor (*Rob Roy on the Jordan*, p. 83) as "a black rich loam, without fences or towns, and with only a dozen trees in sight." Close to what was once the Tanitic arm of the Nile, now only a canal, on its eastern bank, stands the miserable little fishing-village of *Sân*. The ruins of the ancient city are a mile away to the E., buried under mounds which rise at one point about 200 feet above the plain. These ruins (more than a mile in extent from N. to S., and about ⅔ of a mile from E. to W.) have been carefully explored by Mariette, whose excavations, under the patronage of the Khedive of Egypt, accomplished by the forced labor of 500 men at a time, have thrown much light upon what had been the obscurest portion of Egyptian history. The great temple was one of the grandest in Egypt, with ten at least—if not twelve—obelisks, which were about 5 feet in diameter and from 50 to 60 feet high. The material employed in building was, much more largely than at Memphis or Thebes, the hard granite of the upper Nile, apparently in order to withstand the moister climate of the Delta. The famous Museum at Boolak, near Cairo, has been immensely enriched by the antiquities discovered at Sân. One of the most interesting of these antiquities is the "Canopus Stone," discovered in 1865. It is a limestone slab, six feet high, with a trilingual inscription (hieroglyphic, demotic, and Greek), resembling the Rosetta Stone, discovered by Boussard in 1799. It records a decree of the priests of Egypt assembled at Canopus in the year 254 B. C. Very little new light is thrown upon the history of the Israelites in Egypt. R. D. HITCHCOCK.

Zo'ar [Heb., "the little"], the only one that was spared of the five "cities of the plain." Originally it was called *Bela* (Heb., "swallowed, devoured," Gen. xiv. 2), Jerome says, because, according to Hebrew tradition, it was destroyed for the third time by an earthquake (*Com. in Isaiam*, xv. 5). The four cities that perished were Sodom, Gomorrah, Admah, and Zeboim. In the book of Wisdom, x. 6 (written about 100 B. C.), it is implied that Zoar likewise perished, mention being made of "the fire which fell down upon the five cities." Josephus also speaks (*Jewish War*, iv. 8. 4) of "the faint remains of five cities" as "still discernible." But according to the biblical narrative (Gen. xix.) Zoar escaped destruction in answer to the prayer of Lot, who sought refuge in it, although (Gen. xix. 30) he did not remain there long. It must not be looked for among the hills of Moab. It was, with the rest of the five cities, in the plain or circle (*siccar*) of Jordan (which is not to be identified, as it often has been, with the Vale of Siddim, where the battle occurred), and was near enough to Sodom to be reached between dawn and sunrise. It has generally been supposed that these five cities stood at or toward the southern end of what is now the Dead Sea. Jerome (d. 420 A. D.) evidently thought there was no Dead Sea at all till after the destruction of the cities of the plain (*Heb. Quæst. in Gen.*, xiv. 3). Since it was ascertained how deep the sea is (1316 feet) in its upper part, the theory has been that only the shallow lower third of it (in the autumn only three feet deep) covers the sites of the submerged cities. But there is no scriptural warrant for submersion at all, the Hebrew word constantly employed (*haphak*) indicating earthquake rather; while in Deut. xxix. 23 the picture set before us is of a land of "brimstone, and salt, and burning, that it is not sown, nor beareth, nor any grass groweth therein." As for Zoar, Irby and Mangles (in 1818) suggested its identification with ruins found by them at the mouth of the Wady Kerak, on the E. side of the shallow part of the Dead Sea, and Robinson is inclined to accept the identification. The principal objections are that this locality is not visible, as Zoar appears to have been, from the hill near Bethel (Gen. xiii. 10); nor does it answer very well to the description (Gen. xix. 28) of what was in sight from Hebron; nor could Moses have seen it (Deut. xxxiv. 3) from the top of Pisgah. Accordingly, George Grove, one of the editors of Smith's *Bible Dictionary* (1863), argued in favor of locating the cities of the plain at the northern end of the Dead Sea. And in 1876, Selah Merrill discovered there what he takes to be the remains of the five cities. One of the five tells examined by him, the one nearest the mouth of the Wady Hesban, is called *Ektanu*, a word which has no meaning in Arabic, but may have come from the Hebrew *Katan*, which means the same as *Zoar*. (See *Fourth Statement* (1877) of the American Palestine Exploration Society.)

R. D. HITCHCOCK.

Zoar, p.-v., Franklin co., Mass.

Zoar, p.-v., Lawrence tp., Tuscarawas co., O., on Tuscarawas River and Ohio Canal, 65 miles from Cleveland, and on the Tuscarawas branch of Cleveland and Pittsburg R. R., is pleasantly situated, has a meeting-house, school, hotel, woollen-factory, and other business places. It was settled in 1817 by a German community under the leadership of Joseph M. Bäumeler (or Bimeler), who were incorporated in 1833 as "the Society of Separatists of Zoar, O.," more generally known as the Zoar Society. This society holds a tract of land of about 7300 acres in common, through a system based on community of property, having a board of three trustees for its exterior management, and a committee of five, elected annually, for its interior government. P. 326. (See *Communistic Societies of the United States* (1875), by Charles Nordhoff.)

Zo'diac [Gr. ζωδιακός], an imaginary zone or belt in the heavens, extending from 9° N. to 9° S. of the ecliptic, and comprising that region of the heavens within which the apparent motions of the sun, moon, and all the greater planets are confined. It is divided into twelve equal parts, called "signs," which are designated by the names of the constellations Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio, Sagittarius, Capricornus, Aquarius, and Pisces, which are supposed to have been invented in Egypt, and refer to the division of the seasons and the agriculture of that country. (See SIGN and CONSTELLATION.)

Zodiacal Light. See APPENDIX.

Zoë'ga (GEORG), b. at Dahler, Danish province of Jutland, Dec. 20, 1755; studied at the University of Göttingen; visited Italy in 1776, again in 1779, as tutor in a private family, and finally in 1782 with a stipend from the Danish government; embraced Roman Catholicism; devoted himself to antiquarian studies; was made Danish consul-general in Rome, and d. there Feb. 10, 1809. He wrote *Nummi Ægyptii Imperatorii* (1787), *De Origine et Usu Obeliscorum* (1797), and *I Bassi-Rilievi antichi di Roma, incisi da Tom. Piroli* (2 vols., 1808). He also published a catalogue of the Coptic manuscripts in the Museo Borgiano. His *Life* has been written in 2 vols. by Welcker (1819).

Zo'etrope [Gr. ζωή, "living," and τροπή, "turning round"], or **Wheel of Life**, a device invented before 1860 by P. H. Desvignes, and at first called mimoscope, by means of which pictured objects seem marvellously endowed with the movements of life. There are several forms of the instrument, in all of which the optical illusion depends upon the principle of the persistence of visual impressions. The phenakistoscope and thaumatrope are in principle precisely the same.

Zol'licoffer (FELIX K.), b. in Maury co., Tenn., May 19, 1812; received an academical education; became a printer; edited a paper at Paris, Tenn., 1829; published the *Columbian Observer* 1834; was chosen State printer 1835; edited the leading Whig paper of the State, the Nashville *Banner*, from 1842; was State comptroller 1845–49; State senator 1849; member of Congress 1853–59; was an advocate of extreme Southern views, but served as a delegate to the Peace congress of Feb., 1861; became a brigadier-general in the Confederate service, commanding in Eastern Tennessee, Aug. 8, 1861; was defeated at Camp Wild Cat, Ky., Oct. 21, and by Gen. Thomas at the battle of Mill Spring, Ky., where he was killed Jan. 19, 1862.

Zoll'verein is the German name of a toll-union between the various states of the German empire, according to which all custom duties along the internal frontiers of the states belonging to the union are abolished, and the revenues proceeding from the custom duties levied along the external frontiers of the union are partitioned among the members according to population. The union was proposed by Prussia in 1827, but not accomplished until 1867, and has proved eminently beneficial by throwing down the vexatious and mischievous barriers which trammelled

all communication in Germany, and by reducing the cost of collecting the revenues.

Zolotono'sha, town of Russia, government of Poltava, on a river of the same name, an affluent of the Dnieper, has 6864 inhabitants.

Zom'bor, town of Austria, in the Serbian woiwodina, is the seat of several civil, ecclesiastical, and educational institutions, and has extensive silk manufactures and a large trade in corn and cattle. It communicates with the Danube through the Francis Canal. P. 24,309.

Zon'aras, b. in Constantinople toward the close of the eleventh century; was private secretary to Alexius Comnenus, but retired during the reign of Calo Joannes to the monastery of Mount Athos, where he became a monk, and died, it is said, in the eighty-eighth year of his age. In his retirement he occupied himself with literature, and there exist several works by him, both printed and in manuscript. The most important are his *Chronicon* or *Annales*, a history of the world from its creation to 1118, edited by Dindorf (Leipsic, 1868–75), and his *Lexicon*, edited by Tittmann (Leipsic, 1808).

Zone [Gr. ζώνη], a part of the surface of a sphere included between two parallel planes. If the planes are secant, the zone has two bases; if one is secant and the other tangent, the zone has but one base; if both are tangent, the zone is equal to the surface of the sphere. If an arc of any curve is revolved about a line exterior to it, the surface generated is called a zone. W. G. Peck.

Zones. See Earth, IV., by Prof. A. Guyot, Ph. D., LL.D.

Zook (Samuel Kosciuszko), b. in Pennsylvania about 1823; became a practical telegrapher, and made some discoveries in his branch of science; settled in New York City 1848; went as lieutenant-colonel of the 6th New York State militia to Maryland Apr., 1861; was military governor of Annapolis; raised and commanded the 57th New York Vols.; commanded a brigade on the Peninsula; was made brigadier-general Nov. 29, 1862; distinguished himself at Chancellorsville, and was killed during the first day's battle at Gettysburg, July 2, 1863.

Zoology. See Appendix.

Zo'ophytes [from the Gr. ζῶον, "animal," and φυτόν, "plant"], a term introduced by Cuvier and applied to the lowest primary division of the animal kingdom, including the groups of Infusoria, Entozoa, and Radiaria. Subsequent writers, however, excluded the Infusoria and Entozoa from the zoophytes, and confined the name to animals constructed on the radiated type, and even in this narrow field it has of late fallen almost entirely into disuse.

Zo'ospores [from ζωός, "living," and σπορά, "seed"], the name of a certain kind of spores produced by acotyledonous plants, which by being furnished with cilia are enabled to move around for a short time after being discharged from the spore-case of the parent plant. The motion is probably owing to hygrometric and electric changes, but its appearance of spontaneity caused the spores to be mistaken for a long time for animalcules. (See Spores.)

Zoril'la ["little fox," a name given in Spanish America to certain skunks, but in many books transferred as a popular name to *Ictonyx* or *Rhabdogale*], a genus of South African mustelids, somewhat resembling the skunk. There is but one species, *Z. striata*, a handsome striped animal, which can emit an intolerable smell.

Zorn'dorf, village of Prussia, province of Brandenburg, is famous for the battle fought here on Aug. 25, 1758, between the Russians under Fermor and the Prussians under Frederick the Great; the Russians were defeated.

Zoroas'ter [the corrupt Greek and Latin version of the old Persian name *Zarathustra*, which the later Persians altered to *Zerdusht*], the founder of the ancient Persian religion. His family name was *Spitama*, and *Zarathustra* seems to have been a title, meaning "chief," "senior," or "high priest." He was born in Bactria; his father's name was Pourushaspa, and he had a daughter by the name of Pouruchista. But this is all that is known of his personal life. What the old Persian or Greek authors tell about him is mere myth; even the time in which he lived is utterly uncertain, some placing him 500 years before Christ, others 6000 years before Plato. The religious system which he developed is a complete dualism, Ormuzd being the creator and ruler of all that is bright and good, Ahriman the chief of that which is dark and evil. To each of these supreme beings belongs a number of subordinate spirits, Ameshaspentas to Ormuzd, Devas to Ahriman; and all that exists is divided between these two realms. Man has to choose, and according to his choice he will after death go to Ormuzd or to Ahriman; the way to the first is pure thought, pure speech, and pure actions. The only object of worship was fire, the symbol of that which is bright and good, and to fire all temples and altars were dedicated. The priests which maintained the fire and conducted the worship were the Magi. The developments which this system underwent from the time of Zoroaster up to our days are as yet points of contention. The monotheism which is now taught among the Parsees, and according to which Ormuzd and Ahriman are two principles only, not two causes, is by some scholars considered as the original idea of the religion of Zoroaster, while by others it is thought to be a later development.

Zoroaster, Religion of. See Zoroaster.

Zorri'lla y Moral' (José), b. at Valladolid, Spain, Feb. 21, 1817; educated in the College of Nobles at Madrid; studied law at Toledo and Valladolid; became widely known as a poet by his verses read at the funeral of Larra, Feb. 15, 1837; published *Cantos del Trovador* (3 vols., 1841), *Flores Perdidas* (1843), and *Granada* (2 vols., 1853–54); lived for some years alternately at Brussels and at Paris, and was some time director of the theatre in the City of Mexico during the last government of Santa Anna.

Zos'imus, a Greek historian of the fifth century, of whose personal life nothing is known, but whose work, a history of the Roman empire from Augustus to 410, is still extant, edited in 1837 by Bekker. Zosimus was a pagan, and attacks those Roman emperors who were Christians with great acrimony.

Zosimus, pope 417–18; declared first Pelagius orthodox, reproached the African bishops for their opposition, and summoned their leader, the deacon Paulinus, to Rome; but afterward, when the bishops procured a rescript against Pelagius from the emperor Honorius, Zosimus turned round and condemned him in an *Epistola Tractatoria*, thus furnishing an interesting illustration of the doctrine of the papal infallibility. His letters are found in Constant's *Epistolæ Romanorum Pontificum*.

Zouaves [from the *Zouaoua*, a Kabyle tribe of Algiers], originally bodies of Kabyle infantry mercenaries in the service of the Barbary states; in this sense the name is still employed, Tripoli having some 5000 such zouaves in her service. After the French conquest, the French incorporated in 1830 into the same battalions companies of Frenchmen and Kabyles, dressed in Algerine costume. But afterward the zouaves of the two nationalities were separated. The native Africans are called *Turcos*, and the French in modified African costume are called *zouaves*. Their uniform is very picturesque. The men are selected for their strength, courage, and good appearance. There are four regiments of zouaves, each of four battalions, besides some extra battalions and companies, and nearly as many Turcos. The name in the late civil war was applied to regiments of volunteers in zouave costume.

Zrin'yi (Miklós), Count, b. in 1508 of an illustrious Slovak family; fought with great distinction in the Austrian army against the Magyars under Zapolya and the Turks under Solyman II., and became celebrated by his defence of Sziget in 1566. With 3000 men he held the place from Aug. 1 to Sept. 7 against a Turkish force of 65,000 men under Solyman II. and his famous grand vizier, Sokolovich. Solyman died of rage, and the final capture of the castle cost the Turks over 20,000 men. Zrinyi was shot while fighting on the last bastion, and a few moments after the powder-magazine was fired. The place, which was conquered, was absolutely nothing but ruins.

Zschok'ke (Johann Heinrich Daniel), b. at Magdeburg Mar. 22, 1771; was educated in the gymnasium of his native city, but left it in 1788, and accompanied for some time a band of strolling actors as their play-writer. Shortly after, however, he went to the University of Frankfort-on-the-Oder, where he pursued various lines of study—theology, philosophy, history, political economy, and belles-lettres—and began to give lectures in 1792. Meanwhile, his dramatic compositions, *Abällino* (1793), *Julius von Sassen* (1796), etc., attracted considerable attention; but in 1795 he wrote against certain religious edicts of the Prussian government, and when he in 1796 applied for a professorship, he was rejected. Leaving Prussia immediately, he settled at Reichenau, canton of the Grisons, Switzerland, and took charge of a large educational institution. The institution prospered, and Zschokke was made a Swiss citizen. Soon he also began to take a most active and influential part in the politics of the country, acting, however, as a mediator rather than as a partisan. In 1798 he removed to Aarau, and was made chief of the department of public education, but in 1801, when the central government in Berne attempted to restore the old federal constitution, he retired from public life and took up his residence at Biberstein. In 1803, however, he was recalled

and made a member of the board of forests and mines, and from that time to his death, at Biberstein June 27, 1848, he continued to hold various positions in the government of the republic. His celebrity, however, and also his influence, rest chiefly on his literary activity. He edited the *Aufrichtigen und wohlerfahrenen Schweizerboten* (1804–07), *Miscellen für die neueste Weltkunde* (1807–13), and *Ueberlieferungen zur Geschichte unserer Zeit* (1817–23), which periodicals were much read: and his *Sämmtliche Werke*, relating to history, political economy, fiction, and devotion, comprise 40 vols. His most celebrated work is *Stunden der Andacht* (1806; twice translated into English, the last time in 1862 by Frederica Rowan, under the title *Meditations on Death and Eternity*). Of his historical works the most remarkable are *Geschichte vom Kampfe und Untergange der schweizerischen Berg- und Waldcantone* (1801), *Geschichte des baierischen Volks und seiner Fürsten* (4 vols., 1813–18), *Des Schweizerlandes Geschichte für das Schweizervolk* (1822; translated into English by F. G. Shaw, New York, 1855). Of his novels (10 vols.) selections have been made and published in English (Philadelphia, 1845; New York, 1848, by Parke Godwin; and London, 1848). His autobiography, *Selbstschau* (1842), has also been translated into English (London, 1845).

Zuc'caro (Federigo), b. in 1543; painted the dome of the cathedral of Florence, the Pauline chapel of the Vatican, the grand council-hall in Venice, several rooms in the Escurial; visited Flanders and England, where he painted portraits of Elizabeth, Mary Stuart, and others, and finished the frescoes in the Palazzo Caprarola which his brother (Taddeo Zuccaro, b. in 1529; d. in 1566) had begun. Federigo d. in 1609.

Zschop'pau, town of Germany, kingdom of Saxony, on the Zschoppau, has manufactures of linen, lace, woollens, and cotton. P. 7600.

Zubly (John Joachim), D. D., b. at St. Gall, Switzerland, Aug. 27, 1724; was ordained in 1744; came soon afterward to America; took charge of the First Presbyterian church at Savannah, Ga., 1760; preached in English and German, and occasionally in French; was active among the "Sons of Liberty" and as a member of the first provincial congress of Georgia 1775; was chosen to the Continental Congress the same year; opposed the Declaration of Independence, after which he suddenly went to Georgia, where he took sides with the Crown and had to conceal himself from popular resentment; was in that city during the siege of 1779, and afterward went to South Carolina, where he d. July 30, 1781. He was a man of learning, and published a number of patriotic discourses.

Zug, the smallest canton of Switzerland, nearly in the centre of the country, comprises an area of 85 sq. m., with 20,993 inhabitants, who speak the German language and belong to the Roman Catholic Church. The southern part is mountainous; rearing of cattle and dairy-farming are the principal occupations. The northern part, along the Lake of Zug, belongs to the Swiss plain, and is covered with cornfields, orchards, and vineyards. Some manufactures of paper, silk, and cotton are carried on.

Zuider Zee. See Zuyder Zee.

Zuinglius. See Zwingli.

Zu'luland, the name generally given to the country extending along the Indian Ocean on the south-eastern coast of Africa, from the colony of Natal in the S. to the Bay of Delagoa in the N., from lat. 29° 10′ S. to lat. 26° S., and bounded W. by the Orange River Free State and the Transvaal Republic. The country consists of a low coast-land 120 miles broad, marshy and swampy in the northern part, between St. Lucia River and the Bay of Delagoa, but presenting excellent pasture-plains in the southern part. Behind this coast-land the ground rises through undulating slopes, often covered with forests of timber-yielding trees, into a mountain-range from 6000 to 7000 feet high, which separates the lowland from the high inland plateaus. The soil is generally exceedingly fertile. Rice, sugar, cotton, and all kinds of tropical fruits can be grown advantageously, and it is only in the northern part that the climate is unhealthy and injurious to Europeans. The country is inhabited by independent tribes of Zulu Kaffirs, who, though evincing all the characteristic marks of the negroes, are vastly superior to them in almost every respect. They are described as industrious, trustworthy, cheerful, and kindhearted, except in case of war, when the excitement transforms them into demons. On the Bay of Delagoa the Portuguese have a miserable fort garrisoned by a few mulatto soldiers, and here some trade is carried on, gunpowder, muskets, and cotton manufactures being exchanged for gums, ivory, horn, and gold-dust. A desperate war broke out between the English and the Zulus in 1879, resulting in the subjugation of the latter during that year.

Zuma, tp., Rock Island co., Ill. P. 787.

Zumalacarre'gui (Tomas), b. near Villa Real, Spain, in 1789; was a leader of guerillas during the Spanish war of independence 1808–14; served under Quesada 1822; was appointed by the pretender Don Carlos general-in-chief of his army Oct., 1833, and conducted its operations with great skill and daring until he was mortally wounded at the siege of Bilbao, June 15, and d. June 25, 1835.

Zum'bro, tp., Wabashaw co., Minn. P. 458.

Zumpt (Karl Gottlob), b. in Berlin Mar. 20, 1792; studied classical languages and literature at Heidelberg and Berlin, and was appointed professor of Roman literature at the University of Berlin in 1827. D. at Karlshad June 25, 1849. He published much-esteemed editions of Quintilian, Curtius, several of Cicero's works, etc.: wrote a Latin grammar (1818), which has been translated into English and is still much used; and published numerous essays relating to Roman antiquities and history, among which are—*Annales Veterum Regnorum et Populorum, imprimis Romanorum* (1819), *Ueber den römischen Ritterstand* (1839), *Ueber den Stand der Bevölkerung und die Volksvermehrung im Alterthum* (1841), *Ueber die bauliche Einrichtung des römischen Wohnhauses* (1851).—His nephew, August Wilhelm Zumpt, b. at Königsberg Dec. 4, 1815; studied classical philology at the University of Berlin; was appointed professor at the Friedrich-Wilhelm Gymnasium in Berlin in 1851, and wrote, besides other works, *Ueber die Entstehung und historische Entwickelung des Colonats* (1845), *Commentationes Epigraphicæ ad Antiquitates Romanas pertinentes* (2 vols., 1850–54), *Das Criminalrecht der römischen Republik* (4 vols., 1865–68).

Zuñiga. See Ercilla y Zuñiga.

Zuñi Mountains. The Zuñi range of New Mexico lies between the 35th and 36th parallels of N. lat., and is intersected by the 108th meridian W. from Greenwich. Fort Wingate is at its north-western end, and old Fort Wingate at its south-eastern. Its length from N. W. to S. E. is 45 miles; its breadth is 20 miles. It rises 3000 feet above the surrounding country, which has a general altitude of 6500 feet. Its summit is broadly arched, and is clothed with timber. The proportions and scenery of the range are not imposing, and it is overtopped by the neighboring volcanic peak of Mount Taylor, but it is of great interest to the student of "mountain-building" on account of its simplicity of structure and its isolation. All about it the rocks lie in level strata; at its base they are bent upward, and they arch over its top in simple curves. At the S. E. end erosion has removed the crest of the arch and exposed the crystalline rocks which underlie the stratified, but at the N. the continuity of the lower strata is unbroken, and they can be traced from side to side. The flexure of the strata is comparatively abrupt on the south-western flank, and they descend with gentle inclination to the N. E. The crest or axis of the fold lies near the south-western base.

G. K. Gilbert.

Zunz (Leopold), b. at Detmold, principality of Lippe, Germany, of Jewish parentage, Aug. 10, 1794; studied philology at Berlin; was preacher at the synagogue of Berlin 1820–22; editor of the *Spenersche Zeitung* 1824–32; preacher at the synagogue of Prague 1835–39; director of the normal seminary at Berlin 1839–50, and since 1845 member of the board of commissioners for the educational interests of the Jews in Prussia. His first work, *Etwas über die rabbinische Litteratur* (1818), attracted much attention; also his principal work, *Die gottesdienstliche Vorträge der Juden* (1832), and several other of his writings, *Die Namen der Juden* (1836), *Die synagogale Poesie des Mittelalters* (1855), etc. A collected edition of his works was commenced in 1875.

Zurbaran' (Francisco), b. in Spain in Nov., 1598; studied painting under Juan de Roelas at Seville; became an imitator of Caravaggio; executed a notable series of pictures in the cathedral at Seville illustrating the life of St. Peter, and another series of the life of St. Jerome for a monastery at Guadalupe; was employed by many churches at Seville and Madrid, and became royal painter 1650. D. at Seville in 1662. His masterpiece is a *St. Thomas Aquinas received into Heaven*, executed about 1625.

Zu'rich [Ger. *Zürich*], canton of North-eastern Switzerland, bordering on the Rhine and on Lake Zurich, comprises an area of 687 sq. m., with 284,786 inhabitants, who speak German and are Protestants. It consists of three elevated valleys, and contains excellent pastures. The soil is not very fertile, but it is cultivated with the utmost care. Corn and wine are produced, though dairy-farming and manufactures are the principal occupations. In all mechanical arts Zurich competes with England, and in some surpasses her: in the building of locomotives the Zurich engineers have outstripped the English.

Zurich, town of Switzerland, capital of the canton of Zurich, on the Limmat where it issues from the Lake of Zurich, is well and substantially built, though somewhat old-fashioned in its appearance. It has a university, a public library of 45,000 volumes, a botanical garden, several museums of natural history, and a polytechnic school to which pupils from all Europe gather. Its manufactures comprise silk, cotton, leather, ribbons, lace, etc., and are extensive. P. 21,199; with the suburbs, 56,695.

Zurich, Lake of, lake of Switzerland, 23 miles long and 2½ miles broad, is bounded by the cantons of Zurich, Schwytz, and St. Gall, and is celebrated for the picturesque beauty of its scenery.

Zuri'ta (Gerónimo), b. at Saragossa, Spain, Dec. 1, 1512, son of the favorite physician of Ferdinand the Catholic; educated at Alcalá; became a magistrate and a member of the supreme council of Castile 1543; was employed in diplomatic service in Germany 1543–49; became chronicler of Aragon 1549; subsequently private secretary to the king, and travelled through Spain, Sicily, and Italy in search of historical data. D. at Saragossa Nov. 3, 1581. Author of *Anales de la Corona de Aragon* (6 vols., 1562–79).

Zuru'ma, town of Ecuador, South America, on the western slope of the Andes, was formerly an important place, but has now greatly declined, and has hardly 5000 inhabitants, mostly engaged in sugar cultivation and manufacture of preserved fruit and of jewelry.

Zütphen, town of the Netherlands, province of Gelderland, on the Yssel, is beautifully situated and well built, though an old city; its walls have been transformed into promenades. It has tanneries, soapworks, oil and paper mills, spinning and weaving factories, carpet manufactories, and a large trade in wood, bark, and grain. P. 15,301.

Zuy'der-Zee (*i. e.* "South Sea"), a gulf of the North Sea, land-bound by the provinces of Holland, Friesland, Overyssel, Gelderland, Utrecht, and North Holland. It is 80 miles long and 40 in greatest breadth. The islands Texel, Vlieland, Terschelling, and Ameland, continuations of the general coast-line, lie across its mouth, the communications with the North Sea passing between, the chief of which is that of Helsdeur ("Hell Gate"), between the Helder (which see) and the island of Texel. The sea is quite shallow, especially in its southern part, and to avoid the difficulties of its navigation to Amsterdam the North Holland Canal (which see) was constructed. The history of the changes which this sea has undergone is given under the head of Inundations, Maritime, by P. Caland. The Zuyder-Zee receives the waters of the Gueldrian Yssel and of the Amstel, both delta-branches of the Rhine; at the entrance of the latter (scarcely more than a wide canal) into the Y arm the city of Amsterdam, thus deriving its name (the *Dam of the Amstel*), is situated. The Gueldrian Yssel was probably, at a pre-historic date, a principal outlet of the Rhine. (See Inundations.) It is now comparatively small. The Ij, or Y, was a narrow

arm of the Zuyder-Zee, extending westerly from its S. W. corner toward the North Sea coast, to which, by the extension of the Wijkermeer, it approached within about 4 miles, constituting the *neck* or "narrowest part of Holland" (*Holland op Zijn Smalst*). This arm is now drained (see Polder), the North Sea Canal (which see) being laid along its length and across the *neck* of Holland. (See sketch.)

The southern part of the Zuyder-Zee (*shaded* on the sketch), of which the limits are indicated by the islands of Urk and Schakland, has only an average depth of 10 feet. The area is about 487,500 acres (195,000 hectares). It is now contemplated to drain this area, thus recovering to agriculture a surface about ten times as great as that gained from the Haarlem Lake (which see) and forty times that derived from the draining of the Y and Wijkermeer. To this end a dike is proposed through the sea, commencing on the W. at Enkhoizen, touching on the S. the island of Urk, and connecting with the eastern shore just S. of the mouth of the Yssel, a length of about 28 miles. Along the inner or southern side of this dike a wide drainage-receptacle (*Boezem Meer*) will be provided, from which powerful steam-pumps discharge the water into the Zuyder-Zee. From the Orange locks of the North Sea Canal a main navigation-canal (*Boezem Kanaal*) will lead by the island of Marken to Enkhoizen, and thence 2 or 3 miles farther N. (to the *Veu*), where a harbor will be constructed which will be the shipping-port of Amsterdam to ports of the Zuyder-Zee, to the Baltic, Norway, etc. Other canals for navigation or drainage will be led through the drained area. The area will be divided into *polders*, along the dikes of which the needed railways and other ways will be laid.

The estimate for the work (which it is supposed will occupy from twelve to sixteen years) is, exclusive of interest, nearly 125 million florins, or 50 million dollars. The project has as yet acquired no legal status. Parties petition the government for the concession of the privilege, with rights to the redeemed land and other allowances, while the government is itself interested in the redemption of an area nearly as large as the province of North Holland. In the sale of the Wijkermeer lands the hectare (2½ acres) brought fl. 2173 ($870), whereas the lands of the Haarlem Lake drainage brought in 1852 but fl. 473. Most of the sea-bottom to be redeemed (the area available, exclusive of canals, dikes, etc., being 176,000 hectares) is believed to be little different from newly-redeemed provinces in Zeeland, and of excellent quality. (Most of the facts concerning the proposed drainage are communicated to the writer by P. Caland, inspector of the Waterstaat, Holland. An article, "The Zuyder-Zee Reclamation," in *Engineering*, Sept., 1870, may be consulted; also *Revue des Deux Mondes*, Nov., 1875; and concerning the Zuyder-Zee, *La Holland pittoresque, Voyage aux Villes mortes du Zuyderzee*, Paris, 1875. This last work is summarized in *Blackwood's Magazine*, Nov., 1875, under "The Dutch and their Dead Cities.") J. G. Barnard.

Zvenigorod'ka, town of European Russia, government of Kiev, on the Tikitsch, has sulphurous springs in its vicinity. P. 10,010.

Zvor'nik, town of European Turkey, eyalet of Bosna, on the Drina, an affluent of the Save, is fortified and defended by a citadel. It has an extensive trade in wood and timber, and lead-mines in the vicinity. Pop. 12,000.

Zweibrück'en [Fr. *Deux Ponts*, the "two bridges"], town of Rhenish Bavaria, is finely situated on the Erbach near its influx into the Serre, and is well built, though it is an old city. Its manufactures comprise velvet, plush, cotton fabrics, oil, and leather, and it carries on a brisk trade in wine, corn, and timber. P. 8519.

Zwick'au, town of Germany, kingdom of Saxony, is beautifully situated on the Mulde, well built, and the seat of several civil, educational, and benevolent institutions. It has two fine churches with paintings by Wohlgemuth and Lucas Kranach, and many tanneries, breweries, and manufactures of cloth, glass, tobacco, oil, and porcelain, and trade in coal from the neighboring mines. P. 27,322.

Zwin'gli (Ulrich or Huldreich), the Swiss Reformer and patriot, b. in a lowly shepherd's cot at Wildhaus, Toggenburg (canton of St. Gall), of honorable and pious parents, Jan. 1, 1484 (seven weeks after Luther); studied at Wesen, Vienna, 1499–1501, and Bâle, 1502–06; was carried away with the enthusiasm for classical learning, and got an insight into the corruptions of the Church; was ordained priest by the bishop of Constance, and elected pas-

* One of the ancient maps given in the *Atlas universel* (par A. Brué et C. Picquet, Paris, 1820–42) represents Lake Flevo (see Inundations) as having not only the river Flevium (or *Rheni Ostium Orient*) for outlet into the North Sea about where the northern island-channels now are, but also a *Medium Rheni Ostium* discharging from the Wijkermeer, about where now the North Sea Canal crosses the "neck" of Holland, thus making through the Y and the Wijkermeer another delta-arm of the Rhine. No trace of such an outlet exists, and I find no confirmatory evidence.

tor of Glarus 1506. He studied the Greek New Testament very carefully, and copied it with his own hand; preached against the mercenary service of his countrymen; in 1516 accepted a call to St. Mary's at Einsiedeln, and began to attack superstitious practices, but with the consent of his superiors; he even received for a while, as one of the most popular preachers, a pension from the papal nuncio in Switzerland to aid him in his studies and to secure his political influence. In Dec., 1518, he was called to the cathedral at Zurich, where he labored till his death. He preached "Christ from the fountains" and "inserted the pure Christ into the hearts;" broke loose gradually from Romanism; introduced the Reformation in Zurich 1524, after some public disputations with the champions of the old system; led the Reform movement in the other German cantons of Switzerland; attended the conference at Berne 1528, which resulted in the abolition of the mass. He was invited to a personal conference with Luther and Melanchthon at Marburg Sept., 1529, to adjust the only serious doctrinal difference between them on the Eucharistic Presence. He counselled energetic measures for the promotion of the Reform in his native land, but was defeated by the policy of hesitation which prevailed in Berne. He also entered into bold political combinations with Philip of Hesse for the triumph of the Protestant cause in Germany, and addressed the emperor of Germany and the king of France with a confession of his faith. But he was cut down in the midst of his career. At the outbreak of the war between the Roman Catholic and Protestant cantons he accompanied the Zurich regiment as chaplain, according to Swiss custom, and was pierced by a lance in the disastrous battle at Cappel, Oct. 11, 1531, while stooping to comfort a dying soldier. His last audible words were, "What of that? They can indeed kill the body, but they cannot kill the soul." His remains were burned, and the ashes scattered to the four winds. A plain monument in granite erected in 1838 marks the spot where he died.

Zwingli was a bold Reformer, an able scholar, an eloquent preacher, a patriotic republican, and far-sighted statesman. He lacked the genius and depth of Luther and Calvin, the learning of Melanchthon and Œcolampadius, but he was their equal in honesty of purpose, integrity of character, heroic courage, and devotion to the cause of Reformation, and surpassed them in liberality. His prominent intellectual trait was clear, strong common sense. He had no organ for the mystic element in religion. He loved music and poetry, but in public worship he favored puritanic simplicity, and removed all pictures from the churches to prevent the temptation to idolatry. In his theological views he was more radical than Luther, and departed farther from the mediæval traditions. He differed chiefly from his view of the real presence of Christ's body and blood in the sacrament, and held this ordinance to be merely a commemoration of the atoning death of Christ: but notwithstanding this difference he offered him with tears the hand of brotherhood, which Luther refused. In some articles he was ahead of his age, and held opinions which were then deemed dangerous and heretical. He had a milder view on original sin and guilt than the other Reformers, and believed that all infants dying before the age of responsibility, whether baptized or not, and all the nobler heathen who lived up to their standard of virtue and longed after the true religion, are saved by the grace of Christ, which may operate upon the heart without the ordinary means and visible signs. His principal works are a *Commentary on the True and False Religion* (1525), a sermon *On Providence* (preached at Marburg, 1529), his *Confession of Faith*, addressed to Charles V. at the Diet of Augsburg (1530), a similar *Exposition of Faith*, addressed to Francis I. of France (July, 1531, three months before his death). This last document is clear, bold, spirited, and full of hope for the triumph of the truth, warns the king against the slanderous misrepresentations of Protestant doctrines, and entreats him to give free course to the gospel, and to forgive the boldness with which he dared to approach His Majesty. A few years afterward (1536) Calvin dedicated in a most eloquent preface his famous *Christian Institutes* to the same monarch, but with equal want of direct success. It is questionable whether he ever read either document. Zwingli represents only the first stage in the history of the Reformed Church. His work was completed after his death by his successor, Bullinger, at Zurich, and still more by Calvin at Geneva.

Literature.—H. Zwinglii Opera, ed. Schuler and Schulthess (Zurich, 1828–42, 8 vols.); a popular edition of his works by Christoffel (Zurich, 1843 *seq.*, 15 vols.); *Biographies* of Zwingli by Myconius (1536), Nüscheler (1776), Hess (1811; trans. by Aiken, London, 1842), Schuler (1819), Hottinger (1843; trans. by Th. C. Porter, Harrisburg, 1856), Robins (in *Bibliotheca Sacra* for 1851), Röder (1855), Christoffel (1857; trans. by John Cochran, Edinburg, 1858), Güder (in Herzog's *Encykl.*, 1864), and especially Mörikofer (*Ulrich Zwingli nach den Quellen*, Leipsic, 1867–69, 2 vols.). On the theological system of Zwingli see Zeller, *Das theolog. System Zwingli's* (1853); Siegwart, *Ulrich Zwingli der Charakter seiner Theologie* (1855); Spörri, *Zwingli-Studien* (1866). Compare also Merle d'Aubigné's *History of the Reformation*, 4th vol.; Hagenbach, *Geschichte des Reform.* (1870, pp. 183 *seq.*), and Fisher, *The Reformation* (1873, pp. 137 *seq.*).

PHILIP SCHAFF.

Zwinglians. See ZWINGLI.

Zwir'ner (ERNST FRIEDRICH), b. at Jakobswald, Silesia, Feb. 28, 1802; studied at the building-school of Breslau, afterward at the architectural academy of Berlin; worked several years under Schinkel, and was appointed in 1833 architect to the cathedral of Cologne. He finished the restoration of the old building and erected the transept and the northern and southern portals. He also built a number of villas, palaces, and churches in the regions along the Rhine. D. at Cologne Sept. 22, 1861.

Zwol'le, town of the Netherlands, capital of the province of Overyssel, on the Zwarte-Water, is one of the finest and handsomest cities of the country, with broad and straight streets and many public squares and promenades planted with trees. It is the seat of many educational and benevolent institutions, and has extensive manufactures of oil, beer, spirits, linens, and iron goods. By canals it communicates with the Yssel and Vechte, and has a trade in corn, butter, cheese, cattle, fish, and oysters. P. 21,329.

Zygade'nus, or, less correctly, **Zygabenus** (EUTHYMIUS), a Byzantine theologian of the twelfth century, and "the last of the Greek commentators." He was monk of a convent dedicated to the Virgin Mary near Constantinople, and flourished under Alexius Comnenus (1081–1118 A. D.), at whose request he wrote his *Panoply against all Heresies*. His commentaries on the Psalms and Gospels are still referred to by scholars. Other commentaries (on the Pauline and Catholic Epistles), and other works (including letters), are extant in manuscript in the Vatican.

R. D. HITCHCOCK.

Zygæn'idæ [Lat. *Zygæna*—Ζύγαινα, from ζυγόν, "yoke," the ancient name—a name of the typical genus], a family of selachians of the order Squali, and containing the hammer-headed sharks. The body is moderately elongated, and like that of the typical sharks; the scales are rhomboid or leaf-like; the head is depressed, transverse, and extended outward or sidewise to a greater or less extent; the eyes are lateral and near the angles of the lateral extension of the head, and provided each with a nictitating membrane; the nostrils are developed in the front of the head; the mouth is inferior and convex forward; the teeth are moderate and in several rows (in all the known species nearly alike in both jaws, oblique and with a notch); the branchial apertures are five, of moderate size, and the last are above the pectoral fins; the spiracles are nullified in the adult; the dorsal fins are two, the first between the pectorals and ventrals, the second above the anal; the anal is normally developed; the caudal elongated, and with a well-developed liver-lobe; the pectoral fins are moderate; the ventrals small. The family is anomalous by reason of the peculiar extension of the sides of the head; this extension is carried to its maximum in the *Eusphyra Blochii* (*Zygæna laticeps* of some authors), and is least developed in the *Reniceps tiburo*; in the former it is T-shaped, and in the latter kidney-shaped. The common hammer-headed shark (*Sphyrna zygæna* = *Zygæna malleus*) exhibits an intermediate condition. Five species are known, which by some authors are combined under one genus, and by others are differentiated into three genera—*Eusphyra*, *Sphyrna*, and *Reniceps*. The *Sphyrna zygæna* is not uncommon on the coasts of the U. S., and the *Reniceps tiburo* is an occasional visitor. (See, also, HAMMER-HEAD.) THEO. GILL.

Zymosis. See ZYMOTIC DISEASES.

Zymot'ic Diseases. (See definition and list of, in article on NOSOLOGY; see also GERM THEORY OF DISEASE.) The so-called zymotic diseases are characterized by their division into successive periods and more or less regular sequence of symptoms and uniform duration. The period between exposure to the source of disease and its final development is termed the stage of "incubation" or "formative stage," and it is especially during this period that the morbific matter has multiplied by zymosis or ferment. The "germ theory," which has many supporters, assumes that each zymotic disease has peculiar cellular or organized vitalized elements, and that each, by its individual peculiarities of development, determines the stages and symptoms of the sickness which its access to the blood has created.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

APPENDIX.

[EMBRACING SUPPLEMENTARY ARTICLES AND ARTICLES RECEIVED TOO LATE FOR INSERTION IN THEIR ORDER.]

A.

Aall (Jakob), b. at Porsgrund, Southern Norway, July 27, 1773; studied theology at the University of Copenhagen, afterward natural history and mineralogy at the mining school of Freiberg; settled in 1799 on his estate, Näs Ironworks, near Arendal, and divided his time between the development of his extensive possessions, public business, and literary occupations. He was one of the most prominent among the representatives who assembled at Eiswold in 1814 and formed the present free Norwegian constitution, and he sat in the Storthing from 1816–30. D. Aug. 4, 1844. His *Erindringer som Bidrag til Norges Historie fra 1800 til 1815* (3 vols., 1844–45) is one of the principal sources of the history of Norway during that period. He also published a translation of Snorre Sturleson's *Heimskringla* (2 vols., 1838).

Aba'no, d' (Pietro), also called Petrus de Apono or de Padua, b. in 1246 at Abano, near Padua; studied Greek at Constantinople, mathematics at Padua, and medicine at Paris, and settled at Padua, where he taught alchemy and astrology according to the methods of Averroës, and practised medicine, also according to Arabic methods, with such success that he could charge Pope Honorius IV., who called him to Rome to consult him, 400 ducats a day. Envious of his fame and riches, the clergy denounced him as a sorcerer, as possessor of the philosopher's stone, etc., and the Inquisition sentenced him to be burnt. He d., however, a natural death in the dungeon, in 1315 or 1316, and his corpse was rescued by a friend, but his image was burnt in the public square. His principal work, *Conciliator differentiarum, quæ inter philosophos et medicos versantur*, has often been reprinted.

Abbe (Cleveland), M. A., b. in New York Dec. 3, 1838; graduated in 1857 from the New York City Free College; studied mathematics, astronomy, and meteorology; taught mathematics at Ann Arbor, Mich., and Cambridge, Mass.; was employed 1860–64 by the U. S. Coast Survey; visited Pulkova, Dorpat, and other European observatories 1864–66, and was appointed director of the observatory of Cincinnati in 1868, and of the government weather bureau in 1871. Among his numerous publications and contributions to scientific papers are—*Dorpat and Pulkova* (1867), *Annual Reports at Cincinnati* (1868–70), *Weather Bulletin of Cincinnati Observatory* (1869–70), *Solar Spots and Terrestrial Temperature* (1869), *Suggestions on the Use of Weather Reports* (1871), *The Nova Scotia Hurricane of Aug. 23, 1872, The Aurora of April 7, 1874*, etc.

Ab'bot (Joel), M. D., b. Mar. 17, 1766, at Bridgefield, Conn., the son of a physician; commenced to study medicine about the year 1790; removed to Georgia, and commenced to practise in 1791; in 1809 was elected a member of the State legislature, and sat in Congress 1816–25; in 1820 was appointed by the Georgia Medical Society a delegate to assist in forming a national pharmacopœia. D. Nov. 19, 1826, at Lexington, Ga. Paul F. Eve.

Abbot (Joseph Hale), b. at Wilton, N. H., Sept. 26, 1802; graduated at Bowdoin College 1822; was tutor there 1825–27; professor of mathematics and of modern languages at Phillips Academy, Exeter, N. H., 1827–33; principal for several years of a ladies' seminary at Boston, and subsequently of the Beverly High School; was long the recording secretary of the American Academy of Arts and Sciences, to whose *Transactions* he contributed papers on pneumatics and hydraulics; wrote in favor of Dr. Charles T. Jackson in the "ether controversy," and was an assistant of Dr. J. E. Worcester in the preparation of his *Dictionary*. D. at Cambridge Apr. 7, 1873.

Ab'bott (Austin), son of Jacob, b. at Boston, Mass., Dec. 18, 1831; educated in New York City; was admitted to the bar about 1852; practised his profession in partnership with his brother, Benjamin Vaughan, and attained high reputation as a consulting attorney. He has published two novels, *Concert Corners* and *Matthew Caraby*, in which he was assisted by his brothers, and has aided Benjamin in the preparation of his legal publications.

Abbott (Benjamin Vaughan), b. at Boston June 4, 1830, a son of Rev. Jacob Abbott; was admitted to the bar of New York in 1851, and formed a partnership with his younger brother, Austin. Conjointly, they published *Admiralty Reports* (1857), *C. P. Reports* (8 vols.), *Digest of U. S. Statutes and Reports, 1789–1867* (1 vols.), *Digest of the Law of Corporations* (2 vols., 1869), etc., and wrote much for the law magazines.

Abbott (Edward), son of Jacob, b. at Roxbury, Mass., July 15, 1841; educated in New York City; wrote several religious books for children, a *Paragraph History of the U. S.* (1876), and other historical treatises, and is the principal editor of the *Congregationalist* newspaper.

Abbott (Emma A.), b. in Chicago Dec. 9, 1849; appeared as a public singer when only nine years old, and her musical gifts happened to attract the kind attention of Miss Clara Louise Kellogg in Toledo, O., who sent her to New York for musical instruction under Signor Errani. Her talent gradually developed, and she was afterward engaged as soprano of Dr. E. H. Chapin's church on Fifth Avenue. To finish her education she went in 1872 to Europe, her expenses being assumed by the members of Dr. Chapin's congregation; studied in Milan under San Giovani, and in Paris under Wartel, and during the four years of absence won the praise of some of the finest critics in Europe—Patti, Gounod, Titiens, Baroness Rothschild, etc. Feb. 26, 1874, she married in London, Eng., Mr. E. J. Wetherell, a native of Massachusetts, and May 2, 1875, she made her début as a dramatic singer at the Covent Garden Theatre in London in Donizetti's popular opera, *The Daughter of the Regiment*. After visiting several of the largest cities of Great Britain, singing both in concerts and operas, she returned in Dec., 1876, to New York, and made her American *début* in Chickering Hall Feb. 7, 1877.

A'begg (Julius Friedrich Heinrich), b. Mar. 27, 1796, at Erlangen, Bavaria; studied jurisprudence at various German universities, and was appointed professor in 1821 at Königsberg, in 1826 at Breslau, where he d. May 29, 1868. He was a very prolific writer. *Lehrbuch des Criminalprocesses* (1826), *Versuch einer Geschichte der preussischen Civilgesetzgebung* (1848), *Entwurf einer Strafprocessordnung für den preussischen Staat* (1865), are his principal works. Both directly and indirectly he exercised great influence on the criminal legislation of Prussia, Saxony, Bavaria, Würtemberg, Baden, and Norway.

A'bich (Wilhelm Hermann), b. in Berlin Dec. 11, 1806; studied natural science at the university of his native city; travelled in Italy and Sicily, and published *Erläuternde Abbildungen von geologischen Erscheinungen, beobachtet am Vesuv und Aetna 1833 und 1834* (1837), and *Ueber die Natur und den Zusammenhang der vulkanischen Bildungen* (1841); was appointed professor of mineralogy at Dorpat in 1842, and undertook extensive explorations in the Caucasus, Armenia, and Northern Persia, the results of which he communicated partly in the annals of the Academy of St. Petersburg, partly in independent works, the principal of which are—*Ueber die geologische Natur des armenischen Hochlandes* (1843), *Vergleichende geologische Grundzüge der kaukas.-armenischen und nord-persischen Gebirge* (1858), *Sur la Structure et la Géologie du Daghestan* (1862), *Die Schlammvulkane der Kaspischen Region* (1863).

Acanthuridæ. See Teuthididæ, in Cyclopædia.

Achard' (Franz Karl), b. in Berlin Apr. 28, 1753; studied physics and chemistry, and published *Vorlesungen über Experimentalphysik* (4 vols., 1791–92); made extensive researches and experiments with reference to the production of sugar from the beetroot, the results of which he published in 1799–1800, and received from the Prussian king the estate of Cunern in Silesia for the purpose of establishing there a beetroot-sugar manufactory; succeeded in 1806 in developing the true practical process of manufacturing, and brought the establishment into splendid condition, especially during the enforcement of the continental system; wrote *Die europäische Zuckerfabrikation aus Runkelrüben* (3 vols., 1809). D. Apr. 20, 1821.

Achil'les Ta'tius, a rhetorician of Alexandria, lived probably in the fifth or sixth century of our era, and wrote a love-story, *History of Leucippe and Clitophon*, which has come down to us. The story is tedious, the characters insipid, and the style affected, but the book contains much curious information on Greek life and taste at that time. Edited, with commentary, by Fr. Jacobs (2 pts., 1821), and with revised text by Hercher in 1857, translated into English by A. H. (Anthony Hodges, Oxford, 1638). There exist some fragments of an astronomical treatise whose author bears the same name, but whether he is the same person is doubtful.

Acipenseridæ. See STURGEON, in CYCLOPÆDIA.

Acronuridæ. See TEUTHIDIDÆ, in CYCLOPÆDIA.

Ad'albert, a descendant of the famous Saxon family, the counts of Wettin; was appointed archbishop of Hamburg and Bremen—to which diocese the whole of Scandinavia belonged—in 1043 by the emperor Henry III., and in 1050 Leo IX. made him legate to the North. Endowed with a powerful intellect and an irresistible eloquence, and possessed of a vast ambition, he formed a plan for combining Germany and Scandinavia into a northern patriarchate—a plan which, if realized, would have changed not only the history of Germany, but probably that of the Roman Catholic Church. But all his exertions were frustrated by the resistance of the Norwegian king Harald, by the intrigues of Cardinal Hildebrand, and by the death of his great patron, Henry III. He now confined himself to German politics, and gained such an ascendency over the young Henry IV. that for years he was the actual ruler of the empire. In 1066 his enemies, the archbishops of Mayence and Cologne, succeeded in expelling him from the court; the Billmeyers, a rival Saxon family, invaded his territory; and the Slavs burnt down Hamburg. But Adalbert came victorious out of all his trials. In 1069 he returned to the imperial court, and vindicated himself in his position till his death, Mar. 16, 1072. (See Grünhagen, *Adalbert, Erzbischof von Hamburg*, 1854.)

Adam of Bremen (ADAM BREMENSIS), the author of a history in four books *Of the Propagation of the Christian Religion in North Germany and Scandinavia* (the Bremen and Hamburg archbishopric) from the time of Charlemagne down to Henry IV., to which work is added *A Geographical Description of Denmark and the Countries beyond Denmark* (Sweden, Norway, Iceland, Greenland, the Faröes, etc.). The year of his birth is not known, but he was invited from Magdeburg to superintend the high school of Bremen, and all the schools of the Bremen church, in the year 1067. He was one of the best educated men of his time. He was thoroughly acquainted with the Church Fathers, such as Hieronymus, Ambrosius, Orosius, Cassiodorus, Gregory of Tours, Gregory the Great, and Beda. He had diligently studied the heathen poets, Virgil, Horace, Juvenal, Persius, and Lucan, who were his favorites. Among the prose-writers he gave special attention to Sallust, Cicero, Macrobius, Solinus, and Martianus Capella. With such preparation he went to work, toward the close of his life, to write the history of the Church of the North. In order to get the facts, he went personally to Denmark, where he visited Svend Estridson, "who knew the history of the barbarians by heart, as if it had been written." Adam succeeded in getting at all the facts, and produced, writing in Latin, the most complete and the most reliable work on the propagation of Christianity in the North that we have. The appendix to his work, which gives a pretty complete geographical description of the North, is especially valuable, for it contains a distinct mention of America, which had been discovered by the Norsemen; and it is not beyond the range of possibilities that Columbus, who was a close student, had read Adam's work, and in it found good reasons for undertaking a voyage to Iceland in 1477. After Adam has described Iceland and Greenland he says: "Besides he (Svend Estridson, king of Denmark and nephew of Canute the Great) mentioned another land, which had been discovered in this ocean (the Atlantic), which is called Vinland, because the vine, producing excellent wine, grows there spontaneously; and corn grows there abundantly without being sown. This we know, not from fabulous conjecture, but from positive statements of the Danes." Adalbert, archbishop of Bremen, died in 1072, and Svend Estridson in 1076. Adam of Bremen's book being written after Adalbert's death, and before the death of Svend Estridson, it must have been composed some time between 1072 and 1076. Whether Adam himself died immediately after the completion of his celebrated work is not known. According to the Church Book of Bremen, he died on Oct. 12, but the year is not given. He was buried in a grove that was once his property, but which he had donated to the cloister of Remeslo. The oldest translation of his work is into French by De Chastelus of Saumur in the year 1796. It was translated into German by Miesegaes (1825) and by Laurent (1850). The geographical appendix was translated into Swedish by Peringskjold in 1817, and into Danish by Suhm in 1790. The whole work appeared in a Danish translation in Copenhagen by P. W. Christensen in 1862. There is yet no English version of the book, so far as we know. R. B. ANDERSON.

Ad'ams (CHARLES FRANCIS, Jr.), b. at Boston, Mass., May 27, 1835; graduated at Harvard 1855; was admitted to the bar 1858; served as an officer of cavalry in the civil war, rising to the brevet rank of brigadier-general; has since taken a prominent part in the discussion of social, economical, and political questions; has written on railroad management in the *North American Review*, and was appointed railroad commissioner for Massachusetts in 1869. Author of *Chapters of Erie* (1871).

Adams (HENRY BROOKS), son of Charles Francis, b. at Boston, Mass., Feb. 16, 1838; graduated at Harvard 1858; was private secretary to his father when minister to England; became assistant professor of history at Harvard 1870, and was editor of the *North American Review* from 1870 to Oct., 1876.

Adams (JULIUS W.), son of Julius Walker, b. in Westfield, Mass., Apr., 1840; graduated at U. S. Military Academy June, 1861, and entered the army as second lieutenant of infantry; served at West Point as assistant instructor of infantry tactics till June, 1862, when he joined his regiment; at the battle of Gaines's Mill, June 27, he was severely wounded and taken prisoner; exchanged and promoted to be captain Aug., 1862, he rejoined his regiment, and served with distinction at Fredericksburg, Chancellorsville, and at Gettysburg, where he commanded his regiment, until finally struck down at Cold Harbor, Va. D. from effects of wounds and exposure Nov. 15, 1865, at Brooklyn, N. Y.

Adams (JULIUS WALKER), b. in Boston, Mass., Oct. 18, 1812; entered the U. S. Military Academy June, 1830; assistant engineer of Stonington and Providence R. R. 1832, Norwich and Worcester R. R. 1836, Western R. R. of Massachusetts 1839, Albany and Schenectady R. R. 1842, U. S. dry dock, Brooklyn navy-yard, 1844, Cochituate waterworks, Boston, 1846; superintending engineer New York and Erie R. R. 1846; chief engineer Central R. R. of Kentucky 1852, Memphis and Ohio R. R. 1855; engineer for establishment of a system of sewers in Brooklyn, N. Y., 1856; engineer of New Haven waterworks 1860. Served with credit as colonel of the 67th New York Vols., and wounded at Fair Oaks. Since then has been engaged in many important hydraulic works; chief engineer city of Brooklyn; past president American Society of Civil Engineers; member of New York Academy of Science; author of various scientific papers.

A'delaer (CORT SIVERTSEN), b. at Brevig, Norway, Dec. 16, 1622; served in the Dutch navy under Tromp 1637–45; entered the Venetian service, and distinguished himself greatly in many actions; broke (May 13, 1654) with a single ship through a Turkish fleet consisting of 67 galleys stationed in the Dardanelles, and sank or burned 15 of the enemy's vessels; left Venice in 1661, and was placed at the head of the Danish navy in 1663, which he remodelled after the Dutch fashion. D. Nov. 5, 1675.

Æ'gis, the shield of Zeus, from αἴξ, a "she-goat," so called because, in his contest with the Titans, Zeus wore the hide of the goat Amaltheia, which had suckled him in his infancy, together with the head of the Gorgon.

Ælia'nus (CLAUDIUS), b. at Prænestе; lived in Rome; flourished in the second century, and wrote several works in Greek, of which his *Varia Historia*, *De Animalium Natura*, and some *Epistolæ* are still extant, edited by Hercher (Paris, 1858), the *Varia Historia*, with commentary, by Perizonius (1701), the *De Animalium Natura* by Fr. Jacobs (1832, 2 vols.).

Æpi'nus (FRANZ ULRICH THEODOR), b. at Rostock Dec. 13, 1724; studied medicine, physics, and mathematics; became professor of physics in St. Petersburg in 1757; was appointed teacher of physics to the czarowitz Paul, and superintendent of the normal schools in Prussia. D. at Dorpat in 1802. He improved the microscope, invented the electrophorus, discovered the electrical polarity of tourmaline, and wrote *Tentamen Theoriæ Electricitatis et Magnetismi* (1759), *Réflexions sur la Distribution de la Chaleur sur la Surface de la Terre* (1762), *Description des nouveaux Microscopes* (1789), etc.

Afann'sieff (ALEXANDER NIKOLAIEVITCH), b. at Moscow in 1826; studied at the university of his native city; was secretary to the council of magistrates there. D. Oct., 1871. In 1863 he published a collection of Russian popular tales in 4 vols., and in 1869 a representation of the views of nature entertained by the ancient Slavs (3 vols.).

Agobard', b. in 779, a Spaniard by descent; was ordained a priest in 804 by Archbishop Leidrad of Lyons; became his coadjutor in 813, his successor in 816. D. June 6, 841. He may be characterized as one of the men of Charlemagne, as representative of his ideas politically and theologically. His writings, which were collected and published in Paris by Masson in 1605, and by Baluze in 1666, were directed against the idea of the verbal inspiration of the Bible, against the worship of images, against the belief that hail and thunder storms were raised by sorcerers, against ordeals and against adoptionism, etc. A treatise by him against the Jews was translated into German, 1852. See Hundeshagen's monograph on the *Life and Writings of Agobard* (1831).

Agoult', d' (Marie Catherine Sophie), Countess, b. in 1805 at Frankfort, whither her father, Count de Flavigny, had emigrated during the Revolution; was educated in Paris, and married in 1827 Count d'Agoult, who died in 1856. Under the pseudonym of "Daniel Stern" she wrote a number of novels and literary reviews, a volume of moral and political aphorisms, *Esquisses morales* (1849), and *Histoire de la Révolution de 1848* (2 vols., 1851).

Aguesseau', d' (Henri François), b. at Limoges, department of Haute-Vienne, France, Nov. 27, 1668; studied law, and was appointed advocate-general in 1696, and procureur-general in 1700, to the Parliament of Paris, in which positions he acquired great reputation as an eloquent orator, a consummate jurist, and a man of perfect probity. In 1717 he became chancellor, but resigned in 1718 on account of his opposition to Law. In 1720 he was recalled, but resigned again in 1722 on account of his opposition to Cardinal Dubois. Once more, in 1737, he was installed in his chancellorship, and retained it till 1750. D. Feb. 9, 1750. His collected works were published in 16 vols. in Paris (1819-20). His *Lettres inédites* were published in 1823 (2 vols.).

Ai'rey (Richard), Baron, b. at Newcastle-on-Tyne, England, 1803; educated at the Royal Military Academy at Sandhurst, and entered the British army as ensign in 1821, rising through successive grades to be colonel in 1851; served on staff and regimental duty; appointed deputy adjutant-general 1838, military secretary to commander-in-chief 1852; appointed major-general in 1854, and commanded brigade in Crimean war, but after disembarkation of the army served as quartermaster-general during the campaign, and filled that office at the Horse Guards from 1857 to 1865; was governor and commander-in-chief of Gibraltar 1865–70, and adjutant-general to the forces 1870–76. In 1862 he became lieutenant-general, and general in 1871. He also held in succession the colonelcy of the 17th and 7th regiments; was created a K. C. B. in 1855; further honored with G. C. B.; and in 1876 was raised to the peerage, with title of Baron Airey.

Alcmæon'idæ, The, one of the most prominent families of ancient Athens, were expelled from the city in 596 B. C., their chief, Megacles, having committed sacrilege by allowing Cylon and his partisans to be massacred, though they had sought refuge in the temple of the Eumenides. The family went to Phocis, but its immense wealth and its connections with some of the most powerful families in Greece enabled it to return to Athens after an exile of about thirty years. Then followed the long and turbulent contest with Pisistratus, in which the Alcmæonidæ were once more driven from Athens. During this their second exile they spent a great deal of their wealth in rebuilding the temple of Apollo in Delphi, which was burnt down in 548 B. C., and the magnificence with which they accomplished this great undertaking made them so popular throughout all Greece that the Spartans finally restored them by armed force. Among the famous members of the family were Clisthenes, Pericles, and Alcibiades.

Al'cock (Sir Rutherford), b. in London in 1809; was a surgeon in the navy in Portugal 1833–34, inspector of hospitals under Sir Evans in Spain 1835–37, auditor of accounts of the English-Spanish legion 1839–44, consul at Foo-Chow, Shanghai, and Canton 1846–59, minister to Japan 1859–62, minister to China 1865–71, and published *Medical History of the British Legion in Spain* (1838) and *The Capital of the Tycoon* (2 vols., 1863).

Alexan'der (James Edward), b. in Scotland in 1803; served in the Burman war 1825, in the Russian war against Turkey 1829, under Dom Pedro in Portugal 1834, in Canada 1839, in the Crimean war 1858, in the Maori war 1863, and published *Travels from India to England* (1827), *Expedition into the Interior of Africa* (1838), *Incidents of the late Maori War* (1863).

Alexander (William Lindsay), D. D., b. at Edinburgh, Scotland, Aug. 24, 1808; educated at the universities of Edinburgh and St. Andrew's; became classical tutor in Lancashire College, and subsequently (1835) a Congregational minister at Edinburgh; professor of theology 1851, and a member of the Old Testament revision company 1870. Author of several doctrinal and miscellaneous works, including a *Life of Dr. Wardlaw* (1856) and *Christian Thought and Work* (1862), and was the editor of the 3d ed. of Dr. Kitto's *Biblical Cyclopædia* (3 vols., 1865–66).

Algazza'li (Abu Hamed Mohammed), b. at Tus, Persia, in 1058; taught philosophy, first in Bagdad, then in Nishapoor, where he d. in 1111. He was one of the most prominent philosophers of the Arabian literature, and a very prolific writer. Several of his works have been translated into French. (See Lewes's *Biographical History of Philosophy.*)

Al'ison (Sir Archibald, Jr.), Bart., son of the eminent historian, b. at Edinburgh Jan. 21, 1826; educated in the universities of Glasgow and Edinburgh; entered the army; served in the Crimea and in India, where he was military secretary to Lord Clyde; lost an arm at Lucknow, and distinguished himself as brigadier-general, second in command of the Ashantee expedition of 1873–74. He succeeded to the baronetcy 1867, and became deputy adjutant-general in Ireland Oct., 1874. Author of a treatise *On Army Organization* (1869).

Alkin'di, or **Alchindus,** a very prolific Arabian writer on medicine and philosophy, b. at Bassorah, flourished in the middle of the ninth century. Several works, translated into Latin, were much read during the Middle Ages; the most celebrated was *De Theoria Magicarum Artium.*

Allan-Kardec' (Hippolyte Léon Denizard), b. at Lyons Oct. 3, 1803; was the representative of the spiritualistic movement in France, and wrote *Le Livre des Esprits* (1857), *Le Livre des Médiums*, and *L'Imitation de l'Evangile selon le Spiritualisme* (1864). He also founded the *Revue spirite* (1858). D. in Paris Apr. 1, 1869.

Al'len (Charles), b. at Greenfield, Franklin co., Mass., Apr. 17, 1827; graduated at Harvard College 1847; was reporter of decisions of the supreme court of Massachusetts 1861–67, and attorney-general of Massachusetts 1867–72, and published 14 vols. of Massachusetts *Reports.*

Allen (Frederic de Forest), Ph. D., b. at Oberlin, Lorain co., O., May 25, 1844; was educated at Oberlin College; studied at the University of Leipsic; was appointed professor at the University of East Tennessee in 1866, and at the University of Cincinnati in 1874, and published an ed. of the *Medea* of Euripides.

Allen (George), b. at Milton, Vt., Dec. 17, 1808; studied law at the University of Vermont, and was admitted to the bar in 1831, but felt himself drawn to the study of theology both by his own interest and by the influence of Dr. James Marsh; was rector of the church of St. Alban's, Vt., 1834–37; professor of languages at the Delaware College, Newark, Del., and finally professor of Greek at the University of Pennsylvania; joined the Roman Catholic Church in 1847. D. at Worcester, Mass., May 28, 1876. He published a *Life of Philidor* (1865) and some papers in the *United States Service Journal*, but his chief work was as a teacher. (See *Penn Monthly*, July and Aug., 1876.) R. E. Thompson.

Allen (William), b. in 1806 at Edenton, Chowan co., N. C.; early lost both his parents, and received a poor education until he in 1822 settled at Chillicothe, O., and was enabled to study law. Having become a lawyer of reputation, he soon became an influential politician (Democrat); was a member of Congress 1833–35, U. S. Senator 1837–49, and governor of Ohio 1874–75. D. July 11, 1879.

Al'lies (Thomas William), b. at Bristol, England, in 1813; studied at Eton, where he gained the Newcastle scholarship; graduated at Wadham College, Oxford, 1832; became a fellow there; took orders in the Church of England; was rector of Launton, Oxfordshire, 1842–50, when he joined the Church of Rome, and became secretary to the (Roman Catholic) poor-school committee 1854. Author of *The See of St. Peter* (1850) and other controversial treatises, and of an unfinished work on *The Formation of Christendom* (2 vols.), a learned contribution to the philosophy of history from a Roman Catholic point of view.

Allix' (Pierre), b. at Alençon, France, in 1631; was minister to the Reformed congregation of Charenton, but emigrated to England on the Revocation of the Edict of Nantes in 1685; formed a French Reformed congregation in London; and in 1690 was made canon of Salisbury cathedral. D. in London Mar. 3, 1717. He was a prolific writer in Latin, French, and English, and intensely polemic. His principal historical works are—*Remarks on the Churches of Piedmont* (1690) and *Remarks on the Ancient Churches of the Albigenses* (1692).

Almodo'var (Ildefonso Diaz de Ribera), Count, b. in 1777 at Granada; was educated at the military academy of Segovia, and fought with distinction in the war against the French. By the reactionary government of Ferdinand VII. he was suspected of liberalism and confined in the dungeons of the Inquisition, but was liberated by the revolution of 1820. In 1823, however, he was compelled to flee to France, and did not return until after the death of Ferdinand, when he at once took rank as one of the leaders of the liberal party. In the cabinets of Mendizabal, Calatrava, and Espartero he was minister of war, but retired in 1843 from public life. D. at Valencia Jan. 26, 1846.

Al'vord (Thomas Gold), b. at Onondaga, N. Y., Dec. 20, 1810; graduated at Yale College in 1828; admitted to the bar in 1832; practised at Syracuse until 1846; elected to the legislature of 1844, and re-elected nine times; Speaker in 1858 and 1864; lieutenant-governor in 1865–66; member of the constitutional convention in 1867–68; is engaged in the manufacture of coarse salt, and resides at Syracuse.

Amal'aric, b. in 501, the son of Alaric II., king of the Visigoths; succeeded his father in 507 by the aid of his grandfather, Theodoric, king of the Ostrogoths, and married in 527 Clotilde, a daughter of Clovis, king of the Franks, but in order to compel her to embrace Arianism he treated her so cruelly that her brother, Childebert, came to her rescue with a great army in 531. Amalaric was defeated and slain, and Theudis succeeded him as king of the Visigoths, while Clotilde returned with her brother to the land of the Franks, where she died shortly after.

Amalason'tha, b. in 498, a daughter of Theodoric the Great, king of the Ostrogoths; married Eutharic and bore him a son, Athalaric, who in 526, when only ten years old, succeeded his grandfather as king of Italy under the guardianship of his mother, his father having died the previous year. The government of Amalasontha was very successful, but her son grew up a debauched and dissipated drunkard, utterly unfit to reign. He died in 534, and Amalasontha now married Theodatus in order to strengthen her power, but, instigated by Theodora, the Byzantine empress, who hated Amalasontha, Theodatus imprisoned her, and had her strangled in 535.

Amal'rich of Be'na, a scholastic philosopher who taught dialectics and the liberal arts at Paris in the twelfth and thirteenth centuries, was born at Bena (Bène), near Chartres, and attempted to reconcile theology with the Averroistic and materialistic interpretation of Aristotle's metaphysics. He and his book (*Physion*) were condemned by the university and the pope; and Amalrich, after an enforced recantation, d. of grief in 1209. In 1210 his bones and his books were burned together. His followers (Almericians) appear to have been a pantheistic and mystical sect, finally blended with the Brethren of the Free Spirit. They were subjected to severe persecutions.

Amat' (Felix de Torres), an Aragonese ecclesiastic and literary historian, was b. at Sallent Aug. 6, 1772; became bishop of Astorga, and a senator under the reformed constitution of 1837. In 1808 he was charged by the government of Spain to prepare and annotate a new Castilian translation of the Bible. Of this work the first edition appeared in 1823 in 8 vols., besides a volume of notes and appendices. In the edition of 1832 the notes are chiefly printed at the foot of the pages. D. at Madrid on Dec. 29, 1840. Amat is best known abroad by his *Memorias para ayudar a formar un Diccionario critico de los escritores Catalanes* (Barcelona, 1 vol. 8vo, 1836). A supplement to the *Diccionario*, by Juan Corminas, appeared at Burgos in 1 vol. 8vo in 1849. These works are valuable contributions to the history of Catalan literature, and indispensable to all who wish to become acquainted with that literature and its bibliography. George P. Marsh.

Amelot' de la Houssaye' (Abraham Nicolas), b. at Orléans, France, in 1634; served for some time as secretary to the French embassy at Venice, but devoted himself afterward exclusively to the study of history and literature. D. in Paris Dec. 8, 1706. He wrote *Histoire du Gouvernement de Venise* (3 vols., 1676); also translated Paolo Sarpi's history of the Council of Trent, and the *Prince* by Macchiavelli.

Amelotte' (Denis), b. at Saintes, France, Mar. 15, 1606; studied theology and joined the Congregation of the Oratory in Paris, where he d. Oct. 7, 1678. He maintained for many years a very bitter contest with the writers of Port-Royal, and is said not to have disdained to use his influence at court in order to defeat them. His translation of the New Testament, of which Louis XIV. subscribed for 100,000 copies, appeared in 4 vols. (1666–70).

American Eclectic, The, or **New School of Medicine** was first known in this country as a separate school about the year 1826, although physicians entertaining its peculiar sentiments flourished from the period of the Revolution. Wooster Beach of New York in 1826 established a college in that city for the dissemination of its doctrines. He also prepared works on practice, surgery, materia medica, midwifery, and physiology for his students, which were widely popular. Among his early associates were Thomas Vaughn Morrow and Isaac G. Jones. About this time Rev. Dr. Chase, bishop of Ohio and uncle of the statesman, had obtained a charter for the Worthington University. He invited thither the faculty of the New York Reformed Medical College. Profs. Morrow and Jones accepted, and a medical department was duly organized. After ten years of successful labor, Prof. Morrow left Worthington and established a college in Cincinnati. This was incorporated by the legislature of Ohio in 1845 by the name of the "Eclectic Medical Institute." He next undertook the organization of the reformed physicians of the U. S. as a school of practice, apart from Homœopathists, Thomsonians, and Mercurialists. To this new school he gave the name "Eclectic," that being the designation of the ancient Galenists and Alexandrian academicians. State societies were organized over the country, and colleges established in Massachusetts, New York, Philadelphia, Georgia, Tennessee, Missouri, and Illinois. The death of Prof. Morrow deprived the Eclectics of their wisest leader. The new practice continued to flourish, however, chiefly in the North-western States, but the national organization ceased to exist. After the civil war the cause received a new impetus, perhaps in part due to the fact that Eclectic surgeons were excluded from appointment in the army. New colleges were established in the cities of New York, Chicago, St. Louis, and Macon, which soon became prosperous. State societies were formed in all the Northern States, and in 1870 the National Eclectic Medical Association was revived under the auspices of these institutions and societies, and was incorporated the ensuing winter by the legislature of New York. Its sessions are held annually, and it is an influential organization. The number of Eclectic physicians in the U. S. is estimated at 12,000. There are also many Eclectics in the Dominion of Canada. Conspicuous among these are Thomas R. Fraser of Halifax, N. S., and Alexander M. Ross of Toronto, both authors of ability. There is also an Eclectic association in Great Britain, holding conferences annually. Dr. William Hitchman of Liverpool, George Sexton of London, and the late J. Hughes Bennett of Scotland, are classed as Eclectics.

The distinctive tenets of the New School relate to the hygienic treatment of the sick and the rejection of mercury, antimony, and other minerals as medicines. They aim in medicine and surgery at the strictest conservative practice, performing only necessary operations and carefully husbanding and promoting the vital powers. The Eclectics have the credit of discovering and introducing into the materia medica over 100 new remedies prepared from the indigenous American flora, all which are used more or less by rival practitioners. To Dr. Robert S. Newton, now of New York, is also due the merit of having first inculcated the doctrine of cellular pathology in 1845, and also the introduction of the antiseptic treatment in surgery in 1846. Joseph R. Buchanan of Louisville, Ky., is also the author of several anthropological works, and the late W. Byrd Powell was the originator of a novel theory of human temperaments. Alexander Wilder.

American Museum of Natural History. This institution was incorporated in 1869 for the purpose of establishing and maintaining in the city of New York a museum and library of natural history, of encouraging and developing the study of natural science, of advancing the general knowledge of kindred subjects; and to that end furnishing popular instruction and recreation. The collections it has already acquired, besides many smaller gifts and purchases, consist of the following specimens of scientific and popular interest: The first choice of all the mammals and birds left by the late Edward Verreaux of Paris, who possessed at the time of his death collections from all parts of the world, which were valued at 600,000 francs. These include what are regarded as the finest specimens of the art of taxidermy that Europe has yet produced. A nearly complete series of all the birds of America N. of the Rio Grande was purchased of Mr. D. G. Elliot; also the entire museum of Prince Maximilian of Neuwied, on the Rhine above Bonn (not Maximilian, late emperor of Mexico). This prince occupied the years 1815–17 exploring Brazil from Rio Janeiro up to Bahia, and a large proportion of his specimens were never before described, and the collection is therefore particularly rich in *types*. A collection of shells made during a long, active lifetime by Dr. John C. Jay and an unrivalled library on conchology have been presented by Miss C. L. Wolfe as a memorial of her father, the first president of the corporation. The most important department yet established is that of palæontology, which

comprises the great collections of Prof. James Hall of Albany, containing probably one-half of the authentically labelled specimens of paleozoic paleontology yet gathered on our continent. About 7000 of these specimens have been figured, and are types. The Tertiary beds of South Carolina are well represented by the collection of Prof. F. S. Holmes of Charleston, also gathered during many years. A department of archæology is now being formed from the specimens obtained by Hon. E. G. Squier on his Central American and South American travels, and from his labors, jointly with those of Dr. E. H. Davis, in exploring the ancient mounds of the Mississippi Valley.

These collections are the property of the corporation above mentioned, and not of the city, the corporation undertaking to furnish specimens and books and take care of them, and the city to supply the required land and buildings. For this purpose that part of the Central Park formerly known as Manhattan Square, on the W. side of the park proper, which contains 18¼ acres, has been set aside for ever. The section of the building now finished is 200 feet long by 66 feet wide, and about 100 feet high, and forms one-eighteenth part of the whole plan to be ultimately finished, which is to occupy the whole square, and be six times larger than that now in course of erection by Her Majesty's government in London, and five times greater than the Capitol at Washington. The part completed consists of a series of magnificent halls 170 feet long by 60 feet wide, and severally of 18, 30, and 22 feet in height, for exhibition, and a curator's room on each floor. Over the whole is a Mansard story 16 feet in height, divided into laboratories for the free use of scientific gentlemen who may visit our shores from other lands, and for the national and State surveys, and other scientific investigators of our own land, the aim of the museum being to be the means both of creating and diffusing knowledge. The number of its visitors during 1876 was 1,120,191, or one-half more than that of the most popular museum in Europe.

A. S. Bickmore.

American Sunday-School Union, The, was organized at Philadelphia May 25, 1824. It was, however, the immediate successor of the Philadelphia Sunday and Adult School Union, which was organized in 1817, and had auxiliary "unions," or branches, in eleven of the States when, in 1824, it transferred its capital and schools to the new national organization. The American Sunday-School Union is under the direction of thirty-six managers, of whom at least twenty-four must reside in Philadelphia and its vicinity. All these managers are laymen, and they are selected from various Christian denominations. The Union is not a union of denominations, but of individual Christians of different denominations. The object of the Union was, at its formation, "to concentrate the efforts of Sabbath-school societies in the different parts of our country, to strengthen the hands of the friends of pious instruction on the Lord's Day, to disseminate useful information, circulate moral and religious publications in every part of the land, and to endeavor to plant a Sunday-school wherever there is a population." Various denominational Sunday-school societies have resulted from the work of the Union, but it has continued its operations without interruption, and its aim still is to improve existing Sunday-schools and to organize new ones. Its plan is, to publish books and papers suited to the wants of Sunday-schools, and to send out missionaries, lay and clerical, of various denominations, to organize new Sunday-schools wherever there is a needy population. No Sunday-schools are under the control of the Union, but its missionaries watch and help as they have opportunity the pioneer schools they have organized. Many of these schools have proved the foundation of Christian churches. Indeed, a large share of all the Protestant churches organized in the newer States within the past thirty years have had their beginning in union Sunday-schools. The Union has been the parent of most of the distinctive agencies and methods of the American Sunday-school system. Sunday-school libraries, question-books, periodicals, teachers' helps, conventions, plans for teacher-training, schemes of limited lessons uniform throughout the country, were originated by or first gained prominence through the agency of the Union or of its officers and managers. Moreover, its work created or stimulated a demand in these departments which has greatly increased the supply in them all. Its list of separate publications exceeds 2000. The value of these, circulated by sale and donation, up to Mar. 1, 1876, amounts to nearly $6,500,000. Up to the same date its missionaries had organized 63,793 Sunday-schools, including, at the time of their organization, 419,796 teachers and 2,745,610 scholars. In addition to this, its missionaries have visited and helped many thousands of existing schools, including several millions of scholars. (See Sunday-Schools, in Cyclopædia.)

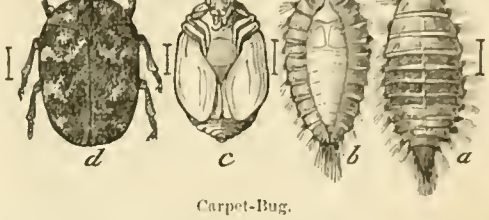
Henry Clay Trumbull.

Amphacanthidæ. See Teuthididæ, in Cyclopædia.

An'necke (Mathilde Franciska Giesler), b. on the estate of her grandfather, near Blankenstein, Prussia, Apr. 3, 1817. Early in life she engaged in literary pursuits, and took a deep interest in the political and social freedom of her country. When her husband, a Prussian officer and powerful leader in the revolution of 1848, was imprisoned under sentence of death at Cologne, Madame Annecke put a printing-press into her parlors, and herself edited a paper in the interests of the revolution. She had actual service on the battle-field as one of her husband's staff, of which Carl Schurz was also a member. When the revolutionists were overpowered she, with her family, sought refuge in America, where she has been one of the most earnest champions of woman's enfranchisement. She edited the *Frauen Zeitung* at Milwaukee, Wis., in 1850, where she now (1877) is principal of an academy for young ladies.

Susan B. Anthony.

Anthrenus scrophulariæ (Linn.), "carpet bug." This insect is popularly known as "the new carpet-bug," the name having been given to it when its ravages were first detected in the State of New York in the year 1874, and its difference from the larva of the carpet-moth observed. It belongs to the destructive family of beetles known as the *Dermestidæ*. Although, if left unchecked, it overruns houses and preys upon a variety of woollen and some other fabrics, its special home is beneath the borders of carpets, where in the larva state, shown at *a* in the



Carpet-Bug.

figures (all enlarged), it eats large holes in the carpets, or, following the joinings of the floors, cuts in straight lines through entire breadths. The cast skins of the larva, *b*, are found with the living forms in the summer months. The pupa, *c*, is formed in autumn within the split skin of the larva; and the perfect insect, shown at *d*, of a black color, marked with red along the back, and with red and white spots on the wing-covers, emerges in the winter, and may often be taken on the windows of infested rooms in the month of May. It is a very difficult insect to eradicate. Kerosene oil and benzine are probably the most efficient agents for destroying it in its earlier stages. It is of European origin, introduced many years ago in California, and by a later importation into New York. *A. lepidus* (Le Conte) is simply a Western variety of it. J. A. Lintner.

An'tony (Milton), b. Aug. 7, 1789, in Virginia; removed early with his parents to Georgia; studied medicine at the University of Pennsylvania; began to practise as a physician in New Orleans; removed subsequently to Augusta, Ga., and founded the Medical College of Georgia. D. of yellow fever Sept. 19, 1839. Paul F. Eve.

Ap'pleton (James), b. at Ipswich, Mass., Feb. 14, 1785; was early in life elected a member of the legislature of the State, and served during the war with England as a colonel of Massachusetts militia, having been entrusted with the command of the district of Gloucester; after the close of the war he was made a brigadier-general. He subsequently removed to Portland, Me.; was also a member of the Maine legislature, but returned finally to his native town, where he d. Aug. 25, 1872. He was a very influential and energetic champion of total abstinence and a decided enemy of slavery, on which two points his speeches and publications contributed much to form public opinion. By his elaborate report to the Maine legislature in 1837 he was the first expounder of the principle underlying the Maine law.

Apron. In the Authorized Version of Gen. iii. 7, *apron* is used to render the Heb. *chagorah* (which is rendered "girdle" in 2 Sam. xviii. 11): "And they sewed fig-leaves together, and made themselves aprons"—in the margin, "or, *things* to gird about." In the Geneva (Barker) Bible (1599) it is rendered, "And they sewed figge tree leaues together, and made themselues breeches"—in the margin, "*Ebr. things to gird about them to hide their priuities.*" Because of the translation "breeches," this is called "the Breeches Bible." In Acts xix. 12 *apron* is the rendering of σημικίνδυον, from the Latin *semicinctium*, a half-girdle, or belt covering half the person—an apron worn by workmen, servants, etc. T. O. Summers.

Argyrop'ulos (JOHANNES), b. in Constantinople in 1416; went early to Italy, where he contributed much to the revival of letters. He taught the Greek language and literature and Aristotelian philosophy at Padua 1434–56, Florence 1456–71, and Rome, where he d. in 1486. Pallas Strozza, Politianus, and Reuchlin were among his disciples. He became a master of the Latin language, and translated the works of Aristotle into Latin. But for the Latin authors he showed a sovereign contempt; of Cicero he said that he understood neither Greek nor philosophy.

Arm'strong (JAMES LOUDON), M. D., b. in Greenbrier co., Va., Apr. 2, 1782. His parents came West, and he became a student of medicine under the celebrated Dr. Dudley. In 1809 he settled in Rutherford co., Tenn., and served his country as surgeon in the war of 1812. He was one of the early advocates of temperance. D. Apr. 5, 1868.

Ar'nold (JOHN WILLIAM SCHMIDT), A. B., A. M., M. D., b. at Charleston, S. C., May 16, 1845; graduated at Columbia College, New York, 1868; studied medicine; was appointed curator of the Bellevue Hospital in 1871, professor of physiology and histology at the University of New York in 1874, and pathologist at the lunatic asylum of Blackwell's Island in 1875; and contributed to various medical papers.

Arrhidæ'us (PHILIP), a son of Philip II. of Macedon by a dancing-girl, Philinna of Larissa; accompanied his half-brother, Alexander the Great, in his campaigns in Asia, and was always kindly treated by him, but never held any civil or military command. He was imbecile, and it was said that he had become so from a potion administered to him while a boy by Olympias, his father's wife and Alexander's mother. He was present at Babylon when Alexander died, and was immediately proclaimed king by the army, though the son of Alexander by Roxana, born shortly after, was associated with him. He now married Eurydice, a granddaughter of Philip II., a daughter of Cynane, his own and Alexander's half sister. Eurydice was, like her mother, a woman of thoroughly masculine education, of many masculine talents, and of an exorbitant ambition. She wished to get rid of Roxana and her son, of Olympias, and of Alexander's generals; and after the death of Antipater (in 319) she collected an army and marched against Polysperchon. But in Polysperchon's army was Olympias, and the Macedonian soldiers declared that they would never fight against Alexander's mother. Eurydice was deserted, captured in her flight, and confined, together with her husband, in a narrow dungeon, whither Olympias sent to her a sword, a rope, and a cup of hemlock. She accepted the presents, made Arrhidæus drink the hemlock, and then hanged herself (317 B. C.).

Ar'thur (WILLIAM), b. in the county of Antrim, Ireland, in 1796; graduated at the College of Belfast; emigrated shortly after to America; settled at Bennington, Vt.; studied first law, then theology; was minister of a Baptist church at Bennington, and subsequently at various other places—at New York from 1855 to 1863. D. at Newtonville Oct. 30, 1875. He is the author of the well-known book on family names.

Articles of Confederation. See CONFEDERATION, ARTICLES OF.

Ar'widsson (ADOLF IVAR), b. at Padasjoki, Finland, Aug. 7, 1791; studied at the University of Åbo, and was appointed professor of history there in 1817. A periodical which he founded in 1821 was suppressed in the same year by the Russian government, and in 1822 he was exiled. He went to Stockholm, where he was made director of the royal library. D. June 21, 1858. He published *Svenska Forsångar* (3 vols., 1834–42), *Stockholm förr och nu* (1837–40), and a translation of Frithiof's *Saga*.

Asbjörn'sen (PETER CHRISTIAN), b. in Christiania, Norway, Jan. 15, 1812; studied botany and zoology; visited Asia Minor and Egypt in 1849–50; spent two years at the academy of Tharand, Saxony, 1856–58, and on his return was appointed inspector-general of the forests of Norway. Besides a number of popular books on natural history and essays on forest-culture, he published *Norske Folke-Eventyr* (1842–43) in connection with Jorgen Moe, and *Norske Huldreeventyr og Folkesagn* (1845–48); which two books not only exercised a considerable influence on the development of the Norwegian literature, but also attracted much attention in the other Scandinavian countries, in Germany, and in England.

As'pinwall (WILLIAM H.), b. in the city of New York in 1807; was trained as a clerk in the house of G. G. & S. S. Howland; became a partner in 1832; formed the firm of Howland & Aspinwall in 1837; retired from the firm in 1848. D. in New York Jan. 19, 1875. He was the chief promoter of the construction of the Panama R. R., the eastern terminus of which is named after him.

As'selijn (JAN), b. at Antwerp in 1610; studied painting, first in his native city under Isaiah Vandervelde, then in Rome, where Bamboccio and Claude Lorraine became his models; settled subsequently in Amsterdam, and d. there in 1660. He painted battle-pieces, animals, and landscapes, and his views of the neighborhood of Rome are much appreciated.

As'sing (LUDMILLA), b. in Hamburg Feb. 22, 1827, a daughter of the poetess Rosa Maria Assing and the poet Dr. D. A. Assing; was educated in Berlin in the house of her uncle, Varnhagen von Ense; wrote for various periodicals, and edited the diaries and correspondence of her uncle. On account of the irreverence which these works show for the king of Prussia, the queen, etc., Ludmilla Assing was prosecuted twice, and sentenced to eight months', and then to two years', imprisonment, but she lives in Florence.

As'ter, von (ERNST LUDWIG), b. at Dresden in Nov., 1778; received a military education, and served first in the Saxon, then in the Russian, and finally (after 1815) in the Prussian service. In 1810, while still in the Saxon army, he attracted the attention of Napoleon by a plan for the fortification of Torgau, and while in the Prussian service he undertook the fortification of Coblentz and Ehrenbreitstein; was made inspector-general of all the Prussian fortresses and general of infantry in 1842. D. at Berlin Feb. 10, 1855. His *Nachgelassene Schriften* were published at Berlin, in 5 vols. (1856–61).—His brother, KARL HEINRICH VON ASTER, b. at Dresden Feb. 4, 1782; d. there Dec. 23, 1855; colonel in the Saxon army; wrote several valuable military works, of which the most noted are *Lehre vom Festungskriege* (2 vols., 1812; often reprinted and translated into other languages) and *Die Gefechte und Schlachtene bei Leipzig* (2 vols., 1852–53).

Asteroids. At the date of the publication of our Vol. I. there had been discovered 135 of the small planets revolving in orbits between those of Mars and Jupiter, commonly called asteroids. The latest contained in the list then given was of date Feb. 18, 1874. Since that time there have been discovered (Jan. 1, 1877) thirty-four more, of which the dates and names (so far as they have yet been named), and the names of their discoverers, are given below. This list has been obligingly communicated by Prof. C. H. F. Peters, Ph. D., M. N. A. S., of Hamilton College, Clinton, N. Y., himself the discoverer of a larger number of these bodies than any other observer:

Asteroids discovered since Feb., 1874.

No.	Name.	Date of discovery.	Discoverer.
136	Austria	1874, March 18	Palisa.
137	Melibœa	April 21	Palisa.
138	Tolosa	May 19	Perrotin.
139	Juewa	October 10	Watson, U. S.
140	Siwa	October 13	Palisa.
141	Lumen	1875, January 13	Paul Henry.
142	Polana	January 28	Palisa.
143	Adria	February 23	Palisa.
144	Vibilia	June 3	Peters, U. S.
145	Adeona	June 3	Peters, U. S.
146	Lucina	June 8	Borelly.
147	Protogeneia	July 10	Schulhof.
148	Gallia	August 7	Prosper-Henry.
149	Medusa	September 21	Perrotin.
150	Nuwa	October 18	Watson, U. S.
151	Abundantia	November 1	Palisa.
152	Atala	November 2	Paul Henry.
153	Hilda	November 2	Palisa.
154	Bertha	November 4	Prosper-Henry.
155	Scylla	November 8	Palisa.
156	Xantippe	November 22	Palisa.
157	Dejanira	December 1	Borelly.
158	Koronis	1876, January 4	Knorre.
159	Æmilia	January 26	Paul Henry.
160	Una	February 20	Peters, U. S.
161	Athor	April 16	Watson, U. S.
162	——*	April 21	Prosper-Henry.
163	Erigone	April 26	Perrotin.
164	Eva	July 12	Paul Henry.
165	Loreley	August 9	Peters, U. S.
166	Rhodope	August 15	Peters, U. S.
167	Urda	August 28	Peters, U. S.
168	Sibylla	September 27	Watson, U. S.
169	Zelia	September 28	Prosper-Henry.

In the list of Vol. I. the following were unnamed. Their names are here supplied:

125 Liberatrix.
126 Velleda.
127 Johanna.
135 Hertha.

The following is a list of all the discoverers of asteroids, with their places of observation and the number of asteroids discovered by each. The arrangement of the names is in the order of these numbers, and not in the order of time:

*This asteroid has not yet been named.

Name.	Locality.	No. discovered.	Name.	Locality.	No. discovered.
Peters	Clinton, N. Y.	26	Henecke	Driesen	2
Luther	Bilk	20	Tuttle	Cambridge, Mass.	2
Watson	Ann Arbor, Mich.	19	Piazzi	Palermo	1
Goldschmidt	Paris	14	Harding	Lilienthal	1
Hind	London	10	Graham	Markree	1
De Gasparis	Naples	9	Marth	London	1
Pallisa	Pola	9	Laurent	Nismes	1
Pogson	Oxford and Madras	7	Searle	Cambridge, U. S.	1
Borelly	Marseilles	7	Forster and Lesser	Berlin	1
Chacornac	Marseilles and Paris	6	Schiaparelli	Milan	1
Prosper-Henry	Paris	6	D'Arrest	Copenhagen	1
Tempel	Marseilles	5	Tietjen	Berlin	1
Paul Henry	Paris	5	Stephan	Marseilles	1
Ferguson	Washington	3	Coggia	Marseilles	1
Perrotin	Toulouse	3	Schulhof	Vienna	1
Olbers	Bremen	2	Knorre	Berlin	1

F. A. P. Barnard.

Astié (Jean Frédéric), b. in 1822 at Nerac, department of Lot-et-Garonne, France; was for some time a pastor in New York, afterward professor of philosophy at Lausanne, and wrote, besides various theological works, *Le Réveil religieux des États-Unis* (1857) and *Histoire de la République des États-Unis* (2 vols., 1865).

As'tor (William B.), b. in the city of New York Sept. 19, 1792; studied at Göttingen and Heidelberg; settled in New York; married a daughter of Gen. Armstrong, secretary of war under Pres. Madison, and was known as a good linguist and an able administrator of the enormous property in real estate left to him by his father, John Jacob Astor. D. in New York Nov. 24, 1875, and left $219,000 to the library which was founded by his father, and which bears the name of the family.

At'kins (John D. C.), b. in Henry co., Tenn., June 4, 1825; was educated at the University of East Tennessee, and graduated there in 1846; was elected to the lower branch of the legislature in 1849 and 1851, and to the State senate in 1855; was a Presidential elector on the Buchanan ticket in 1856, and a member of Congress from Tennessee from 1857 to 1861; then resigned and espoused the cause of the Confederates, serving in the field part of the time, as well as in the public councils. He was a member of the Confederate Congress at the time of the general surrender in 1865; was again returned to the Federal Congress 1872–74, and was re-elected to the 45th Congress. Alexander H. Stephens.

At'erbom (Peter Daniel Amadeus), b. Jan. 19, 1790, at Åsbo, in Southern Sweden; studied (1805) at the University of Upsala languages and literature, history and philosophy; travelled in Germany and Italy 1817–19; became tutor to the crown prince Oscar 1819–22, and was appointed docent in 1822 and professor in 1828 at the University of Upsala, where he d. July 21, 1855. In 1807 he formed the literary association *Aurora*, and in 1810 he founded the critical periodical *Fosforus*; and it was through these two institutions that the French or pseudo-classical taste which reigned in all Swedish literature and art received its first and its heaviest blows. The romantic ideas which started this whole movement were afterward developed by Atterbom in a long series of brilliant writings, poetical and historico-critical—*Lyckslighetens Ö* (2 vols., 1824–27), *Samlade Dikter* (2 vols., 1836–37), *Svenska sånar och skaldar* (6 vols., 1841–55), and *Poesiens historia* (4 vols., 1862); but, as can be seen from the article on Swedish Language and Literature, in Cyclopædia, that form of the romantic school which was represented by Atterbom and the Fosforists did not become the model of modern Swedish poetry.

Audouard' (Olympe), b. about 1830 at Aix, department of Bouches-du-Rhône, France; married a notary from Marseilles, but separated very soon from him; visited in 1859 Egypt, Turkey, and Russia, and in 1868 the U. S., where she gave a number of lectures. She wrote *Comment aiment les Hommes* (1861), *Les Mystères du Sérail et des Harems turcs* (1863), *Guerre aux Hommes* (1866), *Lettre aux Députés* (1867), *À Travers de l'Amérique du Nord* (1871).

Au'ersperg (Adolph Wilhelm Daniel), Prince, b. July 21, 1821, a son of Prince Wilhelm Auersperg and brother to Prince Carlos; entered the army very early, and was a major in Prince Eugene's dragoons when he left the military service in 1870. In 1867 he was elected a member of the Bohemian Diet, and in the same year was appointed president of the assembly on the resignation of Count Hartig. In 1869 he was nominated a member for life of the upper chamber of the Austrian Reichstag, and in 1870 was made governor of Salzburg. Finally, he succeeded Count Beust as president of the Austrian ministry, Nov. 25, 1871. Like his brother, who at an earlier date was president of the Cisleithanian ministry, he represents the German interest in Austria, and supports the present organization of the empire, established by Beust, and comprising an Austrian division, in which the German element predominates, and a Hungarian, in which the Magyars rule.

Aurelle de Paladines, d' (Claude Michel Louis), b. at Malezieux, department of Lozère, France, Jan. 9, 1804; received a military education; served in Algeria 1841–48; distinguished himself and was made a general of division in the Crimean war, and was commander-in-chief of the ninth military division (Marseilles) at the outbreak of the Franco-German war. In the battle of Coulmiers (Nov. 9, 1870) he defeated Von der Thann, and compelled the Germans to retire from Orleans. On Nov. 14 he was made commander-in-chief of the first army of the Loire, but his attack on the left wing of the army of Prince Frederick Charles at Beaune-la-Rolande (Nov. 28) failed; on Dec. 2 he was defeated at Artenay by the grand duke of Mecklenburg, and on Dec. 3 and 4 was driven farther back by Prince Frederick Charles, who again occupied Orléans. Gambetta now instituted a committee of inquiry into the conduct of D'Aurelle, who immediately resigned his command, and afterward declined to accept any command under the then government. He sat in the National Assembly of Bordeaux, was one of the members associated with Thiers in the negotiations of peace, and was appointed commander first of the national guard in the department of Seine, afterward of the fourteenth military division (Bordeaux). In 1872 he published *La Première Armée de la Loire*. D. Dec. 17, 1877.

Au'rifaber (the Latinized form of Goldschmidt, Johann), b. in the countship of Mansfeld, part of the present Prussian province of Saxony, in 1519; studied theology in Wittenberg; was chaplain to a Saxon regiment in the Smalcaldic war; became amanuensis to Luther in 1545; was appointed court-chaplain at Weimar in 1551, and minister at Erfurt in 1566, where he d. in 1579; edited several manuscripts of Luther's, and his *Epistolæ* and *Table-Talk*.

Aus'tin (Coe F.), b. at Mount Hope, Orange co., N. Y., June 20, 1831; published *Musci Appalachiani et Hepaticæ Boreali-Americanæ*, and is now preparing a *Synopsis of the Hepaticæ of North America*.

Auzoux' (Théodore Louis), b. at St. Aubin d'Ecroville, department of Eure, France, about 1797; studied medicine in Paris; invented the so-called *anatomie élastique*, a method of making permanent models of anatomical preparations in papier-mâché, and wrote *Mémoire sur le Choléra Morbus* (1832), *Leçons élémentaires d'Anatomie et de Physiologie* (1839), *Des Tares molles et Osseuses dans le Cheval* (1853), *Insuffisance des Chevaux forts et légers, du Cheval de Guerre et de Luxe* (1860). D. Mar. 6, 1880.

Avent (Benjamin Ward), M. D., b. in Greenville co., Va., May 19, 1812; graduated at La Grange College, Ala., and in medicine at Transylvania University in Lexington, Ky.; was appointed surgeon-general for Tennessee 1861; since the war has held the chair of surgery in the Medical College of Memphis.

Azaïs' (Pierre Hyacinthe), b. at Sorrèze, department of Tarn, France, Mar. 1, 1766; was educated in the Benedictine college of his native city, and became secretary to the bishop of Oléron; was condemned to transportation on account of a bitter criticism of the excesses of the revolutionists, but escaped and lived for several years in retirement; went to Paris in 1806; professor of history at the military school of St. Cyr, and afterward inspector of public libraries of Avignon and Nancy; lost this position in 1815 because he wrote a defence of Napoleon; received a pension from the government through the influence of Madame de Staël, and lived quietly in Paris, lecturing on philosophy in his garden, and publishing a great number of books. D. Jan. 22, 1845. His two most characteristic works are *Le Système de Compensation* (1806) and *Le Système universel* (1812).

B.

Baa'der, von (Franz Xaver), b. at Munich Mar. 27, 1765; studied medicine at Ingolstadt and Vienna 1781–86; then natural science, especially mineralogy, at Freiberg, under Werner, 1788–92; visited England 1792–96, and held various positions in the Bavarian mining department from 1797 to 1820. In this period he wrote *Vom Wärmestoff* (1786), *Versuch einer Theorie der Sprengarbeit* (1802), and *Anleitung zum Gebrauche der schwefelsäuren Soda oder des Glaubersalzes zur Glaserzeugung* (1815), for which he received a prize of 12,000 florins from the Austrian government. Meanwhile, he cultivated the study of philosophy and theology with great energy, became acquainted with all the leading men of the time and with their ideas, and finally brought himself to rest in the mysticism of Jakob Böhme. In 1826 he was made professor of philosophy and speculative theology at the University of Munich, and the deep enthusiasm and ingenious argumentation of his lectures and writings attracted great attention, though his ideas were mystical and the form in which he represented them aphoristical. His views tended to a reconstruction of the whole civilization on the basis of religion, of the Church, but in this new Church there should be no pope. In 1814 he presented a memorial to the sovereigns of Russia, Prussia, and Austria in which he urged the necessity of bringing politics once more into close connection with religion, but in 1837, during the troubles at Cologne, he spoke with much sharpness against the pope. He died, however, a good Roman Catholic, May 23, 1841, at Munich. His philosophical writings have been published in a collected edition in 16 vols. by Franz Hoffmann (1850–60), who also has given a general representation of his standpoint—*Vorhalle zur speculativen Lehre Baader's* (1837).

Bab'ington (Churchill), b. in England in 1821; graduated at St. John's College, Cambridge; held the chapelry of Horningsea, Cambridgeshire, 1848–61; was Disney professor of archæology 1865, and rector of Cockfield in 1866; edited from MSS. the recently-discovered orations of Hyperides; has written largely on botany, ornithology, archæology, and numismatics for various works and Transactions, and contributed to Smith's *Dictionary of Christian Antiquities.*

Bage'hot (Walter), A. M., b. at Langport, England, Feb. 3, 1826; graduated at University College, London, and passed A. M. at London University; wrote *The English Constitution, Physics and Politics* (1872), and *Lombard Street* (1873); editor of *Economist* till his death, Mar. 26, 1877.

Bag'ley (John J.), b. in Orleans co., N. Y., in 1832, and emigrated with his father to Michigan in 1840. Since 1847 he has been a tobacconist in Detroit, and very successful in business. He has held numerous public offices in the city government, and filled places of financial trust; governor 1873–77. During his administration the educational and charitable institutions of the State have received special care and encouragement.

Bai'ley (Silas), D. D., b. in Massachusetts about 1808; president of Granville College (now Denison University), Granville, O., and of Franklin College, Lafayette, Ind., and subsequently professor of theology in Kalamazoo College, Mich., and pastor for several years of a Baptist church in Lafayette, Ind., and author of several books; made a tour of Europe. D. at Paris June 30, 1874.

Bailey (William Whitman), B. P., b. at West Point, Orange co., N. Y., Feb. 22, 1843; was educated at Brown University, Providence, R. I., whence he graduated in 1864; was botanist of the U. S. geological survey of 40th parallel in 1867; deputy secretary of state of Rhode Island in 1868; assistant librarian of Providence Athenæum 1869–71, and contributed largely to periodical literature.

Ba'ker (John Gilbert), b. at Guisborough, England, Jan. 13, 1834; educated at the Friends' schools at Ackworth and York; assistant curator of the Kew Gardens since 1856; is lecturer on botany at the London Hospital, and an assistant editor of *Seemann's Journal of Botany;* and has written a large number of works on ferns, flora, botany, etc.

Ball (George H.), A. M., D. D., b. at Oxford, Sherbrook co., East Canada, Dec. 7, 1818; studied at the theological seminary of New York, whence he graduated in 1847; was pastor of the Niagara Square Baptist church, Buffalo, N. Y., for about twenty years; pastor of Roger Williams church, Providence, R. I., for two years; editor of the *Baptist Union*, and published *Guide to the Lord's Supper, Christian Baptism*, etc.

Ba'ring-Gould (Sabine), b. at Exeter, England, Jan. 28, 1834; was educated at Clare College, Cambridge; visited Iceland in 1862; took orders in 1865; was appointed curate of Horbury, subsequently of Dalton, and published *Iceland, its Scenes and Sagas* (1863), *Post-Mediæval Preachers* (1865), *The Book of Were-Wolves* (1865), *Myths of the Middle Ages* (1869), *The Origin and Development of Religious Belief* (1870), *Legends of the Patriarchs and Prophets* (1871), *Lost and Hostile Gospels* (1874), and other works.

Bar'low (Samuel Latham Mitchill), b. at Granville, Hampden co., Mass., June 5, 1826; was educated in New York City; admitted to the bar in 1848, and practised subsequently in the city of New York.

Bartolomme'o (Fra), whose true name was Baccio delle Porta, b. at Savignano in 1469; studied under Cosimo Rosselli and Leonardo da Vinci, and had already acquired a great reputation as a painter when the condemnation and execution of his friend, Savonarola, caused him to give up his art and retire to a Dominican convent in 1500. In 1504, however, he again took up painting, chiefly at the solicitation of Raphael, who came to Florence at that time, and he subsequently visited Rome in order to study the works of Michael Angelo. Most of his life he spent in Florence, where he d. Oct. 8, 1517, and here are his most celebrated pictures, the *Nativity, Circumcision*, and the *Virgin on the Throne*, in the public gallery; the *St. Mark* and the *Descent from the Cross*, in Palazzo Pitti; and *Last Judgment*, in chapel of Santa Maria Nuova.

Bar'ton (Clara), b. on a farm at Oxford, Mass., a daughter of Capt. Stephen Barton, and educated at Clinton, N. Y. Early in life she engaged in teaching, and founded a free school at Bordentown, the first in New Jersey, which she opened with six pupils, but which numbered nearly 600 when, in 1854, she went to Washington. Here she was appointed clerk in the department of patents, but on the outbreak of the civil war she resigned her clerkship and devoted herself to the alleviation of the sufferings of the soldiers, serving not in the hospitals, but on the battle-field. She was present at several battles, and after the close of the war originated, and for some time carried on at her own expense, the search for missing soldiers. Having lectured (1866–67) on *Incidents of the War*, she went to Europe for her health, and settled in Switzerland, but on the outbreak of the Franco-German war she accepted the invitation of the grand duchess of Baden to aid her in the establishment of her hospitals; and she afterward followed the German army, and was decorated with the Golden Cross by the grand duke of Baden, and with the Iron Cross by the emperor of Germany.

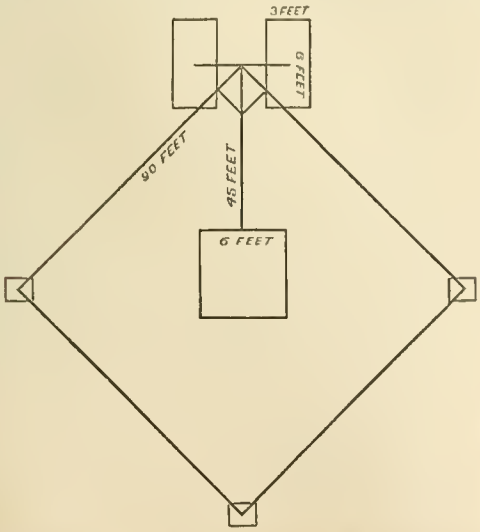
Barycen'tric Calculus, an application to geometry of the mechanical theory of the centre of gravity, executed in two distinct ways, according as metrical or descriptive geometrical properties are to be investigated. It was developed almost completely by Möbius in his *Der barycentrische Calcul* (1827).

Base-Ball. This most popular of all the field-games in vogue in the U. S., and now known as the national game of the country, may be said to date its existence from the organization of the National Association of Base-Ball Players in 1857. Prior to this period the game was not played under any general code of rules, a different method of playing it prevailing in different sections of the country; it being known as the "New England game" in the Eastern States and as the "New York game" in the Middle States. But not long after the establishment of the National Association all other rules were superseded, and ultimately but one code of playing-rules governed the game throughout the entire country. Base-ball is of English origin, it being the American successor of the old English school-boy game of "rounders;" but to this old pastime base-ball, as now played, bears about as much resemblance as draughts to chess, the only similarity which exists being that both are played on the same plane, the two ball-games being played on a diamond-shaped field, and draughts and chess on a checkered board. This similarity between the English and American games, however, does not interfere with the legitimacy of the claim of base-ball to its existing title of "the national game of America."

In the earlier period of its history base-ball was confined exclusively to the amateur class of the fraternity, professional playing being comparatively unknown before the

last decade; but as it progressed in popularity, and thousands of spectators began to be attracted to witness the leading contests of each season where only hundreds had congregated before, the opportunity for pecuniary gain in connection with the game began to exist, and as a consequence the professional class sprang into existence; and henceforth there will necessarily be two classes of base-ball players in existence—the amateur majority and the professional minority. The first regularly-organized base-ball club which sustained a permanent existence was the Knickerbocker Club of New York, which was organized in Sept., 1845. In 1876 this pioneer club celebrated its thirty-first season of playing, and many of the veteran members participated in the proceedings. It is now composed of bankers, brokers, and merchants of the city, and occupies the enviable position of being the model amateur base-ball club of America. From 1845 to 1856, inclusive, the rules of play in vogue at Hoboken—the early home of the game—were those adopted by the Knickerbocker Club, and afterward endorsed by the kindred organizations of the Gotham, Eagle, Empire, Baltic, and Harlem clubs of New York; the Putnam, Excelsior, Atlantic, Eckford, and Continental clubs of Brooklyn; and the Union of Morrisania—all organized between 1845 and 1856, the leading clubs of this list playing at the Elysian Fields at Hoboken, N. J. The rapid growth of popularity base-ball has attained within the past fifteen years is due to the fact of its adaptability to the peculiar temperament of our people. It is a game quickly played, it is full of excitement, and it can be enjoyed with equal zest by the youngest school-boys and the trained professional; to the latter of whom it affords full scope for the exercise of those mental as well as physical qualifications which characterize the intelligent and skilful athlete.

Before the organization of the National Association in 1857 the rule of play gave the victory in a game to the club first making the score of twenty-one aces. The association changed this to the rule awarding the victory to the club scoring the largest number of runs after nine innings' play on each side. Improved as the rule of play was by the old association, these revised rules were nothing in comparison to the complete code of rules which was prepared for the Professional Association in 1872, and which has continued in force ever since with some slight amendments. There is no field-game which is more simple in its theory than that of base-ball, and yet to excel in the game as a noted expert requires not only the possession of the physical qualities of endurance, agility, and strength, with good running and throwing powers, but also the mental attributes of sound judgment, quick perception, thorough control of temper, and the presence of mind to act promptly in critical emergencies, together with courage, pluck, and nerve. The simple theory of the game is as follows: A space of ground being marked out on a level field in the form of a diamond with equal sides, bases are placed on the four corners thereof. The contestants include nine players on each side; one side takes the field and the other goes to the bat. When the field-side take their positions the pitcher delivers the ball to the batsman, who endeavors to send it out of the reach of the fielders, and far enough out on the field to enable him to run round the



bases; and if he reaches the home-base—his starting-point—without being put out, he scores a run. He is followed in rotation by the others of his side until three of the batting party are put out, when the field-side come in and take their turn at the bat. This goes on until nine innings have been played to a close, and the side scoring the most runs wins the game. A regular base-ball field occupies a space of ground of from 300 to 500 feet in width and 400 to 600 in length. At the upper end of this field the "infield" is laid out, this being formed by the diamond-shaped space, on the corners of which the four bases are located. The sides of this square are 90 feet, the home-base being located at the upper corner, the second base at the lower corner, and the first and third bases on the right and left corners. The pitcher's position is within a space of ground 6 feet square and 45 feet distant from the home-base, situated on a line between home and second bases. The catcher stands behind the home base, either close to it or some distance behind as occasion may require. The basemen occupy positions within easy reach of their respective bases, and the short-fielder takes his position between the third and second bases, and not far from the pitcher, his duty being to "back up" the infielders. These six players comprise the "infielders" of the nine, the "outfielders" being the three players located at left, centre, and right fields. The field-side open the game—choice of first innings having been decided by a toss—by the pitcher's delivering the ball to the batsman, either by a toss, a jerk, or an underhand throw, the limit of this throw being the swinging of the arm and hand in which the ball is held below the line of the waist. If the ball be fairly hit by the batsman—that is, if it be not called "foul" by the umpire—the batsman then becomes a base-runner, and he is obliged to run to the first base; and should the ball he has hit be caught before touching the ground, or if it be held by a fielder while touching the first base before the base-runner reaches that base, the latter is out. The batsman is also liable to be put out when a foul ball from his bat is caught on the fly or on the bound, and also if he fails to hit it after striking at it three times. Also, if he refuses to strike at good balls four times he is out, or if he wilfully strike out. Base-runners are liable to be put out when touched off a base, or when forced off by the action of the batsman in hitting a fair ball, or by running out of the line of the bases to avoid the ball in the hands of a fielder, as also from wilfully obstructing a fielder in his effort to catch a ball. To score a run it is necessary for the base-runner to touch each base in regular order from home-base to first, second, and third bases, and thence to the home-base, before he is put out, and before three members of the batting-side are put out. Until three men are out the batting goes on indefinitely until darkness stops play. Each nine in the game are entitled to nine innings' play. No game can be scored unless five innings' play have been completed on each side. An umpire is mutually agreed upon to decide all disputes in the game, and from his decision there is no appeal except to the national association the clubs belong to, and then only in case of a palpable misinterpretation of the rules.

The three special departments of the game are batting, fielding, and base-running. Any one possessing muscular strength and quick sight can readily learn to handle the bat with effect; but fielding requires a special aptitude for one or other of the several positions, and constant practice and training, while base-running needs quick perception, good judgment, and prompt action. In the former a mere tyro may achieve the questionable honor of a "home-run," but none but a practised expert can excel in the other two departments. Different degrees of skill are needed for different positions. The pitcher requires powers of endurance and considerable pluck, together with the ability to pitch the ball swiftly and accurately, not forgetting the judgment required to make strategy a strong point of his attack. The catcher should be a swift and accurate thrower, a sure catch, and a plucky facer of swiftly-delivered balls. These essentials are also necessary in base-players, and the short-fielder requires to be an unusually active player besides; while the outfielders should all three be long-distance throwers and good judges of catches. To complete a nine a change pitcher and catcher is necessary, as also a field-captain. These are essentials of success alike in amateur as in professional nines, but the training and discipline characteristic of a well-managed professional team can never be at the command of an amateur nine, except perhaps in the case of a university nine, and then only to a limited extent. Hence, professional nines must always be the superiors of amateur nines in fielding and base-running, if not in batting.

In 1871 the old National Association, which had apparently fulfilled its mission after thirteen years' existence, gave place to the class organizations known as the National Association of Professional Players and the National Association of Amateur Base-Ball Players. The former was run in the interests of the professional class until 1876, when it was superseded by the League Association of Pro-

fessional Clubs, the co-operative class of professionals still keeping up the National Professional Association, and the amateurs their association.

The prominent events in the history of base-ball were the grand tour made by the Excelsior Club of Brooklyn in 1860; the great Western tour of the National Club of Washington to St. Louis and Chicago in 1867; the brilliant career of the Cincinnati Club in 1869, when they played every club of note from Maine to California without losing a single game; and the trip of the Boston and Athletic clubs to England in 1874, where by their skill as base-ball fielders in the English game of cricket they were enabled to escape defeat in contests with some of the strongest elevens of England and Ireland. The most successful of the professional organizations have been the Boston "Red Stockings," which from 1871 to 1876 won the championship pennant each season. HENRY CHADWICK.

Batrachidæ. See TOAD-FISH, in CYCLOPÆDIA.

Batrachophrynidæ. See TOAD, in CYCLOPÆDIA.

Bat'tershall (JESSE PARK), PH. D., b. in Troy, N. Y., May 26, 1851; began his chemical education 1867 at School of Mines, Columbia College, N. Y.; in 1869 studied under Prof. Wöhler at the University of Göttingen, Germany, where he remained for a year, after which he passed a semester at the University of Leipsic with Prof. Kolbe; then continued his studies for two years under the instruction of Prof. Fittig at the University of Tübingen, Würtemberg, where, after the necessary original research and examination, he received the degree of doctor of natural sciences; his inaugural dissertation is a description of several new derivatives of naphthalene, including the aldehyde of isonaphthoic acid ($C_{11}H_8O$), its amido-compound, hydroisonaphthamide ($C_{33}H_{24}N_2$), sulphonaphthoic and isosulphonaphthoic acids ($C_{11}H_2O_5S$) and salts, and several isomeric oxynaphthoic acids ($C_{11}H_8O_3$). After attending the chemical course of Prof. Marignac in Geneva he returned to this country, where he is engaged as analytic and consulting chemist; an English translation by him of Naquet's *Legal Chemistry* has recently been published.

Bat'tey (ROBERT), M. D., b. in Augusta, Ga., Nov. 26, 1828; took his degree in medicine at the Jefferson Medical College; practised his profession in Rome, Ga., and by his contributions to the journals (one to the London *Lancet* on vesico-vaginal fistula) soon acquired reputation; was called to the chair of obstetrics in the Atlanta Medical College; claims to have first performed normal ovariotomy, and is attempting regurgitation in the alimentary canal. He is editor of the Atlanta *Medical and Surgical Journal*.

Bea'man (FERNANDO C.), b. in Chester, Vt., June 28, 1814; studied law at Rochester, N. Y., and in 1838 became a lawyer of Michigan; was prosecuting attorney of Lenawee co., judge of probate, Presidential elector in 1856, and member of Congress from Michigan 1861–69.

Beat'ty (ORMOND), A. M., LL.D., b. at Washington, Mason co., Ky., Aug. 13, 1815; was educated at Centre College and Yale College, whence he graduated in 1835; was appointed professor of Centre College in 1836, and president in 1872, and has contributed to various papers.

Beck'er (KARL FRIEDRICH), b. at Berlin in 1777; studied philosophy and history at Halle; was a teacher in Berlin, but gave up all kinds of business on account of ill-health, and d. Mar. 15, 1806. From 1801 to 1805 he published his *Weltgeschichte für Kinder und Kinderlehrer* (9 vols.), which has been often reprinted and translated into other languages. On account of a singular felicity both in arrangement and style, it was to young readers a very pleasant and useful book, but since the death of the author it has been so much augmented, continued, corrected, and improved as to become nearly valueless.

Be'dle (JOSEPH D.), b. at Middletown Point (now Mattawan), Monmouth co., N. J., Jan. 3, 1831; graduated with honor at the law school at Ballston, N. Y.; practised law in New York City; entered the law-office of W. L. Dayton at Trenton, N. J., where he completed his term of study; practised at Mattawan until 1855, when he entered upon a very successful professional career at Freehold, N. J.; was appointed a judge of the New Jersey superior court in 1865, and again in 1872, and acquired high reputation; and was elected governor of New Jersey in 1874.

Bed of Justice [Fr. *lit de justice*], meant, first, simply the seat on which the French king sat when in council with the peers of the realm; then those meetings of the Parliament in which, on account of the importance of the business at hand, the king partook personally; and finally, such measures as the king by his presence compelled the Parliament to pass, though it disapproved them.

Belgiojo'so (CRISTINA), PRINCESS OF, b. at Milan June 28, 1808, a daughter of Marquis Geronimo Isidoro Trivulzio; married on Sept. 14, 1824, Prince Emilio Barbian o Belgiojoso. She embraced the Italian cause with great enthusiasm; was expelled from Italy by the Austrian government in 1830, and settled in Paris, where her salon soon became the centre of a most brilliant political and literary circle. In 1848 she returned to Italy, equipped a corps of volunteers at her own expense, and took part most actively in the revolution in Milan and Rome. But in 1850 she was once more exiled; visited Greece and Turkey, and settled in 1855 once more in Paris, still working indefatigably for the cause of her country. In 1861 she finally returned to Italy, and d. in Milan July 5, 1871. Besides being a frequent contributor to various French and Italian journals, she published *Essai sur la Formation du Culte dogmatique* (1846), *Souvenirs d'Exile* (1850), *Emina, Récits turco-asiatiques* (2 vols., 1856), *Asie mineure et Syrie*, and *Scènes de la Vie turque* (1858), *Histoire de la Maison de Savoie* (1860), and *Réflexions sur l'État actuel de l'Italie, etc.* (1869).

Bell'mann (KARL MICHAEL), b. in Stockholm Feb. 15, 1740; received a rather desultory education; vacillated for several years between business and literature; received in 1776 a small office in the state lottery from Gustavus III., but hired another to perform its duties and gave himself up to his passion for gay company and poetry. D. in Stockholm in poverty and melancholy Feb. 11, 1795. His works consist of songs, both words and melodies by himself, a kind of ballad in which he gives a most burlesque representation of the companions of his nightly revelries and of their exploits. But these characters are drawn with the most exquisite elegance; their extravagances are blended with something which is exceedingly sweet and innocent; and the whole picture is borne along by a stream of striking, joyous melody, in which, however, a peculiar undertone of romantic sadness now and then becomes very perceptible. These songs have made his name one of the most celebrated within the Scandinavian countries. They have been printed over and over again, and are sung at the courts and by the peasants; and in Sweden they have given rise to a very rich song-literature of considerable merit, both poetically and musically, and to innumerable and generally excellently-trained singing associations which form a characteristic feature of Swedish social life. His statue has been raised in Djurgården, near Stockholm, and May 1 is celebrated there with an annual festival in his honor. CLEMENS PETERSEN.

Bel'ton (JAMES S.), b. in South Carolina Sept. 7, 1833; graduated at La Grange College; joined the Tennessee conference of the Methodist Episcopal Church, South, in 1852, and was transferred to the Alabama conference; in May, 1854, went as a missionary to China, but after two years' arduous labor returned to his native land. D. in New York City Mar. 17, 1856. T. O. SUMMERS.

Be'miss (SAMUEL MERRIFIELD), M. D., b. in Nelson co., Ky., Oct. 15, 1821; graduated M. D. in the medical department of the University of New York City 1846; was elected professor in the medical department of the University of Louisville 1858; has been professor of the theory and practice of medicine since 1866 in the University of New Orleans, which chair he still holds. He has been connected with the medical press since 1858, and is now editing the *New Orleans Medical and Surgical Journal*; has also published essays on croup, marriages in consanguinity, registration in Kentucky, etc., besides furnishing valuable contributions to our medical journals. PAUL F. EVE.

Benét (STEPHEN VINCENT), b. at St. Augustine, Fla., Jan. 22, 1827; after a preparatory course at Hallowell's school in Alexandria, Va., and at the University of Georgia, he entered the U. S. Military Academy at West Point, N. Y., on July 1, 1845, whence he graduated July 1, 1849, and was promoted brevet second lieutenant in the ordnance corps. In 1853 he published a translation of Jomini's *Political and Military History of the Campaign of Waterloo*, and in the fall of 1859 was detailed as principal assistant professor of ethics and law at the U. S. Military Academy, which position he filled until 1861, being then assigned to duty at that institution as instructor of ordnance and the science of gunnery, remaining there until 1864; was promoted captain of ordnance Aug. 3, 1861; in 1862 published his valuable treatise on *Military Law and the Practice of Courts-Martial*, which at once became the standard textbook on military law at the Military Academy. In Feb., 1864, he was relieved from the academy, and placed in charge of the cannon and projectile branch of the inspection service of the ordnance department, and continued in that branch of service until assigned to the command of Frankford arsenal at Philadelphia, Pa., in Aug., 1864, where, in addition to his duties as commanding officer, he discharged the duty also of inspector of gunpowder. At the close of the war he received the honorary distinction of major and lieutenant-colonel by brevet

"for faithful and meritorious services in the ordnance department." In the year 1866 he published his work on *Electro-ballistic Machines and the Schultze Chronoscope*, and Dec. 22, 1866, was promoted to the rank of major in his corps. The office of chief of ordnance becoming vacant by death, he succeeded to that position June 23, 1874, with rank of brigadier-general. GEO. C. SIMMONS.

Betts (BEVERLEY ROBINSON), A. M., b. in the city of New York Aug. 3, 1827; graduated at Columbia College in 1846, and at the General Theological Seminary of the Protestant Episcopal Church in that city in 1850; was ordained deacon in the same year, and admitted to the priesthood in 1851. After a short charge of Trinity church, Rockaway, he was in 1855 made rector of St. Saviour's church, Maspeth, Long Island, which position he held for nearly fourteen years; in 1865 was appointed librarian of Columbia College. Prepared for the press a full catalogue of the library of the college (1874); has been a frequent contributor to Church reviews and journals. Wrote *Sketches of Professors M'Vickar and Anthon*, which appeared in the *Church and the World*, July, 1873.

Bid'dle (JOHN), b. in Philadelphia about 1790; served with distinction in the war of 1812, and became a paymaster in the army and Indian agent; delegate in Congress from Michigan Territory 1829–31, and afterward register of the land-office at Detroit. He resided for some years in Europe. D. at White Sulphur Springs, Va., Aug. 25, 1859.

Big'ney (MARK F.), b. in Cumberland co., Nova Scotia, in 1811; educated in the provincial schools; visited Europe in 1836, and settled in Louisiana, where he adopted journalism as his profession. For seven years he was managing editor of the New Orleans *Times*, and published a volume of poems in 1867, *The Forest Pilgrims*. He has also contributed largely to the literary magazines of the times, particularly the *Weekly Mirror*, of which he was editor. C. G. FORSHEY.

Bil'lings (JOHN SHAW), A. M., M. D., b. Apr. 12, 1839, in Switzerland co., Ind.; graduated at Miami University in 1857, and at Ohio Medical College in 1860; entered the U. S. army as assistant surgeon in 1861, and had charge during the war of hospitals and with the Army of the Potomac. Since the war he has been on duty in the surgeon-general's office at Washington; is the author of Circular 4, *Report on Barracks and Hospitals*; Circular 8, *Report on the Hygiene of the U. S. Army*, and of several medical, bibliographical, and hygienic essays. He is now in charge of the National Medical Library and of the hygienic division of the surgeon-general's office, and is medical adviser to the Johns Hopkins Hospital in Baltimore.

Bishop Seabury Mission, an organization of the Protestant Episcopal Church at Faribault, Minn., was founded in 1860 by Bishop H. B. Whipple and Rev. Drs. Breck and Manney, and owns the Bishop Seabury Divinity School, Shattuck School, Cathedral of Our Merciful Saviour, and buildings and grounds worth $200,000.

Bit'tle (DAVID FREDERICK), D. D., b. in Frederick co., Md., Nov. 19, 1811; graduated at Pennsylvania College 1835; studied theology at the Theological Seminary of the Lutheran Church at Gettysburg, Pa.; pastor in the Valley of Virginia, and afterward in Middletown, Md., until 1853, when he was elected to the presidency of Roanoke College, Salem, Va., during which he d. Sept. 25, 1876.

Black'ie (GEORGE STODART), A. M., M. D., PH. D., b. at Aberdeen, Scotland, Apr. 10, 1834; educated at the universities of Bonn, Paris, and Edinburgh, graduating A. M. and M. D. at the last in 1855, obtaining the gold medals for botany and his thesis; came to the U. S., and became professor of natural history at the University of Nashville 1856–61; served during the civil war as surgeon, medical inspector, etc.; has been professor of botany in Tennessee College of Pharmacy, and of chemistry in Nashville Medical College, since 1875; held prominent positions in Masonry, among them that of grand commander of the State; has published *Cretins and Cretinism* (Edinburgh, 1855), *Botany the Ally of Medicine* (Nashville, 1859), *Medical Flora of Tennessee* (Nashville, 1859), *History of the Knights Templar* (Nashville, 1871), besides numerous other works; and edited the *Nashville Medical Journal* 1858–70, and the *Masonic Record* 1870–71.

Blake (LILLIE DEVEREUX), b. in Raleigh, N. C., of a wealthy Southern family; educated in New Haven, Conn.; first advocated woman suffrage in 1869; addressed conventions and the legislature of New York several years in succession; a writer of novels and newspaper articles. *Fettered for Life*, published in 1874, is the best of her stories. Was a member of the delegation from the National Association who presented woman's declaration of rights at Independence Square July 4, 1876. She was twice married, and resides in New York City. SUSAN B. ANTHONY.

Blake (WILLIAM), b. in London Nov. 28, 1757. In 1783 appeared *Poetical Sketches by W. B.* This was printed and published in the ordinary way, and was without illustrations. In 1789 came *Songs of Innocence*; in 1793, *The Gates of Paradise*; in 1794, *Songs of Experience*, and later several volumes of poetic rhapsody. All these were published by the author, and all were illustrated. Both text and illustrations were engraved, and when printed off Blake tinted both text and border in a style of his own, making each page a picture. Much of his loveliest and sublimest work is in these illustrations. But he produced so much that a mere list of his engravings, water colors, and drawings in distemper would fill a page of this work. He is best known to the public by his *Canterbury Pilgrims*, his *Inventions to the Book of Job*, and his designs to Blair's *Grave*. D. in London Aug. 12, 1827. *Life* by Alexander Gilchrist; Cunningham's *Lives*; *William Blake*, by A. C. Swinburne. *The Poetical Sketches* and *The Songs of Innocence and Experience* were reprinted in 1874. The *Inventions to the Book of Job* have been reproduced by heliotypy by James Osgood (Boston, Mass.). CLARENCE COOK.

Blatch'ford (RICHARD M.), b. at Stratfield, Conn., in 1798; graduated at Union College, Schenectady, in 1818; taught school for a couple of years at Jamaica, Long Island, but studied law at the same time, and was admitted to the bar of New York in 1821; was appointed counsel and financial agent of the Bank of England for the U. S. in 1825; elected member of assembly in 1855, and appointed commissioner of Central Park in 1859; represented the U. S. at the court of Rome 1862–63. D. at Newport Sept. 4, 1875.

Bliss (PHILIP PAUL), b. at Clearfield, Pa., in 1838; received instruction in music from George W. Root; became the chorister of the First Congregational church of Chicago, and superintendent of the Sunday-school; joined afterward in the lay evangelistic labors of Major Whittle, and perished at the Ashtabula railway accident, Dec. 30, 1876. His hymns "Hold the Fort," "Hallelujah, 'tis Done!" "More to Follow," etc.—of which he generally composed both text and melody—became very widely used in the Christian Church, especially in revival meetings.

Bliss (PORTER CORNELIUS), A. M., b. on the Cattaraugus reservation of Seneca Indians, Erie co., N. Y., Dec. 28, 1838; studied at Hamilton and Yale colleges; travelled in Maine, New Brunswick, and Nova Scotia 1860–61, investigating the condition of the Indian tribes in behalf of societies at Boston; was employed for some months as clerk in the Indian bureau, and subsequently in the post-office department at Washington, 1861; took part in volunteer organizations for the defence of the capital; visited England the same year; accompanied Gen. J. W. Webb as private secretary on his mission to Brazil 1861–62; was commissioner of the government of the Argentine Republic for the exploration of the Indian country called the Gran Chaco 1863; edited at Buenos Ayres a monthly periodical, *The River Plate Magazine* (1864); was appointed by Pres. Lopez historiographer of Paraguay; became secretary to Hon. C. A. Washburne, U. S. minister to Paraguay, 1866; aided him in collecting materials for his *History of Paraguay* (2 vols., 1871); was imprisoned by command of Lopez on a charge of treason and conspiracy for his assassination Sept. 10, 1868; was rescued by an American squadron Dec. 10, 1868; was appointed translator to the state department at Washington Mar., 1869; was editor of the Washington *Chronicle* 1869–70, and secretary of legation in Mexico 1870–74, and was acting minister for several months 1872–73. He has resided in New York since 1874, and is vice-president (1876) of the American Philological Society.

Bloom'er (AMELIA), b. in Homer, N. Y., in 1818; married in 1840, and settled at Seneca Falls, N. Y.; wrote frequently on reformatory subjects, and Jan. 1, 1849, established *The Lily*, a semi-monthly publication, of which she was editor and proprietor. It was devoted to the interests of women, and attained a circulation of over 4000. She has earnestly advocated the enfranchisement of woman through her paper, the public press, and from the lecture-stand for the last quarter of a century. Since 1855 she has resided in Council Bluffs, Ia., where she has taken active part in the woman's suffrage work of that State. Mrs. Bloomer did not originate the costume which bears her name, as is generally supposed, but after seeing it worn by Elizabeth Smith Miller, daughter of Hon. Gerrit Smith, who was the first, so far as known, to wear the dress in public, she with Elizabeth Cady Stanton, Lucy Stone, and others, adopted it, and introduced it to the public through *The Lily*. The need felt by women for some reform in dress was evidenced by letters of inquiry from all parts of the country. SUSAN B. ANTHONY.

Blount (JAMES H.), b. in Jones co., Ga., Sept. 12, 1837; graduated at the State University in 1857. He was quite a young man when the question of secession was mooted in

1860, and opposed it as long as it was an open question. But as soon as the war broke out he went with the people of his native State, and entered the Confederate army as a private in the 2d Georgia battalion of infantry; before the close of the war was promoted to the rank of lieutenant-colonel of cavalry. Soon after his graduation he studied law, and was admitted to the bar. At the close of the war he resumed the practice of his profession in Macon, Ga., where he still resides. In the fall of 1865 he was elected to the State convention for the formation of a new constitution under the reconstruction policy of Pres. Johnson. In 1872 he was elected to represent his district in the 43d Congress; re-elected in 1874 to the 44th Congress, and in 1876 to the 45th Congress. In the 44th Congress he was on the committee of appropriations. ALEXANDER H. STEPHENS.

Bolintinea'no (DEMETER), b. at Bolintina, Wallachia, in 1826; was educated at Bucharest; studied in Paris; edited in 1848 a revolutionary paper, and was banished by Prince Stirbey; settled once more in Paris, but returned home under Prince Cuza: edited another journal, and received a high governmental position after the *coup d'état*, May 2, 1864. His novel *Manila* and several of his lyrical poems have been translated into French (*Brises d'Orient*) by himself, and attracted considerable attention.

Bonan'za, a Spanish word probably derived from *bueno*, "good" (adj.), and by the termination *anza* it becomes a noun signifying "goodness." In Old Spain this word is generally used in a nautical sense, indicating fair weather at sea. It is also used to indicate prosperity or success. In California and in Northern Mexico it is used as a mining term to signify an abundance of metal or an ore-body. The mines of Northern Mexico are principally what are called "pocket mines," with thin veins of poor metal connecting the pockets. When a pocket of rich ore is struck the mine is said to be in *bonanza*. When the veins run out without leading to pockets, the mine is said to be in *borra* ("useless words"), from the verb *borrar*, to "rub out" or "to blot out." In the Comstock Lode in the State of Nevada enormous bonanzas have been found. (See COMSTOCK LODE.) JOHN LE CONTE.

Boole (GEORGE), b. Nov. 2, 1815, d. Dec. 8, 1864; was professor of mathematics, Queen's College, Cork, Ireland, and published, besides treatises on mathematics, *An Investigation into the Laws of Thought, on which are founded the Mathematical Theories of Logic and Probabilities*, Lond. 1854.

Boot (JOHN FLETCHER), a Cherokee, a member of the executive council of the nation; he was also a brave warrior. Two years after his conversion in 1825 he was licensed to preach, and was subsequently ordained deacon of the Methodist Episcopal Church, South, in Nashville, Tenn., and elder in Lebanon. He was an eloquent and powerful preacher in his native tongue, and was the first Cherokee that administered the Lord's Supper. He was also one of the founders of the Cherokee Bible Society. D. of hæmorrhage of the lungs Aug. 8, 1853, aged about sixty years. T. O. SUMMERS.

Booth (NEWTON), b. in Salem, Washington co., Ind., Dec. 25, 1825; graduated at Asbury University in 1846; studied law in Terre Haute, and was admitted to the bar in 1850; went to California soon afterward, and engaged in business in Sacramento; returned in 1857 to Terre Haute, and practised law till 1860, when he went back to California. In 1863 he was elected to the California State senate; in 1871 was elected governor of California on an independent ticket; in Mar., 1874, was elected U. S. Senator for six years from Dec., 1875, and resigned his governorship. J. B. BISHOP.

Bo'reas, in Grecian mythology, the personification of the north wind, the brother of Hesperus, Zephyrus, and Notus; was imagined to dwell in the caves of Thrace, and represented with wings, hair, and beard dripping with snow-flakes.

Bouguereau' (ADOLPHE WILLIAM), b. at La Rochelle, France, Nov. 30, 1825; studied in the School of Fine Arts in Paris 1843–50, and in Rome 1850–55, and began to exhibit in 1855. Among his most celebrated pictures are *Triomphe de Vénus* (1856), *La Bacchante* (1863), *Enfants endormis* (1868), and a series of historical and religious representations in the churches of Ste. Clotilde and St. Augustine in Paris. A considerable number of his works are found in the U. S.

Bo'vidæ [from *Bos*, the ancient Latin name of the ox, one of the most prominent of the genera], an important family of mammals rich in species, and including a large number of those most useful to man. The form is quite diversiform, the average type, or that represented by the greatest number of species, being exemplified in the antelopes, while extremes are represented by the oxen, the sheep, and the goats. The head is more or less contracted forward, and the nose generally naked, rarely hairy, with the nostrils large and open; the teeth are of the typical ruminant type—*i. e.* M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{0}{1}$ or $\frac{1}{1}$, I. $\frac{0}{3}$; the molars have mostly four crescentic lobes; in the upper jaw the canines are generally absent or small, but rarely hypertrophied; in the lower jaw the canines are approximated to and of the same form as the incisors, so that they are very often regarded as being true incisors, although quite erroneously; the combined canines and incisors form a series uninterrupted at the symphysis; the frontal appendages are persistent, common to both sexes, and developed as sheaths of true "horn" on osseous cores originating from the frontal bones; the feet are provided each with two hoofs, and generally small false hoofs, though these are sometimes absent; the skull has the palatine axis declivous from the occipito-sphenoid axis; the auditory bullæ are produced forward, especially toward the inside, and applied behind to the paroccipital processes; the styloid processes are deflected more or less forward, and enclosed in oblique folds on the outer surfaces of the auditory bullæ; the nasal bones are elongated, and straight or declivous forward, and connected by suture with the lachrymals, supramaxillaries, and sometimes with the intermaxillaries; the supramaxillary and intermaxillary bones are well developed forward; the olfactory organ is normal in size: Cowper's glands exist, and a gall-bladder, generally of considerable size. The family as thus defined excludes the genera *Antilocapra* of America and *Saïga* of the plains of the middle Palæarctic region, each of which represents apparently a distinct family. The genera still embraced are quite numerous, and are susceptible of being grouped into several sub-families; these are the (1) Bovinæ, with 6 genera; (2) Ovibovinæ, with 1 genus; (3) Caprinæ, with at least 2 genera; (4) Rupicaprinæ, with 1 genus; (5) Oryginæ, with 1 genus; (6) Budorcinæ, with 1 genus; (7) Nemorrhedinæ, with 3 genera; (8) Alcelaphinæ, with 3 genera; (9) Cervicaprinæ, with 6 genera; (10) Cephalophinæ, with 1 genus; (11) Antilopinæ or Gazellinæ, with 5 genera. The latest scheme of classification has been contributed by Sir Vincent Brooke to Wallace's work on the *Geographical Distribution of Animals* (1876). (See also the articles ADDAX, ANOA, ARNEE, BISON, BLAUW-BOC, BLES-BOC, BOVIDÆ (properly Bovinæ), BUFFALO, CHAMOIS, ELAND, GAYAL, GAZELLE, GNU, GOAT, IBEX, KOODOO, OVIBOS, SPRING-BOC, STEINBOC, URUS, YAK, and ZEBU, in CYCLOPÆDIA: and SHEEP.) THEODORE GILL.

Boy'den (URIAH ATHERTON), b. at Foxboro', Mass., Feb. 17, 1804, descended from a family of skilful mechanics and manufacturers, and acquired early, at the workbench and the forge, an intimate knowledge of materials and considerable skill as a workman, with which he connected, as a natural gift, a great power of concentration. Having worked as an engineer on the construction of the railroad from Boston to Nashua, he was for many years employed in hydraulic engineering at Lowell and at Manchester, and here he found opportunity to make a comprehensive study of the theory of the turbine water-wheel, which resulted in a practical reconstruction of the engine. The old theory was comparatively simple, but many of its statements differed widely from the facts, and were worse than useless as guides for practice. To correct these errors demanded an exhaustive knowledge of the laws of force of motion and very laborious computations. Mr. Boyden, however, accomplished the task, and his work received practical confirmation by the tests of some of his turbines, which utilized about 95 per cent. of the total power of the water expended, while the water-wheels of the old construction utilized hardly 76 per cent. He donated $1000 to his native town, known as the "Boyden Fund," the interest being expended for educational purposes; the interest was afterward applied to the public library, named the Boyden Library, established in the Soldiers' Memorial Building of the same town. In 1850 he withdrew from business, settled in Boston, and devoted himself to the study of physics and chemistry, which sciences received much encouragement and support from him. D. Oct. 17, 1879. EDWARD SAWYER.

Boy'land (GEORGE HALSTED), M. D., b. in Cincinnati, O., Jan. 19, 1845; graduated at Yale College 1864, and in medicine at Leipsic, Germany, 1874. Is the author of *Six Months under the Red Cross with the French Army*, also of "Salicylic Acid" in London *Lancet*, Nov. 28, 1874, etc. Decorated for services in the French army during the late Franco-Prussian war. Is now a practitioner in Baltimore, Md. PAUL F. EVE.

Bran'dreth (BENJAMIN), M. D., b. at Leeds, England, June 22, 1808, grandson of Dr. Wm. Brandreth, who introduced Brandreth Pills in 1751 in Liverpool, Eng.; came to America 1835; started a laboratory at Sing Sing, N.Y.; State senator 1849 and 1858; proprietor of "Allcock's Porous Plasters" and Brandreth Pills; in 1871 presented to Dr.

Robert S. Newton and his associates the building used by the Eclectic Medical College of the City of New York. D. Feb. 19, 1880.

Bray [in ancient Gallic, *Bray* meant "marsh"], a fashionable watering-place of Ireland, at the mouth of the river Bray, 12 miles S. E. of Dublin, partly in the county of Dublin, but chiefly in the county of Wicklow, is connected by 2 railways with Dublin; has 2 hotels, 6 churches and chapels, a bank, a court-house, a dispensary, a savings bank, a newspaper, and some trade by sea. P. 6086.

Bray, a small parish in Berks co., England, 22½ miles W. of London. P. about 4000. Famous for its vicar, who changed his religion three times during the reigns of Henry VIII., Edward VI., Mary, and Elizabeth, that he might "live and die the vicar of Bray."

Bre'mer (CHARLES), b. in Germany in 1814; was at first a Pietist, but was licensed to preach in the Methodist Episcopal Church, South, by Rev. Dr. Winans in New Orleans in 1842; organized the first two German M. E. churches in New Orleans. D. Sept. 14, 1847. T. O. SUMMERS.

Brew'er (THOMAS MAYO), A. M., M. D., b. in Boston, Mass., Nov. 21, 1814. His grandfather, Col. James Brewer, was a well-known patriot of the Revolution and a leader in the "Boston tea-party" of 1773. Dr. Brewer graduated at Harvard College in 1835, and at the Massachusetts Medical School in 1838. After two years of professional labor, in 1840 he became editor of the Boston *Atlas*, then a leading Whig paper; in 1857 became a partner in the publishing-house of Brewer & Tileston. Dr. Brewer was actively engaged for a lifetime in professional and business duties, but was best known as a thorough and enthusiastic ornithologist. In 1839 he edited a new edition of Wilson's *Ornithology*, for which he prepared a synopsis of all North American birds then known. He was a personal friend of Audubon. One volume of a fine work of his on the *Oölogy of North America* was published by the Smithsonian Institution, but the publication was suspended on account of its great cost. He also wrote most of the biographical portion of the *History of North American Birds*, of Baird, Brewer, and Ridgway, 3 vols. of which were published by Little, Brown & Co. in 1874. D. Jan. 23, 1880.

Bridge of Allan, so named from the bridge across the river Allan, which bounds it on the W., is situated at the southern base of the western termination of the Ochil Hills in Stirlingshire, Scotland. P. 3055. It has several elegant churches, fine hotels, and numerous lodging-houses. About 50,000 visitors frequent it annually on account of its mineral waters and mild and salubrious climate.

Brieg, or **Brig,** small town of Switzerland, canton of Valais, at the junction of the Saltine and the Rhone, and at the commencement of the road across the Simplon; carries on a considerable transit-trade. P. about 1200. Near by is the Brieger Bad, whose mineral springs formerly enjoyed a great reputation for their curative power, and which are still much used.

Briggs (CHARLES AUGUSTUS), D. D., b. in New York City Jan. 15, 1841; studied at the University of Virginia 1857–60, the Union Theological Seminary of New York 1861–63, and the University of Berlin 1866–69; became pastor at Roselle, N. J., in 1870, and professor of Hebrew at the Union Theological Seminary of New York in 1874, and translated and edited the commentaries to the Psalms and to Ezra in Lange's *Commentaries*; received the degree of D. D. from the College of New Jersey 1876.

Bris'tow (BENJAMIN H.), b. at Elkton, Todd co., Ky., in 1833; studied law, and practised his profession successfully in Kentucky till 1861, when, on the outbreak of war, being of strong Union sentiments, he volunteered his services, and as major of the 25th Kentucky Vols. was engaged at Fort Donelson and Shiloh, being wounded in the last-named battle. Afterward, as colonel of the 8th Kentucky Cavalry, he served throughout the war with distinction. About the close of the war he received the appointment of U. S. district attorney for the Louisville district. The ability here exhibited led to his appointment as solicitor-general on the organization of the department of justice in 1870. After two years' service he resigned and became attorney of the Texas Pacific R. R., which position he held but a short time when he returned to the practice of his profession at Louisville, Ky.; was appointed attorney-general in 1873; became secretary of the treasury in 1874–76. GEO. C. SIMMONS.

Britan'nicus, a surname which, on account of some alleged victories in Britain, the Roman senate bestowed in 42 A. D. on the emperor Claudius and his newly-born son by Messalina, Claudius Tiberius Germanicus, and which afterward became the distinguishing appellation of the latter. In 48, Messalina was executed, and Agrippina, the second wife of Claudius, induced him to exclude Britannicus from the throne and appoint Nero, her son by her former husband, successor. After the accession of Nero, however, Agrippina used Britannicus as a means of intimidating him, and to get rid of this rival, Nero poisoned him Dec. 15, 55.

Brom'ley (ISAAC H.), b. at Norwich, Conn., Mar. 6, 1833; entered Yale College in 1849, remaining there two years, and was admitted to the bar in 1851; in Dec., 1858, established the Norwich *Bulletin*, and was its editor till the spring of 1868, when he became editor of the Hartford *Evening Post*; was a member of the State legislature from Norwich in 1860; in 1862 was captain in the 18th Connecticut Vols., and was provost-marshal for two years during the late war. In July, 1872, he left the Hartford *Post*, and assumed a position on the editorial staff of the New York *Tribune* in the following February. J. B. BISHOP.

Brönd'sted (PETER OLAF), b. at Horsens, Danish province of Jutland, Nov. 17, 1780; studied at the University of Copenhagen, then in Paris 1806–08, and undertook comprehensive explorations in Greece and Asia Minor from 1808 to 1813. In the latter year he was made professor of Greek in Copenhagen, but went in 1818 to Rome, and resided there till 1832, visiting Sicily, the Ionian Islands, Greece, and France. Returning to Copenhagen in 1832 as director of the royal museum of antiquities and professor of archæology, he d. there June 26, 1842. His principal work, *Reise i Grækenland* (2 vols., 1826–30), was published at once in Danish, French, and German. He also wrote—*Bidrag til den danske Historie af Nordfranske Manuscripter fra Middelalderen* (1817–18), *Description of Thirty-two Ancient Greek Painted Vases* (1832), *The Bronzes of Syria* (1836), and finally made a very fine translation into Danish of Æschylus's *Orestias*.

Brontotherium. See TITANOTHERIUM, in CYCLOPÆDIA.

Bross (WILLIAM), b. at Montague, Sussex co., N. J., Nov. 4, 1813; graduated at Williams College, Mass., in 1838; lived several years as a teacher; settled in 1848 in Chicago; was associated from 1849 to 1851 with Rev. J. A. Wight in the publication of the *Prairie Herald*; established in 1852, in connection with the late J. L. Scripps, the *Daily Democratic Press*, which was consolidated with the *Tribune* July 1, 1858, and was for several years president of the *Tribune* company. He published a *History of Chicago*, and was lieutenant-governor of Illinois 1865–69.

Brown (OLYMPIA), b. in Kalamazoo co., Mich., Jan. 5, 1835; educated at home; commenced teaching a district school at the age of fifteen, at intervals attending the village academy, Mount Holyoke Seminary, and Antioch College, O.; graduated in 1860; entered the theological school, under the auspices of the Universalist denomination, at Canton, N. Y.; graduated and was ordained in June, 1863; in Feb., 1864, installed over her first parish in Weymouth, Mass.; in 1869–76 preached at Bridgeport, Conn., in the mean time being married to Henry Willis.
SUSAN B. ANTHONY.

Buchnu'an (JOSEPH RODES), M. D., b. at Frankfort, Ky., Dec. 11, 1814; graduated in medicine at Louisville University in 1842; in 1846 became professor of physiology in the Eclectic Medical Institute of Cincinnati; was for several years dean of the faculty; edited the medical journal connected with this school; published for several years *Buchanan's Journal of Man*, and gave in 1854 a synopsis of his lectures.

Buch'tel Col'lege. The corner-stone of this institution was laid July 4, 1871, and it was opened for the reception of students Sept. 11, 1872. It was founded by the Universalists of Ohio and Pennsylvania, and named Buchtel College in honor of John R. Buchtel, who consecrated his wealth to its support. It is a first-class college, offering to students of both sexes equal opportunities for a thorough practical and liberal education. S. H. MCCOLLESTER.

Buck (GURDON), b. in New York City May 4, 1807; graduated at the College of Physicians and Surgeons in 1830; studied in Paris, Vienna, and Berlin, and began to practise in New York in 1833; visiting surgeon of New York Hospital 1837; was, during the latter part of his life, intimately connected with all the most prominent medical organizations in the city of New York. D. Mar. 3, 1877. He was successful in the most difficult surgical operations. In 1876 he published an elaborate treatise, *Contributions to Reparative Surgery*.

Buck'hout (ISAAC CRAIG), b. in Morrisania, N. Y., 1830; studied civil engineering at New York College; held several important positions in the Harlem R. R. Co., and designed the Grand Central R. R. dépôt in New York City. He also designed the plan for sinking the tracks of the railroads entering New York through Harlem; also a plan for an underground railway beneath New York City, and a dépôt for the city of St. Louis. D. at White Plains, N. Y., Sept. 27, 1874. J. B. BISHOP.

Buck'ley (Samuel Botsford), Ph. D., b. in Torrey, Yates co., N. Y., May 9, 1809; graduated at Wesleyan University in 1836; has travelled extensively, chiefly in the Southern States, as a student of botany, malacology, geology, geodesy, etc.; was assistant naturalist and geologist in the State survey of Texas 1860–61; was connected with the U. S. Sanitary Commission 1862–65; State geologist of Texas 1866–67, and was 1871–72 editorially connected with the *State Gazette*, Austin, Tex.; is author of many scientific and other papers, and has prepared a work on the trees and shrubs of the U. S. He discovered the flowers and fruit of the shrub or small tree *Buckleya distichophylla*, named in his honor by Dr. Torrey.

Bufonidæ. See Toad, in Cyclopædia.

Bull'dozing, Bulldoser, or **Bulldozer,** a slang term in process of adoption in Louisiana, having as yet a variable significance. Its first use was in the parishes of Feliciana and Baton Rouge, in the spring and summer of 1876, in describing the doings of a band of a dozen Regulators styled the "Union Stop," who undertook, in the absence of law, to check the stealing and killing of stock, which was destroying the cattle and hogs of that region. The punishment of offenders was with the well-known bull-whip—a hickory handle of 12 or 15 inches and a plaited thong of 3 to 5 feet. A dozen lashes (or the dozen composing the band) gave the name to the process or dose of strapping, and it was called "bulldosing" or "bulldozing." It soon was applied to all summary punishment not authorized by law. More recently, since August and September, 1876, it has become a political term, particularly as applied to the influencing of negro voters by those of their own color. It is now charged and denied that it was used by the whites, but bulldozing has become a term used to describe all the various kinds of intimidation, real or imaginary, used at elections. It has very rapidly grown into use since the Presidential election by editors and political writers. (See the investigation in Louisiana by the House committee of Congress.) The first use of the term is claimed in Clinton, East Feliciana, and imputed to a German soldier of fortune, who was awakened from a drunken sleep in the street by a sudden dash of the Regulators. He exclaimed, "Hurra for the bulldozers!" It is also traced, with more ingenuity than probability, to the pulldoo, a Southern water-fowl, that arrives in the night and surprises by his numbers. Bulldozing is supposed to be a corruption of pulldoo, the mysterious arrival by night lending plausibility to the theory. Its rapid adoption by political writers of every class in the U. S. to describe all sorts of political influence warrants this analysis of its origin. Its meaning, however, is not yet well determined. C. G. Forshey.

Bü'low, von (Friedrich Wilhelm), Baron, b. on the paternal estate of Falkenberg, Prussian province of Brandenburg, Feb. 16, 1755; entered the army in 1769, and was a lieutenant-general at the opening of the war of independence in 1813. Twice he defeated Oudenot in minor encounters, and by his victory over Ney at Dennewitz (Sept. 6, 1813) he prevented the French from pushing onward to Berlin. In the battle of Leipsic he took a conspicuous part, and drove then the French out of Westphalia, Holland, and Belgium, joining the allies in Paris, where the Prussian king made him count of Dennewitz and gave him estates worth $200,000. He also distinguished himself at Waterloo. D. at Königsberg Feb. 25, 1816.

Bülow, von (Hans Guido), b. at Dresden Jan. 8, 1830; studied law in Leipsic and Berlin, but determined, under the influence of Richard Wagner and Liszt, to devote himself exclusively to music; studied under Liszt at Weimar 1851–53, and settled in 1854 in Berlin, where he was made professor of the piano at the Conservatory of Music in 1855. Having made several concert-tours in Germany and Russia, and acquired a great reputation as a pianist, he removed in 1867 to Munich, where he became chapel-master to the king. He has composed several pieces both for the pianoforte and orchestra, and written much for the *Neue Zeitschrift für Musik*, and both his compositions and his writings show the enthusiasm with which he has embraced the ideas of Wagner.

Bu'reau Ver'itas, an institution for the classification of the steamships and sailing vessels of all nations, for use by underwriters, maritime insurance agents, etc., with head-quarters at Brussels in Belgium. It was founded at Antwerp, Belgium, in 1828, by Charles Bal, Esq. During the revolution of 1830, which separated Belgium from Dutch rule, the Bureau Veritas was removed to Paris, France, where it was long known as the French Lloyd's. In the Franco-German war of 1870–71 the bureau was finally located at Brussels. Its surveyors and agents are found in the seaports of all maritime countries, and their ratings of vessels are the fruit of the utmost severity in examination. H. H. McFarland.

Bur'gess (John W.), b. at Cornersville, Giles co., Tenn., Aug. 26, 1844; was educated at Cumberland University, Lebanon, Tenn., and Amherst College, Mass.; whence he graduated in 1867; studied law, and was admitted to the bar of Massachusetts in 1869; was appointed professor of English literature and political economy at Knox College, Galesburg, Ill., in 1869; went to Europe in 1871; studied history and public law at Göttingen, Leipsic, and Berlin; was appointed professor of history and political science at Amherst College in 1873, and professor of political history and public law at Columbia College, New York, in 1876.

Business Colleges are of comparatively recent growth in the U. S., although schools for instruction in book-keeping, writing, and arithmetic have been in vogue for the past 50 years. Among the pioneers in this field were James Arlington Bennett of New York, R. M. Bartlett of Cincinnati, G. N. Comer of Boston, and Peter Duff of Pittsburg. Mr. Bartlett first appropriated the term "college," and first issued "diplomas" upon graduation. In 1853, Bryant & Stratton established, in the city of Cleveland, the first of a series of "mercantile colleges" afterward known as the "Bryant & Stratton International Chain of Business Colleges," which in 1866 comprised some 50 separate schools in the principal cities of the U. S. and Canada. The co-working of so many schools under one management, and the employment of the best talent as teachers did much to elevate the work, while the identification of the "Spencerian system of penmanship" with the enterprise gave it a peculiar prominence and zest. In 1867 the colleges of the "chain" passed into the hands of the resident partners, and have since been conducted independently, though with harmony and reciprocity. Outside of this combination are many excellent and prosperous schools, the number at present being, in all, about 140, with an approximate daily attendance of 25,000 students. The course of study varies in different schools, but embraces generally, besides the studies named, commercial law, commercial geography, political economy, modern languages, phonography, telegraphy, practical grammar, etc. The main feature of the more important schools is the business practice which comes through actual correspondence between the students of the several institutions. This is done in a manner and with a degree of efficiency and thoroughness which cannot be approached through any isolated school. The peculiar work of these institutions has necessitated the production of a large number and variety of textbooks, which have greatly added to our technical literature. S. S. Packard.

But'ton [Fr. *bouton*, "bud"], the name applied to an article of dress of various forms used either for ornament or for fastening together the parts of a dress by means of a loop or worked buttonhole. Buttons are used for various articles of male and female apparel, and for hats, bonnets, shoes, and gloves. The word is also applied in *carpentry* to a flat oblong piece of wood or metal, turning on a nail or screw, to fasten doors and the like; and in *assaying* to a round mass of metal remaining in the cupel after fusion; but the use of the word in relation to articles of dress is the one of most importance. The button is generally considered a sign of civilization. The savage fastens his blanket or tunic, his leggings and moccasins, with strings, and has no idea of buttonhole or button; and it is only when a considerable degree of civilization is attained that we find buttons taking the place of strings or lacings, while fashion, in the artificial condition of society in great cities, requires a profusion of buttons, not so much for use as for ornament. Except the occasional use of a gem to fasten the toga at the neck, the Greeks and Romans seem to have had no idea of buttons, as indeed their flowing robes did not require them. They were first applied to dresses (probably in the thirteenth or fourteenth century) for purposes of ornament only, but somewhat later the buttonhole, an expansion of the idea of the loop, was invented, and the button became indispensable for the dress. In the beginning of the seventeenth century the manufacture of buttons had attained some importance in England, Birmingham being then, as now, its principal seat. These buttons were of cloth, covering a wooden disk, of gold, steel, and ivory, the last three the work of the goldsmiths, who were very expert in the arts of chasing and carving metals. Some of the steel buttons made at the Soho works about this time were sold at 140 guineas the gross, or almost $5 the button. About 1745, Matthew Boulton made many improvements in inlaid and steel buttons. Gilt buttons came into use soon after the accession of George III. in 1760, and John Taylor of Birmingham, originally a cabinetmaker, patented many improvements in gilt, plated, and lacquered buttons. The making of the shanks or eyes of these buttons was improved by Ralph Heaton, also of Birmingham, not far from 1800. This is still a separate branch of the business at Bir-

mingham. From 1760 to the present time the manufacture of buttons has been a constantly-growing industry in England, France, Switzerland, and the U. S. All descriptions of buttons may be classed under three distinct heads—viz. shank buttons, hole buttons, and covered buttons—but each kind is made of a great variety of materials and an almost infinite diversity of forms. The shank buttons, those having a wire loop, eye, or shank to attach them to the dress, are made of gold, silver, brass gilt or bronzed, copper or bronze, nickel, iron, steel, ivory, bone, mother-of pearl, and other shells, Whitby jet and other forms of coal, glass, jade, malachite, amber, tortoise-shell, horn, vegetable ivory, wood, papier-mâché, bois brulée, India-rubber, gutta-percha, steatite, clay, etc. The hole buttons (two, three, or four holes) are made of iron, sheet iron, sheet brass, sheet tin, wood, paper—of both these combined with brass or sheet tin—ivory, bone, porcelain, or white glazed ware, glass, mother-of-pearl, papier-mâché, clay, etc. The covered buttons, having a basis of wood, brass, zinc, or tin, have their covering of farmers' satin, prunella, broadcloth, brocade, velvet, silk, mohair, grenadine, twist, linen, cotton, and, in short, every description of textile fabric. Both the shank and the covered buttons are to a considerable extent made on the *shell* plan—*i. e.* the face of the button is stamped out of a thin sheet of metal—and may have a flat, oval, or round surface as desired; and the back or under surface is also stamped, and its edges being turned, it is pressed into the upper shell and locked there by the pressure. The principle on which all shell buttons are made was first devised by B. Sanders, a Dane who had lost most of his property in Copenhagen in the bombardment of that city in 1807, and removed to Birmingham, England, where he commenced the manufacture of buttons. He applied it only to covered buttons, which he made of sheet brass or tin in two parts, the upper blank or disk having its edge turned up and being covered with cloth, silk, or lasting, and the under blank, which was smaller than the upper and convex in form, having a wire shank, and the cloth and paper or cardboard which was to keep it in place put inside of it, and the two were pressed together, the turned edges interlocking so as to make a perfect button. An improvement was made in these by a son of Mr. Sanders, the lower blank having a circular hole in it (and receiving in consequence the name of "collet"), through which in the act of pressing the two blanks together a portion of the cloth or textile inside of the collet was thrust, so as to make a flexible cloth shank in place of the wire one. Other modifications were made by other inventors which reduced the price and greatly increased the facility of production. One of these was the production of what is known as the silk-back button, which dispenses with the collet, though it substitutes for it a round piece of sheet iron smaller than the upper blank. The so-called silk-back is a very thick heavy cloth having a silk face, which is cut out, of the proper size, by a die, its back having first been coated with a heavy sizing; a filling of soft spongy paper is placed upon this sizing, and the back is then gathered over the small blank of sheet iron and pressed into the upper blank or shell, which had previously been covered with the proper material, and the button is completed, no metal appearing upon either surface. In the shell covered buttons sheet iron is now used for the blanks, and where the metal shows, as in the ordinary flexible shank buttons, it is lacquered. The process for making the metallic shell buttons is different, though the principle is the same. These buttons, whether of flat or oval surface, and whether figured or plain, are made from rolled brass plate; originally, the flat buttons were solid and struck out as blanks from a thick plate, the eye or shank soldered on, and the whole finished, polished, and gilt or silvered by the old cream-of-tartar process for silvering or the mercury amalgam for gilding. It was said that by this latter process six cents' worth of gold would suffice for gilding a gross of buttons. Both processes have been superseded by electro-plating. (See GILDING and ELECTRO-PLATING, in CYCLOPÆDIA.) When buttons began to be made on the shell-plan the upper blank was forced by the falling of a heavy weight into a finely-engraved die of hardened steel, which gave it the oval form and the beautifully-ornamented surface, and the under blank into another die, which stamped upon it the maker's name or trade-mark, and at a later date riveted the shank (which before had been soldered to it) into this plate; a filling of stout paper or binder's board was then placed upon it. The two plates were then pressed together by a fly-press, and the button was trimmed and ready for the gilding. When gilt it was burnished and set on cards containing a dozen, when it was ready for market. Subsequent improvements have combined and simplified these processes, so that now a single machine completes the button except the gilding, burnishing, and carding; and the last process is also performed by a machine. Embossed buttons have been made of horn softened by heat, dyed and pressed in a die, of *bois brulée* (sawdust and shellac heated), and of India rubber and gutta percha vulcanized, which were for some years very popular. These have now mostly given place to oval and flat buttons of ivory, bone, vegetable ivory, mother-of pearl, and celluloid. The ivory, bone, and vegetable ivory buttons are engraved and dyed in a variety of patterns and checks. The mother-of pearl may be either of the ordinary color of pearl or what is known as smoked pearl. The celluloid buttons are made in moulds and dies like the vulcanite and horn. Those made of VEGETABLE IVORY (see in CYCLOPÆDIA), at present very popular, are cut from slabs sawed out of the vegetable ivory-nut by bits attached to spindles and made to turn very rapidly, and are then turned, polished, dyed, and worked in figures in a lathe. They are then carefully sorted and put upon cards. The hole buttons, when made of ivory, vegetable ivory, pearl, malachite, onyx, etc., are cut by a tubular saw or bit revolving with great rapidity; the eyes are made by fine revolving drills. Pearl shirt buttons are made in great quantities both in this country and Europe, and many of them are made of cheap substitutes for pearl. Agate or feldspar buttons for under-clothing, as well as clay buttons, are made in moulds and baked and glazed like porcelain. They are mostly imported, requiring very cheap labor for their production. The greater part of the pantaloon buttons in use are made either from japanned iron stamped out by a heavy die or embossing swedge, or are made as shell buttons, with the back of paper or wood, and the whole button made by one machine and almost by a single blow. They are afterward japanned. Fancy and ornamental buttons for ladies' dresses are sometimes made of combinations of cloth and glass or papier-mâché, pearl, metal, or choice woods, sometimes of vulcanite, glass, pearl, or Whitby jet, but oftener at the present day of silk, velvet, silk cords and figures, or what is known as passementerie, or of brocade and embroidered silk. These are usually made upon a wood foundation, especially if they are oval or of fanciful shape. Their manufacture is often carried on in connection with other dress trimmings.

The manufacture of covered buttons in this country, except in its simpler forms of hand-made covered buttons, was not attempted earlier than 1825 or 1826. Samuel Williston, who was the founder of the covered-button business in this country, commenced covering buttons by hand at Easthampton, Mass., in 1826, and by the gradual introduction of machinery and a consolidation of his methods and machines with those of the Haydens at Haydenville in 1834 (the Haydens had been making buttons in a small way after the Sanders patterns from 1831), laid the foundations of the extensive works of the National Button Co., which employs 175 hands and can turn out 2500 gross per day. Waterbury, Conn., was one of the early seats of the manufacture, but has been largely occupied with the production of metal buttons. There are 8 button-factories in Waterbury; 19 factories were reported in New York City in 1870, besides 3 in Brooklyn, the larger part making ornamental dress buttons; 13 in Philadelphia; 13 in Massachusetts; 22 in Connecticut, and 8 in New Jersey. In Great Britain five-sevenths of the manufacture are concentrated in Birmingham, 4980 hands being employed in the business there, and not quite 2000 elsewhere. London has 58 factories; Germany, 65; Austria, 39; Hamburg and Lubeck, 7; Brussels, 5; Switzerland a large number, though most of them on a small scale. France has great numbers of shops where dress buttons are made in connection with other dress trimmings, and also many engaged in the production of pearl buttons. The statistics of the button manufacture in the census report of 1870, like those of many other branches of manufacture, were very imperfect. That report gives 64 establishments (there are known to have been 78 in five States at that time), employing 1912 hands (617 men, 949 women, 346 children), with a capital of $1,013,700, paying $580,380 in wages, using raw material to the amount of $751,183, and producing annually buttons to the value of $1,778,893. The present condition of the manufacture would require the trebling of all these figures. C. B. JOHNSON.

Byrd (HARVEY LEONIDAS), M. D., b. in Salem, S. C., Aug. 8, 1820; received his degree in medicine from the University of Pennsylvania 1847; was first professor of materia medica and therapeutics in the Savannah Medical College; then professor of principles and practice in the Oglethorpe Medical College, Ga.; professor of obstetrics in the Washington University, and professor of the diseases of women and children in the College of Physicians and Surgeons of Baltimore; was also dean of the three first named, and president of the last; served as surgeon during the civil war, and has written largely for the medical journals. PAUL F. EVE.

C.

Ca'bell (James Lawrence), A. M., M. D., LL.D., b. in Nelson co., Va., Aug. 26, 1813; studied medicine at the universities of Virginia, Maryland, and Pennsylvania, and finally in Paris; was appointed professor of anatomy and surgery in the University of Virginia in 1837; published a volume on the unity of mankind and numerous minor essays and monographs, and is president of the State board of health and vital statistics of Virginia. Paul F. Eve.

Ca'dy (Daniel), b. in Columbia co., N.Y., in 1773; admitted to the bar in 1795, and practised with great distinction for over sixty years; was several times a member of the legislature of New York and of Congress, and for eight years judge of the supreme court and the court of appeals of New York. His wife was a daughter of Col. James Livingston, an officer in the army of the Revolution, and one of his five daughters is the celebrated Elizabeth Cady Stanton. D. at Johnstown, N. Y., 1859. A sketch of his life by his son-in-law, Henry B. Stanton, is contained in vol. xviii. of Barbour's *S. C. Reports*.

Cal'laway (Elisha), b. in Delaware Jan. 8, 1792; joined the South Carolina Methodist Episcopal conference Jan., 1818, and was a most laborious minister, laboring in extensive fields in South Carolina, Georgia, Alabama, and Mississippi. He represented the Alabama conference in the Louisville convention, at which the Methodist Episcopal Church, South, was organized. He belonged to the North Mississippi conference at the time of his death, June 21, 1870. T. O. Summers.

Cam'eron (Angus), b. at Caledonia, Livingston co., N. Y., July 4, 1826; studied law in Buffalo, and in 1857 removed to La Crosse, Wis.; served two years as representative, being Speaker one year, and four years as senator in the legislature of Wisconsin; was regent of the University of Wisconsin 1866–75, and in 1875 was chosen U. S. Senator from that State. J. B. Bishop.

Cameron (Sir Duncan A.), b. about 1808; entered the British army as ensign in 1825, and in 1854 became colonel; commanded the 42d regiment at the battle of Alma; the Highland brigade at the battle of Balaklava, in the expedition to Kertch, the siege and fall of Sebastopol, and assault of the outworks; was created a C. B., officer of the Legion of Honor, and received a medal with three clasps from his own government, besides the Sardinian and Turkish medals. He was in command of the forces in New Zealand during the war of 1863–65, with the local rank of lieutenant-general, where he distinguished himself; was appointed colonel of the 42d Highlanders in 1863, lieutenant-general in 1868, and general in 1874; governor of the Royal Military Academy at Sandhurst 1868–75; was nominated a K. G. C. B. in 1873.

Cameron (Henry Clay), Ph. D., D. D., b. at Shepherdstown, Jefferson co., Va., about 1830; graduated at the College of New Jersey in 1847, and at the Princeton Theological Seminary in 1855; was appointed adjunct professor of Greek in 1855, and professor in 1861, at the College of New Jersey; was licensed to preach in 1859, and ordained to the ministry in the Presbyterian (O. S.) Church Feb. 1, 1863; was appointed a member of the board of visitors of the U. S. Military Academy at West Point in 1876, and has contributed largely to various magazines and periodicals.

Cameron (James Donald), eldest son of Hon. Simon Cameron, b. at Harrisburg, Pa., May 14, 1833; graduated at Princeton College in 1852, and has since been interested and identified with the development of the coal, iron, lumber, and manufacturing interests of Pennsylvania, residing at Harrisburg; was cashier, and afterward president, of the Middletown Bank, and in 1861 was made vice-president, and in 1863 president, of the Northern Central R. R., which position he held until his resignation in 1874, being then succeeded by Hon. Thomas A. Scott. This road was of great service to the government during the war (although several times cut by the Confederates) as a means of communication between Pennsylvania and the national capital *viâ* Baltimore, and after the war, under Mr. Cameron's administration, it was extended to Elmira, so as to realize its original purpose of forming a direct communication from the lakes to tide-water at Baltimore. He has always been an active Republican; on May 22, 1876, was appointed secretary of war in Pres. Grant's administration, and in 1877 took his father's place in the Senate.

Can'dler (Milton A.), b. in Campbell co., Ga., Jan. 11, 1837; received a classical education, graduating at the University of Georgia in 1854; studied law, and was admitted to the bar in 1856, commencing practice in De Kalb co., Ga.; was elected to the lower house of the State legislature, occupying a seat in that body 1861–63; was elected to the State constitutional convention in 1865, and to the State senate 1868–72; was elected to the 44th Congress, and re-elected to the 45th. Alexander H. Stephens.

Canos'sa, small town of Italy, 24 miles S. W. of Modena, contains the ruins of the famous castle belonging to Matilda of Tuscany, before whose gates the German emperor, Henry IV., stood three days bareheaded and barefooted before Pope Gregory VII. would admit him to his presence.

Capel (Thomas John), b. at Brompton, Kent, England, Oct. 28, 1835; was educated at Layston and Hastings; assisted in 1852 in the foundation of the normal school at Hammersmith, London; was appointed vice-principal of that institution in 1856, but resigned his office in 1859 on account of ill-health; lived from 1859 to 1869 at Pau in the Pyrenées, where he founded a mission for English Catholics, and became private chaplain to the marquis of Bute in 1869. The pope has conferred on him the title of *monsignore*.

Ca'pen (Elmer Hewitt), b. at Stoughton, Norfolk co., Mass., in 1838; graduated at Tufts College in 1860, studied law one year in the Harvard Law School, and was admitted to the bar in 1863; was elected to the legislature in 1859, while still in college. After practising law for a short time in his native town, he began the study of theology, and was ordained in Gloucester in 1865, where he preached for four years; then preached for one year at St. Paul, Minn., and in 1870 accepted a call to the First Universalist church in Providence, R. I. In 1875 he became president of Tufts College. J. B. Bishop.

Ca'pers (Rev. Samuel Wragg), b. in Georgetown, S. C., Mar. 5, 1797; after receiving a classical education entered the legal profession, which he abandoned for the ministry, and joined the South Carolina Methodist Episcopal conference in 1828. He was a member of the Louisville convention at which the Methodist Episcopal Church, South, was organized. D. in Camden, S. C., June 22, 1855. T. O. Summers.

Car'nochan (John Murray), M. D., b. at Savannah, Ga., in 1817; studied medicine at Edinburgh and various places on the European continent; began to practise in New York in 1847, and soon gained distinction for his bold and successful surgical operations. Thus, he excised the whole trunk of the second branch of the fifth pair of nerves for the cure of neuralgia depending upon disease in the nerve. This nerve was cut out from the infraorbital foramen to the foramen rotundum, and consequently involved an operation through the malar bone to the base of the skull. In 1852 he tied the femoral artery, and thus ingeniously cured a disease of exaggerated nutrition, *elephantiasis arabum*, which operation has been accepted in Europe and extensively practised. He also tied the primitive carotid artery on both sides for the cure of elephantiasis of the head-base and neck. He exscected the entire radius in 1853, the entire ulna in 1854, and has also exscected the entire lower jaw and the calcaneum. In 1851 he became professor of surgery at the New York Medical College and surgeon-in-chief to the State Immigrant Hospital. He has published many valuable professional monographs and lectures, a treatise on *Congenital Dislocations* (1850), a translation of Rokitansky's *Pathological Anatomy*, etc.

Carpet-Bug. See Anthrenus scrophulariæ, in Appendix.

Carruth'ers (Robert), b. at Dumfries, Scotland, Nov. 5, 1799; was apprenticed to a bookseller; became in 1828 editor, and in 1831 proprietor, of the Inverness *Courier;* published with Robert Chambers the *Cyclopædia of English Literature*, and alone an annotated edition of Boswell's *Journal of a Tour to the Hebrides*, etc. D. May 26, 1878.

Ca'ry (Samuel Fenton), b. in Cincinnati, O., Feb. 18, 1814; graduated at Miami University 1835, at the Cincinnati Law School 1837; retired from law-practice in 1845, and became a farmer; was in Congress 1867–69, serving on important committees, and was the only Republican in the House of Representatives who voted against the impeachment of Pres. Johnson; was nominated by the Inde-

pendent party at Indianapolis, May 18, 1876, for Vice-President of the U. S., with Peter Cooper as President.

Ca'sey (THOMAS LINCOLN), b. at Madison Barracks, N. Y. (a U. S. infantry station near Sackett's Harbor), May 10, 1831; was graduated at the U. S. Military Academy in 1852, and assigned to the corps of engineers as brevet second lieutenant, rising through successive grades to be lieutenant-colonel 1874; served as assistant engineer on fortifications and river and harbor improvements Delaware Bay and River until 1851; assistant professor (1854-57) and principal professor of engineering at the Military Academy 1857-59; in command of engineer troops department of Oregon 1859-61; on staff of general commanding department of Virginia season of 1861; in charge of construction of fortifications on coast of Maine and New Hampshire 1861-67, except while on special duty with fleet during the first expedition to Fort Fisher 1864; brevet lieutenant-colonel and colonel for services during the rebellion. Since 1867 in charge of the fortification division of the engineer department at Washington. G. C. SIMMONS.

Cass, an eastern county of the Territory of Dakota. It is bounded E. by Red River of the North, which separates it from Minnesota, and whose tributaries, such as the Cheyenne and others, drain it. The surface is gently undulating and the soil productive, especially along Red River. Cap. Fargo.

Castanhe'da, de (FERNÃO LOPEZ), b. probably about the year 1500; d. in 1559; went to India with his father in 1528, and devoted many years to study, personal examination of local records and scenes of important events, and to the composition of his valuable *Historia do Descobrimento e Conquista da India pelos Portuguezes*, the several books of which were printed in different years from 1551 to 1561. The publication of the first and second books preceded that of the first decade of the *Asia* of De Barros, but by so short an interval that the work of Castanheda could hardly have been used by De Barros, who no doubt derived his material chiefly from original sources. For some not obvious reason, the *Historia* of Castanheda seems to have made a greater impression on the European public than the more attractive labors of De Barros, for the first book of the *Historia* was translated into French in 1553, and the whole work into English some years later, while De Barros, we believe, has never been translated into either language, and even Camoëns is said by Portuguese critics to have drawn his historical facts altogether from Castanheda. Castanheda has the merits of fulness of detail, clearness of exposition, and fidelity to the best authorities, and, though inferior as a writer to his distinguished rival, he is, by no means, superseded as a source of information on his subject. The best edition of the *Historia* is that of Lisbon (1833 *seq.*), in 7 vols. sm. 4to, which conforms to the original orthography. GEORGE P. MARSH.

Cat'alan Language and Literature. After the consolidation of the different political jurisdictions of Spain into a single state was consummated under Ferdinand and Isabella, near the close of the fifteenth century, the predominance of Castile completely overshadowed the other provinces, and gradually threw into obscurity their languages and their literature. The local dialects were sooner or later abandoned to the populace, and Castilian became the almost universal language of culture and of public life. But the independent and insubordinate Catalans long held tenaciously to their native tongue; it was not till the close of the seventeenth century that Castilian supplanted it, and there are instances of its employment, not only for literary but for official purposes, for a century later. It has now, however, followed the fate of the other provincial dialects, and though still spoken in a great variety of forms by the inferior classes over a wide range of territory, and not unfrequently employed as a vehicle for *belles-lettres* dilettanteism, it can no longer be said to have a living status in the literature of Europe.

Considered simply as an object of linguistic study, the Catalan shares with the other dialects of the Hispanic peninsula the advantage of having an approximately known origin and date. For, notwithstanding the opinion of Pers, who holds it to be an indigenous speech, there is no room for doubt that it originated in the dialect of the Roman camps and public offices, and of course its history begins with the Roman conquest. Hence, it, as well as the other Spanish provincial tongues, is essentially younger and less primitive than the numerous local dialects of Italy, many of which are probably as old as Latin itself. Of course, Catalan, as well as Castilian, Galician, and the other provincial tongues, was developed under circumstances peculiar to itself, and like them has maintained in all its multifariousness a marked individuality. The linguistic—or at least the rhetorical—affinities of the Catalan, or as, since the end of the fourteenth century, it has often been called, the Lemosin, with the Provençal, and in some points of structure even with Northern French, are greater than with Castilian, although its vocabulary, with certain wide orthoepical, orthographical, and inflectional differences, is the same as that of this latter dialect. The frequent dropping or contraction of the inflected endings shortens the words to that degree that a Catalan original ordinarily covers not more than three-fourths as much letter press as a literal Castilian translation, and monosyllables are so common that Ballot cites a poem in ninety-six verses, each of seven words of a single syllable. The brevity of the words and their frequent consonantal endings in Catalan necessitate an abruptness of utterance and an *accent* or rhythmic modulation much less agreeable to the ear than the pronunciation of the sonorous Castilian, but this disadvantage is compensated by a simplicity, a directness, and a logical precision of periodic structure which give to it, at least as a vehicle of prose composition, a decided superiority over the periphrastic and cumbrous language of Castile.

So large a proportion of the early monuments of the Catalan and Valencian speech—for the shades of distinction between the two are slight, and we must treat them as practically one—remain still unpublished, and have not yet been subjected to thorough critical examination, that the chronology of the dialect and its literature is not definitively established. Doubtless, it existed for centuries only as a spoken tongue, but its most ancient written relic yet discovered is said to be a document of the year 1037, in which Catalan words and phrases are intermixed with the Latin text. As a literary language it cannot be said to have become fairly established until toward the close of the thirteenth century. At the beginning of the fourteenth century the various very closely-allied dialects then grouped under the general name of Catalan composed the vernacular of so large a population in Northern Spain and Southern France that Ramon Muntaner, writing in 1325, can hardly be charged with exaggeration in affirming (*Cronica*, cap. xxix.) that "in no nation are there so many who use one and the same language as of the Catalans." The important commercial and political relations of the Aragonese kingdom with the other Spanish Moslem and Christian states, with France, with Italy, with Sicily, and finally with Greece, brought the Catalans constantly into friendly or hostile contact with all these nations, and their literary men imbibed more or less of the intellectual culture of all of them. The writings of Ramon Lull and other writers show traces of a familiarity with Arabic, and the Italian poets were studied, imitated, and translated by Catalans in the very infancy of Italian literature. But though the native character, sentiments, and habits of thought were never entirely obliterated, yet most of the Catalan poets have too little individuality and originality to make them really worthy of study for the general purposes of literary culture.

In our survey of this literature our limits of space must confine us to its published and generally-accessible monuments, and as the works of Catalan and Valencian poets who either wrote in Provençal or followed Provençal models belong rather to the history of that school than to that of the native literature of North-eastern Spain, we shall but very briefly notice their productions.

Apart, then, from the linguistic interest of Catalan as a distinct and peculiar offshoot from the ancient Italic stock, its prose, and especially its historical literature, forms its chief and almost only claim to attention of the foreign general student. The oldest published work of this class we possess is the *Cronica del Rey En Pere e dels seus antecessors*, by Bernat d'Esclot. This very interesting and valuable chronicle covers the period between the early part of the twelfth century and the death of King Don Pedro in 1285, in which year it is supposed to have been written. (See D'ESCLOT.) The spirited and justly-celebrated *Cronica Catalana* of Ramon Muntaner embraces the same period, but comes down to 1328. (See MUNTANER, in CYCLOPÆDIA.) Of not inferior interest to either of these, supposing it authentic, is the *Libre dels Feyts . . . d'En Jacme lo Conqueridor*, or autobiography of King Don James the Conqueror, which, though considered genuine by the patriotic criticism of most native investigators, is thought by many foreign scholars to be a production of about the middle of the fourteenth century. (See JACME, in CYCLOPÆDIA.) The *Cronica del Rey En Pere* (Peter the Cruel, Peter the Punctilious), by himself, is, we believe, of undisputed authenticity, and carries the history down to 1380. The *Libre dels Feyts d'Armes de Catalunya*, by Mossen Bernat Boades, continues the military annals to 1420. Many original historical documents of earlier and later periods are contained in the *Coleccion de Documentos inéditos del Archivo-general de la Corona de Aragon*, now in course of publication at Barcelona, of which about forty octavo volumes have appeared. The principal Catalan historians since the invention of print-

ing are Tomich, *Historia dels Reys de Arago é Comptes de Barcelona* (Barcelona, folio, 1495); Carbonell, *Chronica de Espanya* (folio, Barcelona, 1546); and Pujades, *Chronica General de Catalunya* (parte prim., Barcelona, 1609, folio; the following parts are in Castilian). The Catalan prose-writer whose name is oftenest noticed abroad is Ramon Lull (A. D. 1235–1315), a very voluminous philosophical and mystical author, best known by his *Ars Magna*, or *Lulliana*, in Latin. A Latin religious romance by him was translated into Catalan and published at Valencia in 1521 under the title *Blanquerna, qui tracta de cinq estements de persones*, etc., etc. Many of the Latin writings of Lull are contained in an edition published at Mayence (1721–42) in i.–vi., ix.–x volumes. His works in his own tongue remain chiefly in manuscript, though Konrad Hofmann printed in the *Transactions* of the Royal Bavarian Academy (xii. B. iii. Abth. 1812) an apologue by Lull in the original, with a German translation. This is one of 365 tales narrated in a huge work entitled *Libre de Maravelles*, and is a new, or rather old, version of the story of *Reynard the Fox*, agreeing, however, with the French and Dutch fables only in subject. (See LULL, in CYCLOPÆDIA.) Translations of parts, at least, of the Bible into Catalan were made at an early date, and there exist several romances of chivalry in the same dialect, one of which, *Tirant lo Blanch*, professedly translated from English into Portuguese, and from Portuguese into Valencian, by Juan Martorell, was published at Valencia in 1480.

To what we have said of the general character of Catalan poetry the works of Ausias March (*circa* 1400–60) form a conspicuous exception. They were indeed, if not inspired, certainly suggested, by the poems of Petrarch and the Provençals, but they are generally simple, unaffected, tender, and graceful, and not wanting in originality. (See MARCH, AUSIAS, in CYCLOPÆDIA.) The *Libre de les Dones* of Jayme Roig also possesses interest, if not high literary merit.

In the present generation much has been done by private individuals and by literary associations to revive the cultivation of the native tongue by the republication of old works and by original composition, and French and German scholars have essentially aided this movement. Buchon published in 1841 a translation of Muntaner, and in the same volume the original text of D'Esclot; Lanz printed an edition of Muntaner in Catalan at Stuttgart in 1844; Bofarull, an edition of the same chronicler at Barcelona in 1860, and of the *Cronica de Don Pedro el Ceremonioso* at Barcelona in 1850. The beautiful *Biblioteca Catalana*, now in course of publication by Verdaguer at Barcelona, is devoted to the publication of old rare or inedited works, and deserves warm encouragement. Briz has printed (Barcelona, 1867) a *Llibre dels Poetas*, or anthology of poems of the twelfth to the eighteenth centuries, an edition of Ausias March (Barcelona, 1864), and with Caudi and Salto a collection of *Cants Populars Catalans* in 4 vols. 8vo (Barcelona, 1866–74). Of modern original authors in this dialect we may cite Ros Carlos, *Rondalla de Rondalles* (Valencia, 1776); Balaguer, *Poesias Catalanas* (2 vols., Barcelona, 1814); *Los nous Trovadors* (a collection), by Bofarull (Barcelona, 1858–59, 2 vols.), and the Proceedings of the Catalan Academy, *Jochs Florals* (Barcelona, 1859–73, 15 vols. 8vo).

For more detailed information see, besides general works on Spanish literature, Fuster, *Biblioteca Valenciana* (Valencia, 1827–30, 2 vols. folio); Torres Amat, *Memorias para ayudar a formar un Diccionario critico de los escritores Catalanes* (Barcelona, 1836, 1 vol. 8vo), and supplement by Corminas (Burgos, 1849, 1 vol. 8vo); Ballot, *Gramatica y Apologia de la Llengua Cathalana* (Barcelona, 1814, 12mo); Bofarull, *Estudios Sistema Gramatical y Crestomatia de la Lengua Catalana* (Barcelona, 1864, 12mo); Pers, *Historia de la Lengua y de la Literatura Catalana* (Barcelona, 1857, 8vo); Cambouliut, *Essai sur l'Histoire de la Littérature Catalane* (Paris, 1858, 8vo); and especially Helfferich, *Raymund Lull und die Anfänge der Catalanischen Literatur* (Berlin, 1858, 8vo). The various French and German journals devoted to Romance literature may be consulted with advantage. Perhaps the best dictionary is that of Labernia, Catalan, Castilian, and Latin, and Castilian, Catalan, Latin (Barcelona, 1839, 4 vols. 8vo).

GEORGE P. MARSH.

Catastom'idæ [from *Catastomus*—κατά, "below," and στόμα, "mouth"—the typical genus of the group], a family of fishes of the order Teleocephali and sub-order Eventognathi, containing the fresh-water suckers of North America. The body varies between an elongated subcylindrical and an oblong more or less compressed contour; the scales are of medium or rather large size, and cycloid; the lateral line is generally present and decurved, but sometimes absent; the head is diversiform; the opercular bones normally developed; the nostrils double; the mouth more or less inferior, and provided with fleshy and generally papillose or crenated lips; the upper jaw is formed in the middle by the small and lamelliform intermaxillaries, and on the sides by the supramaxillaries; teeth are wanting in the jaws; the pharyngeal bones are developed in a falciform manner, and provided with a row of numerous comb-like teeth; the branchial apertures are restricted to the sides; branchiostegal rays three on each side; dorsal variable in development; anal posterior, and generally short and high; caudal large, and more or less emarginated; pectoral fins low down, but lateral and with their rays branched; ventral fins abdominal; the intestinal canal is very long; the stomach simple and destitute of pyloric cæca; the air-bladder is large, unprotected by an osseous capsule, and divided by transverse constrictions into two or three regions. The family is a very characteristic one, and is richly developed in the fresh waters of the North American continent, but a few species are also found in Northern Asia (Siberia, China, and Japan). The species are generally known in the U. S. under the name of sucker, but some of the forms are also called chub, carp, etc. About eleven or twelve genera may be recognized, which represent three quite distinct groups of perhaps sub-family rank; these are—(1) Catastominæ, including the genera *Catastomus*, *Hypentelium*, *Ptychostomus*, *Moxostoma*, *Placopharynx*, *Pantosteus*; (2) Bubalichthyinæ, comprising the genera *Carpiodes*, *Bubalichthys*, *Ichthyobus*, and *Myxocyprinus*,* and (3) Cycleptinæ, represented by the single genus *Cycleptus*. (1) The Catastominæ are elongated fishes, provided with a moderate dorsal fin of from ten to twenty rays; its species are the ordinary suckers and chubs of the inland inhabitants. (2) The Bubalichthyinæ are deep, compressed fishes, with a long dorsal, generally more or less elevated and falciform anteriorly; its species are known as carps, carp-suckers, buffalo-fishes, etc. (3) The Cycleptinæ are very elongated fishes, with an elongated falciform dorsal; the typical species is recognized in the West under the names of black horse, long buffalo, etc. About fifty species of the family have been described. They are among the most abundant fishes in the regions where they occur, and sometimes, in favorable localities, and when they are exempt from the attacks of enemies, they literally swarm, and cover the bottom of the waters with their compact masses. The mouths of the typical species are small and protractile, and well fitted for sucking in the aliment upon which they feed. Such species do not often bite at a hook; there are, however, species, especially of the sub-family Bubalichthyinæ, which can readily be caught with bait. Many of the species are quite apathetic, and remain basking in the sun or suspended almost motionless in the waters for a long period of time; and this habit is taken advantage of by boy-anglers, who attach a stiff loop at the end of a pole and drawing it over a fish toward the middle, suddenly jerk it from the water. (See SUCKER, in CYCLOPÆDIA.)

THEODORE GILL.

Cathar'tidæ [from *Cathartes*—καθαρτής, "one that purifies," *i. e.* by the consumption of the impure—the typical genus], a family of birds of the so-called order or superfamily Raptores or Ætomorphæ. It comprises the vultures of the New World, or the turkey-buzzards, carrion-crows, condor, etc. These are at once distinguishable from all others of the group by the imperfect or perforated nasal septum, which enables one to see anything on the opposite side through the perforation. In form the species contrast considerably with the typical birds of prey, such as the hawks and owls; and they resemble some of the gallinaceous birds, such as the turkeys, almost as much as they do the typical Raptores; this likeness is indicated by one of the names ("turkey-buzzard") applied to some of the species. The feathers are destitute of after-shafts, and the oil-gland has no circlet of feathers; the head is rather narrow, and the skin of the head as well as neck is naked; the eyes stand outward prominently, and are not overarched by superciliary shields; the bill is more or less elongated and compressed, and its base provided with an elongated and much-depressed cere; the upper mandible is boldly decurved and hooked; the nostrils have longitudinal apertures, and are confluent together through the perforated nasal septum; the wings are elongated, and pointed at the third or fourth primaries; the legs are moderate; the tarsi rather thick, and the inner edges rounded and not much thinner than the other; the toes three anterior on a uniform plane; the posterior somewhat elevated, not reversible, short, and with the second and third phalanges together at least as long as the basal phalanx; the middle anterior toe is very long, and a web is developed between its base and that of the inner one; the claws are rather feebly developed in comparison with those of the Falconidæ, and much less curved. The anatomical characters distinctive of the group

* *Myxocyprinus* is a name proposed for the *Carpiodes asiaticus* of Bleeker, which is distinguished by the multiradiate dorsal and anal fins (*e. g.* D. 52, A. 13).

are important, and amply corroborate the differentiation of the family from the vultures of the Old World; these, according to Huxley, are as follows: The skull is provided with basi-pterygoid processes; the valley between the lacrellar maxillo-palatines is deep as well as wide; the lachrymal bones are so completely ankylosed with the frontals, as well as with the broad prefrontal processes, that all traces of their primitive distinctness are lost; the sternum has, at most, a mere rudiment of the manubrial process, and its posterior margin exhibits either four slight excavations, or two holes externally and two notches internally; the proximal ends of the clavicles are greatly expanded and recurved, and their outer sides present a deep and wide excavation, at the bottom of which lies the pneumatic foramen; a great part of this excavated surface is left uncovered in front of the clavicular process of the coracoid when the bones are articulated together; the scapular process of the coracoid is not prolonged forward to meet the clavicles; the posterior or ischio-iliac edge of the os innominatum presents a deep notch, which is not found in the other Ætomorphæ; no lower larynx is developed. The family is entirely restricted to America, and its head-quarters are the tropical and warm regions of its two continents, although wanderers extend more or less beyond the warm temperate regions both to the northward and southward. The species fulfil an important function in the economy of nature, especially in the tropics, by devouring the putrid flesh of animals that have been for some time dead, although they by no means disdain fresh meat. They are to some extent gregarious in their nature, inasmuch as they assemble in large numbers around the carcasses of animals, and on them gorge themselves to repletion: afterward they rest in the neighborhood. "When thus gorged," says Coues, "they appear heavy and indisposed to exertion, usually passing the period of digestion in the laziest attitude, with their wings half spread." They are, however, birds of very powerful flight, and on the wing they are easy and graceful in their motions; they are fond of circling high up in the air. On the ground they walk with a somewhat stilted gait, but rarely leap. The species are not numerous, at most only ten being known. These, however, represent several decidedly distinct types of structure of generic value. According to Ridgway, the genera are—(1) *Sarcorhamphus*, with two sub-genera—*Sarcorhamphus* proper, represented by the condor, and *Cathartes*, typified by the king of the vultures; (2) *Pseudogryphus*, formed for the large Californian vulture (*P. Californianus*); (3) *Rhinogryphus*, including the red turkey-buzzard of the Southern States (*R. aura*) and a related species of Brazil (*R. burrovianus*); and (4) *Catharista*, restricted to the carrion-crow or black vulture (*C. atrata*) of the Southern States. (See also CONDOR, CATHARTES, VULTURE, in CYCLOPÆDIA.) THEODORE GILL.

Cel'luloid, an artificial substance, the bulk of which is cellulose or vegetable fibrine. The cellulose is first reduced by acids to gun-cotton or pyroxyline. (See PYROXYLINE.) Camphor is added to the gun-cotton, and the mixture is condensed in cylinders by an hydraulic pressure of 2000 pounds to the square inch. The celluloid is yet soft, and may be moulded by heat and pressure into various articles, useful and ornamental. Celluloid is extensively substituted for ivory, bone, hard rubber, coral, etc., closely resembling these substances in hardness, elasticity, and finish. E. DARWIN HUDSON, JR.

Centennial Exposition. See INTERNATIONAL EXHIBITION.

Centrarch'idæ [from *Centrarchus*—κέντρον, "spine," ἀρχός, "anus"—one of the genera], a family of fishes of the order Teleocephali and sub-order Acanthopteri, peculiar to North America. They constitute a very characteristic type in at least the Eastern and Mississippi regions. The body is oblong and compressed, and divided into nearly equal and corresponding halves by a longitudinal axis coincident with the commencement of the lateral line and the middle of the caudal fin; the scales are well developed, and generally ctenoid, but in some cycloid; the lateral line is continuous; the head is compressed, and covered with scales on the opercula and cheeks; the eyes are lateral; the opercular bones normally developed; the preopercula generally entire, sometimes feebly serrated; the operculum has a more or less developed membranous extension around the posterior spine; the nostrils double; the mouth is cleft laterally and obliquely; the upper jaw more or less protractile; teeth are developed in bands on the jaws and, to a variable extent, on the palate; the branchial apertures are ample and continuous below; branchiostegal rays generally six—exceptionally seven—in number; the dorsal fin is elongated, and consists of an anterior spinous and a posterior rayed portion of varying extent; the anal fin in its soft portion corresponds to that of the dorsal, and is armed in front with a variable—frequently large—number of spines; the caudal fin distinct, and generally emarginated; the skeleton has a slightly increased (beyond the normal) number of vertebræ (*e. g.* D. 11 + C. 16–18). The species are quite numerous (about fifty having been described), and generally among the most common fishes of the waters which they frequent. They are all carnivorous, and mostly quite bold and gamy fishes. In the breeding season they generally select a spot which they clear of weeds and obnoxious substances for depositing their eggs; these the male and female guard with zealous care, rushing boldly forward to drive away any intruder not too large for their powers. It is to this family that the black bass, as well as rock-bass, sun-fish, crappie, etc., belong. Several distinct types of structure are exemplified by the species: these are (1) Centrarchinæ, (2) Lepominæ, and (3) Micropterinæ. (1) The Centrarchinæ are fishes with very compressed bodies, and the dorsal and anal fins are correspondingly developed and obliquely opposed to each other; each is armed with approximately equal numbers of spines: to this group belong the many-spined bass (*Centrarchus iridens*), the grass-bass or crappie (*Pomoxys hexacanthus* and *P. annularis*), etc. (2) The Lepominæ are fishes with the soft portions of the dorsal and anal fins almost vertically opposed to each other, and with the spinous portion of the dorsal much longer than that of the anal: it includes the sun-fishes or pond fishes (*Pomotis* and *Lepomis*), the rock-basses (*Ambloplites*), as well as a number of less conspicuous genera (*Acantharchus*, *Archoplites*, *Chænobryttus*, *Brytta*, *Hemioplites*, *Enneacanthus*, and *Mesogonistius*). (3) The Micropterinæ are oblong fishes, with the soft portions of the dorsal and anal fins vertically opposite, as in the former, but with the spinous portion of the dorsal long and low; and the spines of the anal only three in number and of small size: these are restricted to the celebrated black basses of the U. S. (*Micropterus salmoides* and *M. nigricans* or *floridanus*). (See also SUN-FISH, etc., in CYCLOPÆDIA.) THEODORE GILL.

Ceratodon'tidæ [from *Ceratodus*—κερας, κερατος, "horn," and ὀδούς, "tooth"—the chief representative genus], a family of fishes of the order Sirenoidei, supposed, until recently, to be extinct, but lately discovered to be represented by living species in certain Australian rivers. The discovery of these living forms is one of the most important, if not actually the most important of modern additions to ichthyology. The body is elongated, and of nearly equal height from the head to the post-ventral region, but thence tapers backward toward the tail; the scales are large, oblong, and are regularly imbricated; they have the surfaces sculptured with several concentric lines of growth, and the margins are rounded, entire, and membranaceous; the lateral line is slightly decurved from the shoulder, and thence straight and concurrent with and nearer to the abdominal than the dorsal outline; the head is conic in profile, and depressed and oval above; the eyes are lateral, and much nearer the snout than the opercelum; the opercular region is covered with scales, and the bones are scarcely apparent externally; on dissection, however, the operculum is seen to be well developed; the other opercular elements are wanting; the anterior nostrils open on the margin of the snout just outside of the oral aperture, the posterior in the roof of the mouth; the mouth is transverse, and the lateral cleft very shallow; no separate maxillary bones are differentiated, as in ordinary fishes; the lips are thick; teeth are developed in pairs upon the mandible, palate, and vomer; the vomerine teeth are small, broad, and rather low laminæ, with convex and trenchant margins, the outer or posterior parts of which are slightly serrated; the palatal and dentary plates are oblong, with a convex entire inner side and a concave outer side, armed with a number of compressed trenchant teeth-like processes; the palatal and mandibular teeth are traversed by numerous medullary canals terminating in punctate impressions on the surface of the crowns; the branchial apertures extend from the sides of the occipital region to below the pectoral fins, and are covered by the broad cutaneous fringes of the opercula; the dorsal and anal fins are confluent with the caudal, and form together an undistinguishable whole, pointed behind and sustained by indefinitely numerous fine rays; the dorsal fin commences somewhat in advance of the posterior half of the length, and the anal considerably behind it; the pectoral fins are elongated, paddle-like elements, pointed backward, covered with scales, except near the margins, with the dorsal margin slightly convex and the inferior sigmoidally sinuated; the ventral fins are also elongated paddles, pointed behind, and of a somewhat hastiform shape. The anatomical peculiarities are numerous, but cannot be here signalized; suffice it to say, that, as in the other members of the order, the notochord is persistent—that is, there is no differentiation into vertebræ, but a single cartilaginous element extends from the head backward. Some of the elements of the skull, as well

as the ribs, are more or less ossified. The pneumatic apparatus, according to Günther, "may be described either as a single lung, with symmetrical arrangement of its interior, or as two lungs confluent into a single sac, without any trace of a septum. The sac is wide, and extends from one end of the abdominal cavity to the other." Its external surface shows numerous small rounded prominences corresponding to the minor cells of its cavity, except in the stripe running along the middle of its ventral surface, which stripe is indicative of the differentiation of the lung into two lateral halves: "the right half is contracted at its anterior extremity, slightly bent toward the right side, and opens by a very short duct, terminating in a glottis, into the ventral side of the œsophagus, somewhat to the right of the median line;" the interior of the lung is divided into a number of compartments formed by well-developed transverse septa. The heart in its internal structure resembles, in some respects, the typical ganoids, rather than the previously-known dipnoians: "there are two pairs of (ganoid) valves, narrow and rather long, with stiff, non-collapsing walls, thicker along the middle than on the sides, and without tendinous chordæ, in a single transverse series; their tunics are continued in four narrow raised strips behind their bases:" sometimes small papillary prominences exist in a line between the series of stripes and the special valves immediately in front of the latter. Such are some of the most noteworthy characters of the living Ceratodontidæ. Previous to the discovery of these it had been supposed that the representatives of the family were characteristic of the Secondary epoch, and that they had not survived beyond the Triassic period. It was with great astonishment, therefore, that the discovery of living species in the fresh waters of Australia was hailed. The living forms have even been generally regarded as actually congeneric with the Triassic species, but this seems to be questionable, and the differences between the dental laminæ of the living and extinct species are sufficiently great to warrant generic differentiation, independent of any hypothetical considerations. For the living forms the name *Neoceratodus*, proposed by Count Castelnau, may be retained. The only *certainly* known living species (*N. Fosteri*) was first discovered in 1870 by Mr. Girard Kreft, curator of the Australian Museum at Sidney, in a river of Queensland, but has since been found in other streams. The fish is said to frequently leave the water and go on the land at night. It feeds chiefly, if not entirely, on vegetable matter, such as the leaves, etc., of various plants. It attains a length sometimes of about six feet. The extinct species of the family flourished chiefly during the deposition of the Jurassic and Triassic formations in Europe and America, and were among the most abundant and characteristic of the fishes of those epochs. Until the discovery of the living forms they were supposed to have been shark-like animals; thus, the finding of the Australian species has not only greatly extended the range in time of an ancient type, but has enabled us to recognize the affinities of the later, and, in connection with them, of a long series of other extinct forms. THEODORE GILL.

Cer'vidæ [from *Cervus*, the Latin name for deer, the typical genus], a family of mammals of the order Ungulata and sub-order Artiodactyla, containing the deer and related types. The form is for the most part typified by the familiar species of deer, but deviations are exhibited by the moose and reindeer; the head is attenuated forward, and the nose generally tapering, with a moist, naked muffle, but sometimes more or less broad and hairy; the teeth are of the usual ruminant type (M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$ or $\frac{0}{1}$, I. $\frac{0}{3}$); the molars with four crescentiform lobes, two anterior and two posterior; the canines in the upper jaw generally rudimentary or absent, especially in the females, but sometimes hypertrophied and developed as tusks; the canines in the lower jaw and in the incisors alike and proclivous; frontal appendages are generally present, at least in the males, and consist of horns, called "antlers," which are periodically developed preliminary to and during the rutting season, and subsequently cast off, but in some forms they are always absent; they are rarely possessed by the females, the reindeer being, however, an exception; the feet have two main hoofs, and almost always lateral or false ones high up on each side; the skull has its palatine axis nearly parallel with the occipito-sphenoid axis; the auditory bullæ are little produced outward, and are applied only to the inner surfaces of the paroccipital processes; the styloid processes are directed downward, and interposed between the bullæ and paroccipital processes, and not enclosed in oblique folds of the auditory bullæ; the stomach is quadripartite, and exhibits the typical ruminant characters; Cowper's glands and the gall-bladder are generally, but not always, absent. The family thus defined is exemplified in quite a number of genera, which are combinable in seven groups. Commencing with the most generalized forms, there are (1) *Moschus*; (2) *Hydropotes*; (3) *Cervulus*; (4) *Pudu*, *Furcifer*, *Coassus*, *Blastocerus*, *Cariacus*, and *Capreolus*; (5) *Hyelaphus*, *Rucervus*, *Rusa*, *Cervus*, *Elaphurus*, and *Dama*; (6) *Rangifer*; and (7) *Alces*. By recent writers these have been further combined in three sub-families, the first two genera being approximated under the name Moschinæ; the third (3) genus isolated as the type of a peculiar sub-family, Cervulinæ, and the remaining (4–7) segregated as the sub-family, Cervinæ. There are reasons for doubting, however, whether this is a natural classification. A remarkable distinction exists between two of the major groups of deer in the structure of the anterior feet. (1) In the genera of the first, second, fourth, sixth, and seventh groups the lateral metacarpals are well developed at their distal extremities, and atrophied at their proximal, and thus distinguished from other *Pecora*; in the genera of the third and fifth sections the corresponding bones are developed at their proximal extremities, and atrophied at the distal, as in most *Pecora*. The indications are that in the primitive deer the said bones were complete, although slender. (See DEER, FALLOW DEER, ELK, MUNTJAK, REINDEER, ROEBUCK, etc., in CYCLOPÆDIA.) TREODORE GILL.

Chal'mers (LIONEL), b. at Cambleton, Scotland, about 1715; studied medicine at the University of Edinburgh; emigrated to South Carolina; practised in Christ Church parish and in Charleston. D. in 1777. He published *Useful Remarks on Opisthotonos and Tetanus* (1754), *Essay on Fevers* (1767), etc.

Cham'berlain (D. H.), b. at Worcester, Mass., 1837; graduated from Yale College with high honors, and from the Harvard Law School; entered the army in 1864 as lieutenant in the 5th Massachusetts Colored Cavalry, promoted to be captain, and served in Maryland, Louisiana, and Texas; went to South Carolina in 1866, and for two years was engaged as a cotton-planter. Upon the call for a constitutional convention he was chosen as a delegate, and subsequently elected attorney-general of the State, which position he filled for four years with marked ability; resumed the practice of his profession with Judge Melton at Columbia upon retiring from office; in 1874 was elected governor of the State by the Republicans; renominated in 1876, and took the oath of office Jan., 1877.

Chambers (TALBOT WILSON), D. D., b. Feb. 25, 1819, at Carlisle, Pa.; graduated at Rutgers College in 1834; studied theology at New Brunswick and at Princeton, N. J.; was licensed to preach at Clinton, Miss., in 1838, and in Oct., 1839, became pastor of the Second Reformed Dutch Church, Somerville, N. J.; in Dec., 1849, was installed as one of the pastors of the Collegiate Dutch Church, New York. His published works are *The Noon Prayer Meeting in Fulton Street* (1857), *The Life of the Hon. Theo. Frelinghuysen* (1863), *Exposition of Zechariah in Lange's Commentary* (1874), *The Psalter a Witness for the Divine Origin of the Bible* (1876). He is a member of the American Committee engaged in revising the English Bible.

Chancellor (CHARLES W.), b. in Virginia Feb., 1833; educated at Georgetown College, D. C., and at the University of Virginia. In 1853 graduated doctor of medicine at Jefferson Medical College, Philadelphia. He practised medicine in Alexandria, Va., till 1861. During the civil war he was medical director on Maj.-Gen. Pickett's staff. He then practised medicine in Memphis, Tenn., till 1868; was then elected professor of anatomy in the Washington University of Maryland; in 1869 was made dean of the faculty; in 1870 was transferred to the chair of surgery; and in 1873 he severed his active connection with the school, retiring from general practice. He was commissioner of public schools in Baltimore two years; a member of the city council five years, two of which he was president of the board of aldermen; in 1876 was elected secretary of the State board of health; in 1877 was president of Maryland Insane Asylum, still retaining both positions Mar., 1879. In 1876 he made an able report on the prisons, reformatories, and charitable institutions of Maryland, which attracted much attention here and in Europe; has published an able work on contagious and epidemic diseases, with special reference to quarantine and sanitary laws, and has contributed largely to medical literature and sanitary science, etc. F. A. SOULÉ.

Cha'pin (WILLIAM), b. in Philadelphia in 1802; engaged in literary pursuits; was commissioner of schools in Yates co., N. Y., for six years; became supt. of the Ohio State institution for the blind in 1840; visited Europe in 1845; was appointed principal of the Pa. institution for the instruction of the blind in 1849; published a report *On the Benevolent Institutions of Great Britain and Paris* (1846), and prepared the article on the blind in the U. S. census of 1860.

Chap'man (Sir FREDERICK E.), b. in British Guiana in 1816; graduated at the Royal Military Academy at Woolwich, and entered the royal engineers in 1835; became a

captain in 1846, and colonel commandant of engineers in 1872; was present at the battles of Alma and Inkerman; during the siege of Sebastopol directed the left attack in the early part of the siege, and later was executive engineer to the army; was frequently mentioned in official despatches, and brevetted major, lieutenant-colonel, and colonel; was created a C. B., officer of the Legion of Honor, and received a medal with three clasps from his own government, besides the Turkish and Sardinian medals, and the 3d class of the Medjidie. He became a major-general in the army in 1867, and lieutenant-general in 1872; was made K. C. B. in 1867; served as governor and commander-in-chief in Bermuda 1867–70; inspector-general of fortifications and director of works 1870–75.

Chapman (John A. M.), D. D., b. at Greenland, N. H., Aug. 21, 1830; graduated at Waterville College, Me., in 1854; studied at the Biblical Institute, Concord, N. H.; entered the Methodist Episcopal ministry in 1855; has held pastorates in various towns and cities of New England; was stationed in Boston, Mass., 1863–71, and in Brooklyn, N. Y., 1871–74, taking a leading position in his denomination. In 1871 he received the degree of D. D. from the Wesleyan University, Middletown, Conn.

Chartres (Robert d'Orléans), Duc de, b. Nov. 9, 1840, second son of the late duke of Orleans, and grandson of the late King Louis Philippe of France. After the death of the duchess (1858) he entered the military school of Turin. In the war with Austria (1859) the duke served with distinction in the Nice cavalry regiment. (For his services in the civil war in the U. S. in 1861–62 see Paris, Comte de.) Many acts of individual gallantry are recorded, among which may be noticed the capture on the eve of the battle of Williamsburg of seventeen prisoners. Though an exile when the Franco-German war of 1870 broke out, he succeeded (see biography of the Prince de Joinville), though not until after the catastrophe of Sedan, in serving his country as a captain under the assumed name (that of a ducal ancestor) "Robert le Fort." His services, mostly about Rouen and Cherbourg, exhibited his wonted dash and gallantry. Under his borrowed name the duke was proposed by Gen. Chanzy for the grade of chevalier de Légion d'Honneur, which he received. As an officer of the 3d Chasseurs d'Afrique he has more recently served in Algiers. "The duke de Chartres is a *soldier* whom no one, even at first glance, could mistake." (Yriarte, *Les Princes d'Orléans.*) "He is a cavalry soldier" (*officier*) "to whom the life of the camp, its alarms, its dangers, and its glory, are necessary, as are its incessant movement, its physical exposures, and even the stern discipline, in which he is in his element." The duke wedded in 1863 the princess Frances Marie Amélie d'Orléans, daughter of the prince de Joinville. J. G. Barnard.

Chase (William H.), b. in Massachusetts; graduated at the U. S. Military Academy in 1815; appointed brevet second lieutenant of engineers; first lieutenant 1819, captain 1825, major 1838. The events of the war of 1812 having shown the vulnerability of the ports of the Gulf coast, and especially of the key to its western territory, New Orleans, Chase was assigned to duty for their defence in 1819. Forts Pike and Macomb (which see) were his earliest works. His most important were Forts Pickens, McRee, and Barancas (which see), for the defence of Pensacola, regarded then as the great naval station of the Gulf. But subsequently, as senior engineer officer, all the works of fortification and of river and harbor improvement (*e. g.* the Mississippi mouths) came under his supervision. Energetic, observing, but impulsive, there was, moreover, scarce a project connected with the development of the region of his adoption in which he did not take an influential part. The Alabama Georgia and Florida R. R. (projected 1835, a quarter of a century too early) and the associated commercial development of Pensacola, his home, may be cited. Original and bold in conception, want of early discipline alone impaired the value of his projects. Few men have acquired more or warmer friends. In 1856 he was appointed by Pres. Pierce superintendent of the Military Academy, but resigned Oct. 31 from the army without entering on its duties. He espoused the Confederate cause, and was prominent in the seizure of the Pensacola navy-yard, but subsequently took no part in the war. D. at Pensacola Feb. 8, 1870. J. G. Barnard.

Chaun'cey (John S.), b. in New York; entered the U. S. navy as midshipman in Jan., 1812; was promoted to be lieutenant in 1825, commander 1841, captain 1855, and commodore 1862; in 1822, Chauncey commanded the sloop Peacock, and was engaged in the capture of a fleet of armed pirate vessels off Bahia Honda, Cuba; from 1838 to 1843 and from 1843 to 1847 he was assistant inspector of ordnance; in 1861 he commanded the Susquehanna, and was second in command in the engagements of Forts Hatteras and Clark; subsequently in command of blockade on coasts of Virginia and North Carolina. D. at Brooklyn, N. Y., Apr. 11, 1871. Geo. C. Simmons.

Chenpe (Sir John), b. in 1792; entered the royal engineers in 1809; served in the Pindaree war 1815–16, and was present at the siege of Dhamounee and Mundela, siege of Asseerghar 1818; throughout the Burmese war 1824–26, the Punjaub campaign 1848–49, and chief engineer at siege and capture of Mooltan and battle of Goojerat; was second in command in the Burmese war of 1852–53, and in command of the expedition which captured Donaben; succeeded to command of the entire force on the departure of Gen. Godwin, and nominated a K. G. C. B. in acknowledgment of his services; appointed major-general in 1851, lieutenant-general 1859, and general 1866; became colonel-commandant of engineers (late Bengal) in 1844. D. at the Isle of Wight Mar. 30, 1875.

Cheese [Lat. *ca'seus*; Ger. *Käse*; Fr. *fromage*], a variety of food prepared by coagulating milk, separating the curd, pressing it into forms, and subjecting it to a process of ripening or curing.

The material may be either cow's milk, whole or skimmed, cream, or mixtures of these, or the milk of goats or ewes. Cow's milk, which is generally used, varies considerably in composition (see article Milk); the following is an average of several hundred analyses, made by different chemists: Fat, 3.80; caseine and albumen, 4.37; sugar, 4.51; salts, 0.63; water, 86.66. The following analyses by Alex. Müller show the composition of cream and skimmed milk, and the whole milk from which they were obtained:

	Whole milk.	Cream.	Skimmed milk.
Whole product	100.	10.	90.
Fat	4.00	35.00	0.55
Caseine and albumen	3.25	2.20	3.77
Sugar	4.50	3.05	4.66
Salts	0.75	0.50	0.78
Water	87.50	59.25	90.64
	100.	100.	100.

The proper management of the milk exerts an important influence on the character and flavor of the cheese. The utmost cleanliness is necessary to secure good results. Dirty fingers, pails, vessels, etc. are liable to taint the milk, so that no amount of subsequent care will correct the evil. Unless all the vessels and utensils are washed as soon as they are used, fermentation is liable to occur, which is transferred to the next portion of milk which comes in contact with them. Scalding with boiling water is the most effective method for preventing fermentation. Dirty floors or proximity to pigsties or drains will taint the milk. The milk should always be strained to separate leaves, straws, hairs, etc. which may happen to fall into it during milking, and it should be preserved in a cool room till it is used. Salt or nitre is sometimes added to prevent souring. Some think it well to let the milk sour before it is used for making cheese, but the best cheesemakers prefer to prevent this. The evening milk may be cooled in the cheese-tub by placing in it a tin pail of cold water. A better plan is to use a cheese-vat of tin, surrounded by a wooden vat, the intervening space being supplied with a circulation of cold water. In large establishments special coolers are employed. It is difficult to thoroughly incorporate with the milk the cream which rises during the night; and many prefer to take it off, keep it till the morning milk has been added, and then use it for mixing with the rennet. In many cases, however, it is used for butter.

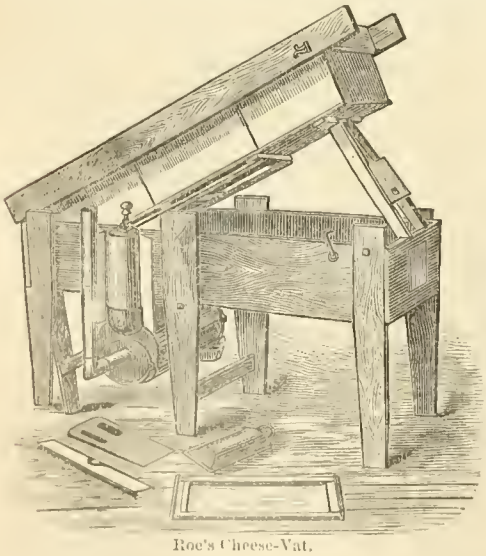
I. Manufacture of Cheese.—The manufacture of cheese may be subdivided into the following operations: (1) curdling or coagulating the milk; (2) cutting the curd; (3) cooking or scalding the curd; (4) separating the whey; (5) grinding the curd; (6) salting; (7) pressing; (8) curing or ripening.

1. *Curdling or coagulating* may be spontaneous, as in the manufacture of cottage cheese, or it may be produced by the addition of rennet or of acids. In most cases rennet is employed. *Rennet* is the fourth stomach of the sucking calf, the *yirning*. It is carefully cleansed without washing, rubbed with salt, stretched, and dried by artificial heat. The stomachs of other animals, as the sheep, pig, etc., are sometimes used. For use, the dried rennet is usually soaked in brine, with or without the addition of spices, in the proportion of one rennet to the gallon. Half a pint of the liquid is sufficient to curdle 70 gallons of milk, one rennet serving to curdle more than 1000 gallons. For details of the preparation see Arnold's *American Dairying*, p. 347, or Flint's *Milch Cows and Dairy-Farming*, p.

248.) Wilkins (*Landwirthschaftl. Centralb. f. Deutchland*, 1874) prepares *rennet essence* by rubbing fresh calves' stomachs with salt, treating with water for two days at 100° F. (or a mixture of equal parts of water and Rhine wine), adding to this solution alcohol (90 per cent.) containing a little hydrochloric acid, and allowing the whole to stand eight days. The liquid is then filtered, and will keep for years. His proportions are 6 oz. fresh rennet, 1 oz. salt, 17 oz. water (or wine and water), 2 oz. alcohol, 12 grains acid. One pint of the essence will curdle 250 gallons of milk in thirty to forty minutes. Schatzmann (*Wiener Landschaftl. Zeit.*, 1873) investigated the action of artificial preparations of rennet, and found them to be very permanent, their action to be reliable and accurate to the minute, and the cheese to separate better, with a higher yield. Hansen (*Landwirthschaftl. Centralb. f. Deutchland.*) is said to have prepared rennet from hog stomachs after they had been used for making pepsin, using acid, and obtaining rennet in solution and in the solid form. *The action of rennet* was formerly explained by assuming that the caseine or curd of milk is held in solution by an alkali, and that rennet acts as a ferment, changing the milk-sugar to lactic acid, which neutralizes the alkali and thus precipitates the curd. This was disproved by Voelcker, who made milk alkaline, and found that rennet still curdled it, although the whey was still alkaline. Heintz (*J. p. Chem.* [2], vi. 374, 384), Hammarsten (*Jahresb. Thier Chem.*, ii. and iv.), and others have shown that the coagulation of caseine does not depend upon the formation of lactic acid; and Hammarsten, that pure rennet does not produce the acid. The latter (*Bul. Soc. Chim.*, 1874, xxii. 352) recognizes three distinct ferments in the mucous coating of the stomach: (1) pepsin, (2) rennet ferment, (3) a ferment which changes milk-sugar into lactic acid. The latter is not precipitated by magnesic carbonate nor by potassic hydrate. Hammarsten also finds that the rennet ferment does not precipitate caseine unless soluble lime-salts are present. L. B. Arnold (*American Dairying*, p. 296) attributes the action of rennet to minute plants (bacteria), and compares the action of rennet to that of yeast. (See article FERMENTATION.) F. Cohn, one of the best authorities on fermentation and bacteria, thinks that rennet ferment is not organized (*Dingl. J.*, 220, 191), as it may be preserved uninjured in alcohol, as it does not increase on keeping, and as a fixed relation exists between the milk and the quantity of rennet necessary for its coagulation.

The use of acids in place of rennet has often been recommended, and hydrochloric acid is said to be used extensively in Holland. It is claimed that cheese made with acids is firmer, sharper to the taste, and keeps longer, and that the acids act with certainty, and give a somewhat larger yield than rennet. On the other hand, they are more expensive than rennet, and the flavor of the cheese is not as good.

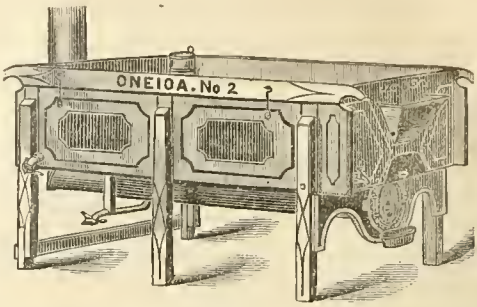
FIG. 1.



Roe's Cheese-Vat.

Warming the milk previous to adding the rennet is absolutely necessary. There is considerable difference of opinion, however, as to the proper temperature, some putting it as low as 72° F., others as high as 98° F. Dr. Voelcker says: "If the temperature of the milk when the rennet is added is too low, the curd remains too soft, and much difficulty is experienced in separating the whey. If, on the other hand, the temperature is too high, the separation is easily effected, but the curd becomes hard and dry." He considers 72° to 75° proper for thin cheeses, but 80° to 84° for thick cheeses like Cheddar. Cheese-vats of various forms (Figs. 1, 2, 3) have been invented to take the place of

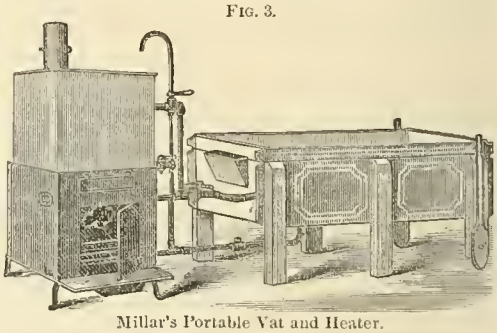
FIG. 2.



Ralph's Oneida Vat and Heater.

the kettles and caldrons formerly used to hold the milk for warming and the tubs for curdling. They are generally

FIG. 3.

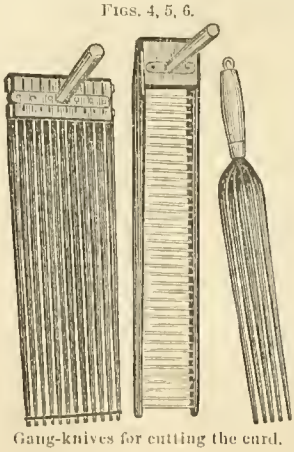


Millar's Portable Vat and Heater.

provided with a water-jacket for applying heat, and are also arranged so that one end can be elevated to drain off the whey. When the milk has reached the proper temperature, enough rennet is added to curdle it in thirty to forty minutes; after it is stirred in, the milk is allowed to remain quiet until it solidifies. Care is taken to avoid jarring it, as it would prevent perfect cohesion. The rennet converts the entire mass into a tremulous jelly.

2. *Cutting the curd*, in order to enable the whey to separate, is the next step. This was formerly accomplished by hand or with the aid of a flat wooden ladle. The mass was cut into thin slices, and then further reduced with a wooden stirrer. Great improvements have been made in the cutting of the curd by a series of American inventions. First came the introduction of a frame of crossed brass wires; then the tin breaker, formed in checks, which was pushed down into the curd, cutting it into long, square vertical strips; the final improvement consisted in the use of the steel gang-knife. Two of these are used; one cuts the curd into perpendicular columns, the other, the horizontal gang-knife, cuts these into cubes. It is found that when the curd is cut with sharp steel knives, the tendency of the fat to go into the whey is prevented. Greater uniformity in the curd can also be secured by the use of the gang-knives, and a larger yield of cheese. (Figs. 4, 5, 6.)

FIGS. 4, 5, 6.



Gang-knives for cutting the curd.

3. *Cooking or scalding* the curd simply means slightly raising the temperature to from 98° to 100° F. Sometimes, after the curd has settled, a portion of the whey is taken out, heated to the proper temperature, and poured back upon the curd. In other cases heat is applied to the outside of the vat by steam or direct heat. During this operation the curd is well stirred. The curd grad-

nally becomes sour; and when it is sufficiently acid, and it has acquired the proper consistence, the whey must be drawn off.

4. *Separating the whey*, or "wheying off," is effected in various ways. It may be dipped out of the tub, piling the curd up against the side; the curd may be ladled out into a cloth which is suspended over the tub and serves as a strainer; a perforated strainer may be run down into the corner of the vat, and a cork drawn out of the bottom to let the whey out; the vat may be tilted up to cause the whey to drain down and out at one end.

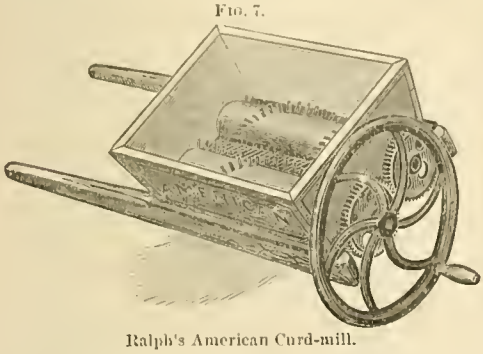
The whey from curd which has been properly cut and handled is nearly as bright and clear as Rhine wine, and of a yellowish green color; but when the curd has been carelessly broken up, the whey will be more or less milky, and a large quantity of curd will separate from it on standing. This curd is of the choicest character, as it is specially rich in butter. "When the *white whey* runs, the the richness of the cheese passes off." In any case the whey will send up a certain amount of cream on standing, which is collected and made into whey-butter. The whey is drunk as a beverage, fed to hogs, or evaporated for the extraction of milk-sugar. The following analyses of whey are selected from a large number by Voelcker (Willard's *Practical Dairy Husbandry*, p. 319):

ANALYSES OF WHEY.

	1.	2.	3.	4.
Fat	0.68	0.49	0.29	0.14
Caseine, albumen, etc.	0.81	1.43	0.93	0.76
Sugar and lactic acid	5.28	4.49	5.03	5.31
Salts	0.58	0.64	0.90	0.69
Water	92.65	92.95	92.85	93.10
	100.	100.	100.	100.

5. *Grinding the curd* in a curd mill or curd-breaker is resorted to in order to make it fine and uniform, for the sake of even salting and to hasten the cooling. (Fig. 7.)

FIG. 7.



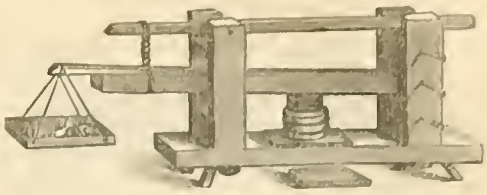
Ralph's American Curd-mill.

6. *Salting* the curd is practised to check and regulate the fermentation of the cheese during the ripening. It is specially necessary in lean cheeses, made from skimmed or half-skimmed milk. Rich cheeses, such as Stilton and cream Cheddar, may be made without salt, as the large amount of butter in them sufficiently preserves the caseine. The proper quantity of salt to be used is from 1 to 2 per cent.; more than the latter quantity is objectionable, as it prevents ripening, though some use as much as 3 or 3½ per cent. The saline taste of old cheese is not due to the salt added, but to the ammonia-compounds formed during the ripening; consequently, over-salted cheese does not taste as salt after six or eight months as under-salted cheese kept the same length of time. The salt must be fine, and must be evenly mixed with the curd. Its purity is a matter of great importance. The objectionable impurities are the magnesic and calcic chlorides, especially the former, on account of its bitter taste. Formerly, Asbton and other imported brands were preferred by the best cheesemakers, but since the beautiful process for purifying salt, invented by Dr. C. A. Goessmann, was put in practice under his direction by the Onondaga Salt Company at Syracuse, a salt of unsurpassed purity has been furnished by that company under the name of *factory-filled dairy salt*. Sometimes the salt is applied to the curd in the whey or to the outside of the pressed cheese, either in the form of brine or by rubbing in the fine salt; but the best results are obtained by mixing the dry salt with the curd.

Saltpetre, added in small quantities, three or four pounds to the barrel of salt, has long been used in some English dairies, and is said to aid in preserving the flavor of the cheese and to improve its keeping qualities.

Coloring cheese is often practised to meet the demands of certain markets. The material employed is annatto, the product of the orelan tree (*Bixa orellana*). It is most conveniently employed in the form of a solution in potash.

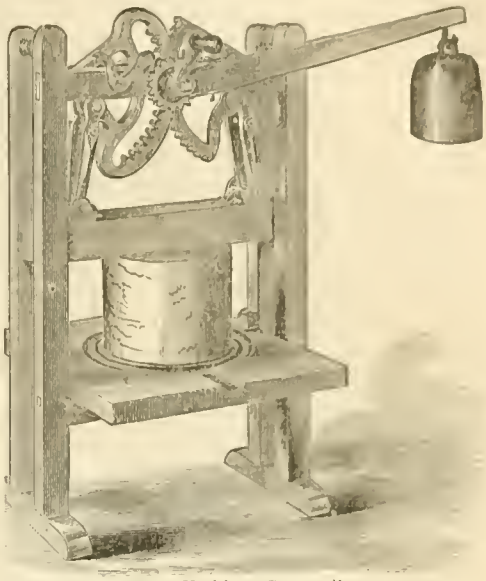
FIG. 8.



Old-fashioned Log-Press.

It is added to the milk just before the rennet is introduced. In summer the desired color can be given to cheese by simply allowing the curd to remain in the vat or tub exposed to the air for a short time.

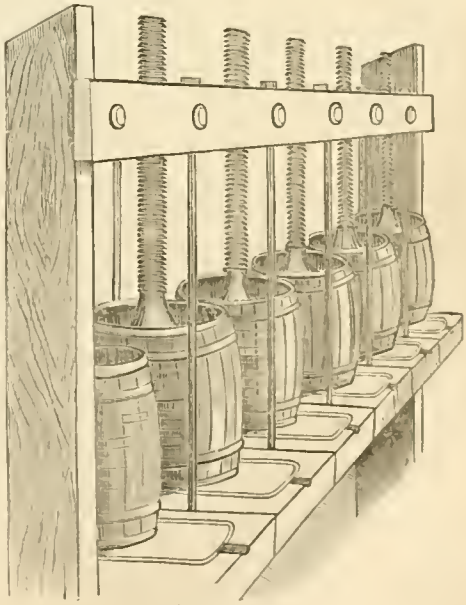
FIG. 9.



Oyston's Herkimer County Press.

7. *Pressing* expels most of the remaining whey, and consolidates the curd into the desired form. Hoops and cloths are employed, and the cheese is turned during the operation and the bandage properly adjusted. Many different presses are in use: lever presses, screw presses, etc. (Figs.

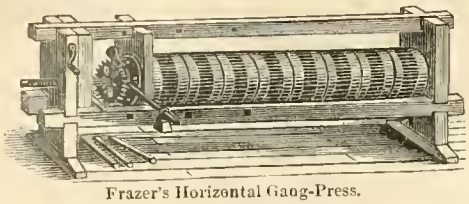
FIG. 10.



Factory Presses.

8, 9, 10, 11.) Horizontal gang-presses are now coming into general use. Eighteen to twenty-four hours is the usual time of pressing. The form of the cheese is determined by the diameter and height of the hoop. The

Fig. 11.



Frazer's Horizontal Gang-Press.

cheese is taken from the press to the curing-room. There it is turned occasionally and rubbed with hot whey-butter, to prevent the rind from cracking.

8. *Curing or ripening.* As the product comes from the press it cannot properly be called cheese. It is a tasteless, insipid, chalky mass, consisting of caseine, fat, and a small portion of the whey. In order that it may acquire the characteristics of cheese, the sharp taste, and peculiar odor, it must be kept a long time, and allowed to undergo a process of fermentation or putrefaction involving a decomposition of the caseine, fat, etc. The extent and character of the changes which occur during this ripening process depend upon the character of the milk, mode of curdling, amount of whey left in the curd, proportion of salt, and, in fact, upon all the intentional or accidental conditions to which the cheese is exposed from the milking of the cow to the day the cheese is consumed. The peculiarities of the cheese produced in different localities depend upon the predominance of one or another of these conditions. The fresh acid curd, which is chalky and pulverulent in the fresh cheese, becomes yellow and translucent on standing, acquires the peculiar odor of cheese, and becomes alkaline. This change occurs more or less rapidly, and terminates at an earlier or later stage, according to the manner in which the curd is prepared and treated.

Generally, the more compact the curd is made by the use of a high temperature during coagulation, the more completely the whey is removed, and the more carefully the access of air is prevented during ripening, the more slowly will the process proceed, and the resulting product will have little tendency to change: it will dry up to a horn-like mass and exhibit a mild and pleasant aroma. The so-called "hard cheeses" are of this character.

On the other hand, the lower the temperature during coagulation, or the use of spontaneous coagulation, and the more whey there is left in the cheese, the sooner will the ripening be completed; the resulting cheese will be soft, and may even deliquesce to a smeary mass having a very strong smell. By variations between these extremes all the different varieties of cheese are produced. Excess of salt retards ripening by its antiseptic properties. The softening of cheese during the ripening is due to a decomposition of the caseine, resulting in the formation of ammonia, which unites with unchanged caseine, forming an ammonic caseate soluble in water. Well-ripened cheese is largely soluble in water chiefly for this reason, while new cheese is insoluble. The peculiar substances tyrosine and leucine ($C_6H_{13}NO_2$) are also produced during the ripening by the decomposition of the caseine; to the amount of several per cent. of the cheese, sometimes. The fats of the butter are also involved in the decomposition, and by combining the elements of water develop fatty acids, as butyric, valerianic, caproic, caprylic, capric, palmitic, stearic, oleic, etc. These combine partly with ammonia, forming salts, partly with caseine to form acid albuminates, and are partly reduced to alcohol radicals, which, replacing hydrogen in ammonia, appear as amines; butylamine, amylamine, etc. These amines, like ammonia, combine with caseine, forming butylamine-caseate, amylamine-caseate, etc. The number of these decomposition products already recognized, or whose formation is highly probable, is extremely large. They exert an important influence on the character of the cheese, and in some cases give rise to odors and flavors which are by no means acceptable to all. Old Limburg cheese is especially rich in valerianic acid and amylamine. It has even been proposed to prepare the above-mentioned acids, amines, etc. artificially, and use them to imitate the different varieties of cheese, as fruit-syrups are now made artificially. The whey left in the cheese contributes its decomposition products. The lactic acid converts the milk-sugar into galactose, and this undergoes vinous fermentation, forming carbonic acid gas, which expands the cheese, producing cavities. This cellular character can be exaggerated by adding sugar to the curd. The conversion of milk-sugar into butyric acid may also produce cells by the formation of carbonic acid gas. Salt retards butyrous fermentation; hence very salt cheese is not cellular. This is the case with most Dutch cheese. Blondeau (*Dingl. J.*, 172, 309) and others have asserted that caseine is changed into fat during the process of ripening, but this has been disproved by Brassier (*Ann. Chim. et Phys.* (4), v. 270) and A. Müller (*Landw. Jahrbücher*, 1, 68). Brassier experimented on skim-milk curd prepared with rennet, and gives the following among his results, which serve to show the changes during ripening. The numbers refer to 100 parts of fresh cheese in each case. The third column represents the case in which 5 parts of salt were added:

	Fresh cheese.	Cheese unsalted, after 4 months.	Cheese salted, after 7 months.
Fat	22.26	15.64	13.25
Caseine	32.07	28.34	22.35
Milk-sugar	3.82	None.	None.
Leucine	None.	3.43	11.14
Other bodies sol. in alcohol	None.	2.79	
Ammonia	Trace.	0.65	1.07
Salts	0.75	0.75	0.75
Water	41.10	19.73	18.68
Salt added	None.	None.	5.00
Weight of cheese	100.	71.33	72.24
Loss in weight	.....	28.64	32.76
Original weight	100.	100.	105.

F. Cohn has investigated the ripening of cheese (*Dingl. J.*, ccxx. 191), and believes it to be a true fermentation caused by bacteria. (See article Fermentation.)

For the proper ripening of cheese, curing-rooms must be used which are well ventilated, free from dampness, and of a uniform temperature—not above 75° nor below 60° F. Moreover, the cheese must be turned often, especially in the beginning.

The American system of associated dairies—"the factory system"—originated with Jesse Williams and his two sons in 1852 at Rome, Oneida co., N. Y. It extended slowly at first, but became very popular when its advantages were fully understood. At present more than two-thirds of all the cheese made in the U. S. is made in the factories. The census of 1870 reported 1313 factories, of which 818 were in New York State, 195 in Ohio, 69 in Illinois, 54 in Wisconsin, the remainder scattered among 17 other States. Arnold, however, estimates the number of factories in 1876 at 5000. The factory is organized by a neighborhood of farmers, who furnish the milk and are credited for the number of pounds of milk supplied. A manufacturer takes charge of the factory as the agent of the farmers, and makes the cheese, which is sold, the proceeds being divided *pro rata* after deducting expenses. In some cases the factory is organized as a stock company, the stock being held by the farmers, but the company paying a certain price for milk. C. L. Flint says: "The factory system has relieved the farmer's family from much drudgery; it has brought the principles of commerce to the farmer's door; has educated him more or less to a knowledge of the favorable influences on price of a uniformity of product, and the great gain to be derived from associated effort. It has rendered possible, and originated, associations for the advancement of dairy interests, where not only the aids of practice and science, but the methods of each, have been brought to the attention of all."

Yield of Cheese.—According to Flint, 227 returns from New York factories, covering eight years—1864–72, inclusive (except 1865)—give the average yield of curd-cheese per cow at 300 pounds. In 1864 the average was lowest, 266 pounds; in 1869 highest, 334 pounds. For nine years—from 1864 to 1872, inclusive—327 factory returns gave 9.80 pounds of milk as required to make 1 pound of cheese; the smallest quantity reported by any factory as its yearly average being 8.31 pounds, the largest, 10.78 pounds. The cheese season varies in different factories from 183 to 230 days, beginning in April or May and ending in October or November.

The most profitable cheese for the farmer to make is shown by the experiments of Voelcker and Goessmann to be obtained by skimming off a portion of cream for the manufacture of butter. The sale of this cheese, together with that of the butter, yields a larger return than could be obtained by making whole-milk cheese and no butter. Voelcker obtained the largest return by skimming the morning milk after twenty-four hours, the evening milk after thirty-six hours. The cheese contained—fat, 27.08; caseine, 30.37; extractive matters and lactic acid, 0.22; salts, 2.90; water, 39.43. Goessmann obtained the largest return by skimming after twelve and twenty-four hours.

II. Composition of Cheese.—*The composition of cheese* has been already discussed in several of the preceding paragraphs, especially in that on *curing*. No detailed quantitative analyses have been made, and it is doubtful if they can be made with any accuracy. The number of different constituents in cheese, especially when well ripened, is so large that their accurate separation and estimation is practically impossible. For purposes of comparison a rough approximate analysis is made by extracting with ether, and calling all the matter extracted fat, determining the nitrogen in the remainder, multiplying it by 6.25, and calling the result caseine. The water is determined by drying at a constant temperature, the salts by burning and weighing the ash. The following analyses by Voelcker exhibit results thus obtained; the portion soluble in water is recorded as extractive matter, after deducting the salts it contained:

Cheese Analyses (*Voelcker*).

	Cream and milk.	Whole milk.	Partly skimmed.	Skimmed.
Fat	41.58	28.91	29.25	27.08
Caseine	23.38	25.00	29.87	30.37
Extractive matter.	2.45	4.91	4.92	0.22
Salts	2.06	3.33	3.08	2.90
Water	30.53	37.85	32.88	39.43
	100.	100.	100.	100.

The mould on and in old cheese consists of a few common species of green, blue, and red fungi, such as *Penicillium glaucum*, *P. globulosum*, *Torula viridis*, *T. aurantiaca*, etc. (See articles Fungi, Mildew, and Mould.)

Cheese-mites, which appear on some kinds of old cheese as a light buff dust, are known as *Acarus domesticus* or *A. siro*. They are of the same genus of the Arachnidæ as the sugar-mites. (See article Sugar.) They are harmless.

Skippers, called also *hoppers* and *jumpers*, are the larvæ or maggots of the cheese-fly, *Piophila casei*, which lays its eggs in the cracks or on the surface of the cheese. This fly is about half as large as the ordinary house-fly. Care and cleanliness are the only means for preventing its inroads; frequent turning, rubbing, brushing, etc.

Poisonous cheese is occasionally noticed. The chemical nature of the poison, which is very violent in its action, has never been determined: it is probably analogous to the "sausage" and "corned-beef" poisons. All of these poisons are now supposed to be due to bacteria, and result from an unusual kind of putrefaction. (See article Germ-Theory of Disease.)

III. Varieties of Cheese.—The varieties of cheese are innumerable. They differ (1) according as they are made from cream, whole milk, skimmed milk, or mixtures; (2) as spontaneous, rennet, or acid coagulation is practised; (3) as high or low temperatures are employed in curdling and scalding; (4) as the whey is more or less completely removed; (5) with the manner of ripening. Some are soft, as cottage and cream cheese, Neufchâtel, Limburg, etc., and will not keep long; some hard, as Cheshire, Gloucester, Cheddar, Parmesan, Dutch, and most American: some intermediate, as Gruyère and Stilton.

Sour-milk cheese, called *cottage*, *pot cheese*, *Dutch cheese*, or *curds*, is the curd of sour milk drained from the whey and pressed into moulds. It is sometimes flavored with sage. It is eaten fresh.

Full-cream cheese is prepared from cream curd drained in a cloth. It must be eaten fresh, as it will not keep long. Neufchâtel, Brie, Vaschrein, Cotherstone, cream Cheddar, and Yorkshire Stilton belong to this class. Neufchâtel and Brie are now manufactured in large quantities in New Jersey.

Half-cream cheese is made from a mixture of the cream from the evening milk and the whole of the morning milk, or about one quart of cream to ten quarts of milk. Stilton and rich double Gloucester cheese are made in this way. Great care is required in making them.

Whole sweet-milk cheese is very extensively manufactured, and includes many of the best-known varieties, as the best Cheddar, Cheshire, Wiltshire, Gloucester, and other English cheeses, the Edam and Gouda cheese of Holland, the Gruyère and Jura cheese of Switzerland. Much of the cheese made in the American factories is made of whole milk, and approximates most nearly to Cheddar in its method of manufacture and its character. Gruyère and Jura are known in the U. S. as Schweitzerkäse. This is now made in Oneida co., N. Y., in Ohio, and elsewhere. It is a tough cellular cheese, with a sharp taste and strong odor. Limburg cheese is a soft cheese, formed at a low temperature and slightly pressed. It is eaten in a state of putrefaction, and is very offensive to persons who have not acquired a taste for it. New York, Ohio, Illinois, and Wisconsin manufacture considerable quantities of it for the German population. Swiss Schabzieger cheese is made by working the fermented curd into a paste with powdered zieger-kraut, *Melilotus cærulea*.

Cheese from partly-skimmed milk is largely manufactured under all the names mentioned under whole milk. There is always a tendency in the dairy to rob the milk of some of its cream for butter.

Skim-milk cheese is also extensively manufactured in all countries, and sold often under the name of whole-milk cheese. It is generally harder and more translucent and horn-like than other cheese. Sometimes the milk is skimmed three times, and yields a cheese which becomes so hard in a short time that a pickaxe must be used to break it. By allowing the curd of skim milk to ferment somewhat, and by leaving considerable whey in it, softer cheese is obtained. Such is the offensive German hand-cheese. Parmesan cheese is made from skim milk.

Oleomargarine cheese, devised by H. O. Freeman of Sherburne, N. Y., has recently been extensively manufactured. It is made by replacing the fat removed in the cream with oleomargarine made from beef suet. The oleomargarine is melted and added to the skim milk, which has been previously heated to 91° F., and colored with annatto. Rennet enough is then added to curdle in eight or ten minutes. Only about 1½ pounds of oleomargarine are retained by 100 pounds of milk. When skilfully made, this cheese appears rich and well-flavored, and passes for fair whole-milk cheese.

Goat's and sheep's milk cheese is made in some localities. The most familiar cheese of this kind is the Roquefort. This is a French cheese made from either goat or sheep milk, the special qualities of which are largely due to the peculiar caves in the Jura limestone in which it ripens at a very low temperature.

IV. Statistics.—*Cheese produced on Farms in the U. S. (Census of 1870), in Pounds.*

Alabama	2,732	Kentucky	115,219	N. C.	75,185
Arizona	11,500	Louisiana	11,747	Ohio	8,169,486
Arkansas	2,119	Maine	1,152,590	Oregon	79,333
California	3,395,074	Maryland	6,732	Pa	1,145,209
Colorado	33,626	Mass.	2,245,873	R. I.	81,976
Conn	2,031,194	Michigan	670,804	S. C.	169
Dakota	1,850	Minnesota	233,977	Tennessee	142,240
Delaware	315	Mississippi	3,099	Texas	34,342
Florida	25	Missouri	204,080	Utah	69,603
Georgia	4,292	Montana	25,503	Vermont	4,830,700
Idaho	4,461	Nebraska	46,142	Virginia	71,743
Illinois	1,661,703	N. H.	849,118	Wash	17,465
Indiana	283,807	N. J.	38,229	W. Va	32,429
Iowa	1,087,741	N. Mex	27,239	Wisconsin	1,591,798
Kansas	226,607	New York	22,769,964		
				Total	53,492,153

Cheese-Factories in U. S. (Census of 1870).

	Factories.	Gals. milk used.	Cheese produced, lbs.	Value of Cheese.
Colorado	1	5,000	4,000	$1,280
Connecticut	7	271,410	231,700	38,624
Illinois	69	4,748,119	4,072,301	556,356
Indiana	17	130,625	107,680	16,076
Iowa	14	248,893	256,906	44,590
Kansas	1	15,000	15,000	2,700
Kentucky	4	265,000	246,000	42,000
Massachusetts	23	2,070,238	1,885,486	321,900
Michigan	30	1,925,031	1,630,997	239,589
Minnesota	2	37,500	37,500	5,850
Missouri	1	9,765	9,785	1,943
Montana	1	2,000	2,000	800
Nebraska	5	29,300	32,400	5,320
New Hampshire	2	31,000	23,250	4,650
New Jersey	8	440,107	440,107	49,272
New York	818	83,345,176	78,006,048	12,143,594
North Carolina	3	44,630	48,800	9,700
Ohio	195	15,746,503	15,984,390	2,287,354
Oregon	1	39,000	40,000	8,400
Pennsylvania	27	2,034,369	1,647,467	234,922
Vermont	28	3,217,126	2,984,179	445,323
Virginia	2	13,300	12,500	2,310
Wisconsin	54	1,797,313	1,696,783	248,556
Total	1313	116,466,405	109,435,229	$16,710,569

New York State produces, according to the above figures, nearly two-thirds (exactly 61.85 per cent.) of the entire cheese-product of the country, thus:

	Cheese made in U. S., lbs.	Cheese made in New York State, lbs.
In farm dairies	53,492,153	22,769,964
In factories	109,435,229	78,006,048
Total	162,927,382	100,776,012

L. B. Arnold estimates the actual cheese-product in 1876 at 225,000,000 pounds, and the butter-product at 710,000,000

pounds. X. A. Willard estimates the cheese at 300,000,000 pounds, the butter at 700,000,000. The census of 1870 reports 194 cheese-box factories, and places the value of their product at $570,840. The New York Produce Exchange report for 1876–77 gives the two following tables:

I. *Cheese Exported from New York.*

1872	67,004,553 lbs.
1873	87,477,483 "
1874	93,460,269 "
1875	88,385,052 "
1876	106,194,063 "
1877	118,355,868 "

II. *Imports and Exports of Cheese into and from the United Kingdom, in cwts.*

	Imports.	Exports.
1872	1,060,130	19,876
1873	1,355,267	18,929
1874	1,488,223	18,590
1875	1,626,413	21,428
1876	1,538,175	17,409
1877	1,651,088	17,554

The following table is from the report of the Department of Agriculture for 1875:

Cheese Imported into England from the United States and from Holland, in cwts.

From United States.				From Holland.			
1864	466,988	1869	487,870	1864	336,831	1869	426,913
1865	442,913	1870	555,385	1865	386,962	1870	422,553
1866	415,726	1871	731,326	1866	426,559	1871	348,148
1867	526,740	1872	598,198	1867	332,628	1872	329,535
1868	489,117	1873	790,238	1868	329,565	1873	336,654

V. LITERATURE.—F. D. Curtis, *Hints on Cheesemaking* (Utica, 1871); X. A. Willard, *Practical Dairy-Husbandry* (New York, 1872); C. L. Flint, *Milch Cows and Dairy-Farming* (Boston, 1874); X. A. Willard, *The Practical Butter-Book* (New York, 1875); L. B. Arnold, *American Dairying* (Rochester, 1876); Benno Martiny, *Die Milch* (Danzig, 1871); C. Husson, *Le Lait* (Paris, 1878); I. J. Ellerbrock, *Die Holländische Rindviehsucht und Milchwirthschaft* (Braunschweig); W. Fleischmann, *Das Molkereiwesen* (Braunschweig, 1877); Johnston's *Chemistry of Common Life* (New York, 1870); Knapp, Ronalds, and Richardson, *Chemical Technology* (vol. iii., London, 1851); Payen, *Précis des substances alimentaires* (4th ed., Paris, 1865); Ure's *Dictionary* (London, 1867); Bolley, *Handbuch der Chem. Tech.* (Bd. iv., 1867); Muspratt's *Chemistry* (London, 1850); Muspratt's *Chemie* (3te Anf. Bd. iii. (Braunschweig, 1876); Hassall, *Food and its Adulteration* (London, 1876); *The American Dairyman* (New York, weekly); *The Milk Journal* (London, monthly); *Milch Zeitung* (Bremen, weekly); *Annual Reports of the Department of Agriculture; Transactions N. Y. State Ag. Soc.; An. Reports Am. Dairymen's Association; An. Reports Butter and Cheese Exchange of N. Y.; An. Reports N. Y. Produce Exchange; J. Roy. Ag. Soc. England;* Wagner's *Jahresb. Tech. Chem.;* Hoffmann's *Jahresb. Ag. Chem.* (For lists of 155 references to special articles see *Die Milch* by Martiny, vol. i. p. 417; vol. ii. p. 324.) C. F. CHANDLER,
Columbia College, Sept., 1878.

Cheiron (Χείρων), one of the Centaurs, is the noblest specimen of a combination of the human and animal forms created by the Greek imagination. Generally, the centaur expresses the sensual and savage features of a man combined with the strength and swiftness of a horse; but to these qualities Cheiron added justness, wisdom, and kindness. Having been instructed by Artemis and Apollo in hunting, gymnastics, music, and medicine, he in his turn became the instructor of many heroes—Achilles, Heracles, and others—in these arts. Together with the other Centaurs, he was expelled by the Lapithæ from Mount Pelion, but sacrifices continued to be offered to him even after his expulsion by the Magnesians; and the family of the Cheironidæ, living in that neighborhood and distinguished for knowledge in medicine, was said to descend from him.

Cherea (CASSIUS), the murderer of Caligula, is first mentioned during the revolt of the German legions after the death of Augustus, when he escaped the general massacre of the centurions by his brilliant valor and intrepidity. As tribune of the prætorian guard he afterward became one of the principal members of the conspiracy against Caligula, and when the emperor, on Jan. 24, 41 A. D., returned from the theatre, where he had been present at the games celebrated in honor of Augustus, it was Cherea who in the long gallery of the palace gave Caligula the first blow. He supported the senate in its attempt to establish the republic, but in the mean time the prætorian guard had declared Claudius emperor, and the next day Cherea was executed.

Chesapeake and Ohio Canal. (See NAVIGATION, INLAND.) The "eastern division" (from Georgetown to Cumberland), as it now exists, follows the N. side of the valley of the Potomac, to the eastern foot of the Alleghany Mountains, at Cumberland, Md. It departs from the immediate valley of the river by a cut-off and a tunnel of 3118 feet in length at Paw Paw Bend, 27 miles E. of Cumberland. The distance saved by this tunnel is about 6 miles. The total lockage from tide-water to the feeding-reservoir at Cumberland is 613¾ feet, and is overcome by 74 locks, varying from 6 to 10 feet lift, with chambers 100 feet long and 15 feet wide. From Georgetown to Harper's Ferry, 60 miles, the canal-surface is 60 feet wide, and from Harper's Ferry to Cumberland it has an average of 70 feet width, the depth throughout its length being 6 feet. The canal is supplied with water from the Potomac River by means of seven dams thrown across the river at suitable distances. The boats used on this canal are ordinary flat-bottomed boats from 90 to 95 feet long and 14 feet wide, drawing 5½ feet when loaded. They carry from 110 to 115 tons of 2240 pounds. The terminus of the canal at Cumberland is 20 miles from the coal-field by the Cumberland and Pennsylvania R. R., its principal connection therewith.

The law of Apr. 30, 1824 (see article cited), was (mainly): "that the President of the U. S. is hereby authorized to cause the necessary surveys, plans, and estimates to be made of the routes of such roads and canals as he may deem of national importance in a commercial or military point of view, or necessary for the transportation of the public mail." . . . "That, to carry into effect the objects of this act, the President be, and he is hereby, authorized to employ two or more skilful civil engineers, and such officers of the corps of engineers, or who may be detailed to do duty with that corps, as he may think proper," etc. Under this law the board of engineers for internal improvements was organized, consisting of GEN. S. BERNARD, COL. J. G. TOTTEN (see biographies), and Mr. John Sullivan, civil engineer. One of the earliest works of this board was the survey of this canal communication, for which it sent into the field three "brigades" of surveyors—two under MAJ. J. J. ABERT and WILLIAM GIBBS MCNEIL (see biographies), each with five assistant lieutenants; and one under James Schriver, with five civil engineer surveyors. The recent surveys by T. S. Sedgwick, C. E., under direction of Col. W. E. Merrill, corps of engineers, were for a canal extension from Cumberland to Connellsville on the Youghiogheny, of 70 feet surface-width and 7 feet depth, with locks 120 feet long and 20 feet wide, with a summit-tunnel 3¾ miles long and 45 feet wide, without tow-paths, and to be operated by steam-propulsion boats or endless ropes. INCLINED PLANES (which see) were constructed in connection with the eastern slope (from Cumberland to the summit near Meyersdale). The canal proper would extend from Cumberland to Connellsville, 92 miles, thence by slack-water to McKeesport, 46 miles. The cost of canal and slack-water is estimated at $25,000,000. (For reports of last surveys see *Ex. Docs. 208* and *265*, 43d Congress, 1st session, and *Ex. Doc. 137*, 44th Congress, 1st session.)
T. S. SEDGWICK. REVISED BY J. G. BARNARD.

Ches'ney (CHARLES CORNWALLIS), b. in England in 1829; entered the British army as second lieutenant in the corps of royal engineers; became lieutenant-colonel in 1868 and brevet colonel 1873. Although he bore an excellent reputation as an officer of engineers, it is by his contributions to military literature his name is best known. He was for many years professor of military art and history at the Staff College, Sandhurst. In 1863 he published his *Campaigns in Virginia;* in 1868 his *Waterloo Lectures;* in 1870, jointly with Mr. Reeve, *Military Resources of Prussia and France;* in 1870 his *Military Biographies*, contributed mainly to the *Edinburgh Review*, including essays on Gens. Grant, Lee, and others, were published in 1 vol. D. Mar. 19, 1876.

Chevaux-legers ("light-horse") was the name of a company of light cavalry created by Henry IV., and used by him as a kind of household troops. The company consisted originally only of 240 men, all noblemen, and ranked next the *garde du corps*. Afterward several other companies were added, and the name became very celebrated until, in 1779, it disappeared from the French army-rolls, the companies having been incorporated with the regular regiments of dragoons. Meanwhile, the name had crossed the Rhine, and not only the minor princes of Germany, but even Austria, created companies of chevaux-legers. The name is frequently met with in the Napoleonic wars, and was much endeared in Germany, but has now disappeared there too.

Chézy, de (ANTOINE LÉONARD), b. at Neuilly Jan. 15, 1773; was educated in the Polytechnic School of Paris; studied Arabian, Persian, and other Oriental languages under Sacy and Langlès; was appointed to accompany Napoleon to Egypt in 1799, but fell sick in Toulon, and was compelled to return home; became conservator of the Oriental manuscripts in the National Library in 1799, and professor of Sanskrit in the Collège de France in 1814, and made a translation of *Medschnun and Leila* in 1807, and of *Sacuntala* in 1830. D. in Paris Aug. 31, 1832.

Chionididæ. See SHEATH BILL, in CYCLOPÆDIA.

Chironectidæ. See TOAD-FISH, in CYCLOPÆDIA.

Chris'tiancy (ISAAC P.), b. at Jamestown, Montgomery co., N. Y., Mar. 12, 1812; went to Monroe, Mich., in 1836, and was admitted to the bar in that place in 1838; was a delegate to the Free Soil convention which nominated Martin Van Buren to the Presidency, and was one of the founders of the Republican party in Michigan; served two terms in the Michigan senate; was editor for a year of the Monroe *Commercial*, and in 1857 was elected a judge of the supreme court of the State; was re-elected in 1865, and again in 1873, both times without opposition. In Jan., 1875, he was elected U. S. Senator from Michigan. Resigned Feb. 10, 1879. J. B. BISHOP.

Christian Union Churches is the name adopted by a denomination which first came together in convention at Columbus, O., in 1863, though the organization was not completed until 1865. Their principles, as stated by themselves, are—(1) the oneness of the Church; (2) Christ the only Head; (3) the Bible the only rule of faith and practice; (4) good fruits the only condition of fellowship; (5) the repudiation of controversy; (6) each local church governs itself; (7) no preaching of partisan politics. Their motto is, "In things essential, *unity*; in non-essentials, *liberty*; and in all things, *charity*." They practise baptism as a condition of membership, but are practically unrestricted in their communion. They have about 30,000 members and an adherent population of about 150,000, principally in Ohio, Indiana, Michigan, Iowa, Illinois, Missouri, Arkansas, Texas, Nebraska, and Kansas. There is some probability of their absorbing the general convention of Christians of the South, a branch of the Christian Connection, which holds to similar views. They have one newspaper, *The Christian Witness*, published at McArthur, O., and have issued several books and tracts. They are active in revival and missionary work. L. P. BROCKETT.

Chris'tie (WILLIAM D.), b. in 1815, and after thorough collegiate training became a member of the bar in 1840. He quickly distinguished himself, and enjoyed many distinctions. In 1842 he gained a seat in Parliament, which he held until 1847, for Weymouth, Dorsetshire. He entered the diplomatic service, and continued in it until 1870, holding last the important post of minister plenipotentiary at the court of Brazil. D. in 1874. His last years were spent in England in literary labors, one of which is *Life of the First Earl of Shaftesbury*. J. H. WORMAN.

Church (JOHN ADAMS), E. M., b. Apr. 5, 1843, at Rochester, N. Y.; graduated in 1867 at the School of Mines in New York City. After three years of professional travel in Europe, he published in 1871 a pamphlet on *Mining Schools in the United States*, and in 1873 *Notes on a Metallurgical Journey in Europe*. Mr. Church has contributed largely to recent technical literature, and was for two years associate editor of the *Engineering and Mining Journal of New York*. From 1872 to 1874 he filled the chair of mineralogy and metallurgy in the School of Mines, and is now engaged in the active practice of his profession.

Cigna'ni (CARLO), b. at Bologna in 1628; studied painting under Francesco Albani; spent several years in Florence and Rome; was made director of the Clementine Academy in 1708 by Pope Clement XI. D. at Forli Sept. 6, 1719. His principal pictures are frescoes in the cathedral of Forli, the church of St. Michael in Bologna, and the Farneso Palace in Florence. Among his oil-paintings is a *Joseph and the Wife of Potiphar*, which was often copied by himself and pupils.

Cinq-Mars', de (HENRI COIFFIER DE RUZÉ), MARQUIS, b. in 1620; came to the court in 1639 as a protégé of Richelieu, who intended to make him the favorite of the king, in order to use him as a spy. The cardinal, however, mistook the young man. Cinq-Mars, proud, noble, and brilliantly gifted, had an ambition of his own, and a deadly hatred soon sprang up between the favorite and the minister. Cinq-Mars joined the Orleans party, a conspiracy was formed for the overthrow of Richelieu, and an alliance was concluded with Spain. Meanwhile, the cardinal had watched the movement from the very beginning, and just as the conspiracy was ripe to enter into action he laid all its traitorous documents before the king, and had Cinq-Mars and his friend De Thou arrested at Narbonne June 13, 1642. In order to save himself, the duke of Orleans confessed all, and Cinq-Mars was executed at Lyons Sept. 12, 1642. Alfred de Vigny has given a very interesting description of his life and character in his romance, *Cinq-Mars, ou une Conjuration sous Louis XIII.*

Clai'borne (JOHN HERBERT), A. M., M. D., b. in Brunswick co., Va., Mar. 10, 1828; studied medicine at the University of Virginia and in Jefferson Medical College, Pa.; was a delegate, then a senator, to the Virginia general assembly; entered into the Confederate service as a surgeon in 1861; organized in 1862 the general hospitals of Petersburg, of which he became chief executive officer, and settled in that city. PAUL F. EVE.

Clai'borne, Clayborne, or **Cleborne** (WILLIAM), b. in England about 1585, was the second son of Sir Edmund Cleburne of Cleburne Hall, Westmoreland; was appointed by Charles I. his secretary of state for the dominion of Virginia Mar. 4, 1626, and treasurer of Virginia for life Apr. 6, 1642. He discovered, purchased, and planted Kent Island in 1631, and owned a large portion of the land upon which Annapolis now stands. He battled for his rights against Lord Baltimore with varying success until 1651, when he withdrew into Virginia, and was appointed by Cromwell a commissioner for the reduction of the colonies. Recent investigations into colonial history prove him to have been the victim of court-favoritism, injustice, and misrepresentation. He has been styled "the champion of Virginia" and the "evil genius of Maryland." D. about 1676. C. J. HUBBARD.

Clarke (Sir ANDREW), entered the corps of royal engineers June 19, 1844, in which he became a captain in 1851, lieutenant-colonel in 1867, and brevet colonel in 1872; was acting secretary of the British government in Van Diemen's Land 1851-52, and surveyor-general and chief commissioner of crown lands in Victoria 1853-58. In 1856 he became an executive councillor and member of the first cabinet in the latter colony, and in 1858 was strongly urged to accept the premiership, but declined. For his distinguished services in successfully inaugurating the new government in the young colonies, and for his vigorous and sagacious administration during the period of excitement which followed the discovery of gold, he was subsequently created a knight commander of St. Michael and St. George. In 1863 he made an inspection of the west coast colonies. In 1864 he was appointed director of engineering and architectural works of the navy under the admiralty, and as such designed and executed the great docks at Malta and Bermuda, also the extensive new works at Portsmouth, and other enormous works connected with the extension of the principal dockyards, until 1873, in which year he was appointed governor of the Straits Settlements, including Penang, Singapore, and Malacca. In 1875 he relinquished this office, and became minister of public works, and member of the council of the governor-general in India. For his services at the admiralty he was created a C. B. in 1869.

Clarke (WILLIAM TRAVIS), b. at Walpole, Mass., Oct. 1, 1829; educated for the pulpit at Meadville and Cambridge; ordained at Hingham, Mass., in 1855, and afterward preached at Haverhill and Chelsea; removed to New York in 1866, and edited the *Liberal Christian* till 1870; associate and afterward sole editor of the *Golden Age* till its discontinuance, Oct., 1875; gathered a Liberal society known as the Unity Chapel Congregation in 1869, of which he was the pastor till the close of 1876; editorially connected with the *Daily Graphic* from its start, Mar., 1873. Several of his discourses have been published, and he has contributed largely to magazines and newspapers.

Cleve'land (ORESTES), b. at Duanesburg, Schenectady co., N. Y., Mar. 2, 1829; came to New York in 1844, and entered the service of an importing fancy-goods house; became a partner in the business in 1854; withdrew in 1858; bought out the partner of his father-in-law, Joseph Dixon of Jersey City, manufacturer of crucibles and graphite articles, and developed the Dixon Crucible Co. to one of the largest and most successful establishments of the kind; was elected mayor of Jersey City in 1864, and re-elected in 1865 and 1866, and was elected to the 41st Congress in 1868, and chosen first vice-president of the U. S. Centennial Commission. H. L. STUART.

Clyt'ia, or **Clyt'ie** [Gr. Κλυτία or Κλυτίη], the name of three mythical personages mentioned by Hesiod, Ovid, Pausanias, and Tzetzes. With Ovid (*Metamorphoses*, iv.) she is a nymph loved by Apollo, the god of the sun, but who, having offended and being forsaken by him, pined away with her eyes fixed on the sun, and was turned into a flower, which (from its ever turning toward the sun) was called *heliotropium* (ἡλιοτρόπιον).

Cole'man (LEIGHTON), b. in Philadelphia May 3, 1837; graduated at the General Theological Seminary in New York City in June, 1861, and settled at once as rector of the memorial church of St. Luke in Philadelphia. In the autumn of 1863 he became rector of St. John's church in Wilmington, Del. Three years later he became rector of St. Mark's church at Mauch Chunk, Pa., remaining there nearly eight years, when he removed to Toledo, O., assuming the rectorship of Trinity church. In 1875 he was elected bishop of the diocese of Wisconsin. J. B. BISHOP.

Col'lins (THOMAS WHARTON), b. in New Orleans 1812; was educated a printer; rose from the case to be editor, and

then studied law; distinguished himself as a jurist; was several times a judge of the district court; was a prominent member of the constitutional convention of Louisiana in 1852, and is the author of several literary and philosophical works—*The Martyr Patriots*, in blank verse, a tragedy, *Humanics* and the *Eden of Labor*, a new theory of political economy, epoited in the form of a Utopia; also of many essays published in the magazines of the day. C. G. FORSHEY.

Col'yar (ARTHUR ST. CLAIR), b. in Washington co., Tenn., June 23, 1818; was self-educated; became a successful lawyer; opposed secession in 1861, but was a member of the Confederate Congress 1861–65; after the war gave his attention to the development of the Sewanee coal-mines, Tracy City, Tenn.; reorganized the Tennessee Coal and R. R. Co., of which he became president, and also gave attention to manufacturing. His enterprise has made the Tracy City mines a great success, and has done much to develop the material interests of his State.

Comstock Lode. This gigantic and famous silver-and-gold-bearing lode is situated in the western part of the State of Nevada, in Storey co., at a point about 12 miles N. E. of Carson City, and about 19 miles E. of the California State line, in lat. (about) 39° 22′ N. and lon. 119° 39′ W. from Greenwich. It lies on the eastern slope of the Virginia Mountains, a nearly due N. and S. offshoot of the Sierra Nevada, near the base of Mount Davidson, the loftiest peak of this secondary range, which is 7827 feet above the sea-level. The most important portion of the lode is included within the limits of Virginia City, which at C street is 1635 feet below the summit of this peak, or about 6192 feet above the level of the ocean.

Discovery.—According to J. Ross Browne, as well as Henry Degroot (*Overland Monthly*, June, 1873), the discovery of the Comstock Lode was a fortuitous occurrence. The sides of the Virginia range of mountains are furrowed by many deep ravines. Two of these, named respectively Gold and Six-Mile cañons, afforded as early as 1849 a considerable amount of placer-mining. In the spring of 1858 the miners working in Six-Mile Cañon found their rockers clogged with particles of a dark-colored mineral, which on account of its weight it was difficult to separate from the gold. This "black stuff" consisted of small pieces of rich sulphuretted silver ore that had been released from the Comstock Lode, which crossed the ravine a short distance above. Being ignorant of its value, these men threw away this material with the tailings. Among these pioneer miners was an elderly man who had taken unto himself the cognomen of James Fennimore. His associates first contracted it into "Old Finny," and afterward it was corrupted into "Old Virginny," probably from the fact that he hailed from the State of Virginia. This old man set about examining the croppings from which the cañon below had been enriched. These, being much decomposed, were found to contain a good deal of free gold, and he forthwith (Feb. 22, 1858) proceeded to take up a "claim" along them. This claim covered a portion of what is now the Mexican and Ophir grounds, at one time the most productive section of the Comstock Lode. It was not, however, until the following spring (1859) that the character of the deposits at this point became fully known. A couple of miners, at that time sinking a shaft at this place for the purpose of obtaining water for their rockers, discovered that this stratum of decomposed ore was not only very rich, but that it extended to a considerable depth beneath the surface. As soon as this became known the belt of croppings on both sides of this spot was "taken up" for a long distance along the lodge. These claims were originally taken up for placer-mining, but it was not long before its value as a silver-bearing lode became known. Indeed, as early as 1857 miners were actually engaged in placer-mining on the southern portion of what is now known to be the Comstock Lode, near Gold Hill, but they failed to recognize its argentiferous character. In the same year (1857) H. B. and E. A. Grosch, two educated metallurgists, first discovered silver ore while engaged in placer-mining in the portion of Gold Cañon near the site of Silver City. But the operations of these gentlemen were conducted at a point more than 2 miles S. E. of the Comstock Lode; so that they failed to recognize the existence of this celebrated ledge.

Origin of Name.—Among the comrades of "Old Finny" was Henry P. Comstock, who offered to purchase the old man's claim, tendering him in part payment an "old bob-tailed Indian pony," the balance consisting of a whisky consideration. The simple-minded Finny accepted the offer, and made over to his friend, "in consideration of the premises," a property which in less than a year after sold for more than a million of dollars. How little Comstock himself appreciated its real value is apparent from the fact that he shortly after disposed of his interest therein for some $5000 or $6000. In the second sale the claim was described as the "Comstock" ground, and being at the time supposed to cover the most important part, the name came soon after to be applied to the entire lode. And thus was poor Finny doubly defrauded—first, out of his interest in the lode itself, and second, out of the honor to which he was entitled as its original discoverer. To atone for this wrong, the miners, when they came to select a name for the new town to be laid out here, called it "Virginia."

Character of the Lode.—The Comstock is probably a true fissure-vein. The jaws of the fissure at the surface are from 250 to 1100 feet apart, gradually approaching each other in descending, forming a V-like section, until the fissure is reduced to an average width of 150 feet or less; in many places, however, swelling out to 500 feet in thickness, and in others contracting to not more than 20 feet in width. Its outcrop is not by any means continuous. In fact, the Comstock, though properly characterized as a single lode, is rather a broad metalliferous belt or ore-channel, carrying a congeries of subordinate lodes, bunches, and chimneys of ore, all reposing in as many distinct clefts, separated by "horses" and dikes of porphyry, belts of quartz, seams of clay, making up a body of vein-matter unparalleled for magnitude and complexity in the history of mining. "In point of geological time," Clarence King says, "the system of fissures which constitutes the Comstock Lode are subsequent to the propylite outflow, and belong in all probability to the dynamical disturbance connected with the eruptions of andesite. It is considered certain that the whole series of volcanic outbursts are *since* the Miocene epoch, and we may safely call the Comstock a Tertiary lode." In general terms, the course or "strike" of the lode may be said to be N. 25° E. (true meridian), to pitch or "dip" toward the E. at an angle of from 35° to 50°, and to have been definitively traced along a linear extent of more than 4 miles in the general direction (a little E. of the magnetic meridian) of the Virginia range of mountains. The *productive* portions of the vein, however, cover a linear space of scarcely over 2 miles.

Character of Ores.—The ores of the Comstock Lode consist chiefly of native gold, native silver, vitreous silver ore (argentite), stephanite, and argentiferous galena imbedded in a quartz gangue. Besides these, ruby silver, horn silver, polybasite, pyrargyrite, and sternbergite occur in small quantities; also, iron and copper pyrites, zinc blende, and several carbonates and sulphates.

Bonanzas or Ore-Bodies (see BONANZA).—These productive masses—variously designated as bonanzas, ore-bodies, ore-chambers, chimneys, zones, etc.—are irregular in shape, with a general tendency to a lenticular form, something like a concavo-convex lens. They usually occur in the swells of the vein, and their position is more vertical than the dip of the lode. Under existing circumstances it is impossible to obtain trustworthy data in relation to the dimensions and present prospects of such of these bonanzas as are at this time yielding more or less productive ores. Indeed, so long as these mining stocks are manipulated in San Francisco and elsewhere for speculative purposes it will be found to be impossible to elicit such information from mining engineers, superintendents, and others who are cognizant of the true condition of the mines. In fact, since the publication of the admirable volume on *Mining Industry* (vol. iii. of the *U. S. Geological Exploration of the 40th Parallel*) by James D. Hague and Clarence King, which indicated the true condition of these mines up to the end of 1869, nothing reliable has been published in regard to the precise dimensions and character of the bonanzas that have been exposed since that time. In the excellent atlas accompanying this volume the topography of the mining explorations on the Comstock Lode are given with all the precision and truthfulness which science demands. During the seven years that have elapsed since that time immense and important developments have been made on this remarkable lode, particularly on the *deep levels*; but our knowledge of them is exceedingly vague and imperfect. Most of these mines have had their prosperous eras, holding for a certain period, to be followed by seasons of restricted production; and it is obviously to the interest of speculators to conceal these fluctuations of productiveness from the public.

From the topographical surveys of 1869, Clarence King estimated that in the longitudinal elevations or sections of the lode not more than one-fourth, or 25 per cent., of the actual face of the lode has been occupied by argentiferous bodies; and that it is safe to say that not more than $\frac{1}{500}$th, or 0.2 per cent., of the lode materials have been charged with silver to a workable percentage. (*Mining Industry*, p. 76.) The true limits of these bonanzas or ore-bodies

cannot be definitely assigned, since the only clues to the bonanza outlines are the measurements of actually "stoped" ground. These deposits of silver ore occur in the quartz, distributing themselves capriciously in segregated bonanzas, separated from each other by intervals of entirely barren gangue, or of ore so poor as not to be workable. Hence their boundaries only represent the limits of the *pay ore* on a grade rarely less than $20 per ton. Moreover, as some of the earlier exploration-workings were scarcely ever surveyed at all, and of which, when measured, the records have not been preserved, it is impossible to obtain a few important features. In relation to the dimensions of the bonanzas that have been exposed since 1869, as has already been intimated, the data are very unreliable, and sadly in need of verification. The numbers contained in the following table relating to the dimensions of the bonanzas are obtained partly from measurements taken from the longitudinal and cross-sections of the lode, as given in atlas-plates 6, 7, 8, 9, and 10 of the volume on *Mining Industry*, and partly from other and less trustworthy sources:

	Bonanza.	Depth of upper limit, feet.	Length along vein, feet.	Extent in depth, feet.	Width or thickness, feet.
1	Mexican and Ophir	Surface.	600	650	2- 70
2	Gould and Curry	Surface.	600	540	3-100
3	Savage (continuation of No. 2)	440	500	300	5- 60
4	Hale and Norcross	260	520	600	3- 40
5	Chollar-Potosi	Surface.	580	500	5- 85
6	Gold Hill	Surface.	1040	550	10-100
7	Yellow Jacket	80	340	500	5- 60
8	Kentuck	.....	300	400	2- 40
9	Crown Point and Belcher	850	600	600	5- 60 (?)
10	Con. Virginia and California	1050	700	600	20-250 (?)

Product of the Big Bonanza for the year 1876.—The *last* in the foregoing table (No. 10) constitutes the world-renowned "Big Bonanza." Scarcely three years have elapsed since its discovery, and there are no trustworthy data from which an estimate can be made of the probable aggregate value of the gold and silver contained in this gigantic ore-body. In fact, until its complete outlines are exposed, and the exact quality of the ore of its various portions is determined, we have no basis for an estimate. It has been *supposed* to contain, in the aggregate, ore to the value of about $150,000,000.

The official returns for the year 1876 furnish the following numbers in relation to the Consolidated Virginia and the California mines, both of which operate upon the Big Bonanza:

Mine.	Ore in tons of 2000 lbs. each.	Value of gold, dollars.	Value of silver, dollars.	Total value, dollars.	Average yield per ton of ore.
Con. Virginia	142,678	7,378,115	9,279,504	16,657,619	$116 75
California	127,541	6,188,641	6,912,201	13,400,842	105 07
Both	270,219	13,866,786	16,191,705	30,058,491	$111 24
Comstock Lode	.....	17,125,000	19,875,000	37,000,000	

It is obvious that nearly five-sixths of the precious metals have come from the Big Bonanza mines.

Bullion-Product.—It is difficult to obtain trustworthy data in relation to the bullion-product of the Comstock Lode. The amount of precious metals yielded by this group of mines has indeed been enormous, but there is scarcely a doubt but that there has been a tendency to publish *exaggerated* estimates. The following figures, taken from a careful estimate furnished by Mr. James D. Hague, the able colleague of Clarence King in the preparation of the admirable volume on *Mining Industry* (vol. iii. of *Report on the Geological Exploration of the 40th Parallel*), exhibit, probably, a more accurate statement of the annual bullion production of this lode since the date of its discovery than any that has heretofore been published:

Year.	Value of bullion.	Year.	Value of bullion.
1860	$100,000	1870	$8,254,272
1861	2,000,000	1871	10,644,704
1862	6,000,000	1872	13,159,093
1863	12,000,000	1873	23,216,062
1864	16,000,000	1874	23,051,196
1865	16,000,000	1875	24,885,617
1866	11,739,100	1876	37,000,000
1867	13,738,618		
1868	8,479,769	Total	$234,074,399
1869	7,405,578		

Hence we may assume the total value of bullion-product of this celebrated lode from the date of its discovery to the end of 1876 to be, in round numbers, about $235,000,000. Comparing this amount with the estimated aggregate value (previously given) of the bullion-product of the Bonanza mines, it is evident that the great bulk of the precious metals comes from a few prominent mines.

The proportional value of *gold* contained in the bullion-product varies from 33 to 70 per cent. In the Big Bonanza it is stated at 42 per cent.; in the product of the Comstock Lode for 1876 it is estimated at 46 per cent. In the total product of the lode from its discovery to the end of 1876 the value of the gold cannot, therefore, be less than 40 per cent.; hence we have to the end of 1876—

Total bullion-product		=	$235,000,000
" gold	"	=	94,000,000
" silver	"	=	141,000,000

By reference to the table it will be seen that the bullion-product of the lode attained a maximum in 1861-65, diminished until 1869-70, and then increased again until 1876, at which time it probably reached its second maximum.

Comparative Product in 1876.—Taking the number furnished by the report of J. J. Valentine, general superintendent of Wells, Fargo & Co. (Dec. 30, 1876), as the basis, we have calculated the following table relating to the comparative product of gold and silver for the year 1876:

Product of Gold and Silver for the Year 1876.

	Value in dollars.			Per cent. of world's product.		
	Gold.	Silver.	Total.	Gold.	Silver.	Both.
World	101,328,501	77,006,672	178,335,173			
United States	44,328,501	41,506,672	85,835,173	43.75	53.90	48.12
Comstock	17,125,000	19,875,000	37,000,000	16.90	25.81	20.75
				Per cent. of United States product.		
Comstock	.....	.....	.....	38.63	47.88	43.11

It thus appears that the gold and silver product of the Comstock Lode for the year 1876 was more than one-fifth of the total world's product for the same year; and that its yield of silver was more than one-fourth of the aggregate silver-product of the world for that year. The proportional yield of gold, although very large, is not so extraordinary. The percentages in relation to the product of the Comstock Lode, in comparison with the aggregate product of the whole U. S., are equally striking in illustrating the enormous productiveness of this lode. The following table presents the latest summary:

Statement of Ore and Bullion Products, Assessments, and Dividends of the Principal Mines of the Comstock Lode during a series of years; prepared from Official Sources by James D. Hague.

Name of mining company.	Period of time considered.	Product of ore in tons during said period.	Approximate yield in gold and silver of said ore-product.	Average yield per ton of said ore.	Amount received from assessments during said period.	Amount paid in dividends in same time.	Percentage of product paid in dividends.	Percentage of product paid in net dividends (after deducting assessments).
Ophir	1860 to Dec., 1876.....16 years	.....	$10,598,055	.....	$2,038,344	$1,394,400	13.15	0.
California	Year ending Dec. 31, 1876.... 1 year	128,800	13,589,841	$105.07	None.	8,640,000	63.58	63.58
Consolidated Virginia	Apr. 14, 1867, to Dec. 31, 1876. 9 years	403,153	39,007,570	96.75	438,500	27,000,000	69.22	68.10
Gould and Curry	1860 to Nov. 30, 1876.....16 "	314,101	15,672,376	49.90	2,245,052	3,826,800	24.40	10.9
Savage	Apr., 1863, to July 1, 1876.....13 "	474,055	15,755,705	33.23	2,730,200	4,208,000	26.71	9.36
Hale and Norcross	Mar. 20, 1866, to Mar. 20, 1876.10 "	324,159	7,930,668	24.44	1,421,450	1,598,000	20.15	2.23
Chollar-Potosi	1865 to May 31, 1876.....11 "	472,019	13,168,900	27.90	1,022,000	3,081,080	23.40	15.74
Imperial	1863 to Apr. 15, 1876.....13 "	218,484	5,580,054	25.54	1,751,000	1,067,500	18.14	0.
Empire	1863 to Apr. 15, 1876.....13 "	81,020	2,678,518	33.06	477,100	489,600	18.27	0.46
Yellow Jacket	1863 to July 1, 1876.....13 "	.....	14,320,905	.....	2,478,000	2,184,000	15.25	0.
Kentuck	Nov. 1, 1865, to Nov. 1, 1874.. 9 "	.....	4,326,536	.....	280,000	662,000	15.30	8.83
Crown Point	May 1, 1865, to May 1, 1876...11 "	798,110	29,576,467	37.06	684,526	11,898,000	40.23	38.
Belcher	1863 to Dec. 31, 1876.....13 "	725,096	34,002,486	46.89	660,400	15,397,200	45.28	43.34
Totals	.....	.....	206,208,081	.....	16,226,572	81,446,580	39.49	31.63
The average yield per ton of		3,939,297	tons of ore is $44.92					

In the foregoing table the stated yield of the ore includes only that derived from the first milling, by which process something more than 70 per cent. of the assay-value is obtained. The treatment of the tailings gives a further revenue from the ore. Of the total bullion value, about 40 per cent. is gold and 60 per cent. silver. In the value stated no allowance is made for the discount on silver—a considerable percentage in recent years. Besides the mines named in this statement, there have been other important sources of bullion, of which no complete records are now available. Among them are the old Mexican mine (now comprised in the Ophir ground); the early surface-workings of what is now the Chollar-Potosi; the old and now consolidated claims in the region of Gold Hill and other points. The Overman and some other less important mines have produced in the aggregate a considerable amount of bullion. The total bullion product of the Comstock Lode at the end of 1876 is not far from $250,000,000.

Future Prospects.—The recent discovery of rich bodies of ore on the deeper levels has brought to notice the various difficulties incident to the execution of mining operations at such great depths. Of course, the economy of such work is of prime consideration. The Comstock now furnishes employment to over 2000 miners; its daily "output" of ore is nearly 2000 tons, estimated to contain about one ton of bullion, valued at nearly $56,000. To obtain this amount of ore, in addition to the labor of mining 15,000 tons of dead weight (cable, cages, and cars) must be hoisted daily; 8640 tons of water are pumped; and 1000 tons of waste rock must, in order to reach the surface, pass daily up shafts 2000 feet in depth. And to this must be added the expense of milling and reducing the ore. Moreover, the great heat experienced in the lower levels of the deeper mines is a very serious obstacle to future developments. "Currents of heated waters still penetrate the lode below, and are unquestionably the lingering traces of solfataric action;" "chemical decomposition is yet active here;" "nearly the whole interior of the lode is in a condition of gentle chemical activity." (*King.*) The unusually rapid augmentation of temperature with increasing depth thus produced is a feature which demands the most serious consideration. In some of these mines at the depth of 1700 feet the temperature has ranged from 110° to 120° F., thus converting the lower levels into a vast sweat-house. Although clothing is reduced to a minimum, it is impossible for the miners to continue operations for more than fifteen or twenty minutes at a time without cooling off preparatory to renewing their labors. The application of more efficient means of ventilation has recently mitigated this evil, but it still remains a serious difficulty. It seems to be evident that the construction of a deep adit is a necessary adjunct to safe, economical, and permanently successful mining on this lode. Whether the Sutro Tunnel will perform in an efficient manner this twofold function of economy in mining and of thorough ventilation remains to be seen.

JOHN LE CONTE.

Confederation, Articles of, adopted in 1781, and forming the Constitution of the U. S. of America until 1788. (See UNITED STATES (*History*), in CYCLOPÆDIA.)

ARTICLES OF CONFEDERATION.—*To all to whom these presents shall come, we, the undersigned, delegates of the States affixed to our names, send greeting:* Whereas the delegates of the United States of America in Congress assembled did, on the fifteenth day of November, in the year of our Lord one thousand seven hundred and seventy-seven, and in the second year of the independence of America, agree to certain articles of confederation and perpetual Union between the States of New Hampshire, Massachusetts Bay, Rhode Island and Providence Plantations, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia, in the words following, viz.:

Articles of Confederation and perpetual Union between the States of New Hampshire, Massachusetts Bay, Rhode Island and Providence Plantations, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia.

ARTICLE 1. The style of this confederacy shall be "The United States of America."

ART. 2. Each State retains its sovereignty, freedom, and independence, and every power, jurisdiction, and right, which is not by this confederation expressly delegated to the United States in Congress assembled.

ART. 3. The said States hereby severally enter into a firm league of friendship with each other for their common defence, the security of their liberties, and their mutual and general welfare; binding themselves to assist each other against all force offered to, or attacks made upon them, or any of them, on account of religion, sovereignty, trade, or any other pretence whatever.

ART. 4. The better to secure and perpetuate mutual friendship and intercourse among the people of the different States in this Union, the free inhabitants of each of these States, paupers, vagabonds, and fugitives from justice excepted, shall be entitled to all privileges and immunities of free citizens in the several States; and the people of each State shall have free ingress and regress to and from any other State, and shall enjoy therein all the privileges of trade and commerce, subject to the same duties, impositions, and restrictions, as the inhabitants thereof respectively; provided that such restrictions shall not extend so far as to prevent the removal of property imported into any State to any other State, of which the owner is an inhabitant; provided also, that no imposition, duties, or restriction shall be laid by any State on the property of the United States or either of them.

If any person guilty of or charged with treason, felony, or other high misdemeanor, in any State, shall flee from justice, and be found in any of the United States, he shall, upon demand of the Governor or Executive power of the State from which he fled, be delivered up and removed to the State having jurisdiction of his offence.

Full faith and credit shall be given in each of these States to the records, acts, and judicial proceedings of the courts and magistrates of every other State.

ART. 5. For the more convenient management of the general interests of the United States, delegates shall be annually appointed in such manner as the Legislature of each State shall direct, to meet in Congress on the first Monday in November in every year, with a power reserved to each State to recall its delegates, or any of them, at any time within the year, and to send others in their stead for the remainder of the year.

No State shall be represented in Congress by less than two, nor by more than seven members; and no person shall be capable of being a delegate for more than three years in any term of six years; nor shall any person, being a delegate, be capable of holding any office under the United States, for which he, or another for his benefit, receives any salary, fees, or emoluments of any kind.

Each State shall maintain its own delegates in a meeting of the States, and while they act as members of the committee of the States.

In determining questions in the United States in Congress assembled, each State shall have one vote.

Freedom of speech and debate in Congress shall not be impeached or questioned in any court or place out of Congress; and the members of Congress shall be protected in their persons from arrests and imprisonments during the time of their going to and from and attendance on Congress, except for treason, felony, or breach of the peace.

ART. 6. No State, without the consent of the United States in Congress assembled, shall send any embassy to, or receive any embassy from, or enter into any conference, agreement, alliance, or treaty, with any king, prince, or state; nor shall any person holding any office of profit or trust under the United States, or any of them, accept of any present, emolument, office, or title of any kind whatever, from any king, prince, or foreign state; nor shall the United States in Congress assembled, or any of them, grant any title of nobility.

No two or more States shall enter into any treaty, confederation, or alliance whatever, between them, without the consent of the United States in Congress assembled, specifying accurately the purposes for which the same is to be entered into, and how long it shall continue.

No State shall lay any imposts or duties which may interfere with any stipulations in treaties entered into by the United States in Congress assembled, with any king, prince, or state, in pursuance of any treaties already proposed by Congress to the courts of France and Spain.

No vessel of war shall be kept up in time of peace by any State, except such number only as shall be deemed necessary by the United States in Congress assembled for the defence of such State or its trade; nor shall any body of forces be kept up by any State in time of peace except such number only, as in the judgment of the United States in Congress assembled, shall be deemed requisite to garrison the forts necessary for the defence of such State; but every State shall always keep up a well-regulated and disciplined militia, sufficiently armed and accoutred, and shall provide and have constantly ready for use, in public stores, a due number of field-pieces and tents, and a proper quantity of arms, ammunition, and camp equipage.

No State shall engage in any war without the consent of the United States in Congress assembled, unless such State be actually invaded by enemies, or shall have received certain advice of a resolution being formed by some nation of Indians to invade such State, and the danger is so imminent as not to admit of a delay till the United States in Congress assembled can be consulted; nor shall any State grant

commissions to any ships or vessels of war, nor letters of marque or reprisal, except it be after a declaration of war by the United States in Congress assembled, and then only against the kingdom or state, and the subjects thereof, against which war has been so declared, and under such regulations as shall be established by the United States in Congress assembled, unless such State be infested by pirates, in which case vessels of war may be fitted out for that occasion, and kept so long as the danger shall continue, or until the United States in Congress assembled shall determine otherwise.

Art. 7. When land forces are raised by any State for the common defence, all officers of or under the rank of colonel, shall be appointed by the legislature of each State respectively, by whom such forces shall be raised, or in such manner as such State shall direct, and all vacancies shall be filled up by the State which first made the appointment.

Art. 8. All charges of war, and all other expenses that shall be incurred for the common defence or general welfare, and allowed by the United States in Congress assembled, shall be defrayed out of a common treasury, which shall be supplied by the several States in proportion to the value of all land within each State granted to or surveyed for any person, as such land and the buildings and improvements thereon shall be estimated according to such mode as the United States in Congress assembled shall from time to time direct and appoint.

The taxes for paying that proportion shall be laid and levied by the authority and direction of the legislatures of the several States, within the time agreed upon by the United States in Congress assembled.

Art. 9. The United States in Congress assembled shall have the sole and exclusive right and power of determining on peace and war, except in the cases mentioned in the sixth article—of sending and receiving ambassadors—entering into treaties and alliances; provided, that no treaty of commerce shall be made whereby the legislative power of the respective States shall be restrained from imposing such imposts and duties on foreigners as their own people are subjected to, or from prohibiting the exportation or importation of any species of goods or commodities whatsoever—of establishing rules for deciding in all cases what captures on land or water shall be legal, and in what manner prizes taken by land or naval forces in the service of the United States shall be divided or appropriated—of granting letters of marque and reprisal in times of peace—appointing courts for the trial of piracies and felonies committed on the high seas, and establishing courts for receiving and determining finally appeals in all cases of captures; provided, that no member of Congress shall be appointed a judge of any of the said courts.

The United States in Congress assembled shall also be the last resort on appeal in all disputes and differences now subsisting or that hereafter may arise between two or more States concerning boundary, jurisdiction, or any other cause whatever; which authority shall always be exercised in the manner following: whenever the legislative or executive authority or lawful agent of any State in controversy with another shall present a petition to Congress, stating the matter in question, and praying for a hearing, notice thereof shall be given by order of Congress to the legislative or executive authority of the other State in controversy, and a day assigned for the appearance of the parties, by their lawful agents, who shall then be directed to appoint by joint consent commissioners or judges to constitute a court for hearing and determining the matter in question; but if they cannot agree, Congress shall name three persons out of each of the United States, and from the list of such persons each party shall alternately strike out one, the petitioners beginning, until the number shall be reduced to thirteen; and from that number not less than seven nor more than nine names, as Congress shall direct, shall, in the presence of Congress, be drawn out by lot; and the persons whose names shall be so drawn, or any five of them, shall be commissioners or judges, to hear and finally determine the controversy, so always as a major part of the judges, who shall hear the cause, shall agree in the determination; and if either party shall neglect to attend at the day appointed, without showing reasons which Congress shall judge sufficient, or being present shall refuse to strike, the Congress shall proceed to nominate three persons out of each State, and the secretary of Congress shall strike in behalf of such party absent or refusing; and the judgment and sentence of the court, to be appointed in the manner before prescribed, shall be final and conclusive; and if any of the parties shall refuse to submit to the authority of such court, or to appear, or defend their claim or cause, the court shall, nevertheless, proceed to pronounce sentence or judgment, which shall, in like manner, be final and decisive, the judgment or sentence and other proceedings being in either case transmitted to Congress, and lodged among the acts of Congress for the security of the parties concerned; provided, that every commissioner, before he sits in judgment, shall take an oath, to be administered by one of the judges of the supreme or superior court of the State, where the cause shall be tried, "well and truly to hear and determine the matter in question, according to the best of his judgment, without favor, affection, or hope of reward;" provided, also, that no State shall be deprived of territory for the benefit of the United States.

All controversies concerning the private right of soil, claimed under different grants of two or more States, whose jurisdiction as they may respect such lands and the States which passed such grants are adjusted, the said grants or either of them being at the same time claimed to have originated antecedent to such settlement of jurisdiction, shall, on the petition of either party to the Congress of the United States, be finally determined, as near as may be, in the same manner as is before prescribed for deciding disputes respecting territorial jurisdiction between different States.

The United States in Congress assembled shall also have the sole and exclusive right and power of regulating the alloy and value of coin struck by their own authority, or by that of the respective States—fixing the standard of weights and measures throughout the United States—regulating the trade and managing all affairs with the Indians not members of any of the States; provided that the legislative right of any State within its own limits be not infringed or violated—establishing and regulating post-offices from one State to another throughout all the United States, and exacting such postage on the papers passing through the same, as may be requisite to defray the expenses of the said office—appointing all officers of the land forces in the service of the United States excepting regimental officers—appointing all the officers of the naval forces, and commissioning all officers whatever in the service of the United States—making rules for the government and regulation of the said land and naval forces, and directing their operations.

The United States in Congress assembled shall have authority to appoint a committee to sit in the recess of Congress, to be denominated "a committee of the States," and to consist of one delegate from each State; and to appoint such other committees and civil officers as may be necessary for managing the general affairs of the United States, under their direction—to appoint one of their number to preside, provided that no person be allowed to serve in the office of president more than one year in any term of three years—to ascertain the necessary sums of money to be raised for the service of the United States, and to appropriate and apply the same for defraying the public expenses—to borrow money or emit bills on the credit of the United States, transmitting every half year to the respective States an account of the sums of money so borrowed or emitted—to build and equip a navy—to agree upon the number of land forces, and to make requisitions from each State for its quota, in proportion to the number of white inhabitants in such State; which requisition shall be binding, and thereupon the legislature of each State shall appoint the regimental officers, raise the men, and clothe, arm, and equip them, in a soldier-like manner, at the expense of the United States; and the officers and men so clothed, armed, and equipped, shall march to the place appointed, and within the time agreed on by the United States in Congress assembled; but if the United States in Congress assembled shall, on consideration of circumstances, judge proper that any State should not raise men, or should raise a smaller number than its quota, and that any other State should raise a greater number of men than the quota thereof, such extra number shall be raised, officered, clothed, armed, and equipped, in the same manner as the quota of such State, unless the legislature of such State shall judge that such extra number cannot safely be spared out of the same; in which case they shall raise, officer, clothe, arm, and equip as many of such extra number as they judge can be safely spared. And the officers and men so clothed, armed, and equipped, shall march to the place appointed, and within the time agreed on by the United States in Congress assembled.

The United States in Congress assembled shall never engage in a war, nor grant letters of marque and reprisal in time of peace, nor enter into any treaties or alliances, nor coin money, nor regulate the value thereof, nor ascertain the sums and expenses necessary for the defence and welfare of the United States or any of them, nor emit bills, nor borrow money on the credit of the United States, nor appropriate money, nor agree upon the number of vessels-of-war to be built or purchased, or the number of land or sea forces to be raised, nor appoint a commander-in-chief of the army and navy, unless nine States assent to the same; nor shall a question on any other point, except for adjourning from day to day, be determined, unless by the

votes of a majority of the United States in Congress assembled.

The Congress of the United States shall have power to adjourn to any time within the year, and to any place within the United States, so that no period of adjournment be for a longer duration than the space of six months; and shall publish the journal of their proceedings monthly, except such parts thereof relating to treaties, alliances, or military operations, as in their judgment require secrecy; and the yeas and nays of the delegates of each State on any question shall be entered on the journal, when it is desired by any delegate; and the delegates of a State, or any of them, at his or their request, shall be furnished with a transcript of the said journal, except such parts as are above excepted, to lay before the legislatures of the several States.

Art. 10. The committee of the States, or any nine of them, shall be authorized to execute, in the recess of Congress, such of the powers of Congress as the United States in Congress assembled, by the consent of nine States, shall from time to time think expedient to vest them with; provided that no power be delegated to the said committee, for the exercise of which, by the articles of confederation, the voice of nine States in the Congress of the United States assembled is requisite.

Art. 11. Canada, acceding to this confederation, and joining in the measures of the United States, shall be admitted into, and entitled to all the advantages of, this Union; but no other colony shall be admitted into the same unless such admission be agreed to by nine States.

Art. 12. All bills of credit emitted, moneys borrowed, and debts contracted, by or under the authority of Congress, before the assembling of the United States, in pursuance of the present confederation, shall be deemed and considered as a charge against the United States, for payment and satisfaction whereof the said United States and the public faith are hereby solemnly pledged.

Art. 13. Every State shall abide by the decision of the United States, in Congress assembled, on all questions which, by this confederation, are submitted to them. And the articles of this confederation shall be inviolably observed by every State, and the Union shall be perpetual; nor shall any alteration at any time hereafter be made in any of them, unless such alteration be agreed to in a Congress of the United States, and be afterwards confirmed by the legislature of every State.

And whereas it has pleased the great Governor of the world to incline the hearts of the legislatures we respectively represent in Congress, to approve of and to authorize us to ratify the said articles of confederation and perpetual union; *know ye*, that we, the undersigned delegates, by virtue of the power and authority to us given for that purpose, do, by these presents, in the name and in behalf of our respective constituents, fully and entirely ratify and confirm each and every of the said articles of confederation and perpetual union, and all and singular the matters and things therein contained; and we do further solemnly pledge and engage the faith of our respective constituents, that they shall abide by the determinations of the United States in Congress assembled, on all questions which, by the said confederation, are submitted to them; and that the articles thereof shall be inviolably observed by the States we respectively represent; and that the Union be perpetual.

In witness whereof, we have hereunto set our hands, in Congress. Done at Philadelphia, in the State of Pennsylvania, the ninth day of July, in the year of our Lord one thousand seven hundred and seventy-eight, and in the third year of the independence of America.

NEW HAMPSHIRE.
Josiah Bartlett,
John Wentworth, Jr.

MASSACHUSETTS BAY.
John Hancock,
Samuel Adams,
Elbridge Gerry,
Francis Dana,
James Lovell,
Samuel Holton.

RHODE ISLAND.
William Ellery,
Henry Marchant,
John Collins.

CONNECTICUT.
Roger Sherman,
Samuel Huntington,
Oliver Wolcott,
Titus Hosmer,
Andrew Adams.

NEW YORK.
James Duane,
Francis Lewis,
William Duer,
Gouverneur Morris.

NEW JERSEY.
John Witherspoon.
Nath. Scudder.

PENNSYLVANIA.
Robert Morris,
Daniel Roberdeau,
Jonathan Bayard Smith,
William Clingan,
Joseph Reed.

DELAWARE.
Thomas McKean,
John Dickinson,
Nicholas Van Dyke.

MARYLAND.
John Hanson,
Daniel Carroll.

VIRGINIA.
Richard Henry Lee,
John Banister,
Thomas Adams,
John Harvie,
Francis Lightfoot Lee.

NORTH CAROLINA.
John Penn,
Cornelius Harnett,
John Williams.

SOUTH CAROLINA.
Henry Laurens,
William Henry Drayton,
John Matthews,
Richard Hutson,
Thomas Heyward, Jr.

GEORGIA.
George Walton,
Edward Telfair,
Edward Langworthy.

Con'go, or Zaïre. This river of Africa—of which a few years ago hardly more than its mouth and a small portion of its lower course was known—has been unexpectedly proved, by the latest investigations of Livingstone, Lieut. Cameron, and H. M. Stanley, to be one of the largest and most remarkable of that continent. Its most remote head-waters are found, like those of the Nile, in the high table-lands forming the main axis of Eastern Africa, 4500 feet above the sea, between 3° and 12° S. lat., and are collected in two large lakes—Tanganyika on the N. and Bangweolo (or Bemba) on the S. The main and longest branch, bearing the name of Chambezi, rises in the plateau S. of Lake Tanganyika, near the waters of the Zambezi, and enters the large lake of Bangweolo (3700 feet above the sea; area, about 8400 sq. miles), from which it flows northward, under the name of Luapula, into the smaller lake of Mweru (altitude, 3000 feet; area, 1800 sq. miles). Continuing its course, it takes the name of Lualaba, receives on the E. the Lukuga, an occasional outflow from Lake Tanganyika, and from the S.W. the Kamalondo, a large river which also passes through a series of lakes. Thence flowing to the N.W., the Lualaba enters its middle course near the city of Nyangwe (4°.16 S. lat. and 1500 feet alt.), below which it receives from the S. the Lumami, and then turning N. again forms numerous cataracts until it reaches the Equator. According to Stanley, who is the first and only traveller who has navigated it throughout its course to the sea, the Congo flows thence to the N.W., receives the Aruwimi from the N. E.; when near 2° N. lat., it gradually curves to the S. W., and, breaking through the coast-chains in a series of rapids to the cataracts of Yellala, enters the Atlantic in about 6° S. lat. During its long middle course many large affluents swell its waters, the most important of which are the Kassabi (or Ikelemba) and the Quango. The basin of the Congo seems thus to occupy a long central depression 1100 to 2000 feet above the sea, extending from E. to W. between the plateaus of 4000 to 5000 feet which surround it on all sides. The main tributaries, however, come from its southern edge, which has been explored by Lieut. Cameron. The northern border of the basin is still a *terra incognita*. Unlike the Nile, which, having its head-waters within the regions of the tropical rains, hastens to the N. through dry and desert tracts without receiving any affluent, the Congo throughout its course remains within the regions of frequent equatorial rains. This situation makes it a purely tropical river, and explains the superabundance of its waters, which are said to exceed three times those of any other of Africa. The Congo is for that continent what the Amazon is for South America, and its basin is a land of exuberant vegetation and great fertility. Stanley estimates the area of its basin at 952,000 sq. miles, and its length at 2900 miles. Its turbid waters are said to be still visible 100 miles from the coast.

A. Guyot. Revised Oct., 1878.

Congressional Term, Limits of. The Constitution of the U. S. provides that members of the House of Representatives in Congress shall be elected every second year. This determines the duration of each succeeding Congress. By a law of the Congress elected under the Articles of Confederation, passed Sept. 13, 1788, Wednesday, the 4th day of March, 1789, was appointed for the assembling of the first constitutional Congress and the inauguration of the new government. No quorum, however, was obtained in the House of Representatives on that day, or until the 1st of April following, and the President was not inaugurated till the 30th of the same month. Subsequently, by an act of the constitutional Congress, passed Mar. 1, 1792, it was declared that "the term of four years for which a President and Vice-President shall be elected, shall in all cases commence on the 4th day of March next succeeding the day on which the votes of the electors shall have been given." At Washington's second inauguration, and at the inauguration of every President since his time, the oath of office has been administered, in each fourth succeeding year, on the 4th of March, at 12 o'clock M.; and until 1851 it was understood that his term of service expired on the 3d of March at midnight of the fourth year following. The limit of the Congressional term was supposed to be the same; so that the legislative powers of each succeeding Congress were presumed to cease at midnight of the 3d of March of each alternate odd-numbered year. At the close of the 31st Congress, however, in 1851, a discussion arose in which the propriety of this limitation was called in question, and the point was made that, since in the Presidential years, a new administration is not inaugurated until 12 o'clock on the 4th of March, the interpretation of law commonly received would create an interregnum of twelve hours' duration. In conclusion, Mr. Speaker Howell Cobb of Georgia ruled that the term of an outgoing Congress did not expire until 12 o'clock noon of the 4th of

March, and that rule has since stood. In conformity with this rule, on the 25th Feb., 1853, Pres. Fillmore, in calling a special session of the Senate to organize the administration of his successor, Franklin Pierce, issued a proclamation in the following words: "The attention of the President having been called to the proceedings of Congress at the close of its session on the 4th of Mar., 1851, from which it appears that the constitutional term of that body was held not to have expired until 12 o'clock at noon of that day; and a notice having been issued, agreeably to former usage, to convene the Senate at 11 o'clock A. M. on the 4th of March next, it is apparent that such call is in conflict with the decision aforesaid. Now, therefore, as well for the purpose of removing all doubt as to the legality of such call, as of establishing a precedent of what is deemed a proper mode of convening the Senate, I, Millard Fillmore, President of the United States, do issue this my proclamation," etc. etc. (convening the Senate for the 4th of March at 12 o'clock noon).

In 1867 a statute was passed declaring the rule specifically as follows: "In addition to the present regular times of the meeting of Congress, there shall be a meeting of the Fortieth Congress of the United States, and of each succeeding Congress thereafter, at 12 o'clock, meridian, on the fourth day of March, the day on which the term begins for which the Congress is elected, except that, when the fourth of March occurs on Sunday, then the meeting shall take place at the same hour on the succeeding day." (Approved Jan. 22, 1867.) This act was repealed Apr. 20, 1871, but as an authoritative declaration of the limits of the Congressional term it must be regarded as still of force. A new Congress, therefore, comes into existence at 12 o'clock at noon on the 4th of March of each odd-numbered year, and ceases to exist at the same hour of the same day in the second year next following, unless one or the other of those days happens to be Sunday, when the 5th of March is taken instead of the 4th of March. Under this rule it further appears that the political day throughout the sessions of Congress properly begins, for legislative purposes, at 12 o'clock M. of the calendar day of the same name. This rule was enforced in a manner to attract public attention during the progress of the count of the Presidential vote in February, 1877, when the Speaker, in the midst of an exciting debate, repeatedly arrested the discussion at 12 M. by announcing the beginning of a new political day, and the chaplain appeared and opened the new session with prayer. F. A. P. BARNARD.

Congressman at Large, a member elected to the House of Representatives by the voters of the entire State, instead of by districts in accordance with the ordinary plan. By the act of Feb. 2, 1872, a new apportionment was made of members of that House, the number being fixed at 292. A specific number of members was assigned to each State. It was then provided that in each State entitled under the apportionment to more than one Representative the number to which such State may be entitled in the Forty-third and each subsequent Congress shall be elected by districts composed of contiguous territory, and containing as nearly as possible an equal number of inhabitants, etc.; but on the election of members to the *Forty-third* Congress in any State to which an increased number of Representatives is given by this apportionment, the additional Representative or Representatives may be elected by the *State at large.* (*Revised Statutes Congress,* § 20–22.) It will thus be seen that the office of "Congressman at large" was a mere makeshift, devised in order to carry into effect the Apportionment act of 1872. The purpose having been accomplished, the office has ceased to exist. T. W. DWIGHT.

Con'way (MONCURE DANIEL), b. in Stafford co., Va., Mar. 17, 1832; graduated in 1849 at Dickinson College, Carlisle, Pa.; became a Methodist minister, and afterward a Unitarian pastor; in 1863 went to England, and in 1867 became a minister at Camden Town; published *Tracts for To-day* (1858), *The Rejected Stone* (1861), *The Golden Hour* (1862), *The Earthward Pilgrimage* (1870), etc.

Cook (REV. JOSEPH), A. M., b. Jan. 26, 1838, at Ticonderoga, N. Y.; graduated at Harvard University in 1865; studied theology at Andover Seminary and in Germany; is the author of *Boston Monday Lectures, Biology, Transcendentalism, Conscience,* etc.

Cook (MARTHA WALKER), sister of Robert James Walker, b. in Pennsylvania in 1807; married to Lieut. (afterward Gen.) William Cook 1825. D. at Hoboken, N. J., Sept. 15, 1874. In 1864 she published the hymn, "In some way or other the Lord will provide." R. D. HITCHCOCK.

Cook (PHILIP), b. in Twiggs co., Ga., July 31, 1817; studied at Oglethorpe University and the University of Virginia; was admitted to the bar in Georgia; in 1861 joined the Confederate service as a private, and at the end of the war was a brigadier-general. In 1865 he was elected to the State convention; was subsequently elected to the 39th Congress, and, after the removal of all disabilities, to the 43d, 44th, and 45th Congresses.

Cooke (JOHN ESTEN), b. at Boston, Mass., Mar. 2, 1783; graduated in medicine at the Pennsylvania University 1805; professor at Transylvania University in 1827, and at the Louisville Medical Institute in 1837. D. near Louisville Oct. 19, 1853. He published a *Treatise on Pathology and Therapeutics* (2 vols., 1827–28), and a number of minor essays. PAUL F. EVE.

Coryph'odon [from Gr. κορυφή, "point," and ὀδούς, "tooth"], an extinct genus of ungulate mammals from the lowest Eocene of Europe and America. The skull in this genus presents many perissodactyl features. It is elongated in the facial region, and the nasal opening is large. The dental formula is—incisors, $\frac{3}{3}$; canines, $\frac{1}{1}$; premolars, $\frac{4}{4}$; molars, $\frac{3}{3} \times 2 = 44$. The brain-cavity is quite small, as in all Eocene mammals, and indicates that the brain itself was of a very inferior type. Its most striking features were the small size of the hemispheres and the large expanded cerebellum. The limbs were short, and the femur had a third trochanter. The feet are especially interesting, as they present a primitive or generalized type, having five toes both before and behind. The first known species was described by Prof. Owen under the name *C. Eocenus,* and was from the London clay. *C. Oweni* is from the lowest Eocene of France. *C. hamatus,* the best-known American species, is from the base of the Eocene in Wyoming, and other species occur in the lowest Eocene of Utah and New Mexico. The genus is thus of great importance, as indicating the parallelism of European and American strata. The animals were about the size of the tapir. O. C. MARSH.

Cot'ton (Sir ARTHUR T.), b. 1803; entered the British service as second lieutenant of royal engineers (late Madras) in 1820; served throughout the Burmese war of 1824–26; became colonel and colonel-commandant (late Madras) engineers in 1854. In recognition of his services in promoting the growth of cotton in India he was knighted in 1861, and in 1866 was nominated K. C. of Star of India; appointed major-general in 1862, lieut.-gen. in 1867.

Cowry. See CYPRÆIDÆ.

Cox (GEORGE WILLIAM), b. in 1827; was educated in Trinity College, Oxford, England; took holy orders in 1850; was a curate for several years; received an assistant mastership in Cheltenham College in 1860, and published *Tales of Ancient Greece* (1868), *A History of Greece* (2 vols., 1874), *Latin and Teutonic Christendom* (1870), *The Mythology of the Aryan Nations* (2 vols., 1870). In connection with W. T. Brande he edited the new edition of the *Dictionary of Science, Literature, and Art* (London, 3 vols., 1865–67).

Cra'po (HENRY H.), b. in Dartmouth, Mass.; was police-justice and tax-collector of New Bedford; removed to Michigan in 1857; engaged in the manufacture of lumber, and also in farming; was mayor of Flint, State senator, and performed great service as governor near the close of the rebellion. D. at Flint, Mich., July 23, 1869.

Crich'ton (JAMES). The evidence of the extraordinary accomplishments of this remarkable person is very strong, and it is contradicted by little but its extreme improbability. But the close coincidence of the accounts of Crichton and another young literary prodigy of an earlier age—a fact not hitherto noticed, so far as we are aware—suggests a doubt whether his panegyrists have not borrowed their eulogiums, at least in part, from a chronicler of the preceding century. In the *Journal d'un Bourgeois de Paris de 1409 à 1449,* published in one of the volumes of Buchon's collection, *Choix de Chroniques, etc., XIVe Siècle* (Paris, 1838), under the year 1446 is a narrative of the appearance at Paris of "a young man of about twenty, who, according to the testimony of all the clerks of the university, knew the seven liberal arts, played all instruments, practised chant and discant, painted and illuminated, better than any other at Paris or elsewhere. In military exercises none so dexterous; he wielded a two-handed sword incomparably, and sprang upon his opponent with a leap of twenty or more paces; he was a master in the arts and in medicine, a doctor of canon law and theology; he disputed publicly with more than fifty perfect clerks of the University of Paris and more than 3000 other clerks, and answered admirably all questions; he spoke excellently Latin, Greek, Hebrew, Chaldee, Arabic, and all other tongues. He was a dubbed knight, he surpassed the four doctors of the Church, and in fine was the nonpareil of the world." His knowledge, of course, came from the Evil One, though he himself was unaware of this diabolic possession, and thought his acquirements merely natural. The chronicler gives the predictions as to his future history, ending with his being carried off by devils at the age of thirty-three. (See CRICHTON, in CYCLOPÆDIA.) GEORGE P. MARSH.

Cro'ly (David G.), b. in New York City Nov. 3, 1829; learned the trade of silversmith; was for a time a student in New York University; taught phonography; was employed on the *Evening Post* and New York *Herald* from 1854 to 1858; was editor and proprietor of Rockford *Daily News*; city editor upon the New York *World* when it first started, subsequently managing editor; resigned in 1871, and has been since then managing editor of the *Graphic*, an illustrated newspaper. He is the writer of a *Life* of Horatio Seymour, and the author of a brochure entitled *The Positivist's Primer*; issued two numbers of the *Modern Thinker*; was the first to introduce the subject of minority representation to the American public in the *Galaxy* in 1866: has written on journalism in the magazines. In 1856 married the lady now known as "Jennie June."

Croly (Jennie Cunningham), "Jennie June," b. in Leicestershire, England; came early to the U. S. with her parents, and married in 1856 Daniel G. Croly of New York. Shortly after she began her literary activity as a contributor to the *Sunday Dispatch*, and she has ever since written for the press; inaugurated the system of duplicate fashion correspondence; has edited *Madame Demorest's Magazine* for several years. She called the first women's congress in New York, 1856, and also the second, 1869, and in 1868 inaugurated the Sorosis (see in Cyclopædia).

Cru'se (Christian Frederic), b. in Philadelphia, Pa., in 1794; in 1817 graduated with honor in the University of Pennsylvania, having been the first moderator of the Philomathean Society of that college; after several years as Lutheran minister he was ordained in the Episcopal Church by Bishop White; was elected to a chair in the university in which he had been educated, and then held several pastoral cures, finishing his official service as librarian of the General Theological Seminary of the Episcopal Church, New York, Sept., 1865. "He was a library in himself," says the writer in an obituary notice of him at the time, "especially in theology and sacred literature in all their departments and languages, and of history extensively, both ancient and modern. Never have I known one who in my judgment understood his Bible so well. He was my living commentator, always ready on the most difficult texts, often original, yet strikingly natural in their interpretation. He was a true Christian philosopher, serene and patient as philosophy itself. Modest, meek, and reverential, in a saintly degree, he was yet a most independent thinker. Profound in his affection for the truth of God, but most impatient of the glosses of men. He had a strong aversion to ecclesiasticism, and yet was equally free from rationalism. He was simply and entirely a disciple of Christ; in patience, gentleness, and in loving acquiescence with the Divine will, he benignly reflected the spirit of his Master. . . . When the end came the saint, the scholar, and the sage, in the fulness of his years, gently glided to his rest among the beatified within the veil." He translated the *Ecclesiastical History of Eusebius Pamphilus* (Philadelphia, 1833) and the whole of Eschenburg's *Classical Manual*, only the part relating to Roman literature being incorporated in N. W. Fiske's translation (Philadelphia, 1836). W. A. Muhlenberg.

Cul'lom (Shelby M.), b. in Kentucky in 1829; studied law, was admitted to the bar, and began to practise at Springfield, Ill., in 1848; was elected to the State legislature in 1856, and re-elected in 1860; was a member of the war commission which sat in Cairo in 1862, and of the 39th and 40th Congresses; was again elected to the State legislature in 1872, and re-elected in 1874, and was nominated governor on the Republican ticket in 1876.

Cumulative Voting. See Proportional Representation, in Cyclopædia.

Cur'tis (Edward), A. B., M. D., b. at Providence, R. I., June 4, 1838; was educated in New York; graduated in 1859 at Harvard College; studied medicine at the University of Pennsylvania, where he took his degree in 1861; served in the regular army as a surgeon 1861–70; was appointed professor of materia medica and therapeutics at Columbia College, New York, in 1872; has devoted himself much to the study of photographing microscopic objects by means of the microscope, and has published various papers on the subject.

Cut'ler (Hannah Conant Tracy), b. Dec. 25, 1815; married in 1834 the Rev. J. M. Tracy, who died in 1843; prepared herself for the office of teaching; was appointed matron of a deaf and dumb asylum in Ohio; went in 1851 to Europe as a correspondent of the *Ohio Statesman*, and lectured in London on woman's rights; married in 1852 Samuel Cutler, and settled in Illinois, where she worked assiduously for the reform of the laws concerning women; was president of the Union Aid Commission in the war; graduated in 1869 at the Women's Medical College, Cleveland, O.; visited Europe again 1873–75, and settled at Cobden, Ill., where she is practising.

Cyclostomoi'dea [from *Cyclostomus*—κύκλος, "circle," στόμα, "mouth"—the typical genus], an extensive group of gasteropod mollusks of the order Pectinibranchiata and sub-order Tænioglossa, containing numerous species distinguished by a modification of the breathing apparatus for the respiration of air direct, and consequently for life on land, and by the circular mouth or peritreme of the shell. The animal has its chief viscera contained in a spiral hernia-like sac, and a corresponding large shell to protect it; the mantle has a simple margin, and the pulmonary cavity is quite open above the neck; the branchiæ are vascular and branched, and analogous to the lungs; the head is rather broad; the muzzle quite long, extensible at the extremity, and frequently used to assist in progression; the tentacles are clavate or attenuated, and simply contractile; the eyes sessile on the outer sides of the bases of the tentacles; the lingual ribbon is narrow, and the teeth in seven rows (3—1—3), and recurved at their apices; the foot is broad, and with the sole frequently divided by a longitudinal groove; the shell is spiral and well developed, so as to perfectly include the animal on retraction, and the aperture is always nearly or quite circular, and with the peritreme continuous; an operculum is developed, and has a median nucleus. The forms thus distinguished are not only not at all related, as was formerly generally thought, to the typical land shells and slugs (Helicidæ, etc.) of the temperate regions, but belong even to a different order. Their affinities are certainly with forms that are for the most part dwellers in the salt or fresh waters, and especially with the family Littorinidæ. The characters of the species combined under the general head above designated, and which by most authors, until within a few years, have been considered to constitute a simple family, are quite various; recent writers have therefore admitted several distinct families. These are—(1) Cyclostomidæ, (2) Cyclophoridæ, and (3) Pomatiidæ. The chief differences between these families are to be found in the modifications of the armature of the lingual ribbon or odontophore (and especially of the external lateral teeth), and modifications of the operculum. (1) In the Cyclostomidæ the external lateral teeth are very large and broad, and their recurved free margin deeply and finely pectinated: no jaws are developed. (2) In the Cyclophoridæ the external lateral teeth are of the same type as those of the innermost and median rows—*i. e.* rather narrow or simply lobate at the extremities: two lateral jaws of goodly size exist. (3) In the Pomatiidæ the external lateral teeth are atrophied or very small, and liable to be overlooked; jaws are present; other differences are coincident with these, but less obvious and universal. The genera recognized by recent authors are very numerous, and many of them are chiefly based upon modifications of the operculum: this may be paucispiral, as in the typical Cyclostomidæ and Pomatiidæ, or multispiral, as in the Cyclophoridæ; other characters exist in the structure, texture, and sculpture; *e. g.* whether provided with one or two layers, whether thick or thin, etc. The chief modifications have been used for the segregation of the genera into distinct sub-families. (1) The Cyclostomidæ, for example, have been divided into the sub-families Cyclostominæ, Cistulinæ, and Licinciné; (2) the Cyclophoridæ into the sub-families Cyclophorinæ, Cyclotinæ, Pupininæ, and Diplommatininæ: the Pomatiidæ are monotypic. The numbers of genera recognized by the best authors are from thirty to fifty, according to the degree of knowledge or conservatism of the individuals. Over 600 species have been described. These are mostly inhabitants of tropical or subtropical countries; numerous species, especially of Cyclostomidæ, are inhabitants of the West Indian islands, and in India and the neighboring regions the Cyclophoridæ are predominant. Very few species extend into the north temperate region, but more in Europe than in America. Theodore Gill.

Cypræ'idæ [from *Cypræa*—Κύπρις, a name of Venus—the typical genus], a family of gasteropod mollusks of the order Pectinibranchiata and sub-order Tænioglossa, distinguished by the beauty of the shells of most of the species. These are much sought after by shell-collectors, and popularly known under the name of cowries. The animal has a broad, flattened foot, more or less truncated in front and pointed behind; the mantle is expanded on each side, and forms lobes which meet over the back of the shell near its median line, and the surface is usually provided with filaments; the siphon is moderate; the head broad; the rostrum rather long and with an invertible tip; the tentacles elongated and subulate; the eyes sessile or in prominences on the head near the external bases of the tentacles; the lingual ribbon is long, and partly contained in the visceral cavity; the teeth are in seven rows, one rhachidian, and

three uncinal on each side; the shell in youth is cylindrical or olive form, and with a conspicuous spire, but toward maturity the outer lip encroaches upon the spire and becomes thickened, while an extensive deposit of callous material is secreted upon the columella, and the shell consequently becomes involute and ovoid in form, and assumes the aspect represented in Cowry, in Cyclopædia; the aperture is then narrow and longitudinal, and occupies the whole length of the shell, and each of the lips is plicated by numerous transverse teeth. The species embraced under the name Cypræidæ by almost all conchologists, and agreeing in the characteristics of the animal so far as given above, differ, however, quite widely in other respects, especially in the presence or want of jaws, as well as in the nature of the teeth of the lingual ribbon. Two groups are thus distinguished, and have been differentiated by Troschel as distinct families—(1) the true cowries, retaining the Cypræacea, and (2) the Triviæ, or small ribbed forms, as well as *Erato*, or marginella-like forms, being contradistinguished under the name Trivinacea. (1) The Cypræacea or Cypræidæ are destitute of jaws, and the rhachidian teeth have each a peculiar flat basal appendage; (2) the Trivinacea or Trividæ are provided with two jaws covered with imbricated scales, and the rhachidian teeth are simple and destitute of basal appendages. The classification of the Cypræidæ is far from being perfected. There are, however, two well-marked sections, distinguished by their dentition—one represented by pustuliferous species, forming the genus *Pustularia*, and the others with smooth shells: these latter have been separated by Troschel into two genera and a number of sub-genera—*i. e.* (1) *Cypræa*, with the sub-genera (*a*) *Talparia* (*C. talpa*, *C. lurida*, etc.), (*b*) *Tigris* (*C. tigris*, *C. exanthema*, etc.), (*c*) *Lyncina* (*C. Lynx*, etc.), (*d*) *Mauritia* (*C. mauritiana*, *C. arabica*, etc.); and (2) *Aricia*, with the sub-genera (*a*) *Erronea* (*C. erronea*, *C. canrica*, etc.), (*b*) *Erosaria* (*C. erosa*, *C. caput-serpentis*, etc.), (*c*) *Monetaria* (*C. moneta*, *C. florendo*, etc.). The Trividæ are divisible into two very distinct genera or groups of even higher value: these are (1) *Trivia*, including the globose, transversely-ribbed species, with the spire invisible; and (2) *Erato*, embracing the smooth species, with the spire exserted. The last are more like the Marginellæ in superficial aspect than the Triviæ, although they in other respects agree with the latter, and are evidently members of the same natural group. The species of the two families are numerous, between 150 and 200 having been described. (See further the article Cowry, in Cyclopædia.)

THEODORE GILL.

D.

Dacres (Sir Sydney C.), b. at Totnes, Devonshire, England, Jan. 9, 1804; entered the British navy 1817; became captain 1832, rear-admiral 1858, vice-admiral 1865, and admiral 1870; was distinguished as lieutenant in the reduction of the Morea Castle in 1828; as captain in the Crimean war; and as rear-admiral commanded the first iron-clad squadron, and in 1861, when trouble between England and America was imminent on account of the Trent affair, was selected as second in command on the North American and West India station; was senior lord of the admiralty 1868–72; governor of Greenwich Hospital 1872–76; in 1874 was placed on the retired list. In 1865 he was created a K. C. B., and has been decorated with numerous foreign orders and medals.

Dale (Samuel), b. in 1772 in Rockbridge co., Va.; became a famous Indian fighter and trader among the Creeks and Cherokees; was major of Kentucky volunteers in the Creek war 1814, and brevetted brigadier-general; became a merchant at Dale's Ferry, on Alabama River, and was much in public life. D. in Lauderdale co., Miss., May 23, 1841.

Dall (Caroline Healy), b. in Boston, Mass., 1821; engaged very early in literary pursuits; was married in 1844 to Charles Henry Apple Dall, a Unitarian minister; became in 1850 a regular contributor to *The Liberty Bell*, and in 1852 corresponding editor of *The Una*; lectured frequently, and published *The College, the Market, and the Court*, *Life of Marie E. Zakrzewska*, *Historical Pictures retouched*, and *Egypt's Place in History*.

Dan'iel (William Coffee), M. D., b. in Greene co., Ga., 1792. In 1821–22 he originated the revulsive stimulating treatment in opposition to calomel and purgatives. He is the author of extension by weights in fractures of the thigh; was a collaborator several years to the Philadelphia *Journal of Medical and Physical Sciences*; was also editor of the Savannah *Daily Republican*; in 1825 published a monograph on autumnal fevers; in 1866–67 wrote several articles on fish-culture; in 1818 was health officer of Savannah; in 1823–24 was mayor of that city. He was also member of the Georgia legislature, and during the war was receiver for that State. D. in Liberty co., Ga., 1868.

PAUL F. EVE.

Dark Day. In New England and in the neighboring States of New York and New Jersey the term "Dark Day" is usually understood to refer to the dark day of 1780, notices of which are found in Barber's (J. W.) *Historical Collections of Connecticut* (New Haven, 1838) and of New England and New York (Worcester, 1841); in Webster's (N.) *History of Pestilential Diseases* (Hartford, 1799); in Munsell's (J.) *Every-Day Book of History and Chronology* (New York, 1858), and in the *Collections* of the Massachusetts Historical Society (1st series, vol. i.). Except the last, these notices are brief, and none of them, with the same exception, give any description of the meteorological phenomena accompanying the approach of the darkness or prevailing during its continuance. Meagre as they are, however, they are more full than those we have of any of the not very rare similar occurrences of earlier or later date. In 1678, Munsell records "a remarkable darkness at noon in England," and in a paper by Dr. W. Derham, published in the *Philosophical Transactions* of the Royal Society, vol. xxxvii., the 1st of Jan., 1807, is said to have been a "cloudy dark day" at Upminster in Essex co., England. In the same paper the author makes the 1st of Oct., 1816, also a "close dark day." He presents, in addition to this, a meteorological table kept at Cambridge, Mass., by Mr. Thomas Robie, by concert with himself in England, for the years 1815 and 1816, and cites the following from Mr. Robie's annotations: "On Oct. 21 (1816) the day was so dark that people were forced to light candles to eat their dinners by; which could not be from an eclipse, the solar eclipse being the 1th of that month." This day is also referred to by Webster, who says that "in Oct., 1816, a dark day occurred after a severe winter in Europe." Barber also mentions this day as "a remarkable dark day in New England and New York." The 9th of Aug., 1732, is mentioned by Webster as another dark day (apparently in Europe), followed by an earthquake and a winter of unusual severity. In Munsell we find the 19th of Oct., 1762, set down as a "dark day at Detroit—one of the darkest days that ever was known." This is likewise spoken of by Webster, who adds that "there was a dark-red or yellowish tinge in the heavens [before sunrise], which gave to the sun when it appeared the color of blood. Rain fell, and the water was of a dirty sulphurous smell." A very remarkable instance of intense darkness of only brief duration, occurring by day, is mentioned by Munsell as having taken place in Canada Oct. 16, 1783. Webster also refers to this, adding that "thunder-squalls and a meteor followed the great darkness in Canada in 1783." In Howard's *Climate of London*, vol. ii., we find the following relating to a dark day in London: "1812, May 10, London was this day involved for several hours in palpable darkness. The shops, offices, etc., were necessarily lighted up, but the streets not being lighted as at night, it required no small care in the passenger to find his way and avoid accidents." Less than two years later than the occurrence here described the same city was visited by a succession of dark days, beginning with an extremely dark night caused by a great fog which came on with the evening of Dec. 27, 1813. (See Hone's *Every-Day Book*, under the title of "Great Frost, 1814.") In Howard's *Climate of London*, above referred to, the 26th Nov., 1816, is entered with the annotation, "Very misty A. M.; cirro-stratus sweeps the ground."

The several hypotheses which have been suggested in explanation of this subject, and which seem to exhaust the limited list of possibilities, are as follow: (1) The smoke of vast burning forests, loading the atmosphere and shutting out the light of the sun. (2) Dense exhalations of smoke and ashes from volcanoes, transported by the upper currents of the air. (3) Vapors generated by the internal heat of the earth, and escaping through fissures in its crust. (4) Smoke produced by the combustion of large meteors traversing the atmosphere. (5) Cosmical dust drifting into the atmosphere from the regions of outer space. (6) Terrestrial dust raised in clouds from deserts, and swept to great distances by atmospheric currents. (7) Ordinary clouds of extraordinary density, reinforced in the neighborhood of large towns by the smokes of countless fires, as well as by those of furnaces and factories.

The first of these hypotheses is disposed of by Dr. Webster very summarily, by presenting two conclusive considerations, which are—(1) that there has been no evidence of the occurrence of great forest conflagrations immediately before these days of darkness or simultaneously with them; and (2) that if such conflagrations had existed, the cause is not adequate to the observed effect. "Had the woods," he remarks, "from the 40th to the 50th parallel of latitude been consumed in a day, the smoke would have been insufficient to produce the darkness of the 19th May, 1780." And as a further confirmation of this conclusion, he adds that the color of smoke is very different from that of the obscuring stratum on the day referred to.

The second hypothesis above mentioned is equally untenable with the first. It is not indeed to be questioned that the exhalations of volcanoes are often dense enough and voluminous enough to shut out the light of the sun from the regions which they overhang. During the eruption in which Pompeii was destroyed the whole country surrounding Vesuvius was involved in the darkness of night. But the dark days we have described above occurred in localities far distant from any volcanic crater, and it is not conceivable that the fumes of volcanic eruptions should have been borne so far and maintained in density sufficient to produce the observed effect without obscuring the intermediate region. There have been, nevertheless, some examples, not indeed of darkness, but of a very remarkable haziness widely diffused through the atmosphere, and involving a whole hemisphere or perhaps the entire globe at once, to which such exhalations may have contributed; as, for instance, the so-called dry fog of 1783. But though it appears that volcanic fumes, or exhalations from fissures in the earth, or the smoke of burning meteors, or accessions of impalpable dust from the regions of space may be presumed with reason sometimes to affect the general transparency of the atmosphere, no one of these causes suggests an explanation applicable to a case of darkness like that of May 19, 1780.

We must equally reject the hypothesis which finds an explanation of these phenomena in the smoke of meteoric bodies consumed in the atmosphere. It is surprising that it did not occur to men like Franklin and Arago that a fire-ball large enough to leave behind it so voluminous and permanent traces of its passage must have been altogether too bright to escape observation somewhere in its flight, if not indeed over half a continent.

Nor is it possible to speak more favorably of that which ascribes the darkness to a cloud of dust falling into the atmosphere from the regions of space; inasmuch as, except the fact of the darkness itself, there is no evidence to sustain this notion, while the circumstances attending the cessation of the phenomena seem decidedly to contradict it. Such a cloud could disappear only by subsidence, or by dissipation through the agency of atmospheric currents, or by the joint effect of these causes combined. A cloud so dense could not subside without leaving a deposit on all exposed surfaces; and a cloud so extensive could not be dispersed without exhibiting a succession of phases of gradually diminishing darkness extending probably through many days, and producing at the same time a greater or less amount of obscuration over the adjacent territory; none of which phenomena are recorded as having been observed after any of the dark days we have been considering.

The hypothesis which ascribes the darkness to clouds of terrestrial dust or sand transported by atmospheric currents must also be dismissed. The cause is no doubt a sufficient one, since, when the sand-storms of Northern Africa are at their height, the light of the sun is often completely extinguished; but in these cases the cloud sweeps along the earth's surface and fills the lower air, so as to produce literally "a darkness which may be felt." But there is no source within New England or the adjacent States from which a dust-cloud could have been raised adequate to produce the darkness of May 19, 1780, nor was there in that instance any mixture of such dust in the lower air, nor any deposit left behind.

In the absence, therefore, of any other supposable cause, we are compelled to attribute these examples of extraordinary darkness simply to the presence of ordinary clouds of very unusual volume and density. Nor will this explanation appear insufficient, when we consider that in the experience of every one occasions are not of very rare occurrence when, for intervals of a few minutes, the darkness produced by heavy rain-clouds is so great as to make it impossible to read or write without artificial light. In such cases it would be only necessary that the cloud should be a little more dense, more general, and more persistent to reproduce the dark day of 1780. The circumstances attending the cessation of the darkness are moreover in harmony with this theory. The immense volume of precipitated vapors discharges itself in torrents of rain or heavy falls of snow, or is revaporized by the solar heat, and the atmosphere resumes its previous transparency. No deposit of dust or sediment appears upon the earth, and no lasting haziness lingers in the air. In reference to the dark days of London, it may be remarked that the truth of the explanation here proposed is unquestionable. In the most remarkable of those instances the fog was the obvious cause of the darkness, and fog is but a cloud resting on the earth. The smoke of countless fires, of course, contributed to the effect, but this alone could not have sufficed; otherwise, during winter London would never enjoy the natural light of day. F. A. P. BARNARD.

Da'sent (GEORGE WEBBE), b. about 1818; graduated in 1840 from Magdalen Hall, Oxford; was called to the bar at the Middle Temple in 1852, and appointed civil service commissioner in 1870; was for many years a steady contributor to the London *Times*, and became in 1871 editor of *Fraser's Magazine*. He has translated *The Younger Edda* (1842), and published *The Norsemen in Ireland* (1855), *The Story of Burnt Njal* (1861), *Selection of Norse Tales* (1862), etc.; also edited *An Icelandic-English Dictionary, based on the MS. collections of the late Richard Cleasby, enlarged and completed by Gudbrand Vigfusson* (1874).

Dasyuridæ. See THYLACINIDÆ, in CYCLOPÆDIA.

Da'vidson (GEORGE), A. M., PH. D., b. at Nottingham, England, May 9, 1825, of Scottish parents; came to the U. S. in 1832, and graduated in 1845 at the Central High School of Philadelphia; entered the U. S. Coast Survey; served in the States bordering the Atlantic and Gulf coasts until 1850, when selected to take charge of a party to the Pacific coast; worked continuously upon the western coast, except during the civil war, when he served on the Atlantic and Gulf coasts; was appointed chief engineer of an expedition for the survey of a ship-canal route across the Isthmus of Darien; in 1867 made a geographical reconnaissance of the coast of Alaska, and reported upon its products, etc., to Congress; in 1868 returned to the Pacific coast, and had charge of the field-work of the parties there; in 1869 brought the San Francisco observatory in telegraphic longitude connection with Greenwich; in 1869 took charge of the expedition to Alaska to observe the total solar eclipse of August; in 1873 determined the 120th meridian; in 1874 conducted the U. S. transit-of-Venus party to Japan; at Nagasaki connected the American and French transit-of-Venus stations by triangulation; visited China, India, Egypt, and Europe for scientific study, the results of which have been embodied in a special report to the superintendent of the Coast Survey; returned to the Pacific coast, and is now in charge of the telegraph-longitude work and of the main triangulation and astronomical party carrying the geodetic work across the continent. During the last twenty-seven years he has continued determinations of the magnetic elements from lat. 32° to 60°; and in 1874 carried a series of dip and declination observations across the Pacific; has improved the character of the instruments used in his observations; published numerous works on transit instruments and observations, irrigation, harbor and river improvements, and many communications in the *Proceedings* of the California Academy of Sciences, of which he has been president for several years, and is a member of various scientific societies.

Davidson (SAMUEL), D. D., LL.D., b. in 1807 near Ballymena, Ireland; studied at the Royal College of Belfast, where he was appointed professor of biblical criticism and literature in 1835; removed in 1842 to Manchester as professor of biblical literature and Oriental languages at the Lancashire Independent College, but subsequently resigned this position and settled in London. Of his numerous works the most remarkable are—*Introduction to the New Testament* (3 vols., 1848–51; new ed. in 2 vols., 1868), *Introduction to the Old Testament* (3 vols., 1862).

Davidson (THOMAS), M. A., b. Oct. 25, 1840, near Fetterangus, parish of Deer, Aberdeenshire, Scotland; graduated with highest classical honors and the Simpson Greek prize at Aberdeen in 1860; was for several years rector of the grammar (Latin) school of Old Aberdeen, and subsequently master in several English schools; spent considerable time in France and Germany; came to Canada in 1866, and to the U. S. in 1867, and after spending eight years in St. Louis, removed to Cambridge, Mass., in 1875. Mr. Davidson has contributed to various periodicals numerous philological and philosophical articles. He was for several years connected with the *Round Table*, and at the same time edited the *Western Educational Monthly*, which afterward, under his conduct, changed its name and became *The Western*. He is at present engaged on a translation of the complete works of Aristotle.

Da'vis (PAULINA WRIGHT), b. at Bluinfield, N. Y., Aug. 7, 1813; was married in 1833 to Francis Wright of Utica, N. Y., and after his death in 1841 was married in 1849 to Thomas Davis of Providence, R. I. D. Aug. 21, 1876. She was an uncompromising advocate of the enfranchisement of women, established *The Una*, wrote a history of the woman-suffrage reform, and gave lectures frequently.

Dawes (Rev. WILLIAM RUTTER), b. at Christ's Hospital, London, Mar. 19, 1799, where his father was mathematical master. Educated for the Church, but dissatisfied with some of its tenets, he studied medicine under Abernethy and Sir William Lawrence; gave up practice in 1826, and assumed charge of a small Independent church at Ormskirk, where was his first small observatory, though previously he had done much work privately with a telescope supposed to be but 1.6 inches aperture; took charge of Mr. Bishop's observatory, Regent's Park, 1839, where he remained until 1841; in 1846 began work in his own observatory at Cranbrook, in Kent, which he finally (1857) removed to Hopefield, Haddenham-near-Thame, where he resided until his death, Feb. 15, 1868. His work was mostly with the double stars, and is justly distinguished for its accuracy. It is mostly contained in *Memoirs R. A. S.*, vols. viii., ix., and xxxiv., and the separate volume published by Mr. Bishop. (For a catalogue of his scientific papers, see *Royal Society's Index of Scientific Papers.*) Elected F. R. A. S. in 1830; received the gold medal R. A. S. 1855; elected F. R. S. 1865. L. WALDO.

Death Valley, California, so called because a party of emigrants, on their way to California, perished there from thirst and starvation in 1849. About eleven years afterward Dr. I. R. N. Owen, of the U. S. and California boundary survey, followed the marks of their wagon-wheels, and discovered the remains of their fires and the iron of their wagons on the spot where they had camped, these remains being perfectly preserved in this rainless region. This valley is the most northern of a chain of desert basins extending from the head of the Gulf of California northward, embracing the Colorado Desert, the Mohave Desert, and the Amargosa Desert, or "Death Valley." It is situated in the south-eastern portion of Inyo co., Cal., about lat. 36° 15′ N. and lon. 116° 50′ W. The basin or sink is about 39 miles long and 11 miles wide, extending in a direction nearly N. and S. It is surrounded on all sides by very high and precipitous mountains, the most conspicuous of which are the Panamint Mountains on the W. and the Amargosa Mountains on the E. It is a dreary and desolate region, nearly destitute of water and vegetation, fearfully hot in summer, and occasionally swept by terrible sand-storms. The Amargosa River flows into the southern end of the valley, and Furnace Creek runs into the eastern side of its northern extremity; all the waters *sink* when they reach the valley. The soil is covered with a white alkaline efflorescence, but in winter it is somewhat marshy near the centre. The formations surrounding it are, to a large extent, volcanic, obsidian being abundant on the W. slope of the Amargosa Mountains. One of the most interesting features connected with the topography of this portion of California is the fact that this valley, although far in the interior of the continent—being on the E. side of the lofty Sierra Nevada range and 200 miles from any sea—*is from 150 to 200 feet below the sea-level.* This fact has been established by careful barometric measurements. Until recently this was supposed to be true of no other part of the North American continent at any considerable distance from the coast; but it is now known, by means of careful levellings, that a large portion of the Colorado Desert in San Diego county, about 200 miles farther S., is below the level of the sea, the greatest depression near the northern extremity, Dry Lake, being from 250 to 300 feet below the sea-level. It may be interesting to add that the remarkable depression of Death Valley occurs in comparative proximity to the loftiest peaks of the Sierra Nevada Mountains, the crowning peak, Mount Whitney, being about 75 miles to the W. of it. JOHN LE CONTE.

Decal'comanie [Fr. *décalquer*, to "counterdraw," and *manie*, "fancy"], the art of transferring pictures and designs permanently upon fabrics of various descriptions, china, glass, marble, wood, leather, etc. The process is very simple. The article to be decorated is carefully washed from grease or dust; the picture to be applied is coated thinly with prepared cement. The picture is then placed in the position required and pressed tightly with a cloth or rolled over with a heavy roller. Finally, a damp sponge is applied to the upper surface till the paper becomes sufficiently moist, after which it can be easily removed, and the picture will remain firmly and permanently upon the object.

De Ko'ven (JAMES), b. at Middletown, Conn., Sept. 19, 1831; graduated at Columbia College, New York, in 1851, and at the General Theological Seminary in the same city in 1854; was admitted to the diaconate of the Protestant Episcopal Church the same year, and to the priesthood the year following; was rector of a church at Delafield, Wis., for five years, and became warden of Racine College in the same State in 1859; in Feb., 1875, was elected bishop of Illinois, but failed to be confirmed on account of his extreme High Church views. D. at Racine, Wis., Mar. 19, 1879. J. B. BISHOP.

Del'afield (EDWARD), b. in the city of New York in 1794; had every advantage of education, and graduated at Yale College at the age of eighteen in 1812; began the study of medicine in the office of Dr. Samuel Borrowe of New York, and at the age of twenty-one graduated at the College of Physicians and Surgeons in 1815. Soon after this he went to London for clinical study, and became a pupil of Sir Astley Cooper and Mr. Abernethy; remained abroad about a year, and on his return to New York he, in conjunction with Dr. J. Kearny Rodgers, established the New York Eye and Ear Infirmary in 1820. He was attending surgeon to the same till 1850, when he resigned and was made one of its consulting surgeons; in 1825 was appointed professor of obstetrics and diseases of women and children in the College of Physicians and Surgeons, and resigned in 1838; in 1831 was appointed physician to the New York Hospital; in 1842 organized the Society for the Relief of the Widows and Orphans of Medical Men, and was its first president; in 1855 was elected consulting surgeon to the Woman's Hospital, and in 1866 was elected president of its medical board; in 1858 was elected president of the College of Physicians and Surgeons; in 1870 became, by virtue of his presidency of the College of Physicians and Surgeons, one of the governors of the Roosevelt Hospital, was elected first president of the board of governors, and was chairman of the building committee. D. Feb. 13, 1875. J. MARION SIMS.

Delafield (FRANCIS), M. D., b. in the city of New York Aug. 3, 1841; graduated at Yale College in 1860; was appointed adjunct professor of pathology and practical medicine in the College of Physicians and Surgeons of New York, and published a *Handbook of Post-mortem Examination.*

Depuy' (HENRY WALTER), b. at Pompey Hill, Onondaga co., N. Y., in 1820; studied law, and was admitted to the bar, but adopted the profession of journalism, and settled in Indianapolis; was private secretary to Gov. Seymour 1853–51; then secretary of legation at Berlin, but returned in 1860, and was appointed secretary of Nebraska, and subsequently Indian agent to the Pawnees. D. in New York Feb. 2, 1876. He wrote *Kossuth and his Generals, Louis Napoleon and his Times, Ethan Allen*, etc.

D'Esclot, Esclot, or **Sclot** (BERNAT), an important Catalan historian, whose *Chronicle* was first published in the original text by Buchon, together with a translation of Muntaner and other matter in his *Collection* of *Chroniques étrangères relatives aux Expéditions françaises pendant le XIIIe Siècle* (Paris, 1841, 8vo). The years of D'Esclot's birth and death are unknown, but his *Cronica del Rey En Pere e dels seus antecessors passats* appears to have been composed in 1285. It embraces a summary view of the earlier history of the Aragonese kings of the family of the counts of Barcelona, but its proper subject is the reign of King Don Pedro, extending from 1276 to 1285. This period comprises the Sicilian Vespers and the expulsion of the French from that island, the intended duel between Charles of Anjou and Pedro, the excommunication of Pedro and the bestowal of his kingdom upon Charles de Valois by the "apostle" or pope, the invasion of Catalonia by Philip the Bold, and the death of that monarch at Perpignan; respecting all which stirring events D'Esclot is one of the best authorities. D'Esclot's *Chronicle* has not the fervor, the "wrath and partiality," of Muntaner's chivalric narrative, but it is not therefore less trustworthy; and it often contains piquant details which Muntaner sacrificed to his rhetoric. Buchon praises with justice D'Esclot's account of the Sicilian Vespers, his description of the wild soldiery called *Almogavares*, and of the arrival of Roger de Loria's fleet at Barcelona, and other passages; but in the opinion of the present writer the narrative of the challenge to Charles d'Anjou by Pedro (chap. xcix.), its acceptance by Charles (chap. c.), and the journey of Pedro to Bordeaux, where the duel was to be fought (chaps. civ. and cv.), is surpassed by nothing in the *Chronicle*; and indeed a more striking historical recital of an actual occurrence of the "age of chivalry" is not to be found in any other mediæval annalist. D'Esclot's is the oldest historical composition of any moment which remains to us from the early stage of the Catalan language, and it is therefore of great linguistic as well as literary interest.

GEORGE P. MARSH.

Des'eret, University of, located in Salt Lake City, Ut., was incorporated in 1850 by an act of the legislative assembly of the State of Deseret, and in 1851, after the organization of the present Territory of Utah, this act of incorporation was legalized by the Territorial legislature. The government of the institution is vested in a chancellor and twelve regents, and in Nov., 1851, it was opened for the reception of students under the supervision of Orson Pratt, Sr. Owing to lack of patronage, the school was discontinued till 1867, when, under the leadership of David O. Caldec, it was started as a commercial college. In 1869, under the presidency of John R. Park, M. D., a scientific, a classical, and a normal department were added to the commercial, and in 1870 were established an academical and a model school department, preparing the students for the college course; which two departments have been in very successful operation since that time.

Desmoulins' (Bénoit Camille), b. at Guise, Aisne, France, in 1762; studied law in Paris, and embraced the ideas of the Revolution with boundless enthusiasm. His two pamphlets, *La Philosophie au Peuple français* (1788) and *La France libre* (1789), not only attracted attention, but exercised influence; and his wild, passionate addresses in the gardens of the Palais Royal (July 12, 1789) raised the public excitement to a point where it could not be controlled, and became the immediate introduction to the Revolution. In his periodical, *Révolutions de France et de Brabant*, which was reprinted in 1833, and is still read with a singular mixture of horror and admiration, he gave to the passion of the moment some of its most brilliant and some of its most revolting catchwords, and the Reign of Terror, although enacted by other persons and overtaking him as one of its first victims, was nevertheless begotten within his brain. He was one of the founders of the Jacobin Club and one of the leaders of the rising Aug. 10, 1792; as a member of the Convention he voted for the death of the king without appeal, and he dealt the party of the Girondists the decisive blow by his *Histoire des Brissotins*, which covered them with ridicule and contempt. But when, after the fall of the Girondists, the Jacobins separated into two parties, the *Enragés* under Hébert, and the *Indulgents* under Danton, Camille Desmoulins joined the latter, and his paper, *Le vieux Cordelier*, is a courageous, often a noble, denunciation of the excesses of the Revolution. These excesses, however, were in reality simply the consequences of his own ideas, and it seems not unnatural that he should fall a victim to them. He was twice accused as a traitor, but saved by Robespierre, his former schoolmate, who felt a kind of personal attachment for him, and who gave in his speeches some very striking characterizations of his noble enthusiasm and dangerous talent, of the peculiar tenderness and waywardness of his character. But when at last it became necessary for Robespierre to crush Danton, Camille Desmoulins could not be saved. He was arrested Mar. 30, 1794, sentenced to death without being allowed to defend himself, and dragged to the guillotine Apr. 4, while tearing his clothes in agonies of terror and despair, and making the most piteous appeals to the surrounding populace. His young wife, whom he loved tenderly, tried to rouse the mass in his defence, but was arrested and guillotined about two weeks afterward.

Clemens Petersen.

Det'mold (William), M. D., b. in 1808 in Hanover, where his father was court-physician; studied medicine in Göttingen, where he graduated in 1830, and soon after entered the Hanoverian army as surgeon. After visiting England and France, he came in 1837 to New York, where he settled after resigning his commission in the army. He introduced orthopædic surgery in this country, and held the chair of clinical and military surgery in the College of Physicians and Surgeons, Columbia College. During the war of the rebellion he volunteered his services on most of the large battle-fields in Virginia. He introduced an improved knife for the use of one-armed men, which under the name of "Dr. Detmold's knife" is furnished by the government to all men who have lost an arm or hand in the line of duty. He has largely contributed to the periodical medical literature of this country.

Devereux' (John Henry), b. in Boston, Mass., Apr. 5, 1832; was educated at Portsmouth, N. H., as a civil engineer, and began to work at once upon the construction of railroads. From 1848 to 1861 he was engaged in the building of railroads in Ohio and Tennessee. He was called to Washington by the government Mar. 31, 1862, and in April following was appointed superintendent of military railroads. In Mar., 1864, he resigned the charge of Virginia railroads, and became superintendent, and subsequently vice-president, of the Cleveland and Pittsburg R. R.; resigned the latter position in 1868, and became president of the Lake Shore R. R., and afterward became general manager of the consolidated Lake Shore and Michigan Southern R. R. Resigning in June, 1873, he was elected president of the Cleveland Columbus Cincinnati and Indianapolis R. R. Co., and president of the Atlantic and Great Western Railway Co.; he is now president of the former and receiver for the latter (1877). J. B. Bishop.

De Witt (Thomas), D. D., b. at Kingston, N. Y., Dec. 13, 1791; graduated in 1812 at the theological seminary, New Brunswick, N. J.; entered the Dutch Reformed ministry; was minister of the Collegiate church, New York, 1827–74. He was a man of profound learning, and an able preacher in the English and Dutch languages. Among the important positions held by him were the presidency of the board of publication of his own denomination; the presidency of the New York Historical Society, of the New York City Mission and Tract Society, etc. He was connected with many educational and charitable enterprises, and was widely known. D. in New York May 18, 1874.

Dexip'pus [Δέξιππος], a Greek philosopher, pupil of Iamblichus, lived about A. D. 355. He wrote commentaries on Plato and Aristotle, and sought to defend the latter against the attacks of Plotinus. There is extant a treatise of his on the *Categories* of Aristotle, but only in a Latin translation, which was printed at Paris (8vo, 1549).

Henry Drisler.

Dick'son (Sir Collingwood), b. 1817; entered the royal artillery as second lieutenant in 1835; became captain in 1846 and colonel in 1866; served during the Eastern campaign of 1854–55 on the staff of Lord Raglan, and was present at the actions of Bulganac and McKenzie's Farm, battles of Alma and Inkerman, capture of Balaklava, expedition to Kertch, siege of Sebastopol; wounded Feb. 4, 1855; commanded the right siege-train, and was present at the bombardment, gaining the Victoria Cross for gallantry Oct. 17; was brevetted lieutenant-colonel and colonel; received medal with four clasps from his own government, also the Turkish medal, and was appointed aide-de-camp to the queen, officer of the Legion of Honor, and created a C. B. He is also a knight of the order of Charles III. and of Isabella the Catholic. In 1870 he was appointed inspector-general of artillery, and in 1871 nominated a K. C. B. In 1875 he was made a colonel-commandant of the 9th brigade of royal artillery.

Dinoceras. See Tinoceras, in Cyclopædia.

Dog'gett (Kate Newell), b. in Charlotte, Vt.; educated at Castleton, Vt., and at the Albany (N. Y.) Female Academy; was married to William E. Doggett of Chicago, Ill., in 1858; invited to take charge of the herbarium belonging to the Academy of Science in that city, and was elected member of the academy in 1869; Nov. 9, 1869, she attended the Frauen Conferenz at Berlin as delegate of the National Woman Suffrage Association, and has since delivered several series of lectures on art; established French and German clubs and a literary society of ladies called the Fortnightly, of which she is the president; and translated *The Grammar of Painting*.

Dole (Rev. George Thurlow), b. Oct. 30, 1808, in (Byfield) Newbury, Essex co., Mass. Having spent eight years in the Lowell Machine-Shop and become master of the arts, he left in 1833, and graduated at Yale College in 1838; spent the three succeeding years in the theological seminaries of New Haven and Andover, Mass.; ordained pastor of the Washington street Congregational church in Beverly, Mass., Oct., 1842; dismissed in 1851; pastor in North Woburn, Mass., from Oct., 1852, to Oct., 1855; pastor in Lanesboro', Mass., 1856 to 1863; principal of Williams Academy, Stockbridge, 1863–64; pastor in Stockbridge 1864–72.

Dore'mus (Sarah Platt), b. in New York Aug. 3, 1802; married Sept. 11, 1821, to Thomas C. Doremus; in 1828, with eight other ladies, organized the Greek Relief Society; in 1836 aided Madame Feller in her Grande Ligue mission to the French peasantry of Canada; in 1840 began to visit the female prisoners in the city prison, and with Miss Catherine Sedgwick established in 1842 the Home for Women from Prison, now called the Isaac T. Hopper Home; was one of the founders of the House and School of Industry, and a manager of the City Bible Society and of the City Mission and Tract Society from their beginning; in 1869 labored efficiently for the relief of the famine-stricken people of Ireland; in 1851 became vice-president of the Nursery and Child's Hospital; in 1855 aided the writer in organizing the Woman's Hospital Association, and was first directress from 1864 till her death; in 1863 assisted in organizing the Presbyterian Home for Aged Women. For fifty years she labored in behalf of foreign missions with untiring zeal. Her labors in behalf of the sick and wounded soldiers from North and South during the civil war were not excelled by those of any other woman in the land.

Measured by the practical results of her labors, Mrs. Doremus was the most remarkable woman of her time. D. Feb. 5, 1877.—Her son, Prof. R. Ogden Doremus, three daughters, and her husband, survive her. J. Marion Sims.

Dors'heimer (William), b. at Lyons, Wayne co., N. Y., Feb. 5, 1832; was educated at Harvard University; studied law, and was admitted to the bar in 1851; practised law in the city of Buffalo, and formed a partnership in 1859 with the late Salomon G. Haven; served in 1861 as aide-de-camp to Gen. Fremont in Missouri; was appointed U. S. district attorney for the northern district of the State of New York in 1867, and became lieutenant-governor of New York in 1877.

Doyle (Sir C. Hastings), entered the British army as ensign in 1819; became captain 1825, colonel 1854; has served in the East and West Indies; was on the staff as assistant adjutant-general and assistant quartermaster-general 1847–56, serving as A. A. G. 3d division of the army of the Crimea; was inspector-general of the militia of Ireland 1856–61; appointed to command of troops in Nova Scotia in 1861, and in 1867 made lieutenant-governor of that province upon the confederation of the British provinces in North America, and placed in command of Her Majesty's forces in North America. For his services in these capacities he was rewarded by the appointment of knight-commander of the order of St. Michael and St. George. In 1871 he was assigned to the command of the southern district, head-quarters at Portsmouth, England. In 1860 he became a major-general, and lieutenant-general in 1870. He is also colonel of the 87th regiment (Royal Irish Fusileers).

Dra'per (Henry), b. in Prince Edward co., Va., son of John William Draper, Mar. 7, 1837; graduated at the medical department of the University of the City of New York in 1858; became professor of physiology there in 1860, and also professor of physiology and analytical chemistry in the scientific department, and published *On the Construction of a Silvered-Glass Telescope* and *Textbook of Chemistry* (1864). He has devoted much attention to photographic and spectroscopic examination of the moon and other heavenly bodies, and has, at Hastings on the Hudson, the largest telescope in the U. S. (28 inches aperture).

Draper (John Christopher), b. in Prince Edward co., Va., Mar. 31, 1835, a son of John William Draper; graduated in 1857 in the medical department of the University of the City of New York; was professor of physiology there 1858–60; subsequently professor of chemistry in the Cooper Union, professor of chemistry in the University Medical College, and of physiology and natural history in the College of the City of New York; published *On Respiration* and *Textbook on Anatomy, Physiology, and Hygiene.*

Drown (Thomas Messinger), M. D., b. in Philadelphia Mar. 19, 1842; graduated in 1859 at the Philadelphia High School; studied at the University of Pennsylvania, whence he graduated M. D. in 1862; at the Sheffield Scientific School, New Haven, 1862–63; at the Lawrence Scientific School 1863–65; at Freiberg and Heidelberg 1865–68; and was appointed professor of analytical chemistry in Lafayette College, Easton, Pa.

Ducis' (Jean François), b. at Versailles Aug. 22, 1733; devoted himself entirely to poetry; declined the seat in the senate which Napoleon offered, and lived in deep retirement in his native city, where he d. Mar. 31, 1816. Of his original works, the tragedy *Abufar* (1795) became very celebrated, but he is now best known from his having translated and arranged for the French stage *Hamlet* (1769), *Romeo and Juliet* (1772), *Lear* (1783), *Macbeth* (1784), *King John* (1791), and *Othello* (1792).

Dud'ley (Thomas U.), b. in Richmond, Va., in 1837; graduated at the University of Virginia; served in the Southern army during the civil war; studied theology after the close of the war, and was ordained deacon in the Protestant Episcopal Church in 1867. He became rector of Christ church in Baltimore in 1869, and in 1874 he was chosen assistant bishop of Kentucky. J. B. Bisnor.

Du'niway (Abigail Scott), b. Oct. 22, 1834, at Pleasant Grove, Ill.; removed to Oregon in 1852 with her parents; was married in 1853; lived on a farm nine years; taught school and music six years; was milliner and dressmaker five years; established the *New Northwest* at Portland, Or., in 1871, a paper devoted to woman's enfranchisement, of which she is the editor and her boys the type-setters, and published an epic entitled *David and Anna Matson.*

Du Pont (Henry), b. in Delaware; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery in 1833, from which he resigned in 1834, and became proprietor of the celebrated powder-mills bearing his name near Wilmington, Del. For many years he was adjutant-general of the State of Delaware, and during the civil war served as major-general of militia in command of the home guards.

Du Pont (Henry A.), son of Henry Du Pont, b. in Delaware; graduated at the U. S. Military Academy, and entered the army as second lieutenant of engineers May, 1861; during the same month was transferred to the 5th Artillery as first lieutenant; promoted to be captain in 1864; served in camp and garrison 1861–63; in command of battery in West Virginia 1863–64; chief of artillery Army of West Virginia 1864–65, being engaged at Opequan, Fisher's Hill, and Cedar Creek, besides numerous skirmishes and engagements; chief of artillery department of West Virginia, Jan.–July, 1865; since the close of the war he has served as instructor in the Artillery School at Fort Monroe and on special duty at West Point.

Dur'yea (Joseph Tuthill), D. D., b. at Jamaica, Long Island, N. Y., Dec. 9, 1832; graduated with the highest honors in 1856 at the College of New Jersey, where he afterward taught Greek and rhetoric 1857–59; graduated at the Princeton Theological Seminary 1859; was pastor of the Second Presbyterian church, Troy, N. Y., 1859–62; associate pastor of the Collegiate Reformed church, N. Y., 1862–68; and from 1868 to 1879 was pastor of the Clesson Avenue Presbyterian church, Brooklyn, N. Y. In 1879 he was pastor of Mt. Vernon Cong. church, Boston, Mass.

Dus'ton (Hannah), wife of Thomas Duston of Haverhill, Mass.; was married Dec. 3, 1677, and became the mother of thirteen children. She was taken prisoner by the Indians in the attack on Haverhill, Mar. 15, 1698, her nurse and infant one week old being also taken, but the child was soon after killed. She was placed in an Indian family of twelve persons on an island (Duston's Island) in the Merrimack River, near the mouth of the Contoocook, in New Hampshire, and with the aid of the nurse and a white captive boy she killed all the Indians in their sleep except a squaw and a boy who escaped. She returned to Haverhill with their scalps.

E.

Eads (James B.), b. at Lawrenceburg, Ind., May 28, 1820; removed with his parents in 1829 to Louisville, Ky., and in 1833, after the death of his father, to St. Louis. From 1839 to 1842 he served as clerk on a river steamboat on the Mississippi, and in the latter year entered a firm engaged in recovering sunken property, a business which under his management assumed such dimensions and was carried on with such success that in 1857 he was able to retire with a fortune. At the outbreak of the civil war in 1861 he submitted to the government a plan for the defence of the Western waters, and contracted for the construction of seven iron-clad gunboats for service on the Mississippi; and in the following year he constructed for the same purpose six iron hull propellers carrying two turrets each. Many new features of his own invention were introduced in the construction of these gunboats. He has since acquired great reputation as a civil engineer, as projector and constructing engineer of the Illinois and St. Louis Bridge. (See Bridge and Foundation, in Cyclopædia.) He is now still more prominent in connection with the work of opening the mouths of the Mississippi to the heaviest draught ships. Instead of a ship-canal (see Ship-Canals), he proposed the deepening of the South-west Pass by jetties—a method which had proved so successful at the Sulina mouth of the Danube (see Danube, in Cyclopædia), and discussed by the writer (*Ex. Doc.*, 113^{43} H. R.). A board of engineers, civil and military, to which the question was referred, adopted the South Pass (see Jetty, in Cyclopædia) instead of the South-west. The work under his own designs is now in successful execution, he having obtained the requisite 20 feet depth (over a bar on which was but 8 feet) which entitles him to the first payment of $500,000.

J. G. Barnard.

Ec'cleston (James Horston), b. in Baltimore, Md., in 1838; graduated at Princeton College in 1856; studied law for three years, when he was admitted to the bar. After practising law for two years, he began the study of theology at the Philadelphia Divinity School, where he was

graduated in 1864. He was rector of St. Matthew's parish in Philadelphia for a time after graduation, and subsequently became rector of the Church of the Saviour in the same city. In the spring of 1875 he was elected bishop of the diocese of Iowa. J. B. BISHOP.

Echeneid'idæ [from *Echeneis*—Gr. ἐχενηΐς, ἴδος, "stopping" or "retarding vessels"—the typical genus], a family of fishes of the order Teleocephali and sub-order Acanthopteri, particularized by the development of a broad oval sucking-disk on the top of the head. The body is more or less elongated, and the scales very small and imbedded in the skin; the lateral line is continuous; the head oblong and very depressed; the eyes lateral, and just under the disk; the opercular bones are normally developed and unarmed; the mouth is moderate, slightly oblique, and cleft laterally, and the lower jaw projects considerably beyond the upper; the upper jaw is scarcely protractile; teeth are developed in bands on the jaws, vomer, and palatine bones; the branchial apertures are large and continuous below; the branchiostegal rays generally nine in number; the dorsal fin exhibits, in part, a perfectly anomalous structure—viz. the anterior portion, instead of being a fin, is developed into the broad oval disk characteristic of the group; of this the skeletal portion is constituted by the spines, whose dichotomous elements divaricate, and are depressed sideward in opposite directions and otherwise modified; the cutaneous portion is a leathery development of the membrane which completely invests the skeleton, and gives rise at the spines, or cross-pieces, to numerous denticles; the structure is surrounded by a smooth, broad leathery margin; by means of this disk the fishes are enabled to adhere to various objects; the posterior portion of the dorsal is normally developed as a true rayed fin; the anal fin corresponds in form and structure with the soft dorsal; the caudal fin is distinctly developed; the pectorals are broad, and low on the scapular arch; the ventral fins are thoracic, and formed each of a spine and several rays; the skeleton is composed of vertebræ in increased number (*e. g.* D. 12–14 + C. 15–16); the pyloric appendages are in moderate number. The fishes comprised in this family are among the most singular of the class, and are familiar to all seafaring people. By sailors and shoremen they are generally designated as suckers; but this name is given to so many different animals that, unfortunately, it is not at all characteristic, although so applicable in other respects to the species. Their peculiar aspect and the depression of their head induce persons unfamiliar with ichthyology to believe that the back is the abdominal surface, and, *vice versâ*, that the belly is the true back. They are sluggish in their movements, and depend for transportation rather upon others than their own exertions. They are to a large extent commensals, or parasitic upon other fishes, and, to a considerable degree, they seem to restrict their attentions to special animals. Thus, of the common species, one (*Echeneis remora*) chiefly attaches itself to large sharks (*e. g. Eulamia, Galeocerdo*, etc.), and another (*Leptecheneis naucrates*) is partial to the sea-turtles. These are the most common; the former is a short, stout species, with about seventeen or eighteen transverse laminæ in the disk; and the latter are elongated, slender species, with about twenty to twenty-six transverse laminæ. Both of the species particularized are cosmopolitan; the others are more limited and much rarer. The more notable are *Remoropsis brachyptera*, which is a parasite of sword-fishes, and *Phtheirichthys lineatus*, which is parasitic upon the barracuda (a large *Sphyræna*). (See also SUCKER, in CYCLOPÆDIA, and REMORA.) THEODORE GILL.

Edison (THOMAS ALVA), b. at Milan, O., Feb. 11, 1847; educated himself while a train-boy on the road between Port Huron and Detroit; received some instruction in telegraphy, and became an operator successively in Port Huron, Memphis, Louisville, Cincinnati, and Boston; but burst suddenly into fame as an inventor by his gold-indicator, 1871, duplex transmission, 1872, etc., and built in 1876 a magnificent laboratory at Menlo Park, N. J., from which he has sent out the telephone, the phonograph, etc.

Eg'leston (THOMAS), A. M., E. M., PH. D., LL.D., b. in the city of New York Dec. 9, 1832; graduated in 1854 from Yale College; went in 1855 to Europe; was assistant in the laboratory of geology at the Garden of Plants, and in the paleontological laboratory at the School of Mines in Paris; graduated at the latter institution in 1860; was appointed mineralogist at the Smithsonian Institution in 1861; formed in 1863 the plan for the School of Mines in Washington, and was appointed professor of mineralogy and metallurgy at the School of Mines in New York in 1864; has published a number of papers on mineralogy and metallurgy.

Elasmobran'chiates [from ἔλασμα, a "thin plate," and βράγχια, "gills"], or **Sela'chians** [from σέλαχος, pl. σελάχη, "cartilaginous fishes"], the class of vertebrates containing the sharks, rays, and chimæras; the fifth, in a descending series, of recently-proposed classifications of vertebrates, and intermediate between the true fishes and the Marsipobranchiates. They may be briefly defined as lyriferous vertebrates, destitute of membrane or dermal bones, and with the branchial chambers separate from each other. THEODORE GILL.

Electoral Commission. See PRES. ELEC. COM.

Eli'jah, a Hebrew prophet, appeared before King Ahab and announced a terrible drought as a punishment for the introduction of the idolatry of Baal, and fled then to Cherith, and subsequently to Zarephath, to avoid the wrath of the king. Three years afterward, when the drought had devastated the whole country, and the king had gathered all the priests of Baal at Mount Carmel to make a huge sacrifice, Elijah again appeared before Ahab: and this time the idolatrous priests were massacred and the people returned to the true worship; but the prophet was compelled to flee and seek refuge in a cavern in the wilderness of Mount Horeb, in order to escape the revenge of Jezebel. Once more, however, he returned to public life, appointed Elisha his pupil and successor, and announced to Ahaziah, the son and successor of Ahab, who lay sick in Samaria, that his illness should end with death; visited the school of prophets at Bethel, and retired then with Elisha to the other side of the Jordan, whose waters he divided by smiting them with his mantle; and while stopping there he was taken up into heaven in a chariot of fire. See books of Kings, I. and II.

Eli'sha, a Hebrew prophet, was called to the prophetic office by Elijah, and received his mantle when he was taken up into heaven; was recognized by the other prophets as their spiritual head, and enjoyed great respect throughout his whole life from the people of Israel. His history is told in the second book of Kings, and his death is commonly fixed at 840 B. C.

El'liot (GEORGE THOMSON), b. in the city of New York May 11, 1827; was educated at Columbia College; studied medicine at the University of New York, in Dublin, and Edinburgh; was appointed resident physician to the New York Lying-in Asylum in 1852, and attending physician to Bellevue Hospital in 1854; lectured on operative midwifery in the College of Physicians and Surgeons 1858–59, and became professor of obstetrics and diseases of women and children in Bellevue Hospital medical college in 1861. D. Jan. 29, 1871. Besides contributions to various medical journals, he published *Obstetric Clinic* (1868).

El'liott (ROBERT WOODWARD BARNWELL), S. T. D., b. at Beaufort, S. C., Aug. 16, 1840; was educated at South Carolina College, whence he graduated in 1861; was aide-de-camp 1861–62 to Brig.-Gen. Lawton of the Confederate States army, and wounded in the second battle of Manassas, and adjutant-general of McLaw's division 1864–65; was ordained a deacon in 1868, priest in 1871, and bishop of Western Texas in 1874, and has published a number of essays and sermons.

Elliott (SAMUEL MACKENZIE), b. at Inverness, Scotland, Apr. 9, 1811; studied at the Royal College of Surgeons in Glasgow, where he graduated in 1828, and in London, where he made the treatment of diseases of the eye his specialty; came in 1833 to America; visited Cincinnati and Philadelphia, and settled finally in New York, where he acquired a great reputation as an oculist. At the outbreak of the civil war he was lieutenant-colonel of the Highland Guard, and was wounded in the first battle of Bull Run. He was subsequently commissioned to raise the Highland brigade, which commission he fulfilled with great personal sacrifices, and was made a brigadier-general. D. at Elliottville, Staten Island, May 1, 1873.

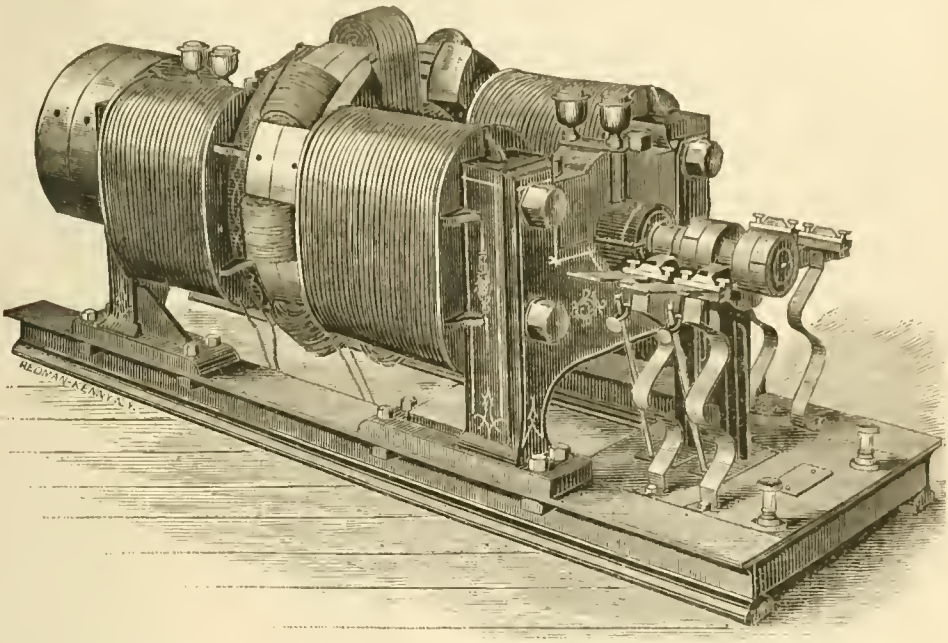
Elliott (WASHINGTON L.), b. in Pennsylvania; was appointed second lieutenant in 1846, first lieutenant in 1847, captain in 1854, major of 1st Cavalry in 1862; chief of the cavalry of the Army of the Potomac; wounded in the second battle of Bull Run; chief of the cavalry of the Army of the Cumberland; commander of the 4th corps Dec., 1864–Apr., 1865; engaged in battles around Nashville, Tenn., for which he was brevetted brigadier-general U. S. A., and brevetted major-general for gallant services in the war. Author of *Manual for Cavalry*.

El'lis (ALEXANDER JOHN), F. R. S., F. S. A., b. at Hoxton, a suburb of London, June 14, 1814; graduated at Trinity College, Cambridge, in 1837; studied law at the Middle Temple for some time, but devoted himself finally to the study of phonetics, and published *Alphabet of Nature* (1845), *Essentials of Phonetics* (1848), *Plea for Phonetic Spelling* (1848), *Universal Writing and Printing* (1856), *Early English Pronunciation* (parts i.–iv., 1869–75), *Glossic* (1870), *Practical Hints on the Quantitative Pronunciation of Latin* (1874), besides papers on various subjects.

Electric Light. Since the publication of the articles ELECTRICITY (CYCLOPÆDIA, Vol. I.) and MAGNETO-ELECTRICITY (Vol. IV., APPENDIX), the question of the practicability of substituting the electric light for the ordinary modes of artificial illumination in the business of life has been a subject of much investigation and experiment. To a certain extent, the desired object has been satisfactorily attained. For all purposes for which lights of great power can be advantageously used, as for the illumination of large open areas, such as public squares, parks, or pleasure-grounds, or of spacious interiors, like those of theatres, churches, assembly-halls, legislative chambers, great railway-stations, foundries, workshops, factories, etc., the electric light is to be preferred to the light of gas-beaks or oil lamps, not only on grounds of economy, but on account also of its vastly superior power and quality. For apartments of moderate dimensions, and for the ordinary uses of domestic life, the problem appears not as yet to have been so satisfactorily solved, or, if it has, its solution has not yet been publicly demonstrated. There is reason, nevertheless, to believe that the simple electric lamp of Mr. Edison described below, which that singularly ingenious inventor has been so long engaged in perfecting, will be found, when given to the public, to fulfil all the conditions necessary to success in this direction also.

Generation of Electric Currents.—A complete account of electric light should include the theory of electric currents and a description of the apparatus or instrumentalities by which such currents are generated. These topics are, however, fully discussed in the articles above referred to in Vols. I. and IV. of the CYCLOPÆDIA. Though the light was earliest produced by the voltaic battery, it is only as it is derived from the currents of dynamo-electric machines that it is capable of useful or economical application. The principal forms which have been given to these machines are described and illustrated in the article MAGNETO-ELECTRICITY. We supplement these descriptions by adding here a brief account of the peculiarities of one or two of the machines of more recent inventors. All these machines embody the general principle of a revolving wrapped armature, first illustrated in the Siemens machine, and made more effective by the modification of construction introduced by Gramme. All more recent improvements consist in further modifications of this armature. In the Brush machine, the device of Mr. Charles F. Brush of Cleveland, O., shown in Fig. 1 below, the armature is an

FIG. 1.

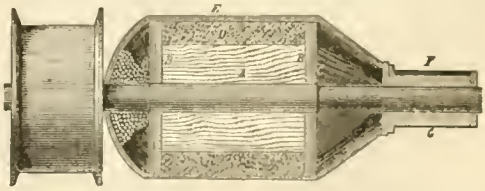


Brush's Magneto-Electric Generator.

iron ring wound as in the Gramme machine with coils of insulated copper wire; but the ring is not, as in the machine just mentioned, wholly covered by the coils, there being uncovered spaces alternating with the covered spaces at equal intervals: these uncovered parts being also larger than the covered, the wire coils falling into, and somewhat more than filling, the intermediate grooves. The coils on the armature are eight in number, the opposite ones being connected end to end, and the terminals carried out to the commutator. The ring revolves between the poles of two large field magnets, the two positive poles being opposed to each other at one extremity of the diameter of the armature, and the two negative at the other. The commutators are so arranged that, at any instant, three of the four pairs of coils are interposed in the circuit of the machine, the remaining pair, which occupies the neutral point, being thrown for the moment out of circuit; while in the Gramme machine the numerous armature coils are connected end to end throughout, forming always two sets of coils in multiple arc interposed at the same time in the circuit; each set consisting of one-half the coils of the armature. It is claimed that the exposure of large surfaces of the armature ring intermediate between the coils, as in the Brush construction, facilitates the dissipation of the heat occasioned by the rapid alternations of magnetic polarity, and thus allows, without disadvantage, a higher rapidity of rotation of the armature than would otherwise be practicable.

In Fig. 2 is shown in section the armature of Edison's new electric generator. In this the ring is formed, as in the machine of Gramme, of many turns of soft iron wire, but the enveloping copper wire carrying the induced current is not, as in other machines, wrapped round and round the annulus, but is applied only to the exterior circumference. The soft iron wire (size No. 20) is wound on a core, A, of wood, capped by soft iron disks, B, B, at the extremities, to which are applied vulcanized rubber disks, C, C, notched to receive the several coils, E, of insulated

FIG. 2.



Edison's new Generator-Armature.

wire wound lengthwise on the cylinder and connected with copper bars, F, on the commutator cylinder. Each of these coils, or strands, contains forty-one wires $\frac{42}{1000}$ inch in diameter. There are forty strands in all, and the opposite ends of all the wires in each are soldered to commutator bars on opposite sides of the commutator cylinder. This cylinder is pressed on opposite sides by copper wire brushes which take off the current.

The field magnets in this machine are immense. They are constructed of two straight magnet-cores, six inches each in diameter and thirty-six inches long, mounted on heavy

cast-iron blocks ten and three-quarter inches high and nine inches wide, and connected at top by a wrought-iron yoke six inches high and seven inches wide, each core being wound with three layers of No. 10 cotton-covered wire. The heavy blocks by which the cores are supported approach each other within about two inches, and form the poles. The adjacent faces are cut semi-cylindrically, forming the space within which the armature revolves. The armature-shaft is one and a half inches in diameter, and carries a ten-inch pulley with a five-inch face. The speed of rotation is about five hundred turns per minute.

With this machine Mr. Edison claims that he realizes, in useful effect, nine-tenths of the driving power. He claims also that the machine will convert and deliver twice the number of foot-pounds of energy that any other machine will deliver under like conditions. Comparing it with the Siemens machine, it is said that while that and nearly all other machines make the external resistance equal to that of the machine, and thus utilize only half the energy, "in Mr. Edison's generator five-horse power is transferred upon a resistance of five ohms, of which one-half an ohm is in the machine, thus delivering nine-tenths of the total current upon a circuit exterior to the machine, so that nearly the maximum economy is attained where other machines, under like conditions, will scarcely give any current at all."

Production of Light.—The luminous phenomena produced by the electric current are in all cases due to the resistance arising from the occurrence in some part of the circuit of imperfectly conducting materials. The energy expended in overcoming the resistance disappears as electricity, but reappears as heat, and, when the temperature is sufficiently raised, of light also. These effects are most strikingly manifested when the continuity of the metallic conductor joining the terminals of a voltaic battery or other source of electricity is interrupted at some intermediate point, and the electrodes or extremities of the interrupted conductor are slightly separated. The resistance is that of the intervening air, which is heated to incandescence by the force expended in bridging the gap. The electrodes themselves become also white hot at the extremities, and, unless of very refractory material, are fused, and to some extent volatilized, the vapor being transported by the current, and, by their added incandescence, exalting the intensity of the light. The electrodes are thus connected by an apparent flame of vivid brightness, which, when they are held horizontally, is convex upward, and is hence called the voltaic or electric arch.

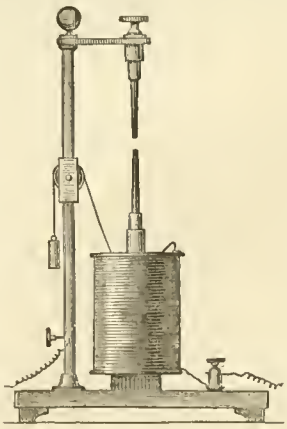
No material substance is a perfect conductor of electricity. All substances offer more or less resistance to the current flowing through them, and experience, accordingly, in transmitting the current, a greater or less elevation of temperature, dependent in degree on their conducting power, their dimensions, and the volume of the current. A comparatively good conductor of small cross-section and limited length may thus be heated to whiteness by a passing current, and so become a source of light. It thus appears that in endeavoring to apply the light of electricity to useful purposes resort may be had to contrivances of two distinct classes—viz. those which aim to utilize the electric arch, which is an incandescent gas or vapor, and those which employ an incandescent solid. Each of these modes of generating light has its advantages and its difficulties. The electric arch gives a light of great intensity, which it has not been found practicable so far to subdue as to adapt it to ordinary domestic uses. It requires very delicate adjustments, without which it is liable to annoying fluctuations of brightness, and which even the best automatic regulators yet constructed fail perfectly to effect. It is nevertheless well adapted for the illumination of large spaces, and under these circumstances several lights compensate each other's irregularities, and produce a satisfactory general effect. The light of an incandescent solid varies in intensity only with the variations of the current; and when this is derived from a dynamo-electric generator, it may be made almost absolutely uniform. But the heat of incandescence is far above the melting-point of most metals, and very near to that of the most refractory, such as platinum or iridium. Carbon, which will endure a very high heat without change, is extremely combustible, and when heated in the free air is soon consumed. Carbon and platinum have, however, both been employed in electric lamps of the second class, and it is to be hoped that some one of the inventions dependent on these will be successful.

Electric lamps employing the electric arch may be subdivided into such as are governed by mechanical regulators and those that regulate themselves. In all of these the material employed for the terminals or electrodes is carbon. In the early history of this subject, while the electric light was only a subject of laboratory experiment and illustration, ordinary wood carbons, first introduced by Sir Humphry Davy, sufficed for the purpose. Foucault, in the year 1844, suggested as a substitute the hard carbonaceous incrustations formed in the interior of gas-retorts, which are very compact and durable. The electrodes formed from this substance, however, have serious defects. Owing to the presence in them of saline and earthy impurities, they conduct irregularly, and sometimes splinter. In recent years they have been to a great extent superseded by carbons artificially prepared of pure material and solidified by great pressure. Many processes have been invented for this manufacture—the difficulty not being to prepare a good article, but to prepare one which shall be cheap as well as good. Among the names of inventors may be mentioned those of Staite and Edwards, Le Molt, Lacassagne and Thiers, Carmer, Peyret, Archereau, Carré, Gaudoin, and Sawyer-Mann. (For information in regard to the several processes in detail reference must be had to systematic treatises.)

In order to improve the conducting power of the carbons, which is a matter of some importance when the current is sent through a considerable length of the substance, as takes place in many regulators and in the Jablochkoff candles, they are sometimes coated externally with precipitated copper or nickel. The Brush carbons are so treated. To the same purpose it has been proposed to introduce powdered metal into the substance of the material during the process of manufacture, or to form the rod around a wire as a core. The external coating is to be preferred.

Electric Lamps with Mechanical Regulators.—The electric current being supposed to be uniform and the electrodes homogeneous, the steadiness of the electric light will be dependent on maintaining the distance between the terminals invariable. As the carbons are gradually consumed by vaporization and combustion, it is necessary to provide some means of compensating the increase of distance between them which would otherwise take place. In the early laboratory experiments the correction was made from time to time by hand, the light being therefore subject to unequal and irregular fluctuations. Later, a variety of automatic contrivances were invented for accomplishing the adjustment by the action of the current itself. All of these depend on bringing in some manner into action the force of electro-magnetism; in order to which a solenoid, or a proper electro-magnet, is introduced into the circuit conveying the current. When the distance between the electrodes begins to increase by the consumption of the carbons, the magnetic energy diminishes, with the result of causing the carbons to approach each other. One of the earliest and simplest of these contrivances is Archereau's lamp, shown in Fig. 3. Here, as in most electric lamps, the two carbons stand vertically one above the other, the upper one being carried by a horizontal bar which is supported by an upright pillar. The lower carbon is sustained at the end of a rod, half of iron and half (the lower half) of copper, which descends into the interior of a solenoid, with the copper lining of which it is in contact, though free to move. The current enters the solenoid, as shown, at the base of the figure, passes thence upward through the carbons and down through the pillar to the connection on the left or negative side. A cord attached to the lower end of the rod within the solenoid passes over a pulley fixed to the pillar, and supports a counterpoise weight, which, when the current is not passing, lifts the lower carbon into contact with the upper. The passage of the current excites the solenoid and draws the lower carbon downward, till the increasing resistance and diminishing attraction establish an equilibrium between the two forces of magnetism in the solenoid and gravity in the counterpoise. This contrivance operates tolerably for a time, but, owing to the necessary friction in the interior cylinder of the solenoid, is not very delicate; and manifestly, as the carbons are consumed, and the iron rod is farther and farther withdrawn from the solenoid, the distance between the carbons at which equilibrium will be established will

Fig. 3.



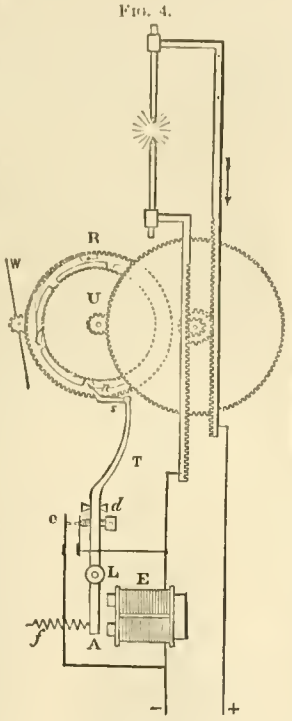
Archereau's Regulator.

diminish. Moreover, the upper carbon-holder being fixed and the lower one only movable, the position of the light changes with the consumption of the carbons; a disadvantageous circumstance if the light is to be used for optical projections.

This disadvantage is obviated in the regulator of Gaiffe of Paris, which is similar in principle, but in which both carbons are movable, and are so connected by a rack-and-wheel arrangement as to approach or recede simultaneously, the point of meeting remaining constant. The constancy of this point is maintained by giving to the positive carbon double the amount of movement of the negative, for the reason that the consumption is twice as rapid on the positive side. The object is accomplished by making the radii of the gear-wheels which move the carbons severally, and which have a common axis, unequal in the ratio of one to two.

The same expedient is employed in several other regulators, as, for instance, in Duboscq's, Foucault's, Serrin's, the Häfner-Alteneck (otherwise called the Siemens), etc. This last, which is a good example, is shown in Fig. 4. The upper carbon, which is the positive, descends by its own weight, or it may be urged in its descent by a spiral spring in a barrel on the common axis of the intermediate gear-wheels. When contact is made, the current, which ascends on the right, descends on the left, and animates the electro-magnet E in the circuit. This attracts the armature A, pivoted at L, which through the pawl *s* acts on the ratchet-wheel U. In this movement the contact-screw *d* comes into contact with the stop *c*, and switches off the current from the electro-magnet E; whereupon the armature is withdrawn from the magnet by the spiral spring *f*, the magnet comes into circuit again, and this action is repeated until the carbons are so far separated that the magnet fails to act. R is a train set in motion by the descent of the positive carbon, and W is a fly moderating the velocity of descent. This train does not go backward when the wheel U is turned back by the pawl *s*; but when U goes forward it carries R, the connection between the two being made by another pawl shown in the figure. When the magnet is not in action the pawl *s* is held clear of the wheel U by the pin *n*. The Siemens regulators are used in two of the five British lighthouses which are lighted by electricity—viz. those at Lizard Point in Cornwall. Three others—viz. the two at the South Foreland, and one at Souter Point near the mouth of the Tyne—use the Holmes regulator.

Fig. 4.



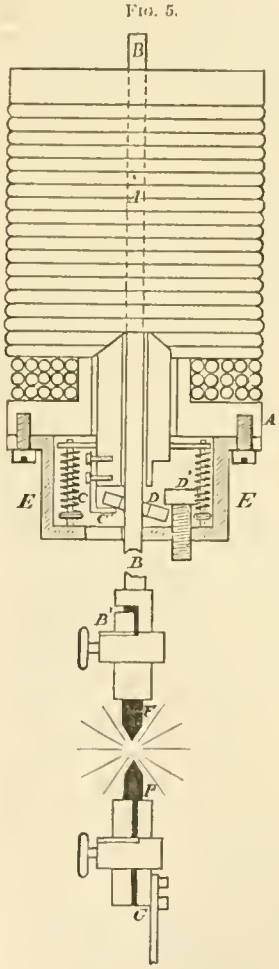
The Siemens or Häfner-Alteneck Regulator.

In the Duboscq, the Foucault, and the Serrin regulators the force of electro-magnetism is employed, not, as in those just described, to effect directly the approach or the separation of the carbons, but to lock or unlock a train of wheels by which the regulation is effected. In the Duboscq regulator this train is driven by a clock-spring in a barrel. Its effect when in action is to cause the carbons to approach each other, but when the proper limit is reached, an electro-magnet interposes a detent, which stops the train. When, by the consumption of the carbons, the distance becomes too great, the magnet is enfeebled and releases the train, which advances the carbons again. In actual use there is no continuous motion of the train, but the arms of the stop-wheel escape at brief intervals with much regularity. Duboscq's regulator provides only for the approach, and not for the separation, of the carbons. Hence, in the beginning, it is necessary to make the first contact and to adjust the proper length of the electric arch by hand. Foucault's regulator is a Duboscq with a second train added, the object of which is to separate more widely the carbons when too near. A single detent serves to check both trains when the adjustment is right; but by inclining in opposite directions it releases one or the other as occasion may require.

Serrin's regulator is one in which the weight of the upper carbon-holder, which is considerable, instead of a spring, serves to drive the regulating train. The upper carbon descends freely, and the train moves until contact is established, but then, as the circuit is closed, an electro-magnet draws downward the lower carbon, reversing the train and raising the upper carbon, but also, when the proper distance has been secured, interposes a detent, which stops the train and holds it until, by the waste of the carbon, the current has become enfeebled; when the magnet yields and the train moves again. In this, also, as in Duboscq's, the movement of the train, while the lamp is in action, is almost imperceptible. The Serrin regulator is used in the three electric lighthouses on the French coast—viz. two at Cape la Hève, near Havre, and one at Cape Grisnez, near Calais. Also at the Russian electric lighthouse at Odessa on the Black Sea, and at the Port Said lighthouse marking the entrance to the Suez Canal.

The Brush regulator, an American invention of much simplicity and well adapted to large lights for general illumination, is shown in principle in Fig. 5, in which A is a solenoid (seen partly in section toward the bottom), C is a soft iron core perforated from end to end, moving freely within the solenoid, and B a brass rod moving also freely within the core, and sustaining the positive carbon-holder B′. The iron core C is partially sustained by the spiral springs shown in the figure, which rest on the bottom of a box E E screwed to the base on which the solenoid rests. A flat ring D of brass is supported at one side by a bracket C′ attached to the core, and in the oblique position represented in the figure takes hold of and supports the rod B. The head of a set screw D′ limits the upward movement when the core is attracted by the solenoid. Supposing the circuit broken, the core drops and rests on the base of the box, the bracket C′ passing through an opening made for it, so that the ring D may lie flat. The action of the contrivance is this: When no current is passing, the core and ring rest on the base of the box, the rod B drops freely, and the carbons come into contact. When the current passes, the core rises, lifts the ring D into the oblique position, in which it seizes the rod B, and thus lifts the rod also, separating the carbons. As the carbons consume and the resistance increases, the magnetic energy of the solenoid diminishes, and the ring D touches the base by its lower edge, and presently loses its grip of the rod. This, descending, revives the energy of the solenoid, which lifts the ring again free of the base. The action here described takes place, however, by insensible steps, and the distance between the carbons is maintained to all appearance invariable.

Fig. 5.



The Brush Regulator.

The Wallace-Farmer regulator is another American invention of great simplicity, in which the carbons are in the form of plates eight or ten inches long and three or four broad, which meet, by their longer sides, the upper

plate, which is the positive, having twice the thickness of the lower. The plates are in contact when the current is not passing, but in the original adjustment the parallelism of the opposing edges is not quite exact, and the contact is perfect only at one end. On closing the circuit, an electro-magnet raises the upper carbon and the arch is established. With the consumption of the carbon the light travels along from end to end of the plates, and then, reversing its direction, travels back again to the starting-point.

One of the earliest devised regulators, and one which is not surpassed in its performance by any of those since invented, is that of MM. Lacassagne and Thiers. In this the lower carbon is supported by a piston moving freely in a cylinder of two or three inches diameter containing mercury, both piston and cylinder being of iron. The upper carbon is fixed, but capable of adjustment by hand. A reservoir containing mercury standing at a higher level than the cylinder communicates with the latter by a small caoutchouc tube, the communication being closed by a stopcock near the reservoir when the lamp is not in use. When the carbons are in contact and the current is established, an electro-magnet in the circuit compresses the caoutchouc tube. The stopcock being opened, the mercury flows into the tube, but is prevented by the pressure of the armature of the magnet from passing into the cylinder. On gradually withdrawing the upper carbon the arch is produced. The force of the magnet ought to be so regulated that when the distance of the carbons exceeds a certain limit the armature shall yield, permitting mercury to flow into the cylinder, and thus lifting the lower carbon-holder. In practice there is no alternation of flow and stoppage, but the armature becomes stationary at a pressure which allows a minute thread of mercury to flow steadily into the cylinder, producing an arch of invariable length. The disadvantages of this regulator are, that it is somewhat cumbrous, and that the light does not remain fixed at one point, but travels upward as the upper carbon is consumed. This might be obviated by substituting for the reservoir a second cylinder with a piston carrying the upper carbon. This second cylinder should, in the beginning, be charged with mercury: and if the upper carbon is the positive, it should be only one-half as large as the lower in cross-section.

A lamp adapted to produce a light with a current insufficient to maintain an electric arch of sensible length has been invented by Profs. Thomson and Houston. The source of light is chiefly the secondary spark always produced on the sudden rupture of an electric current. In this the lower carbon is supported near the end of a horizontal elastic bar, which also carries the armature of an electro-magnet situated beneath it. The upper carbon rests on the lower, being guided, but not firmly held, by its support above. Its weight, if necessary, may be partially counterpoised. On closing the circuit, the armature of the magnet is so suddenly attracted as to break contact between the carbons, producing a vivid spark; but as this rupture of contact destroys the power of the magnet, the elasticity of the spring prevails, and contact is immediately restored. Thus there takes place a rapid motion of vibration, occasioning a succession of sparks so closely succeeding each other as to produce the effect of a continuous light.

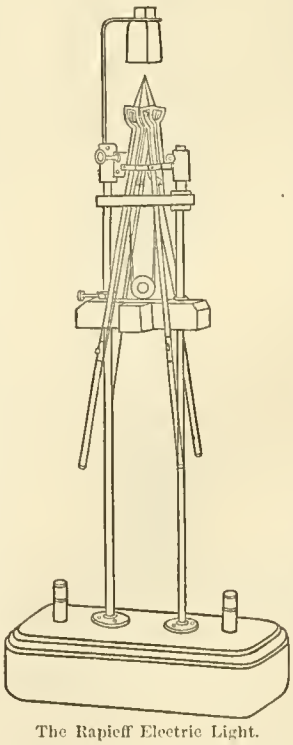
Lamps without Regulators—Electric Candles.—Within the past two or three years the public interest in the subject of electric light has been strongly reawakened by the introduction of some forms of electric lamp in which the cumbrous and costly mechanical contrivances previously regarded as indispensable for maintaining the steadiness of the illumination are dispensed with. The first device of this kind, proposed and patented as long ago as 1846 by Staite of London, though apparently feasible enough, attracted little attention and failed to command success. It consisted in bringing two inclined rods of carbon near to each other at their lower extremities, where they were supported by some solid and refractory substance, the rods descending in guiding grooves as fast as consumed. The distance between the extremities could be varied by a lateral movement given to the support of one of the rods. A more successful form of electric candle is that now so well known by the name of its inventor, Jablochkoff, an officer of the Russian army. This invention dates as far back as 1876, but it was first introduced into public use in May, 1877, at the grand magazines (commercial establishments) of the Louvre. It was not long after this that the same mode of illumination was employed in a number of the large open squares in Paris and in some of the public streets of that city. Early in 1879 more than three hundred Jablochkoff lights were in operation in Paris alone, and perhaps an equal or greater number in other parts of France. During the winter and spring of 1878–79 experiments were made with this light on the Thames Embankment, on the Holborn Viaduct, and in the Billingsgate Market in London, with results satisfactory so far as illumination is concerned, but less so as regards economy.

The construction of this candle is so simple as to require no figure to explain it. It consists of two flat strips or cylindrical rods of carbon, not more than three-eighths of an inch thick and about ten inches long, placed vertically side by side and about one-eighth of an inch distant from each other, the space between them being filled with some insulating substance like kaolin or gypsum. The current ascends one of the rods and descends the other. In order to establish the arch some conducting substance, like a bit of carbon, must be laid across the top. This candle does not perform well with a continuous current, the positive carbon wasting faster than the negative—a fault which the inventor endeavored to correct, but without success, by making the positive carbon of double thickness. With a machine giving a reciprocating current, however, it works perfectly. The principal objection to it is the rapidity with which it burns out, each candle lasting only about an hour and a half. Wilde has shown that the insulating substance between the carbons is unnecessary, provided they are well insulated from each other at the base. The presence of this substance to some extent diminishes the brilliancy of the light. Wilde's lamp, therefore, is a Jablochkoff without the insulator; and it has the advantage that in it the carbons may be adjusted to different distances at pleasure, and also that, by inclining one of them till the extremities meet, the arch may be established without employing any auxiliary conductor.

Another improvement on the Jablochkoff candle is that of De Meritens, who introduces, between the two carbons conveying the current, a third one wholly insulated and out of contact with either. This serves as a kind of intermediate pier in the bridge which the arch forms between the principal carbons, and increases, according to the inventor, the brilliancy of the light.

Another form of electric light which may most properly be called a candle is the Rapieff, in which there are two carbon rods on the positive and two on the negative side; the members of each pair being inclined to each other and meeting as here shown. Λ. Each rod slides in a guiding support, being urged forward as consumption goes on by a pulley and small counterpoise. The figure shows the arrangement now preferred by the inventor, though he at first placed one pair of carbons vertically over the other. Immediately above the arch is fixed a small block of lime or alumina, which by absorbing the radiant heat becomes luminous and improves the effect. This light has been successfully employed in the office of the London *Times*.

Fig. 6.



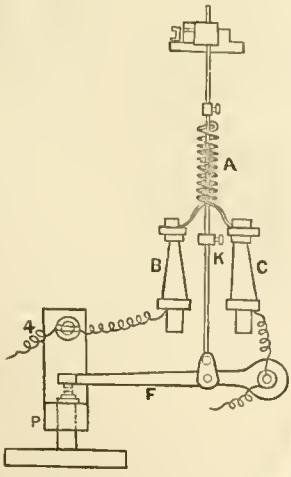
The Rapieff Electric Light.

Electric Lamps employing Incandescent Solids.—The light of the voltaic arch in the ordinary forms of self-regulating lamps is too powerful for the purposes of domestic illumination, and the lamps themselves are too cumbrous and too costly. Much ingenuity has been, therefore, directed to the endeavor to obtain from a given current many lights of moderate power in the place of one of excessive brightness; or, in other words, to accomplish what is called the subdivision of the light. There is no difficulty in obtaining many lights from one circuit. The misfortune is, that the sum-total of the intensities of such a series of lights is by no means equal to that of the single light which the same current will produce—in other words, there is a large absolute loss of light by subdivision. Some writers on the subject have maintained that this diminution obeys the law of living forces—that the vibratory velocities of the luminiferous molecules are reduced to one-half by a division

of one light into two, to one-third by division into three, and so on; with the resulting consequence that, as the intensities are proportioned not to the velocities themselves, but to the squares of the velocities, each light in the first case will become only one-fourth, and in the second only one-ninth, of the original light. Granting the fundamental assumption of this hypothesis in regard to the velocities, the conclusion would be correct enough; but the assumption itself is not self-evident; and though there is always a large loss in the total amount of light on subdivision, it appears not to be by any means proportioned to the squares of the numbers of lights. Mr. Shoolbred in his recent useful and compendious work on this subject has shown that in the use of Jablochkoff candles the loss by doubling the number on a circuit is not more than one-third of the total intensity. The voltaic arch, however, requires too great an amount of electric energy to maintain it at all, to allow, whether by subdivision or otherwise, of the construction of lamps of sufficiently moderate power to be used for the study or the table. If such lamps are ever produced, it will probably be by taking advantage of the incandescence of solids by electricity.

Lamps employing incandescent solids, or, more briefly, lamps by incandescence, were among the forms earliest proposed for making electricity available as a source of light. In 1841, Mr. F. Moleyns of Cheltenham, England, patented a contrivance of this sort, in which a spiral of platinum wire enclosed in a glass globe is made white hot by the passage of a current of electricity through it. The globe was air-tight, but a funnel-shaped tube filled with powdered charcoal let into it at the top allowed a minute stream of this powder to fall, like sand in an hour-glass, through a minute orifice upon the incandescent spiral, very materially heightening the brilliancy. In 1849 the same idea, omitting the charcoal, was reproduced by Petrie, who employed iridium instead of platinum. In 1858 it was reported to the French Academy of Sciences that De Changy, a French inventor, had solved the problem of the divisibility of the light, and had succeeded in producing twelve steady lights, independent of each other, from a single battery of twelve Bunsen elements. He also employed incandescent spirals of platinum. All these inventions were, however, practical failures. The difficulty in the case is, that the temperature of incandescence is too near that of fusion in platinum for safety, and that the spiral is almost inevitably destroyed by the current. Recently, this difficulty has apparently been overcome by Mr. Edison, who has constructed a lamp with a double spiral of platinum, in which, by an ingenious automatic contrivance, the current is switched off the moment the temperature approaches the limit of safety, and is turned on again as soon as the danger is past. Fig. 7 illustrates the principle of this invention. The source of light is a double spiral of platinum wire, of which the two ends are secured to studs, as shown. The current enters on the right, ascends and descends the spiral, and passes out on the left. A slender platinum rod or wire passing upward through the spiral and insulated at the top is attached at bottom to a horizontal bar which communicates with the positive conducting wire on the right, but is sustained just above and out of contact with the set screw P on the left. The radiant heat of the spiral expands the vertical rod, and at length brings the horizontal bar down to the contact-screw P, when the current leaves the spiral and passes along the bar. As the temperature falls, the contact is broken, and the current returns to the spiral. In another form of this lamp the current passes first upward through the rod, and is thence conducted to the foot of the spiral on the right, after which everything proceeds as above described. The design of this last arrangement is that the rod may be heated by the electric current directly, and not merely by the radiant heat of the spiral. In either case the contact-screw P must be set experimentally at a point which keeps the temperature within the limit of safety.

Fig. 7.



Edison's Electric Lamp by Incandescence.

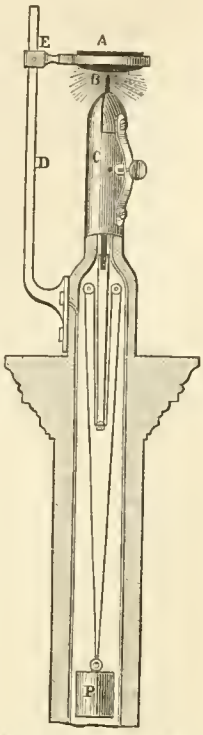
An additional security against danger from overheating in this lamp has been furnished by a remarkable discovery made by Mr. Edison in regard to the condition of platinum, and indeed of most metals, when prepared by ordinary metallurgic processes. In this condition, he says, metals contain air imprisoned among their molecules, which increases their fusibility, and is the cause of the phenomena of tempering and annealing. When a platinum wire has been repeatedly heated to incandescence in a perfect vacuum this air is expelled, and on the cooling of the metal, also *in vacuo*, is not reabsorbed. Its density is then found to have been increased, and its fusing-point raised. Moreover, it is no longer susceptible of being annealed, and it retains its strength and elasticity at the highest temperatures. With spirals prepared in this way, Mr. Edison even believes that the contrivance above described for preventing overheating will be unnecessary. This lamp bids fair, therefore, to be a practical success; and inasmuch as he proposes to furnish it at a very moderate price, it is quite possible it may soon come into general use in large towns. Neither this nor any other form of electric lighting can be economically substituted, however, for gas, oil, or candles in private dwellings, if every householder attempts to run an electric generator for himself. Economy will only be attained when the electricity is generated on the large scale, and supplied to individuals as gas is supplied at present.

Lamps by incandescence have been constructed in a variety of forms in which the incandescent substance employed has been a slender rod of carbon. The great combustibility of carbon suggests that in all these contrivances the incandescent rod shall be enclosed hermetically within a glass bulb or tube exhausted of air or filled with an incombustible gas, such as nitrogen. In the latter case it is not necessary to take the trouble to charge the bulb with the incombustible gas, since if it should be originally full of air the oxygen would very soon be exhausted, with no material loss to the carbon. The earliest invention of this kind was that of Starr and King of Cincinnati, U. S., in 1845, who employed the carbon *in vacuo*. Greener and Staite of England patented a similar contrivance in the following year. Neither of these proved successful. Recently the idea has been revived, first by Lodyguine of St. Petersburg (1873) and Kosloff of the same city; then (1875) by Konn of Paris; and later still by Bouliguine, an officer of the Russian army, and Fontaine of Paris. The several contrivances of these inventors are substantially similar in principle, but differ in details. A common difficulty attends them all. The carbons waste away, and must from time to time be renewed. The lamps of Konn and Fontaine are furnished with more carbons than one, which may be successively brought into use. That of Bouliguine has a single one of some length, which is gradually raised as it is consumed by cords attached to its lower extremity passing over pulleys above, in the manner of the Rapieff carbons. The upper portion only is incandescent, the carbon being grasped a little below the end by a metallic band conducting the current. Considered as light-producers, these lamps may be regarded as measurably successful, but the inconvenience of being compelled frequently to dismount them must prevent their coming into general use.

There remain what are called by Fontaine the "lamps by imperfect contact." By this is meant the contact between a slender rod of carbon reduced to a point at its extremity, and a mass of the same substance of much larger dimensions, on which it rests lightly by its own weight, or against which it is pressed upward by a pulley or counterpoise. The Reynier lamp is a French invention in which the carbon rod rests on the circumference of a carbon disk mounted on an axis on which it turns. The contact being not vertically over, but in advance of the axis, the slow descent of the rod as it is consumed determines an equally slow rotation of the disk, removing the residue of the combustion, which might otherwise interfere with the free passage of the current. The Werdermann lamp is an English invention founded on the same principle, in which the rod is pressed upward against the middle point of a lenticular disk of carbon placed horizontally. In both these constructions it is to be understood that the current is conveyed to the rod at a point very near the extremity, and that it is only the small terminal portion which is incandescent. The construction of the Werdermann lamp is shown in Fig. 8, in which B is the carbon rod passing through a fixed carbon-holder or guide C, one lip of which is movable and is pressed against the carbon by a spring. The lower extremity of the carbon is fixed in a wooden supporting rod, which in turn rests on a cord passing over pulleys and connected below with a counterpoise P. An insulated arm D sustains the carbon disk A, set in a metallic ring and supported by the bracket E.

The small part of the rod above the holder at B is incandescent when the current passes. Theoretically, in this lamp there is a minute voltaic arch formed between the constantly wasting point of the rod B and the lenticular disk A; but, practically, the light of the lamp proceeds from the incandescent part of the rod. Mr. Ducretet of Paris has constructed a lamp of this form, varying only in the mechanical mode employed for advancing the carbons. In place of the pulleys and counterpoise he employs a cylinder filled with mercury, in which the carbons are for a large part of their length immersed, being consequently kept in contact with the disk by hydrostatic pressure.

Fig. 8.



Werdermann's Electric Lamp by Imperfect Contact.

Relation of Motive-power to Intensity of Light produced.—It is to be understood that in every system of electric lighting, whatever the form of apparatus employed, economy requires the use of mechanical generators of electricity, and not of voltaic batteries. It is an interesting question, therefore, what amount of light, photometrically measured, can be produced by the expenditure of a given amount of power in driving an electrical machine. This question does not admit of a general solution, since the resultant intensity of light produced in a single lamp by a given amount of horse-power in the motor varies materially with the kind of apparatus employed. Mr. Shoolbred remarks: "The luminous results per horse-power, as given off in a single light from the same machine, seem to be approximately represented by 15 for regulators, 5 for candles (Jablochkoff, etc.), and 1 for incandescent lamps. On the other hand, the luminous effect is not capable of subdivision in the use of regulators with the same economy as with candles and incandescent lamps."

Again, the luminous effect per horse-power is greater with large engines than with small ones, because there is less proportional loss in the mechanical resistances within the engine itself. Finally, the distance between the carbons of a regulator, or the length of circuit on which a line of lights is placed, affects materially the intensity of each, owing to the greater or less power required to overcome electrical resistances; and the total intensity increases with the velocity of rotation in the same magneto-electric machine. Every particular question of this kind, therefore, will have to be solved in reference to the particular conditions of the case proposed. It is found, moreover, that the intensity of the light furnished by a given regulator or lamp, especially with continuous currents, is unequal when observed at different angles in altitude. With the Serrin regulator and the Gramme machine the maximum intensity is found at an angle 60° below the horizontal, where it is sixfold greater than in the horizontal plane. With the same regulator and a reciprocating machine the intensity in the horizontal plane is greatest, and the difference at different inclinations is much less. With the Jablochkoff candles the intensity vertically upward exceeds by about one-eighth that in the horizontal plane. The light is also nearly fifty per cent. greater at right angles to the plane of the rods than directly in that plane. A reciprocating current is also about one-fifth less effective than a continuous current.

In measuring intensities, a certain standard light is taken as a unit. The standard in England is fixed by act of Parliament, and is a sperm candle, six to the pound, consuming 120 grains (7.77 grams) per hour; in Germany it is a paraffine candle, six to the half kilogram (1.102 pounds), 20 millimètres (0.8 inch) in diameter, and burning 50 millimètres in height of flame per hour; in France it is a Carcel lamp (*bec Carcel*), burning colza oil at the rate of 12 grams (648 grains) to the hour. Leblanc, chief gas-examiner to the municipality of Paris, rates the bec Carcel at 9.5 British candles, a value generally accepted by British authorities.

It is to be further observed that, in speaking of the relation between electric light and the mechanical force producing it, the phrase "force absorbed" is to be understood as signifying the net force which remains after deducting the amount of energy consumed in moving the engine itself. With these explanations the following statements will be intelligible.

Experiments made by Mr. Fontaine on the intensity of the light emitted horizontally and at different inclinations in altitude from a Serrin regulator (the positive electrode uppermost), with a Gramme generator of the ordinary type, making 750 rotations per minute, driven by a gas-engine of five horse-power (nominal), and an effective "force absorbed" of 2.7 horse-power, the carbons being three millimètres apart, and the length of the circuit 100 mètres, having a conductibility of 95 per cent. (silver being taken as unity), gave the results exhibited in the table below, in which 0° indicates horizontality, the positive sign denotes angles of elevation, and the negative, angles of depression:

Angle of observation.	Intensity in becs Carcel.	Intensity per horse-power.
+ 90°	12	4.44
+ 75°	21	7.77
+ 60°	79	29.26
+ 45°	119	44.08
+ 30°	130	48.15
+ 15°	144	53.33
0°	225	83.33
— 15°	400	148.15
— 30°	822	304.44
— 45°	1175	435.19
— 60°	1325	490.74
— 75°	1051	389.26
— 90°	00	00.00

The most effective distance of the carbons is one-half of that at which the light becomes extinct. The velocity of rotation of the generator greatly influences the luminous intensity. At 1000 rotations the intensity is four times greater than that obtained with 700, and twice as great as with 800. The force absorbed per 100 becs is more than twice as great at 700 rotations as at 1000.

The following table of the efficiency of different machines under similar circumstances is also derived from Fontaine's work. It will be understood that 75 kilogrammètres per second is the equivalent of one horse-power:

Generator.	Revolutions, per minute.	Mean intensity, becs Carcel.	Force absorbed per sec. in kilogrammètres.		Becs per horse-power.
			Total.	Per 100 becs.	
Wallace (small)	1000	118	292	248	30
Brush (small)	1400	242	282	116	64
Holmes	400	217	240	110	67
The Alliance	400	279	270	96	77
Brush (large)	1340	332	244	73	100
Gramme (small of 1873)	800	190	138	72	103
Gramme (large of 1873)	420	573	397	68	108
Siemens (large)	480	1276	735	56	130
Siemens (medium)	850	591	247	41	179
Gramme (normal)	750	590	192	25	231

In this table the statements in regard to the numbers of revolutions per minute of the Brush machines are in both instances considerably in excess of the fact; and the luminous effect does not correspond to the statements of the same by the constructors. According to these, a small-pattern Brush machine (No. 3) makes 1200 revolutions per minute, and furnishes a light of 2000-candle power (210 becs Carcel); and a large-pattern machine (No. 7) makes only 750 revolutions per minute, and gives a light of 35,000-candle power (3700 becs Carcel).

Cost of the Electric Lights.—The cost of lighting by electricity depends so much upon conditions that it is difficult to present any satisfactory general statements on the subject. Where numerous and powerful lights are needed, and where the service is regular and long continued, there is great economy in the use of this light as compared with the cost of any other form of artificial illumination; but for ordinary street lighting where gas is cheap, as in London and Paris, the light as produced by the Jablochkoff method (the most suitable for this use) or the ordinary regulators, is in excess of the need, and the theoretic economy has not been realized. The following results of experiment and computation will convey information on this subject as definite as can well be succinctly given.

Mr. Edmund Becquerel, in a report made twenty years ago to the Society of Encouragement of Paris, gave as the minimum cost at which an electric light of the mean intensity of 50 Carcel becs could be maintained by a Bunsen battery, three francs per hour, which is equivalent to six centimes per hour per bec. Mr. Leroux, more recently, has computed that with an Alliance machine and

a Serrin regulator in the most unfavorable circumstances—viz. where a steam-engine is employed exclusively to drive the generator—a light of 125 bees may be maintained ten hours per day at a cost of 1.725 francs per hour, or $1\frac{3}{8}$ centimes per bee per hour, or a five hours' daily service at a cost of 2.57 francs per hour, or two centimes per bee per hour. Mr. Fontaine gives the following table:

Comparative Cost of Different Lights.

Kind of light.	Consumption per hour.	Cost per bee per hour.	Cost for 400 bees per hour.	Remarks.
		fr.	fr.	fr.
Refined colza oil..	42 grams.	0.07	28.00	Price 1.70 per kilo at Paris.
Allaire neutral oil	39 "	0.06	24.00	" 1.55 " "
Oil of schist.....	36 "	0.0468	18.72	" 1.30 " "
Petroleum.....	30 "	0.054	21.60	" 1.80 " "
Tallow candle....	83 "	0.141	56.40	" 1.70 " "
Wax candle.	60 "	0.33	132.00	" 5.00 " "
Stearine candle ..	82 "	0.246	98.40	" 3.00 " "
Voltaic pile.....	.....	0.06	24.00	.....
Alliance machine.	.....	0.024	9.00	500 hours per annum.
The same.....	.....	0.007	2.80	4000 " "
Coal gas.....	140 liters.	0.029	11.60	0.15 fr. pr. c. metre; 500 h. pr. an.
The same.....	" "	0.025	10.00	" " " ; 4000 " "
The same.....	" "	0.050	20.00	0.30 " " ; 500 " "
The same.....	" "	0.046	17.80	" " " ; 4000 " "
Gramme machine.	.....	0.0042	1.78	Steam-power; 500 " "
The same	.....	0.0016	0.56	" " 4000 " "
The same.....	.....	0.004	1.60	Water-power; 500 " "
The same.....	.....	0.0011	0.44	" " 4000 " "

On this table Mr. Fontaine remarks: "It shows that, for the same intensity, the normal Gramme machine, in the most unfavorable case, produces a light

75 times cheaper than the wax candle,
55 " " than the stearine candle,
16 " " than oil of colza,
11 " " than gas at 0.30 fr. pr. cub. mètre,
$5\frac{1}{2}$ " " than gas at 0.15 " " " "

Gas at 0.30 fr. per cubic mètre is equivalent to gas at 16 cents per 100 feet. The assumed prices of gas in the table are therefore much lower than the prices paid in American cities.

The foregoing table supposes the electric light to proceed from a Serrin regulator. With the Jablochkoff candle the economy is less, but this form of light is most available for ordinary uses. Fontaine found the intensity of each Jablochkoff light in the Avenue de l'Opéra at Paris to be equal in horizontal intensity to 58 Carcel bees. The opaline globe placed over the light to soften its dazzling brightness cuts off forty per cent. of its luminosity, reducing it to 34 bees. The lights, however, are placed so high that on the level of the sidewalk they produce an effect only equal to 17 bees. Mr. Th. Levy, engineer in the municipal service of Paris, shows that the cost per light per hour is 0.73 fr., which is equivalent to $4\frac{1}{2}$ centimes per Carcel bee per hour, which the table shows to be about equal to the cost of coal-gas at 0.30 fr. per cubic mètre. In England a number of experiments have been made with the same form of light. For street-lighting the cost has been found to exceed that of gas. On the Holborn Viaduct in London, for example, 16 Jablochkoff candles were employed to replace 86 gas lamps. The city engineer, Lieut.-Col. Hayward, reported the cost of maintenance to be seven and a half times that of the gas replaced, but that the light furnished was seven times superior to the light of the 86 gas lamps. On the other hand, the large commercial and industrial establishments which have introduced the Jablochkoff light have found the change greatly to their advantage. In the magazines of the Louvre the substitution of this light in place of gas has reduced the cost of lighting 30 per cent.

The Brush Company of Cleveland, U. S., claim that with a machine of their construction, yielding sixteen to eighteen lights of 2000 candle-power (210 bees Carcel) each, with steam-power specially employed for the purpose, for 3000 hours per year, the cost per hour per light is only three cents, or less than $1\frac{1}{2}$ mills per Carcel bee. If the power can be spared from motors maintained for other purposes, this cost will be reduced one-fourth. (Further details on this subject must be sought in systematic treatises.)

The question as to the possible economy of small electric lights adapted to domestic purposes remains yet to be settled. It will probably soon be tested by the introduction into use of Mr. Edison's lamp by incandescence.

Marine Electric Lights.—No application of the electric light more strikingly illustrates the usefulness of this mode of illumination, or has been more unquestionably successful than its introduction into seacoast lighthouses on dangerous coasts. The first experiment of such application was made at Dungeness, the southern headland of the county of Kent, England, in 1862. This light was some time after transferred to the South Foreland, N. E. from Dungeness, on the Strait of Dover. The machines used are those of Holmes, a modification of the Alliance machine (see MAGNETO ELECTRICITY), and the lamps are those of the same constructor. They are of more than 1500 candles (160 Carcel bees) power; but the intensity of the concentrated illuminating beam exceeds that of 20,000 candles or 2100 bees. There are two lights, and each light has a double optical apparatus (one above the other), the second one being held in reserve to be used in case of accident or interruption to the first. For a similar reason, two lamps are provided for each optical apparatus, arranged on a shunting-table and railway to allow of the instantaneous substitution of one for the other. Within the last few years similar lights have been established at Souter Point in Northumberland, near the mouth of the Tyne, and at the Lizard, on the coast of Cornwall, the southernmost point on the coast of England. At the first of these, the power of the lamps is nearly 2000 candles (210 bees) each; at the other, 4125 candles (435 bees). In all of them arrangements are made by which the current from two machines united may be sent to one lamp, doubling the intensity of the light. This is done only in case of fogs or heavy weather.

An electric light was established at Cape La Hève, France, in 1863, and a second in 1865. Recently a third has been established at Cape Grisnez. All these employ Alliance machines with Serrin lamps, and give a light equal to 200 Carcel bees. The electric light recently erected at Odessa on the Black Sea, and that at Port Saïd, Suez Canal, employ similar apparatus with somewhat inferior power.

Sanitary Advantages of the Electric Light.—In the ordinary modes of artificial illumination, whatever be the materials or apparatus employed, the luminous effect is ultimately the combustion of a gaseous hydrocarbon. The products of this combustion are aqueous vapor and carbonic acid. Both these products are formed at the expense of the oxygen of the air. The first is innocent, the second noxious. Powerful gaslights or lamps, or candles in large numbers, in an apartment of limited dimensions, vitiate the atmosphere, and are deleterious to health for a twofold reason; first, by exhausting the oxygen, which is the life-sustaining principle, and secondly, by generating a gaseous compound which is positively injurious. It is very much in favor of the electric light that it is free from these objections, or so nearly so that they need not be taken into account in regard to it.

It is another point in favor of this light that it does not, like gas light, sensibly heat the air of the apartment in which it is employed. This assertion may seem paradoxical, when it is remembered that the heat of the voltaic arch, or of an incandescent solid, exceeds immensely that of an ordinary gas flame; but it is to be considered that the amount of radiant heat emitted from any given source depends not only on the temperature, but on the mass of the body heated; and this mass in the electric lamp is very insignificant. Moreover, every gas-jet or candle-flame not only heats by radiation, but also by contributing to the surrounding air a great volume of vapor or gas which has made part of the flame itself, and has partaken of its temperature; while nothing of the kind occurs with the electric lamp. Hence the effect of such a lamp upon the temperature of the surrounding medium is inappreciable.

Edison's Carbon Lamp.—After this article had been electrotyped (Nov., 1879), Mr. Edison publicly announced that he had abandoned his platinum lamp, and had adopted a new construction in which the incandescent substance is a filament of carbon. This filament is in the form of a horseshoe, about an inch in the height of the arch, and exceedingly thin, being prepared from cardboard by stamping it out in proper shape, and afterward carbonizing under pressure. It is enclosed in an exhausted bulb of glass, the ends being connected with platinum wires passing through the glass and fused into it. So far as the principle goes, there is nothing in this which differs essentially from the lamp of Starr and King above mentioned, patented in 1848. Whether it will be more successful is yet to be proved.

AUTHORITIES.—The literature of this subject is as yet to a large extent floating in the scientific and technical journals. The principal authority is Fontaine, *Éclairage à l'Électricité*, 2d ed., Paris, 1879. The work of Paget Higgs, *The Electric Light in its Practical Applications*, London, 1879, is next in importance. This author has also translated Fontaine's work. *Electric Lighting and its Practical Application* is a smaller treatise, by S. N. Shoolbred, London, 1879, which gives a very good summary of the present state of progressive electric lighting. For electric sea-coast lights the fullest information may be obtained from the official report made to the Lighthouse Board of the U. S. by Maj. Geo. H. Elliot in 1874, and published as a Congressional document.

F. A. P. BARNARD.

Elliot (George Henry), b. at Lowell, Mass., Mar. 28, 1831, graduated at West Point in 1855 as a lieutenant of artillery; served on the frontier of Texas, and in 1857 was transferred to the engineers; was engaged in the construction of fortifications on the Pacific until 1870; was a member and the engineer secretary of the lighthouse board, 1870–74, and chief engineer of the Washington aqueduct 1870–71. He was engaged in an inspection of European lighthouse systems from May to Sept., 1873, and is (1874) major and assistant to the chief of engineers at Washington, D. C. Geo. C. Simmons.

Elliott (Washington L.), b. in Pennsylvania; was appointed second lieutenant in 1846, first lieutenant in 1847, captain in 1854, major of 1st Cavalry in 1862; chief of the cavalry of the Army of the Potomac; wounded in the second battle of Bull Run; chief of the cavalry of the Army of the Cumberland; commander of the 4th corps Dec., 1864–Apr., 1865; engaged in battles around Nashville, Tenn., for which he was brevetted brigadier-general U. S. A., and brevetted major-general for gallant services in the war. Author of *Manual for Cavalry*.

Encyclopæ'dia, or **Cyclopæ'dia** [Gr. ἐγκύκλιος and παιδεία—*i. e.* a circular or general course of education], a compilation usually, but not always, in alphabetic arrangement, which professes to impart information, more or less complete, upon the whole circle or range of human knowledge. The most noted of the earlier cyclopædic works were—the work of Speusippus (the nephew of Plato, died B. C. 339), not now extant; the great collections of Varro, of the Elder Pliny, of Stobæus, Suidas, Isidorus, and Capella, crude summaries of the then known arts and sciences; the *Speculum Majus*, in 4 parts, of Vincent de Beauvais (1264), in 3 vols.; and other similar compilations. We should note also the work of Alfarabi of Bagdad (died A. D. 950). The earliest of modern encyclopædias was that of J. H. Alsted (1630, 35 books). L. Moréri's *Grand Dictionnaire* appeared in 1673; Hofmann's *Lexicon Universale*, 1677, 2 vols.; T. Corneille's *Dictionnaire des Arts*, 1694, 2 vols.; and P. Bayle's *Dictionnaire Historique et Critique*, 4 vols., Rotterdam, 1697. In the eighteenth century the principal works were—J. Harris's *Lexicon Technicum*, 2 vols. folio, London, 1710; Ephraim Chambers's *Cyclopædia*, 2 vols. folio, 1728; Zedler's *Universal-Lexikon*, 64 vols., Leipsic, 1732–50; the French *Encyclopédie* of the *Encyclopédists* Diderot, D'Alembert, Voltaire, Rousseau, Grimm, and Helvétius, 28 vols., 1751–72; 7 vols., 1776–80; the *Encyclopædia Britannica*, 3 vols., 1771; 2d ed. in 10 vols., 1776–83; a 3d ed. in 18 vols., 1797; the *Deutsche Encyklopädie* of Köster and Roos, 1778–1804; and the *Encyclopédie Méthodique par Ordre des Matières*, 1781–1832, 201 vols. In the nineteenth century the first European work was Dr. A. Rees's *Cyclopædia*, 1802–19, in 45 vols. A work called the *British Encyclopædia*, edited by Thomas Dobson, was published in Philadelphia 1798–1804; Dr. Brewster's *Edinburgh Encyclopædia*, 18 vols., 1820–30, followed. The *Conversations-Lexikon* of F. Brockhaus, Leipsic, 1812, and of which 11 eds. have appeared, was the basis of many other cyclopædias. The *Encyclopædia Metropolitana*, 1818–45, 30 vols. 4to, was a series of scientific treatises, as was also *Lardner's Cyclopædia*. The *Encyclopædia Americana*, 1829–33, 13 vols., and supp. vol., 1848, edited by Prof. Lieber, was based on the *Conversations-Lexikon*. The *Penny Cyclopædia*, 28 vols., 1833–43, subsequently rearranged in 4 divisions and 27 vols. as the *English Cyclopædia*; 8 new eds. of the *Encyclopædia Britannica*, the 9th now publishing; the *London Encyclopædia*, 22 vols., 1829; and Messrs. W. & R. Chambers's *Encyclopædia*, 10 vols., 1859–68, are the principal British cyclopædias of this century. In German the *Allgemeine Encyklopädie* of Ersch and Gruber, 1818 *seq.*, 160 vols. issued; Meyer's *Grosse Conversations-Lexikon*, 52 vols., 1840–55; Pierer's *Universal-Lexikon*, 1840–46, 34 vols.; 5th ed. 1867–71, 19 vols.—are the best cyclopædias. The French have *Encyclopédie des Gens du Monde*, 1833–44, 22 vols. 8vo; *Encyclopédie Moderne*, 36 vols., 8vo, 1848–57; *Encyclopédie Catholique*, 18 vols. and sup.; *Dictionnaire de la Conversation*, 68 vols., 1839–51; a later edition not yet complete. The later American cyclopædias have been—*The New American Cyclopædia*, 16 vols., 1857–63, revised as *The American Cyclopædia*, 16 vols., 1873–76; Zell's *Encyclopædia*, 2 vols. large 4to, 1869–72; an abridgment, in 1 vol. 4to, 1872; *The National Encyclopædia*, 8vo, 1872 *seq.*; an edition of Chambers's *Encyclopædia*, printed from imported plates, 10 vols. 8vo; Schem's *German-American Encyclopædia*, 1869, to be completed in 11 vols.; and Johnson's New Universal Cyclopædia, 4 imp. 8vo vols., 1874–77. Works treating of only a single department of science, literature, or art have been called improperly *encyclopædias*. They are really dictionaries. (See also Dictionary and Lexicon, in Cyclop.) L. P. Brockett.

En'dicott (John), colonial governor of Massachusetts, was born at Dorchester, England, in 1589. He came to America in 1628, was acting governor of Massachusetts Colony in 1629–30, and was elected to that office in 1644, again in 1649, and re-elected to it every year from 1650 to 1665, except in 1654. He was a bold and energetic man, a zealous Puritan, and intolerant of whatever he considered wrong. Under his administration, from 1659 to 1661, four Quakers who refused to obey the laws, which banished them from the colony under pain of death if they returned, were executed in Boston. D. Mar. 15, 1665.

Engraft'ing, or **Graft'ing** [a word kindred to the Gr. γράφω, to "write;" γραφίον, a "pencil," referring to the pencil-shape of the scion or graft], the uniting of a shoot (the scion or graft) of one variety of plant (mostly of fruit trees) upon the stock of another variety, or even another species, so that the scion shall live and grow as if a part of the tree upon which it is grafted. Many reports have been published of trees grafted upon species of widely different genera and orders of plants, but it is believed that such reports are not founded in truth. Whether grafting could be practised upon animals has been disputed; but skin-grafting (the transplanting of a small piece of skin to denuded portions of the human body, there to grow and cover the whole naked patch) is an established operation in surgery; and many reports of the successful grafting of spurs, feathers, combs of cocks, etc. have of late frequently been published, mostly from French sources. These experiments are somewhat damaging to our ideas of personal identity, but there seems to be no reason why engrafting should not succeed upon animals as well as upon plants.

In selecting stocks for grafting care should be taken not to insert a free-growing variety upon one which is slow of growth, lest an unsightly over-development take place above the point of union. In some cases, however, as when dwarfs are desired, the stock to be grafted upon is to be of much smaller growth. Thus, the pear is dwarfed when set on the quince; the cherry on the mahaleb; the apple on the thorn. There are many styles of grafting, but in all the principle is to place the alburnum or sapwood and the cambium (or new wood) of the scion against that of the stock. The hard wood of scion and stock never unites. There is no question but that some stocks decidedly affect, for better or for worse, the quality of the fruit grown upon the graft, but in most cases the effect is not strongly marked.

Among the more important kinds of engrafting we may mention: (1) *cleft-grafting*, very commonly employed where the stock is much larger than the scion. Here the stock is sawn across, its end split once or more, and one, two, or more scions, the lower end flattened into a wedge, are inserted in the cleft. (2) *Crown-grafting* is cleft-grafting when more than one cleft is made; or in other cases it is the insertion of a scion, the lower end of which is cut very thin, into a space between the wood and bark of a large stock, which is cut off, as in cleft-grafting. This method is highly approved. (3) *Splice* or *whip grafting* is done with a stock of the same size as the scion. They are simply spliced together, tied and waxed, as hereafter shown. (4) *Saddle-grafting* is accomplished by shaping the upper end of the stock into a wedge and cutting a corresponding notch in the scion. (5) *Tongue-grafting* is the reverse of this, the scion forming the wedge. (6) *Peg-grafting*, rarely used, is like tongue-grafting, except that a hole is bored in the end of the stock, and the scion, neatly sharpened into a peg, is fitted exactly to the stock. (7) *Shoulder-grafting* is done by cutting shoulders in both stock and scion, which are otherwise fitted as in splice-grafting. (8) *Budding* is a kind of grafting in which the bud of one kind of tree is inserted under the bark of another. (9) *Flute-grafting* differs from budding in that a ring of bark is taken off with the bud and inserted upon the stock in the place of a piece of bark of corresponding size which has been taken off. (10) *Inarching*, or *arcuation*, takes place when the scion is not detached from the parent stem until after union has taken place between stock and scion. (11) *Side-grafting* is the insertion of a scion into the side of the stock without cutting the stock off.

In all varieties of grafting, except cleft and crown-grafting, it is necessary to tie the scion to its place. Strips of bass matting or of waxed muslin are generally used. In all cases it is necessary to exclude the air from the cut, either by means of grafting-wax (a mixture of resin and beeswax, softened with tallow) or of clay mixed with horse-dung, a compound now seldom employed.

Grafting succeeds best when the scions have been kept for some time and become partly dried. The scion should be cut before the buds begin to swell. Grafting is done in the spring, but budding may be performed in autumn also.

E'ly (Smith, Jr.), b. in New Jersey in 1825; studied law, and was admitted to the bar in 1846; did not practise, but entered a wholesale leather business in New York; was elected a school trustee in 1856; member of the State senate in 1857; county supervisor from 1866 to 1870; Representative from New York to the 42d and 44th Congresses; commissioner of public instruction in 1872; chairman of the committee on expenditures in the treasury department in 1875; mayor of New York 1877.

Embiotic'idæ [from *Embiotica*—ἔμβιος, "living," and τόκος, "bringing forth"—the typical genus], a remarkable family of fishes limited to the northern Pacific Ocean, and especially represented on the shores of the Pacific States, and distinguished by their viviparity. It belongs to the order Teleocephali and sub-order Acanthopteri. The body is compressed and oblong; the scales are cycloid and of moderate size, and cover the entire trunk as well as head; on the back they form a sheath of from one to three rows wide at the base of the dorsal fin; this sheath diminishes backward to the end of the fin, and is separated from the back by a well-defined groove; the lateral line is continuous, and parallel with the back; the head is compressed and moderate; the nostrils double; the eyes lateral; the mouth has a moderate or slight lateral cleft; the lips simple, and more or less developed; teeth are present on the jaws, but absent from the palate; the branchial apertures are ample, and continuous below; branchiostegal rays five or six on each side; the dorsal fin is oblong, and modified in two ways, severally characteristic of distinct sub-families; the anal fin is oblong, and armed in front with three slender spines; the anterior portion of the anal fin is developed in a peculiar way as a conduit for the milt and eggs; the pectoral fins are produced and more or less angulated, and the rays branched; the ventrals are inserted behind the bases of the pectorals, and each has a spine and five branched rays; the vertebral column has an increased number of vertebræ; the lower pharyngeal bones are confluent together; the stomach is simple, and pyloric cæca are absent. The family exhibits two distinct modifications of structure; in one (Embioticinæ) the dorsal has its spinous portion rather less developed than the soft, and only composed of from nine to eleven spines. In the other (Hysterocarpinæ) the dorsal has the spinous portion much longer than the soft, and sustained by about fifteen or more spines. (1) The Embioticinæ are by far the most numerous in forms, and the species are marine. By American naturalists fourteen genera are admitted—viz. *Ditrema*, *Hypsurus*, *Phanerodon*, *Embiotica*, *Taniotica*, *Damalichthys*, *Rhacochilus*, *Amphistichus*, *Holconotus*, *Cymatogaster*, *Hypocritichthys*, *Hyperprosopon*, *Brachyistius*, and *Abeona*. (2) The Hysterocarpinæ are, as far as known, represented by but one species (*Hysterocarpus Traskii*), which is peculiar to the fresh waters of the Sacramento River. All the species are viviparous, and the young are developed in small number in special uterine sacs. Some of the species are among the most common of the Californian fishes, and are brought to the markets in large numbers; they are known to the inhabitants of the coast indicated under the name of "perch," although they have no relation whatever with the perches properly so called of Europe and the Eastern U. S. On the whole they are mostly nearly related to the Labridæ and Gerridæ, but their differential characters are very positive. Theodore Gill.

Enomoto, or Inomoto, b. in the province of Shidzuoka, Japan, but known as a Yedo-man; went to Holland when quite young as a naval student under the tycoon's government; was appointed an admiral under the old government; toward the close of the rebellion in 1868 he took a fleet of seven ships to Yeso for the purpose of making a last stand against the imperial government; was forced to capitulate at Hakodadi; was imprisoned for three years; on his release in 1872 was appointed to a position of the fourth rank in the *Kai-ta-kushi*, or colonization department of Yeso; and in 1874 was appointed vice-admiral of the imperial navy, and also envoy extraordinary and minister plenipotentiary to Russia.

Eohip'pus [Gr. ἠώς, "dawn," and ἵππος, "horse"], an extinct genus of the horse family, occurring in the Lower Eocene deposits of the West, and allied to *Orohippus* (see Horse, Fossil, in Cyclopædia), but of a less specialized form, and apparently in the direct ancestral line. The feet had four toes in front and three behind, with a rudiment of the outer or fifth metatarsal, and may have had a rudiment of the first toe in the fore foot. This genus is represented by species from the lowest Eocene beds of New Mexico and Wyoming. O. C. Marsh.

Ernst (Oswald H.), b. June 27, 1842, near Cincinnati, O.; entered Harvard College July, 1858; graduated at the U. S. Military Academy in June, 1864, and was commissioned first lieutenant in the corps of engineers; served as assistant chief engineer of the Army of the Tennessee to the close of the Atlanta campaign; as assistant engineer in construction of fortifications on the Pacific coast 1864–68, having the immediate superintendence of the great blast at Lime Point, Cal., 1868; commanded a company of engineer troops at Willett's Point, N. Y., 1868–71, being detached to serve as astronomer with the commission sent by the U. S. government to Spain to observe the solar eclipse of Dec., 1870; was appointed instructor of practical military engineering and military signalling and telegraphy at the U. S. Military Academy in 1871; which chair he now occupies, performing also the duties of architect for the more important structures at that place. He was brevetted captain for "faithful and meritorious services" in 1865, and commissioned captain of engineers in 1867. His principal publication is a *Manual of Practical Military Engineering* (1873).

Esclot (Bernat). See D'Esclot.

Esoc'idæ [from *Esox*, an ancient name, later applied to species of this family], a family of fishes of the order Teleocephali and sub-order Haplomi, containing the true pikes. The body is elongated, with the back and abdomen nearly straight and parallel; the scales are cycloid and of small size, and cover the whole of the body and more or less of the head; the lateral line is nearly straight and continuous; the head is oblong, and produced into a broad, depressed, and flattened snout; the eyes are lateral; the opercular bones developed in normal number and proportions; the nostrils double; the mouth is large, and has a deep lateral cleft; the upper jaw formed toward the middle by the intermaxillaries, and at the sides, backward, by the supramaxillaries; the teeth are developed on the jaws, vomer, palatine, and hyoid bones; on the jaws they are enlarged and sharp, and on the other bones are aggregated in cardiform bands; the branchial apertures are wide and confluent below; the branchiostegal rays in large number (11–19); the dorsal and anal fins are situated far behind, opposite each other, and higher than long; the caudal fin is well developed and more or less emarginated; the pectorals are inserted near the breast, and moderately developed; the ventrals are abdominal; the skeleton has numerous vertebræ, and the abdominal ones are much more numerous than the caudal (*e. g.* D. 41–43 + C. 20–21); the stomach is siphonal, and has no pyloric appendages; the air-bladder is simple, and connected by a duct with the œsophagus. The family, as thus limited, is entirely confined to the northern hemisphere, and is characteristic of the "arctogæan" division of the globe. It is chiefly represented in America, where about ten species are known, while in Europe only a single species—and that also common to the two continents—is found. All the members of the family are very voracious, and by the nature of their dentition well adapted for making havoc among their cohabitants of the water. The most notable species of the U. S. are the *Esox nobilior*, or true maseelonge, which is pre-eminent among the species of the family for the delicacy of its flesh; the *E. lucius*, or *E. estor*, which is the same as the common pike of Europe; and the *E. reticulatus*, or ordinary pickerel, of the Middle and Eastern States. The *Esox nobilior* is not only the best, but also the largest, species of the family, and is the most distinctly differentiated of them all, and perhaps entitled to generic distinction. In England the name "pike" is bestowed on the *Esox lucius* as a specific term, as well as a designation implying maturity, while the name "pickerel" is restricted to the young. In the U. S., however, both these appellations are very diversely applied. (See Pike and Pickerel, in Cyclopædia.) Theodore Gill.

Etchers' and Engravers' Proofs. It was formerly universally believed—and Gilbert Hamerton, in his treatise on *Etching*, holds—that there is no other mode of getting a good proof of etchings and engravings than by means of a press. Mr. T. C. Chapman, however, an American artist living in Rome, and a distinguished etcher himself, has succeeded in taking perfect proofs without the use of a press—by pouring over the inked plate a solution of gelatine (isinglass) in alcohol. When hard it is easily removed, and resembles an India proof. The proof may be backed with paper, and preserved or not at pleasure.

Ev'ans (Edward P.), b. at Remsen, N. Y., Dec. 8, 1833; graduated at the University of Michigan in 1854; studied at Göttingen, Berlin, and Munich 1858–62; was appointed professor of modern languages in the University of Michigan in 1862, and visited Europe again in 1870. He published *Abriss der deutschen Literaturgeschichte* (1869), and translations of Stahr's life of Lessing and Coquerel's *First Historical Transformations of Christianity*.

F.

Fal'lows (Samuel), D. D., b. at Pendleton, near Manchester, England, Dec. 13, 1835; removed with his parents to Wisconsin 1845; graduated as valedictorian at the University of Wisconsin 1859; became a minister of the Methodist Episcopal Church; entered the army as chaplain 1861; afterward engaged in active military service; reached the rank of colonel and brevet brigadier-general; was seven years a regent of the University of Wisconsin; was State superintendent of public instruction 1870–72; became president of the Illinois Wesleyan University at Bloomington 1874; rector of St. Paul's Reformed Episcopal church, Chicago, May, 1875; editor-in-chief of the *Appeal*, the organ of the Reformed Episcopal Church, Jan., 1876, and was chosen a bishop July 15, 1876, at the fourth general council of that new organization, held at Ottawa, Canada.

Fel'ton (William H.), b. in Oglethorpe co., Ga., June 19, 1823; graduated at the State University in 1842, and at the Medical College in Augusta in 1844; did not practise his profession, but settled at Cass, now Bartow, Cass co., engaging in farming and planting, and devoting much interest to the affairs of the Methodist Episcopal Church; was elected a member of the State legislature in 1851 on the famous Georgia platform; opposed the policy of secession in 1861, but went with his State when she adopted that cause; was elected a member of Congress in 1874, and re-elected in 1876. Alexander H. Stephens.

Ferra'ri (Giuseppe), b. in Milan in 1811; studied law at Pavia, but devoted himself subsequently to literature; published in 1835 a complete edition of the works of Vico; went in 1837 to Paris, where in 1839 he published *Vico et l'Italie*; was appointed professor of philosophy in 1840 at Rochefort, and afterward at Strasbourg, but was removed on account of his radical ideas; published in 1847 *Essai sur le Principe et les Limites de la Philosophie de l'Histoire*; was reinstated in his chair in Strasbourg in 1848, but again removed, and returned in 1859 to Italy, where he was successively made professor in Turin, Milan, and Florence. Of his numerous works, the most remarkable are *Filosofia della Rivoluzione* (1851), *Histoire des Révolutions d'Italie* (4 vols., 1856–58), *Corso di Lezioni sugli Scrittori Politici Italiani* (1862–63), besides a number of articles in the *Revue des Deux Mondes*. D. July 2, 1876.

Flem'ing (Walter M.), M. D., b. at Portland, Me., June 14, 1838; graduated at Antioch College, O., 1859, and at the Albany Medical College 1862; went to Rochester, where he became health physician 1862–65, and during the same time was surgeon to the 7th division N. G. S. N. Y.; removed to New York; was appointed surgeon to the 3d brigade N. G. S. N. Y. 1870–77, and became consulting physician and surgeon to St. Elizabeth's and Roosevelt hospitals; is a member of various medical and other associations, and published *Catarrh, and its Relation to Throat and Lung Diseases* (1873), *Motive-power of the Human System* (1868), *Pathology of Female Diseases* (1875), *Treatment of Cerebral and Nervous Diseases* (1876), etc.

Fol'som (Joseph L.), b. in New Hampshire in 1816; graduate of the U. S. Military Academy, and brevet second lieutenant of infantry July 1, 1840; served in Florida against the Indians, and on the Northern frontier 1840–44; transferred to the quartermaster's department, with rank of captain, Sept., 1846, and served in California during the war with Mexico. He was among the first to appreciate the discovery of gold in California, and communicate the information officially to his government. He was identified with the early history and development of San Francisco, where he became a large property-owner. Folsom City, on the American River, near the locality where gold was discovered, is named in his honor. D. at San José, Cal., July 19, 1855.

Fol'well (William Watts), b. Feb. 14, 1833, at Romulus, Seneca co., N. Y.; graduated at Hobart College 1857; was teacher in Ovid Academy for two years, then became adjunct professor of mathematics in Hobart College; in 1860 and 1861 studied philology in Berlin and travelled extensively in Europe; in Jan., 1862, was commissioned first lieutenant in the 50th U. S. Engineers, with which command he served through all the campaigns of the Army of the Potomac till the close of the war, attaining the actual rank of major of engineers and the brevet rank of lieutenant-colonel U. S. Vols. After some years spent in business he became in 1869 professor of mathematics in Kenyon College, Gambier, O., and later in the same year was elected president of the University of Minnesota, where he is still employed. He has published various papers and addresses, among which is *Public Instruction in Minnesota*, in the *Transactions* of the Nat. Ed. Assoc. (1875), and is now preparing *Lectures on Political Economy, the Science of Industry*.

Fos'ter (Abby Kelley), b. at Amherst, Mass., Jan. 15, 1811; was educated at Worcester; worked several years as a teacher; began in 1838 to lecture against slavery; married in 1845 Stephen L. Foster, and continued to deliver lectures and circulate papers and tracts against slavery, the subjection of woman, intemperance, and kindred evils.

Fos'ter (Ellen Horten), b. in Lowell, Mass., 1840; early moved to Clinton, Ia.; married 1869; admitted to practise law 1874; argued a case in the supreme court 1875. A leading woman in the temperance crusade.

Foster (George Whitefield), b. at Swanton, Vt., May 9, 1794; studied law, and was admitted to the bar, attaining prominence in his profession, and for twenty years held a prominent place in the affairs of his State. Was State's attorney, commissioner of the Vermont Central R. R., and repeatedly chosen to the legislature and State senate; though without political ambition, he had been selected for nomination to the U. S. Senate just previous to his death, which occurred Oct. 12, 1848.

Fow'ler (Samuel), M. D., b. near Newburg, N. Y., Oct. 30, 1799; studied medicine at Penn Medical College of Philadelphia; was licensed in 1800, and began to practise at Hamburg, N. J.; after a few years removed to Franklin, N. J. D. Feb. 20, 1844. He was highly esteemed as a physician. He took an active part in politics, representing his county in the upper branch of the State legislature, and afterward his State in the 24th and 25th Congresses, during the administration of Gen. Jackson, of whom he was a warm supporter and one of the earliest friends in New Jersey. As a mineralogist and geologist he was regarded by men of science as among the first in the country; was made a member of the Geological Society of Pennsylvania and of the New York Lyceum of Natural History; an honorary member of the Literary and Philosophical Society of New Jersey, and corresponding member of the Academy of Natural Sciences of Philadelphia; was also an honorary member of the scientific societies of London and Dublin, and others. In 1825 he published in *Silliman's Journal of Science*, vol. ix., *An Account of some New and Extraordinary Minerals discovered in Warwick, Orange co., N. Y.*; in 1832, in the same journal, vol. xxi., *An Account of the Sapphire and other Minerals in Newton township, Sussex co., N. J.*; contributed to Gordon's *Gazetteer and History of New Jersey* an article on *The Franklinite, Red Oxide of Zinc, and other Minerals, found in the Valley at the foot of the Hamburg Mountains*; also a notice of the geology and mineralogy of the same region, for Cleaveland's *Mineralogy*. The rare mineral fowlerite was discovered by and named for him, and the iron and zinc ore franklinite is supposed to have been so called by him; he made it known to eminent naturalists in Europe, and awakened an interest in it which has since resulted in its successful development and manufacture. The extensive zinc-mines of New Jersey were once owned by him. A. Guyot.

Fran'cis (James Bicheno), b. at Southfield, Oxfordshire, England, May 18, 1815; adopted engineering as his profession; came to the U. S. in 1833, and obtained employment with George W. Whistler on the Stonington R. R.; went to Lowell in 1834, and became engineer of the proprietors of locks and canals on Merrimack River. Published in 1855 his first ed. of *Lowell Hydraulic Experiments*, followed by a second in 1858, with many additions. These experiments, in their practical range of the measurement of the flow of water and the percentage of effective power obtained from hydraulic motors, especially turbines, are much more extensive than any other, and are not only standard for the rules obtained, but also for the methods and accuracy with which the experiments were conducted.

Fred'erik, the name of seven kings of Denmark, belonging to the Oldenburg dynasty. Under the reign of Frederik III. (1648–70) the constitution of the country was changed from an elective monarchy, in which the power of the Crown was circumscribed within very narrow

limits by the privileges of the nobility, to an hereditary monarchy, in which the Crown was invested with an absolute and unlimited power (Nov. 14, 1660). Under FREDERIK VII. (1848–63) this constitution was again changed, and the present constitution established (June 5, 1849), according to which the executive power rests with the king and his responsible ministry; the legislative power, with the *Thing*, consisting of an upper and a lower house, elected indirectly and directly by the people; and the judicial power, with courts, in which the judges are appointed by the king, but for life. At the death of Frederik VII. (Nov. 15, 1863) the Oldenburg dynasty became extinct.

Fur'ness (HORACE HOWARD), son of Rev. Dr. William H., b. in Philadelphia Nov. 2, 1833; was graduated at Harvard College 1854; studied law in the office of Hon. William M. Meredith, and was admitted to practice 1859; furnished chapters in Troubat and Haly's *Practice* on "Ejectment," "Domestic" and "Foreign Attachment," etc.; has published the first 3 vols. of a New Variorum ed. of Shakespeare's plays—viz. *Romeo and Juliet* (1871), *Macbeth* (1873), and *Hamlet* (1877); is an honorary member of the German Shakespeare Society, and one of the vice-presidents of the New Shakespeare Society of London. His library ranks among the best in the world in Shakspearean literature.

G.

Gad'idæ (See Vol. II.). The importance of this family demands a more extended notice than has been given. It is one of the most useful to man, and quite characteristic in its range. The body is elongated, and more or less compressed and conoidal backward, and tapers into the caudal fin; the scales are cycloid and very small; the lateral line continuous and parallel with the back; the head is generally conic; the eyes lateral and large; the nostrils double; the opercula normally developed and unarmed; the mouth has a more or less extensive lateral oblique cleft; the upper jaw is little protractile; the supramaxillary bones straight and rather narrow—*i. e.* very little expanded backward; the teeth acute, and aggregated in bands on the jaws, and mostly on the palate; the branchial apertures cleft far forward below; the branchiostegal rays generally seven on each side; the dorsal fin is diversiform, and its modifications distinctive of several sub-families; the anal fin is also diversiform, but always much shorter than the dorsal; the caudal fin is distinct, but encroaches above and below on the caudal peduncle; the pectoral fins are moderately narrow, and their rays branched; the ventral fins jugular, but otherwise diversiform; the vertebræ are developed in increased number; the pyloric cæca are few or moderate in number. The species are chiefly confined to the cold waters of the globe, and mostly to those of the northern hemisphere, but a few types are found in the cold deep waters of the lower latitudes, and reascend toward the surface in oceans of the southern hemisphere. Several well-marked sub-families express the chief modifications of the vertical and ventral fins. (1) The Gadinæ have three dorsal and two anal fins, and the ventral fins are complete—*i. e.* have five to seven rays: this sub-family includes the true cod-fishes (*Gadus*), the pollocks (*Pollachius*), the haddock (*Melanogrammus*), the tom-cods (*Microgadus*), whitings (*Merlangus*), etc. (2) The Phycinæ have two dorsal fins (a first short and a second very long one) and one anal fin, and the ventral fins are simply bifurcated: to this group belong the so-called "hake" (not the true hake, which is a *Merlucius*) of the New England and neighboring provincial coasts. (3) The Lotinæ have also two dorsal fins (an anterior short and a posterior long one) and undivided anal, but the ventral fins are complete: this group has two types, *Molva*, the true ling, which is marine and restricted to the fresh waters, and *Lota*, embracing the cusks or burbots of the interior lakes and rivers of the North. (4) The Ciliatinæ are distinguished by an anterior dorsal fin composed of small fringes, preceded by a long slender ray and a long posterior dorsal: the anal is long and simple: this includes the smallest and least useful species of the family: those of the American coasts are rare and of no economical importance, and unknown to the fishermen; on the European coasts, however, they are more common, and in England are known under the name of rockling. (5) The Brosminæ are forms with the dorsal rays confluent in a single long fin extending from near the neck to near the tail; the anal is also simple; the ventral fins are perfect: the sub-family includes the *Brosmius*, which is consumed in large quantities on some portions of the New England and northern coasts of America, and known under the names of cusk and torsk. About 60 or 70 species of the family have been described, among which are several genera peculiar to the depths of the tropical or sub-tropical seas (*e. g.* the Mediterranean), where the water has a low temperature compared with the surface and the land. As many as 17 species have been discovered along the eastern coast of North America, but only 3 or 4 in the western or Pacific region. THEODORE GILL.

Gage (MATILDA JOSLYN), b. at Cicero, N. Y., Mar. 24, 1826; was married in 1845 to Henry H. Gage; entered the Woman Rights movement in 1852; was presiding officer of the New York State and the National Woman Suffrage Association; wrote a work on *Woman as Inventor*; was one of the editors of the *History of the Woman Suffrage Movement*, and a member of the committee to prepare and present the "Woman's Declaration of Rights" in Independence Square July 4, 1876.

Gaines (RICHARDSON WILSON), M. A., b. in Maysville, Ky., Dec. 9, 1825, where he received his early education. In 1837 the family removed to Tuscaloosa, Ala., the seat of the State University, at which institution he graduated in 1845 at the head of his class; was appointed tutor, and subsequently adjunct professor, of ancient languages in the university, and in 1851 resigned to visit Europe, where he spent three years in travel and study; was elected at his return professor of Latin and French in the University of Mississippi, and in 1860 professor of ancient languages in Oakland College; from 1861 to 1864 was paymaster in the Confederate army; was afterward professor of ancient languages in Davidson College, N. C., and in 1874 professor of Latin and French in Central University, Richmond, Ky., where he still remains. At the instance of the bureau of education at Washington, he has lately prepared an exhaustive treatise on *Latin Pronunciation in the Colleges of the United States*. Prof. Gaines was for some years associated with the principal editor of this CYCLOPÆDIA in the University of Alabama, and subsequently in the University of Mississippi.

Gale (LEONARD DUNNEL), A. M., M. D., b. July 25, 1800, in Sutton, Millbury, Mass.; in 1821 entered Brown University, Providence, R. I., but graduated at Union College, Schenectady, N. Y., 1825. Studying medicine, he received in 1830 his degree of M. D. from the College of Physicians and Surgeons of the city of New York. In 1832 was resident physician in the Crosby street cholera hospital, New York; was afterward assistant professor of chemistry in the New York College of Physicians and Surgeons, and professor of chemistry in the New York College of Pharmacy.

Gav'it (JOHN E.), b. in New York City Oct. 29, 1817; went early in life to Albany, and began business there, when twenty years old, as a bank-note engraver and printer. He felt a great interest in astronomy, and took an active part in establishing the Dudley Observatory, being sent to Europe, together with Spencer the optician, to secure the most perfect equipment for the observatory. He was an expert microscopist, his investigations being rare and extensive. His knowledge of optics and the canons of art was minute and exhaustive, and at his death he was president of the New York Microscopical Society. As an engraver of bank-notes his attention was early called to the study of finance and banking in their relations to his art, and his great mental activity and inventive mechanical talent soon produced great and decisive improvements in his art and in his business. In 1855 he organized the American Bank-Note Co. in New York, of which he was superintendent until 1866, when he became its president, and under his direction the company furnished bonds, bank-notes, revenue-stamps, etc., not only to the U. S., but also to the governments and banks of Spain, Italy, Greece, Switzerland, all the states of Southern and Central America, and Japan. D. in Stockbridge, Mass., Aug. 25, 1874. H. L. STUART.

Gelatine Proofs. See ETCHERS' AND ENGRAVERS' PROOFS.

Ge'nus [from the Lat. *genus*; Gr. γένος, "kind"], the lowest group in the animal or vegetable kingdom with which a name is habitually connected that enters into the composition of the specific designation of each independent species; thus, we have in the wolf (1) a representative of a genus (*Canis*), to which it belongs in common with a number of other animals; and (2) of a peculiar species (*Canis lupus*): the specific name (*Canis lupus*) is, as a whole, peculiar to itself and shared with no other species. The genus, as now limited, has been defined as the expres-

sion of the ultimate modification of structure; and this definition is perhaps as good as one of such few words can be, but without explanation it will convey an erroneous idea to those who are otherwise unacquainted with natural science, and the definition can only be appreciated when the group itself is thoroughly understood; and hence it cannot be considered as a definition in the true sense of the word. An adequate idea can only be given by example; thus, the wolf, in common with the dog, coyote, jackal, and certain other like forms, constitutes a genus, *Canis*, in contradistinction to the red fox (*Vulpes*), which is also composed of a number of species, and the gray fox (*Urocyon*), of which there are at most but two species: the species, in each of these genera, are defined by trivial differences in detail of structure or color, and they differ from each other in certain distinctive anatomical characters which are more prominent than any observable within the limits of any one of the genera. A necessary element of the genus, at least in the opinion of the best naturalists, is the possession of some peculiar character, or peculiar combination of characters, which distinguishes it from others. The number of species is no criterion, as a genus may have one or several species, or, exceptionally, hundreds of species. The genus was at an early period employed in natural history, but was not definitely and invariably distinguished and limited to a single name until the time of Linnæus: since his time the limits of genera have been undergoing gradual modifications. The genera recognized by him in the animal and vegetable kingdoms were quite differently appreciated; his genera of plants were little if at all more comprehensive than those admitted in the present age, while those in the animal kingdom corresponded rather with those groups which are now designated as families, or were even still more comprehensive. The tendency until within a few years past was toward an excessive differentiation into genera distinguished by trivial and superficial characteristics; but a reverse movement commenced first in botany, and subsequently in zoology, and a certain conservatism in the adoption of genera is now prevalent. THEODORE GILL.

Ger'hard (JOHANN), b. at Quedlinburg, Saxony, Oct. 17, 1582; studied theology in Wittenberg, Jena, and Marburg; was superintendent, and subsequently superintendent-general, of Saxe-Coburg 1606–16; returned then to Jena as professor of theology. D. there Aug. 17, 1637. His *Loci Communes Theologici* (9 vols., 1626) was received with much applause as the most complete and learned exposition of the doctrines of Protestantism; also, his *Meditationes Sacræ* (1606) were often reprinted.

German'icus (CÆSAR), b. in 15 B. C., a son of Nero Claudius Drusus, the brother of Tiberius, and Antonia; was adopted in 4 A. D. by Tiberius, and accompanied him in his campaigns in Pannonia and Dalmatia (7–10) and in Germany (11). In 14 he was made commander-in-chief of the legions on the Rhine, and gained greater victories than had been achieved by the Roman arms for many years. But Tiberius became afraid of his popularity, and recalled him in 17, before he could perfectly consolidate his conquests and make them useful to the empire. He was then sent to the East against the Parthians and Armenians, and d., probably poisoned, at Epidaphne, near Antioch, Oct. 9, 19. By his wife, Agrippina the Elder, he had nine children, six of whom survived him: the two most famous of them were Caligula, the emperor, and Agrippina the Younger, mother of Nero.

Gibbs (ROBERT W.), M. D., b. in Charleston, S. C., 1809; was educated in what is now called the University of South Carolina; received his medical degree from the college in Charleston 1830; was immediately appointed assistant to Dr. Cooper, and at his death became his successor in the chair of chemistry, geology, and mineralogy; was also associated with Prof. Josiah C. Nott, M. D., in teaching medicine; formed an extensive collection of fossils, made comprehensive researches in palæontology, and wrote extensively for the *Southern Quarterly Review* on ornithology, artesian wells, microscopy, etc. During the civil war he was surgeon-general of his State. D. in Columbia, S. C., Oct. 15, 1866. PAUL F. EVE.

Gill (THOMAS), B. A., b. at Sweet Farms, the family seat, Enniscorthy, Ireland, 1783; commissioned a lieutenant in the British army; came to New York, and joined the expedition of Gen. Don Francisco de Miranda for the liberation of Colombia, S. A., from Spanish rule; was captured, but escaped, and returned to New York in 1809; was business-manager of the New York *Evening Post* till 1832, when with Major M. M. Noah he founded the New York *Evening Star*. D. Apr. 29, 1839. MARY L. G. HOWE.

Gil'lett (EZRA HALL), D. D., b. at Colchester, Conn., July 15, 1823; graduated at Yale College 1841, and at Union Theological Seminary 1844; was pastor of the Presbyterian church in Harlem, N. Y., 1845–68; in 1868 was appointed professor of political economy, ethics, and history in the University of New York. D. Sept. 2, 1875. He was a remarkably industrious and patient scholar; wrote much for the *American Theological Review*, the *Presbyterian Quarterly*, the *Historical Magazine*, and other periodicals, and, besides several minor works, published *The Life and Times of John Huss* (2 vols., 1861; 3d ed. 1870), *History of the Presbyterian Church in the United States of America* (2 vols., 1864; revised ed. 1875), *God in Human Thought* (1875), *The Moral System* (1875). R. D. HITCHCOCK.

Godet' (FRÉDÉRIC L.), D. D., b. in Neufchâtel, Switzerland, in 1812. After having finished his college course and studied theology in his native town, he continued the study of theology and philosophy in the University of Berlin; was ordained minister in Neufchâtel; in 1838 was called by the present emperor of Germany, then prince royal of Prussia, to the high office of civil governor, or director of the education of his only son, Frederick William, now prince imperial of Germany, a post which he occupied with honor and success until 1844; became in 1850 one of the principal pastors of the city of Neufchâtel and professor in the theological school of the national Church of the canton. At the disruption of the church of Neufchâtel in 1873, in consequence of the encroachments of the political power, he became the prominent leader of the independent Church then established, and professor in the theological school of the same. Among his numerous works and pamphlets the most important are a *Commentary on the Gospel of John* (2 vols.), a *Commentary on the Gospel of Luke* (2 vols.), and 2 vols. of *Biblical Studies*—one on the Old, the other on the New, Testament. All these works have passed through several editions, and some have been translated into both English and German. He received the degree of D. D. from the University of Bâle, Switzerland. Author of the articles on the four Evangelists and on the book of Revelation in this CYCLOPÆDIA. A. GUYOT.

God'frey (THOMAS), b. in Philadelphia; worked as a glazier in his native city, and studied mathematics with great energy; he even learned Latin in order to read mathematical works in that language. In 1730 he communicated an improvement he had made in Davis's quadrant to James Logan, and the invention was subsequently laid before the Royal Society in London. In the mean time, Edmund Hadley had made a very similar invention, and communicated it to the society, which now investigated the case and declared that both claimants were entitled to the honor of invention, awarding to each of them a prize of £200. The instrument is still in general use, and is called either Godfrey's or Hadley's quadrant. Godfrey d. in Philadelphia in 1749.

Good'win (ICHABOD), b. in Berwick, Me., in 1796; a successful merchant and ship-owner in Portsmouth, N. H.; Republican governor of New Hampshire through two terms, covering the breaking out of the late civil war; put into the field the first two regiments of volunteers from the State. Gov. Goodwin is distinguished for his ability as a railroad and bank manager, and in all public affairs.

Gra'ham (JOHN), VISCOUNT DUNDEE and LORD GRAHAM OF CLAVERHOUSE, b. near Dundee, Scotland, in 1643; studied at the University of St. Andrew's; served in the French and Dutch armies 1670–77; was made captain of dragoons by Charles II., and sent into the Western Lowlands against the Covenanters; was defeated at Drumclog, but was victorious at Bothwell Bridge, and obtained a fearful notoriety by his atrocities. In 1688 he was ennobled by James II., whose cause he supported against William III. At Killiecrankie Pass he defeated William's troops, but fell himself July 17, 1689. (See Mark Napier, *Memorials and Letters illustrative of the Life and Times of John Graham of Claverhouse*, 3 vols., 1859–62.)

Great'orex (ELIZA), b. at Manor Hamilton, Leitrim co., Ireland, Dec. 25, 1820; came early to America; studied painting in New York under William H. Wotherspoon and James Hart, and in Paris under Émile Lambinet; visited England in 1857, France 1861–62, Germany and Italy 1870–73, and was made an associate of the National Academy of Design, New York, in 1870. Her principal works are—*Bloomingdale* (1868), *Château of Madame Oliffe* (1869), *The Old Porch, Views of Amsterdam, Old St. Paul's* (1876), besides a number of pen-and-ink drawings, of which *Albert Dürer's House in Nuremberg* is in the possession of Pius IX.; *The Homes of Oberammergau* was reproduced and published in Munich in 1871; and *Sixty Pen-and-Ink Drawings of Old New York, from the Battery to Bloomingdale*, were reproduced and published by G. P. Putnam's Sons (New York, 1876).—Her two daughters, ELEANOR and KATE GREATOREX, are distinguished as artists, having illustrated several books, and exhibited paintings at the Academy of Design and at the Centennial.

Grimké (Angelina Emily), b. in Charleston, S. C., Feb. 20, 1805; joined her sister Sarah in Philadelphia in 1828, and held in 1836, with Sarah, a series of drawing room séances in New York, in which she gave her views on slavery to large audiences of ladies. At the invitation of the Massachusetts Anti-Slavery Society the sisters went to New England. Rev. Samuel J. May, at South Scituate, Mass., invited them to lecture in his church, and introduced them in neighboring towns. (See his *Recollections of the Anti-Slavery Conflict.*) In 1837 she wrote several letters to Catharine Beecher in reply to an essay on slavery and abolitionism. In 1838 she twice addressed the legislature of Massachusetts. May 14, 1838, she was married to Theodore Dwight Weld.

Susan B. Anthony.

Grimké (Sarah Moore), b. in Charleston, S. C., Nov. 6, 1792; made in 1821 Philadelphia her place of residence, and published in 1827 *An Epistle to the Clergy of the Southern States.* This was considered one of the most efficient anti slavery documents of the day. While lecturing in New England she wrote *Letters on the Condition of Woman and the Equality of the Sexes*, and afterward made her home with the Weld family, and assisted as a teacher in their school, established in Belleville, N. J., in 1840; moved to Englewood, N. J., 1854; to West Newton, Mass., 1863; to Hyde Park, N. Y., 1864. D. at Hyde Park Dec. 23, 1873. She also published a translation of Lamartine's *Biography of Joan of Arc* and other smaller works.

Susan B. Anthony.

H.

Had'ley (John), an English astronomer, the date and place of whose birth are unknown, became a fellow of the Royal Society in London in 1717, and published in the *Transactions* of the society for 1731 an account of an invention he had made with respect to the quadrant. Shortly after, however, Thomas Godfrey of Philadelphia laid before the society a very similar invention. The case was investigated, both parties were declared entitled to the honor of invention, and each of them received a prize of £200. Hadley d. Feb. 15, 1744.

Haines (Daniel), b. in New York Jan. 6, 1801; graduated at Princeton 1820; studied law with Judge Thomas C. Ryerson at Newton, N. J.; was admitted to the bar 1823, and settled at Hamburg 1824; in 1837 entered public life as a member of the council (now called senate), and as, *ex officio*, one of the board of canvassers resisted Gov. Pennington in giving certificates of election to the Whig candidates in the famous "broad seal" election; in 1843 the legislature made him governor and chancellor for the usual term of one year; while in office he proclaimed the new constitution made that year, and his efforts in behalf of education have left their impress in the improved condition of the common schools and in the State normal school, which was first proposed by him. He was re-elected governor in 1847 for a term of three years; in 1852 was appointed one of the judges of the supreme court, and served for fourteen years; was also, *ex officio*, a member of the court of error and appeals. From 1870 to 1876 was a member of several judicial commissions relating to State boundaries and the municipal affairs of Jersey City and Paterson. In politics he was a Democrat, and actively supported the Union cause during the civil war. One son, Capt. Thomas R. Haines, of the 1st New Jersey Cavalry, was killed at the battle of Harrisonburg, Va., June 6, 1862; another son, Rev. A. A. Haines, entered the army soon after, and served as chaplain of the 15th New Jersey till the close of the war. He was a man of deep religious convictions and active benevolence, a ruling elder in the Presbyterian Church for many years, and his counsels were often sought in ecclesiastical courts. He was one of the committee for the reunion of the two branches of that Church, and several times at critical junctures saved the project from defeat. He was influential in the establishment of the insane asylum at Trenton, the home for disabled soldiers at Newark, and the reform school for juvenile delinquents at Jamesburg; was a commissioner to the National Prison Reform Congress at Cincinnati in 1870, and one of the committee to organize an international congress on prison discipline and reform, which met in London in 1872. He was made vice-president, and presided at one of its sessions. D. at Hamburg, Sussex co., N. J., Jan. 26, 1877. At the time of his death he was president of the Sussex County Bible Society and the oldest trustee of Princeton College.

A. Guyot.

Halicor'idæ [from Gr. ἅλς, "sea," and κόρη, "maid," with the patronymic *-idæ*], a family of mammals of the order Sirenia (see in Cyclopædia), having a fish-like form, with the tail emarginated or forked behind; the head moderate; intermaxillary bones with the anterior portion deflected, and with the branches prolonged backward; with two upper incisors, in the male at least; and with the molars successively increasing in size backward, with simple hollow roots, and with crowns capped by few tubercles. A single living genus (*Halicore*) represents this family: its species are found in the Red Sea and along the eastern coasts of Africa and the shores of the Indian Ocean, Australia, etc. The best-known species is the dugong (*Halicore dugong*) of the Red Sea, which is also the taschash of the Bible, whose skin was employed in the construction of the tabernacle, and hence it was called by Ruppell *Halicore tabernaculi.*

Theodore Gill.

Halitheri'idæ [from Gr. ἅλς, "sea," and θήρ, "beast"], a family of extinct mammals belonging to the order Sirenia and closely related to the Halicoridæ (which see), from which they principally differed in the molars having each two or three roots (they were mostly three-rooted above and two-rooted below), and their crowns being studded with obtuse tubercles arranged in transverse yoke like eminences, and in the posterior ones having an additional narrower tuberculated yoke behind the principal ones. The family was represented in Europe by species during the greater portion of the Tertiary period (from the Eocene to the Pliocene), and these have been referred to a number of distinct genera, but which appear to be reducible to two, or even one—*Halitherium.* The pelvic bones seem to have been more developed than in the existing sirenians.

Theodore Gill.

Halosau'ridæ [from the Gr. ἅλς, "sea," and σαῦρος, "saurus" or "lizard-like fish"], a family of abdominal malacopterygian fishes represented by a single known species, having an elongated and compressed body, covered with cycloid scales, and terminating in a very long and tapering tail, beneath which the anal extends forward to the vent; the dorsal fin is short, and belongs to the abdominal region; the pectorals are inserted high up on the sides; the head is small and with a produced snout; the opercular apparatus incomplete, the operculum being produced behind into a long flat process which replaces, according to Günther, the subopercullum and interopercullum; the margin of the upper jaw formed above by the premaxillaries, and on the sides by the maxillaries. The stomach has a blind sac, and the pyloric appendages are in moderate number. The air-bladder is large and simple. The single known species (*Halosaurus Owenii*) is a deep-sea fish, and has hitherto only been found off the island of Madeira. Nothing is known of its habits.

Theodore Gill.

Han'aford (Phebe Coffin), b. in the island of Nantucket in 1829; educated in the public schools; became a teacher and writer at fifteen; in 1868 ordained as minister in the Universalist church in Hingham, Mass.; called to New Haven, Conn., in 1870, thence to Jersey City, where she now resides. She has edited several papers and published a number of books: among these the *Life of Abraham Lincoln* and *Life of George Peabody.* Performed the duty of chaplain in the legislature of Connecticut on several occasions; married in 1849.

Haplochiton'idæ [from Gr. ἁπλόος, "simple," *quasi*, "smooth," and χιτών, "coat," with the patronymic termination *-idæ*], a family of fresh-water malacopterygian fishes with abdominal ventrals, having the physiognomy of the salmonids, and, like them, possessing an adipose dorsal fin: the body is naked or scaly; the head small; the margin of the upper jaw is formed entirely by the intermaxillary bones; the branchiostegal rays are few in number (3 to 6); the ovaries laminated, and not provided with an oviduct, and consequently the eggs fall into the cavity of the abdomen; the stomach is simple, and has no pyloric appendages; the air-bladder is simple. This family is composed of two genera, which represent the salmonids in the southern hemisphere: one (*Haplochiton*) is naked, whence the name, and the two known species inhabit Tierra del Fuego and the Falkland Islands; the other *Prototroctes*) has scales, and is represented by a single known species, found in Southern Australia. (See Günther, *Catalogue of the Fishes in the British Museum*, vol. v. pp. 381–383, etc.)

Theodore Gill.

Haplodon'tidæ [from Gr. ἁπλόος, "simple," and ὀδούς, "tooth"], a very peculiar family of mammals belonging to the simplicidentate rodents, with the fibula and tibia

separated, and distinguished by the breadth of the skull behind (resulting from the lateral extension of the mastoid bones); the elongated bony tubes of the auditory bullæ, which are closely attached to the mastoid processes; the development of the anteorbital foramen as a contracted round canal; and the structure of the lower jaw: the latter is very peculiar, the dentigerous areas being parallel, or rather converging backward, and the descending ramus between the inferior angle and the condyle is abruptly and greatly bent outward into a triangular extension, and terminates in a sharp angular apex: the molar teeth are rootless $\left(\frac{4-5}{4}\right)$. In external appearance the animals have some resemblance to the woodchucks or ground-hogs (*Arctomys*), having a squat body and the tail almost wanting. A single genus (*Haploodontia*) is known, with one or perhaps two species, confined to a few regions in Washington Territory and the Rocky Mountains: the size is about that of the muskrat, and they burrow in the ground. In the vicinity of Puget Sound the *H. leporina* is called the sewellel or showt'l. THEODORE GILL.

Har'denberg, von (KARL AUGUST), PRINCE, b. at Essenroda, Hanover, May 31, 1750; studied law at Leipsic and Göttingen, and held various positions in the service of the king of Hanover, the duke of Brunswick, and the margrave of Anspach, until he became Prussian minister of state in 1791. His opposition to the policy of Napoleon compelled him to resign immediately after the battle of Austerlitz, but when war nevertheless broke out between Prussia and France, he was recalled to power, and was minister of foreign affairs till 1807. He lived for some time in exile in Russia, but was recalled to Berlin, made chancellor in 1810, and carried out the plans of Stein for the reorganization of the Prussian state. He signed the Treaty of Paris, was made a prince, received a great dotation, and sat in the congresses of Vienna, Aix-la-Chapelle, and Verona. D. at Genoa Nov. 26, 1822. He left some *Memoirs*, which were not to appear until fifty years after his death.

Harpagifer'idæ [Lat. *harpago*, "hook," and *ferre*, to "bear"], a family of acanthopterygian fishes with a cottoid or sculpin-like body; with vertebræ in increased numbers (11 + 18–24?); a naked skin; head with unarmed cheeks; with six branchiostegal rays; operculum and subopercnlum spinigerous; mouth terminal and with the cleft moderate; two dorsal fins, anal fin shorter than the second dorsal; caudal fin not forked; pectoral fins well developed, and with the inferior rays branched. To this family belongs a genus (*Harpagifer*) of marine fishes, represented by two species hitherto found only about the Falkland Islands. They are analogous in appearance, and probably in habits, to the cottoids of the northern seas. (See Gill, *Proc. Acad. Nat. Sc. 1861*, pp. 501–512.) THEO. GILL.

Have'land (LAURA SMITH), b. at Ketley, county of Leeds, Canada West, Dec. 20, 1808; was received at thirteen as a birthright member of the Society of Friends; was married at 17 to Charles Haveland, Jr., and joined some years after the Wesleyan Methodist Church; in 1842 founded the River Raisin Institute for manual labor, near Adrian, Mich.; and in 1869 founded the Michigan Orphan Asylum. During the war she was indefatigable in bringing aid and consolation to the suffering in the hospitals and camps.

Hayes (RUTHERFORD BIRCHARD), LL.D., 20th Pres. of the U. S., b. at Delaware, O., Oct. 4, 1822; graduated from Kenyon College, O., 1842, and from Harvard Law School 1845; began the practice of law at Fremont, O.; removed to Cincinnati 1849; was city solicitor 1858–61; was appointed June 7, 1861, major 23d Ohio Vols., of which W. S. Rosecrans was the first colonel and Stanley Matthews (now U. S. Senator) lieutenant-colonel. In July the regiment was sent to West Virginia. He (see Reid, *Ohio in the War*) was promoted lieutenant-colonel Oct. 15, 1861, from which date he commanded the 23d until Dec., 1862. After the unimportant (as compared with subsequent events) campaign in West Virginia and the disastrous result of the Peninsular campaign, the 23d Ohio was ordered to Washington, arriving there Aug. 24, 1862, and ten days later, with the army of Gen. McClellan, was on its way into Maryland, following the invading Confederate force of Gen. Lee. In the brilliant action of South Mountain, attached to the advance brigade of Cox's division, 9th corps, it was the first infantry engaged, and early in the day Hayes received a severe wound in the left arm which compelled him to leave the field. After the battle of Antietam the regiment was returned to West Virginia, where, Nov. 30, 1862, Hayes rejoined it as colonel, having been promoted Oct. 15. He was soon after placed in command of the 1st brigade of the Kanawha division, which he retained until Sept., 1864, when he succeeded to the command of the division. In the summer of 1863 his command was engaged in the pursuit and defeat of Morgan, then raiding through Ohio, and in Apr., 1864, took part in Crook's raid on the Virginia and Tennessee R. R. His subsequent military history may be briefly told in the language of his farewell order to his command, Apr., 1865: "With many of you I have been associated in the service almost four years, with three of the regiments of the brigade more than three years, and with all the regiments during the memorable campaign of 1864. The battle of Cloyd Mountain, the burning of New River bridge, and the night-march over Salt Pond Mountain under Gen. Crook in May; the days and nights of marching, fighting, and starving on the Lynchburg raid in June; the defeat at Winchester, and the retreat on the 24th and 25th of July; the skirmishing, marching, and countermarching in the Shenandoah Valley in August; the bloody and brilliant victories in September; the night-battle at Berryville; the turning of the enemy's left at Sheridan's battle of Winchester; the avalanche which swept down North Mountain upon the rebel stronghold at Fisher's Hill; the final conflict in October; the surprise and defeat of the morning and the victory of the evening at Cedar Creek, . . . form part of our common recollections." He was soon after commissioned brigadier-general of volunteers, to date from the latter battle, at the close of which he received news of his election to Congress from the 2d district of Ohio. He was now brevetted major-general for gallant services during the war, and June 1, 1865, resigning from the army, returned soon after to Cincinnati. In December he took his seat in Congress; was re-elected in 1866, but left his seat in 1867, having been nominated for governor of Ohio, to which office he was elected in October, and re-elected in 1869. In 1872 he suffered his first defeat for Congress; in 1875 he reluctantly consented to allow his name to be used once more as a candidate for governor, and was elected for a third time—an honor never before conferred on a citizen of Ohio. The prominent issues were the currency and school questions, which attracted the attention of the whole country and caused his name to be favorably mentioned as the Republican candidate for President for the proximate term; and on June 16, 1876, he was nominated at Cincinnati on the seventh ballot, receiving 384 votes, to 351 for J. G. Blaine and 21 for B. H. Bristow. The ensuing canvass, one of the most bitter and exciting known in our national history, was closed by a disputed election, the electoral votes of Florida, South Carolina, and Louisiana, and one of those of Oregon, being claimed by both parties. Under the head PRESIDENTIAL ELECTORAL COMMISSION the proceedings are related which terminated in the announcement that R. B. Hayes had been duly elected President of the United States, to which office he acceded Mar. 4, 1877, the inauguration ceremonies taking place on the Monday following. G. C. SIMMONS.

He'liotype [Gr. ἥλιος, "sun," and τύπος, "mark," "outline"], generally, any process of reproducing pictures obtained by the actinic power of the sun's rays on a prepared surface, by printing in fatty inks, but more especially the process invented by Poitevin in 1855, and afterward developed and completed by Edwards. Poitevin discovered that on a plate covered with bichromated gelatine, and exposed to light under a negative, some pores of the gelatine would become completely, others only partially, closed, while others, again, would remain entirely unchanged. If, now, this plate be steeped in water and rubbed over with grease, the grease will speedily attach itself to those places of the gelatine sheet where the light has closed the pores, while it will not touch those places where the pores have remained open and consequently become filled with water. Thus, if the grease employed be lithographic ink, which is simply grease to which coloring-matter has been added, the light-produced image will at once be revealed. The development which this process received from Edwards consisted principally in the production of a movable film. He discovered that gelatine, without losing its property of being acted upon by light in presence of a bichromate, and of receiving and refusing greasy ink, might be converted into a tough, insoluble substance, like leather or parchment, by the addition of alum or chrome alum. The gelatine, with a sufficient quantity of bichromate of potash to make it sensitive to light, and of alum to make it hard and durable, is poured on a level plate, and dried in the dark by means of heat. When dry or required for use, the sheet of gelatine is stripped from the plate and printed under a photographic negative.

Her'on (MATILDA), b. in Labby Vale, Draperstown, Ireland; came to the U. S.; made her début in Philadelphia in 1851, as Bianca in *Fazio*; performed throughout the country; visited London in 1861; was married to Robert Stoepel 1857, and divorced 1862. D. at New York Mar. 7, 1877. Her principal rôles were Camille in *La Dame aux Camélias*, and Ulah in *De Soto*.—Her daughter, MISS BIJOU HERON, is also an actress.

Hesperor'nis [Gr. ἑσπερος, "west," and ὄρνις, a "bird"], an extinct genus of birds belonging to the sub-class Odontornithes, and found in the Cretaceous of Kansas. These birds had the legs fitted for swimming, and closely resembling those of the modern divers, but the sternum was destitute of a keel, as in apteryx and the ostrich, and the diminutive wings were incapable of supporting the body in flight. The most remarkable feature was, however, the presence of well-developed teeth both above and below. These teeth were not set in sockets, as in Ichthyornis, but in a groove, as in Ichthyosaurus. Other reptilian characters were shown in the skeleton, but the vertebræ are of the true bird type, with cylindroid articular surfaces on the centra. *H. regalis* was nearly six feet in height. (See also ODONTORNITHES, in CYCLOPÆDIA.) O. C. MARSH.

Hey'ne (CHRISTIAN GOTTLOB), b. at Chemnitz, Saxony, Sept. 25, 1729; studied law and Greek and Roman archeology at Leipsic; was *professor eloquentiæ* at the University of Göttingen from 1763 till his death, July 12, 1812. Besides contributions to learned periodicals and valuable editions of Tibullus, Pindar, the *Iliad*, Epictetus, etc., he published *Opuscula Academica* (6 vols., 1785–1812).

Hill'yer (Rev. SHALER GRANBY), D. D., b. in Wilkes co., Ga., June 20, 1809; graduated at the State University with distinction in 1829; taught school for two or three years; studied law and was admitted to the bar, but abandoning this profession early in 1832, devoted himself to the ministry. After having had pastoral charge of several churches, he was in 1846 called to the chair of belles-lettres and metaphysics in Mercer University, which position he held for two years. He then resigned and took charge of the Baptist church in Rome, Ga. In 1859 he was urged by the trustees of Mercer University to return to that institution and take charge of the chair of theology. This position he held until 1862, when the institution was suspended in consequence of the war. In 1867 he was called to the presidency of the Monroe Female College, located at Forsyth, Ga., where he is also pastor of the Baptist church. ALEXANDER H. STEPHENS.

Hitch'man (WILLIAM), M. D., D. C. L., b. at North Beach, Gloucestershire, England, in 1819; was articled to a physician; entered subsequently Guy's Hospital in London; passed through the Royal College of Surgeons; devoted several years to the study of lunacy and anatomy; graduated in medicine in 1841 at the University of Erlangen, Bavaria; was for a number of years president of the British Medical Reform Association, is one of the representatives of the Eclectic school of medical practice, and has published essays on *Consumption, Physiology of Inflammation, Homœopathy, Hydropathy*, and *Mesmerism; Vaccination and its Compulsory Enforcement*, etc.

Hiwas'see College, in a post-village of the same name, in Monroe co., Tenn., was designed to secure a thorough practical training to those young men of bright intellects who had not the means to attend the more expensive colleges. It was organized in 1849, and has been quite successful; its first graduate was Hon. D. M. Key, who recently succeeded the late Andrew Johnson in the Senate of the U. S. The college is 7 miles from the East Tennessee Virginia and Georgia R. R., but is supplied with a daily mail. J. KEY BRUNNER.

Holy Grail. See SANGREAL, in CYCLOPÆDIA.

Ho'mer (WINSLOW), b. in Boston, Mass., Feb. 24, 1836; went with his family to Cambridge, Mass.; in 1854 was placed by his father with Mr. Bufford, a lithographer of Boston, to learn the business. Bufford had been a fellow-pupil of A. F. Bellows, S. Rowse, and Eastman Johnson under Pendleton, a pioneer in the art of lithography in America. On leaving Bufford, Homer took to drawing on the block for wood-engravers, and was at first employed on *Ballou's Pictorial*. His work attracted attention, and he was invited to New York by the Harpers, for whom he made many drawings. In 1859, becoming acquainted with artists in New York, he felt his way in painting, and in the winter of 1860–61 studied in the school of the Academy of Design under Mr. Cummings, and had a month's instruction from Mr. Rondel, a landscape painter. In 1863 he exhibited for the first time at the Academy exhibition, sending two pictures, both subjects relating to war-times: *Home, Sweet Home!* a soldier listening to the band playing that air, and *The Last Goose* at Yorktown, two soldiers foraging, creeping up to a sleeping goose. These pictures made a strong impression upon the public, but Homer's name had already been gradually making itself known as that of a man who had something to say, and knew how to say it tersely, clearly, and strongly. In 1865 he painted *Prisoners at the Front*, a squad of Southern prisoners brought up before a Northern captain. The personages of this scene are all portraits; the Northern officer is Gen. Francis A. Barlow. This picture is perhaps the one artistic result of the war, and made Homer's name famous. In the Paris Exposition of 1867 it was one of the two or three pictures in the American department at which French artists would look. In this year (1867) Homer went to Paris, where he stayed nine months. He joined J. Foxcroft Cole and W. R. Baker in their studies from the life-model pursued independently and under no master, though Homer acknowledges a great impulse received from the paintings of Mr. John La Farge. Since 1867, Homer has resided in New York. CLARENCE COOK.

House (JAMES ALFORD), b. in New York City Apr. 6, 1838; was brought up as an architect, but his taste and his studies in mechanical engineering led him in 1860 to prefer that pursuit to architecture. Having invented the Wheeler & Wilson buttonhole machine, first patented by him and his brother in 1862, he became in 1864 the mechanical engineer of the Wheeler & Wilson Manufacturing Co., and has held that position to the present time. In 1866 he invented the india-rubber trunk shield, and the same year a buttonhole attachment for the Wheeler & Wilson family sewing-machine, a silent feed for the same, and many other valuable sewing-machine patents, the most important of which are those on the new manufacturing and family machines, Nos. 6, 7, and 8, of the Wheeler & Wilson Manufacturing Co., in which he has made very novel and ingenious adaptations of the variable motion by means of a steel pin moving over unequal distances in equal times in a slotted disk. L. P. BROCKETT.

How'ard (EDWARD LOYD), M. D., b. in Baltimore Jan. 14, 1837; graduated at the University of Maryland 1861; served in the Confederate army from Oct., 1861, to the close of the war, and rose to be chief surgeon in Jackson's corps of artillery; was professor of anatomy in Baltimore College of Dental Surgery, and is now professor of physiology in the College of Physicians and Surgeons of Baltimore; was editor of the *Baltimore Medical Journal* for three years, and has contributed largely to the medical journals.

Hu'lett (ALTA M.), b. near Rockford, Ill., June 4, 1854; learned telegraphing when ten years old, and was for some time an operator; subsequently taught school and studied law; in 1872 passed the required examination and applied for admission to the bar, but was refused because of her sex. She then succeeded in getting a bill through the legislature giving all women, married and single, the right to practise law; went to Chicago, spent a year in the office of Messrs. Sleeper & Wheton; was again examined, received her diploma on her nineteenth birthday, and began practising her profession. D. in California Mar. 27, 1877.

Hulls (JONATHAN), obtained in 1736 a patent for a "machine for carrying ships out of or into any harbor against wind and tide." This machine was to be moved by steam-power, being thus one of the earliest applications of steam to locomotion; but it failed because the inventor did not use the proper means of transferring the motion from the piston to the axle.

Hunt (HARRIOT K.), M. D., b. in Boston, Mass., in 1805; taught school in 1827; studied medicine in 1833 under private instructions from Dr. Mott; opened an office in 1835, and was probably the first woman physician in the U. S. She organized a Ladies' Physiological Society in Charlestown in 1843 with fifty members, and there had her first experience in lecturing. In 1847 she was refused admission to the medical lectures of Harvard College; in 1853 the Woman's Medical College of Philadelphia, Pa., conferred upon her the honorary degree of M. D.; in 1850 she attended the Woman's Rights Convention at Worcester, Mass.; was an able speaker. As she was a property-holder, she was obliged to pay taxes, but she did that uniformly under protest; which protests have been filed in the treasurer's office for twenty-five years. D. Jan. 2, 1875.

Hutch'inson (ABBY), b. at Milford, N. H., Aug. 29, 1829; was of a musical family, and early showed a remarkable talent for singing. At the age of eleven years she began to sing in public. Her summers were spent acquiring a good education; the winter seasons were devoted to public life, in company with her brothers, Judson, John, and Asa. They soon made a popularity unknown before in the Northern States of this country by their harmonies and the sentiment of their songs. Much of this success was owing to Miss Hutchinson, who seemed the "bright particular star," and possessed a voice of great sweetness and pathos. In 1845 she, with her brothers, crossed the Atlantic, and spent one year singing with great acceptance and financial success through Great Britain and Ireland. In common with her brothers, she was also gifted in song-writing. Miss Hutchinson was married Feb. 28, 1849, to Ludlow Patton, a banker of New York City, since which time she has only occasionally appeared before the public. SUSAN B. ANTHONY.

I.

Igle'sias (José Maria), b. in the city of Mexico Jan. 5, 1823; was a professor of English and French in the College of San Ildefonso at twenty, and at twenty-four a professor of law. As early as 1846 he entered official life as a member of the ayuntamiento (council) of the city of Mexico. During the occupation of the capital by the American army (1847–48), having followed the Mexican government to Querétaro, Iglesias was employed first as an official of the supreme tribunal of war, and subsequently as military judge for the army of the East. In 1850 he was made chief of a bureau of the board of public credit, which he gave up to enter the Mexican congress in 1852. In 1855 he returned to the bureau of public credit as its chief, and in 1857 was entrusted with the portfolio of the ministry of justice in the cabinet of Pres. Comonfort, to the duties of which place were soon added for a time those of minister of the treasury. Subsequently, in the cabinet of Pres. Juarez, he continued to be minister of justice, aiding the treasury, however, in the customs bureau. In 1863, Señor Iglesias, following the fortunes of Juarez, was charged successively with the functions of minister of the treasury, of justice, and of the interior. At the same time he wrote many papers of conspicuous force upon the subject of foreign intervention in Mexican affairs. Upon the re-establishment of the government of Pres. Juarez at Mexico, Señor Iglesias acted as minister of the treasury until 1868, when he re-entered congress, but soon returned to the cabinet as minister of gobernacion, as also minister, *ad interim*, of justice, holding both portfolios until 1872, when he resigned the latter. In 1873 he was called by election to the high post of president (chief-justice) of the supreme court of the republic. Señor Iglesias has been an active writer in periodical literature. Thomas Jordan.

Illustrated Journalism. The *Penny Magazine* of London was the first publication that made a systematic use of the pictorial cut, and its popularity led to the establishment of a number of illustrated ventures. *Punch* was started in 1841, but its first pictures were poor and trivial; afterward the efforts of John Leech, Richard Doyle, Thackeray, A Becket, and Mark Lemon made it successful. The true pioneer, however, of all the illustrated papers was the *Illustrated London News*, started May 14, 1842, by Messrs. Ingram and Cook, two London compositors. They had been engaged in a small printing business in Nottingham, where they had become agents for the sale of Morrison's pills, printing the advertisements and posters in their office and travelling around the country as their own salesmen. In the course of their wanderings they met a Mr. Roberts, a large druggist in Manchester, who offered to sell them a recipe for a far better pill than Morrison's. Mr. Ingram purchased the recipe, written hurriedly and in the spirit of a joke, returned to London, and with his partner began the manufacture of the pellets, to which Mr. Roberts had given the name of Parr's Life Pills, after the greatest subject of authenticated longevity on record. Their success was so rapid that within a short time they started the well-known publication as an advertising medium, the first issue being printed by their former employers. In the course of time they began the publication of books in addition to the *Illustrated News*. Mr. Ingram next purchased his partner's interest in the *News*, and abandoned book-publishing to Mr. Cook, who carried it on for a time. In 1860, Mr. Ingram visited the U. S. with his son, and on the 7th of September both perished in the Lady Elgin disaster on Lake Michigan. The next prominent journal started was *L'Illustration*, which made its first appearance in Paris, Mar. 4, 1843. In the latter part of the same year the *Illustrirte Zeitung* was established in Leipsic. Then followed, in chronological order, *The Illustrated American News*, New York, June 7, 1851; *The Illustrated News*, Boston, Jan. 1, 1853; the *Illustrated Times*, London, June 9, 1855; *Frank Leslie's Illustrated Newspaper* (Eng.), New York, Dec. 15, 1855; *La Ilustracion Española y Americana*, Madrid, 1856; *Harper's Weekly*, New York, Jan. 3, 1857; *Le Monde Illustre*, Paris, Apr. 18, 1857; *Frank Leslie's Illustrirte Zeitung* (Ger.), New York, Aug. 22, 1857; the *Illustrated News of the World*, London, 1858; *L'Univers Illustre*, Paris, and *Ueber Land und Meer*, Stuttgart, each same year; the *New York Illustrated News*, New York, Nov. 19, 1859; *Illustreret Tidende*, Copenhagen, later in the same year; *Frank Leslie's Ilustracion Americana* (Spanish), New York, 1866; *Harper's Bazar*, 1867; the *Canadian Illustrated Newspaper*, Montreal, 1869; the *Illustrated Midland News*, Birmingham, England, Sept., 1869, which in Mar., 1871, was brought out in London as the *Illustrated Newspaper*; the *Graphic*, London, Nov., 1869, started by Mr. Cook, formerly of the *Illustrated London News*, with a number of artists, engravers, etc., upon a co-operative basis; the *Neue Illustrirte Zeitung* (semi-weekly), Vienna, 1872; *L'Illustrazione Italiana*, Milan-Rome, *La France Illustrée*, Paris, and the *Graphic* (daily), New York, each 1873; the *Pictorial World*, London, 1874, and the *New York Illustrated Times*, New York, Oct., 1876. The first daily illustrated paper in the world was the New York *Daily Graphic*, which was started Mar. 4, 1873. Its pictures are produced by a photo-lithographic process, and in many notable instances it has given full illustrations of events the day after their occurrence.

In America, whose illustrated press now occupies a conspicuous place in the illustrated press of the world, the first illustrated paper was started in Boston by Messrs. Ballou and Gleason, but the first successful attempt to start a real, live illustrated newspaper in the U. S. was made by P. T. Barnum and the Beach Bros. Their paper was the *Illustrated News*, and the first number (Jan. 1, 1853) had a sale of 150,000 copies. The entire art department was placed in the hands of Frank Leslie. In consequence of a lack of mechanical accessories, the founders relinquished it in about a year. Mr. Leslie being an artist, engraver, and printer, and perfectly familiar with all the mechanical details of the business, started his *Illustrated Newspaper*, and began a series of experiments and inventions. He introduced the first cylinder press, with *inking-table attached*, ever used in this country, and substituted for the large solid blocks upon which drawings were made for the engravers small ones firmly bolted together. By this arrangement of the blocks a full-page drawing, instead of requiring the work of one engraver for several weeks, can be taken apart and distributed among sixteen men, and finished in a few hours. He also introduced the system, now generally adopted in all newspaper offices, of printing with card overlays. A solid impression is taken on a piece of card-board, and the plan consists in cutting away the lights, in contradistinction to the old system of building up the overlays on the cylinder. Instead of a week, but three or four hours are now requisite for the forms to be made ready for the press.

Various attempts have been made to cheapen the cost of production of illustrated papers, founded upon the experiments and discoveries of M. Albert of Munich, but the only successful ones have been valuable in imitating pen-and-ink drawings; none have guaranteed the sharpness and finish of wood-engraving. When illustrated papers were first started, it was considered a bold thing to expend $200 per week for illustrations; now, more than that is often laid out upon a single page. Frank Leslie.

Inclined Planes for Canals: for raising and lowering boats from one level to another on a canal, as substitutes for lift-locks. The plane consists of an ordinary railway track of wide gauge laid on a graded plane leading from the lower to the higher level or pool to be connected. The track leads from the bottom of the lower pool along the plane, over, into, and down to the bottom of the upper pool. The boats are carried up or down the plane on wheeled carriages running on the railway track. The carriages are moved by an endless wire rope passing around large horizontal pulleys fixed at the head and foot of the planes in each pool, and attached to a winding drum operated by a turbine motor. The turbine is operated by a head of water taken from the upper pool. The boats are received by being floated over the carriage in either level, and made fast thereto, and the machinery being put in motion the boat settles down upon the carriage as it rises along the plane, and is carried to the other level, where the carriage sinks to the bottom of the pool, the boat floats, is detached, and passes on its way. Planes may have one or two tracks, and are single or double track planes. The carriages may be arranged with caissons filled with water carrying the boats. The boats are taken into and discharged from the caisson at the foot of the plane in the same general manner as for the carriage-planes. At the upper end of the plane there is a masonry chamber with one pair of gates, the caisson having a falling gate and a projecting end. The caisson is drawn up to the masonry

chamber, which receives the projecting end of the caisson, making a water tight connection. The gates of the chamber and the door of the caisson being opened, the boat passes into the pool of the canal. Boats are taken into the caisson and down the plane by the reverse operation.

The economy of these planes is in their cost, in time saved on lockage, and in expenditure of water. A single-track carriage-plane for a lift of 64 feet costs about one-sixth, and a double-track plane about one-third, as much as eight locks of 8 feet lift each. The cost of caisson-planes is about twice as much as for carriage-planes of equal height. A boat can be passed over a plane of this height in about the same time occupied in passing a lock of 8 or 10 feet lift. The most effective economy is in the use of water. Having found the weight of carriage and boat to be moved on a given inclination of plane, the required power of turbine, and the consequent expenditure of water under a fixed head, which may be the difference of elevation of the connected pools, are readily found by established formulas. The expenditure of water is as the load moved. An empty boat can be taken over the plane with one-third the expenditure of water required for a loaded one. With locks the difference in expenditure is the difference in the displacement of the loaded and the empty boat. In the comparison of a single-track carriage-plane of 64 feet height with a lock of 8 feet lift, the boats carrying 120 tons, in the case of two loaded boats passing each way the expenditure of water by the plane was 84 per cent. of that by the lock; and in the case of two loaded and two empty boats passing each way the expenditure by the plane was 58 per cent. of that by the lock. If locks overcoming an equivalent height be grouped in a flight, they expend for upward-bound boats eight times as much water as an isolated lock. If boats should not alternate in direction regularly in passing over the summit-level, the expenditure of water by locks is increased 50 per cent.; but such irregularity does not affect the expenditure by planes. In the case of double-track planes, loaded boats going in opposite directions and passing the plane at the same time balance each other on the plane, and but a small quantity of water need be expended in moving them; and if the ascending boat is empty, the descending loaded boat will draw it up after passing the crest of the plane. In the case of caisson-planes a like economy in expenditure of water takes place in regard to empty boats, as no more water need be kept in the caisson than will float the boat; and the same balance of loads obtains on the double-track caisson-planes as noted in the case of the double-track carriage-planes.

In a mountainous country, where the inclination of the valley to be followed by the canal is great and the water-supply not abundant, indicating a great number of locks of low lift, a great saving in cost of construction, in time of transit, and in expenditure of water for operating the canal can be made by the use of inclined planes; also, an increase in tonnage capacity.

Carriage-planes, varying in height from 40 to 100 feet, are in use on the Morris Canal in New Jersey, U. S., and others on the Duke of Bridgewater's Canal in England; and caisson-planes are in use on the Monkland Canal near Glasgow, Scotland, and are said to be in use in Switzerland. A caisson-plane has lately been put in use as an outlet of the Chesapeake and Ohio Canal, near Georgetown, D. C. (A detailed discussion of carriage-planes, by Thomas S. Sedgwick, Amer. Soc. Civ. Engrs., is given, in connection with the report of surveys for the extension of the Chesapeake and Ohio Canal, in the annual report of the chief of engineers U. S. army for 1874.) THOMAS S. SEDGWICK.

Inomoto. See ENOMOTO.

International Exhibition, 1876. The "International Exhibition of Arts, Manufactures, and Products of the Soil and Mine" was held in the city of Philadelphia, Pa., in the summer of the year 1876, in accordance with the act of Congress of Mar. 3, 1871, providing that such an exhibition should be held in celebration of the completion of the centenary of American independence. A commission for the management of the exhibition, consisting of two persons from each State and Territory of the Union, was appointed. A general invitation to all nations to participate was extended by the President and Congress. The exhibition was opened on the 10th of May by the President in the presence of the commission, the foreign commissions, diplomatic representatives, and members of the cabinet, and it was closed by the President on the 10th of November, according to the official programme. It thus remained open daily, except Sundays, for six months consecutively. During this period there were upwards of 10,000,000 admissions, over 8,000,000 paying the uniform admission fee of half a dollar, excepting a comparatively small number of scholars' tickets sold at twenty-five cents. These visitors came from all parts of the U. S., and many of them from abroad.

Nearly all the foreign countries were represented by commissioners and by their raw products and manufactures. Amongst these countries, Great Britain and her colonies were especially prominent. Japan, China, Spain, Portugal, Egypt, Sweden, Brazil, Mexico, and the South American States made more extensive displays than at any previous exhibition. The total number of exhibitors was about 40,000, but this number would be much larger if the methods of enumeration adopted at Paris and Vienna were used. The original systematic classification adopted by the commission and reported to Congress contemplated the arrangement of objects by classes, as well as by countries, upon the plan initiated at Paris in 1867, but in planning the buildings and allotting the space this system was disregarded and abandoned, and there was no systematic arrangement of objects or grouping of countries in either of the five chief buildings of the exhibition. (For a description of these buildings, with illustrations, reference is made to PHILADELPHIA in CYCLOPÆDIA.) The total area of floor-space of the chief buildings was approximately 50 acres, and of the exhibition enclosure 236 acres, or 10,000,000 square feet, which last number represents also the aggregate of admissions and of the capital stock. The financial portion of the work and the erection of the buildings were entrusted to a board of finance elected by the holders of Centennial stock, which was issued in shares of $10 each by authority of Congress, in order to raise the money needed for the construction of the buildings and the management of the exhibition. The board was authorized to issue stock to the extent of $10,000,000, but the total subscriptions did not exceed $2,500,000. The city of Philadelphia appropriated $1,500,000 for the construction of buildings to remain the property of the city, and the State of Pennsylvania appropriated $1,000,000 for the construction of Memorial Hall, the permanent building used as the art-gallery. Congress appropriated $1,500,000 in aid of the work, besides the expenditure of a similar amount in the government display. Several of the States made large appropriations—notably, New Jersey $100,000, and the State of Connecticut $25,000—$10,000 being a subscription to the stock. The aggregate cost of the exhibition, exclusive of the expenditures by States and governments, and including the $2,500,000 expended for the permanent structures, was about $9,000,000. The receipts from admissions were about $4,000,000, and from the sale of concessions and privileges $500,000.

The aggregate weight of the exhibits amounted to about 28,000 tons, according to the data obtained from the terminal railway service. A large part of the exhibits in the U. S. section was delivered by wagons, but the bulk of the objects arrived by rail, and were expeditiously delivered without confusion to the respective sections by an organized force known as the "terminal agency," under the direction of the bureau of transportation. At the close of the exhibition the goods were removed in the same manner, and without cost to the exhibitors.

The plan of awards for meritorious products differed from any adopted at other exhibitions. Instead of indicating the relative excellence of objects by means of medals differing in value or in name, one uniform bronze medal was given, to serve merely as a token or indication of some merit expressed in writing by the judges. The essence or value of the award is found in the report, which is presumed to express the qualities or points of excellence deserving special recognition. This plan is based chiefly upon the recommendation of the foreign commissioners at the close of the Paris Exhibition in 1867. It contemplates the consideration of each product upon its own inherent merits, rather than in comparison with others of the same class. Under this system, therefore, there is no "highest" or "lowest" award. The appreciations of merit were made by a board of 225 judges, selected from the most distinguished specialists in the several branches of science, art, and technology in this country and abroad.

Popular judgment accords to this exhibition an unparalleled success, and it is pleasant to know that this view is accepted and promulgated by many of the foreign commissioners and visitors. Probably no exhibition has been more productive of direct and prospective good. Its effects upon the U. S. and foreign countries are already manifest. The results are manifold, and broader perhaps than even the projectors of the work anticipated. They are as varied as the occupations of men, and as general as civilization. In a broad sense, the effect of the exhibition has been educational, this being the grand function and aim of well-ordered exhibitions, but the results are also commercial and industrial. For convenience, the results may be grouped as political, industrial, scientific, and moral.

Politically, the exhibition has made the people of all sec-

tions better known to each other. The administrative and constructive functions of the general government have, for the first time, been shown to the people in a connected manner. The patriotism of the people has been stimulated, and an increased respect for the institutions and history of the U. S. has been aroused. The crude resources of the country have been made known at home and abroad. The productive capacity and advantages of the U. S. have been shown to foreign capitalists and artisans. Immigration in general, and especially of skilled labor, has been stimulated.

Industrially, the effects of the exhibition have been to thoroughly inform American and foreign manufacturers of the relative merit of domestic and foreign products, and to show conclusively that the manufactures of the U. S., particularly those dependent upon the use of labor-saving machinery, are in general superior to those abroad, where the products of cheap hand-labor have not wholly disappeared. This superiority is especially manifest in the hardware, edge-tools, cutlery and cheap brasswork, machinery and machine tools. At the same time, the great superiority of certain foreign products, notably of ceramics and artistic manufactures generally, was evident. This superiority has aroused the quick sense of American manufacturers and of consumers, and has stimulated the already existing germs of higher art-work in American manufactures. A great impetus has been given to the appreciation of art in its application to household decoration, and the importance of permanent museums of industrial art is more than ever recognized and acted upon. The Pennsylvania Museum of Industrial Art, founded at Philadelphia, obtained its already choice collection in great part from the exhibition, while the Metropolitan Museum in New York, the Art Museum in Boston, and the Corcoran Museum and the National Museum in Washington, have been enriched from the same source. The new Connecticut Museum of Industrial Art at New Haven may also be considered as one of the direct fruits of the exhibition.

Another great industrial result is the establishment of new industries upon American soil based upon superior natural and undeveloped advantages, and also the transfer of industrial establishments from the Old World to the New. The foreign demand for American manufactures has been largely increased by the exhibition, and thus a fresh impetus has been given to commerce.

In a scientific point of view the exhibition has been productive of great good in bringing together in a common field of labor so many of the leading minds of the time, thus greatly promoting the dissemination and unification of knowledge. The general educational effects of the exhibition may here be included. Not one of the ten millions of visitors could avoid learning something of consequence. To the diligent seeker of instruction it was an exhaustless mine. It was object-teaching upon a large scale. By covering in its universality the whole range of natural products and of human effort, all classes of men, from the humblest to the most highly cultured, found something to learn. The exhibition period was a season of national and international education.

High moral and social effects are inseparable from such an international concourse in the interests of industry and peace. Industrial and educational occupation preclude immorality. The presence of foreign commissioners, judges, and visitors gave opportunities for the exercise of liberal hospitality by the citizens of Philadelphia and throughout the country, which were freely improved. One of the most gratifying results of the official and social intercourse of the celebration was found in the heartiness and good-will uniformly manifested by the British people and sovereign toward the U. S., and the enthusiastic reciprocation of such kindly feelings on all occasions by our citizens. This friendliness was emphasized at the close of the exhibition by the presentation, with the special approval of the British crown, of the beautiful English buildings to Fairmount Park. W. P. Blake.

Iowa Agricultural College, The, was established by an act of the State legislature passed in 1858, providing for the purchase of a farm, for the erection of the college buildings, and for experiments in agriculture. In 1859 the trustees selected and secured a section of land near Ames, Story co., for the college farm. The present college buildings were erected at an expense of some $250,000, and on Mar. 20, 1869, the main college building was formally opened, and more than 100 students of both sexes were enrolled. Since then the yearly attendance has reached nearly 300. There are four courses of study, requiring four years each—namely, (1) the course in agriculture, embracing practical farming, farm engineering, stock-breeding, horticulture, and forestry; (2) the course in mechanics, embracing civil and mechanical engineering; (3) the ladies' course; (4) the course in general science. The library has nearly 6000 volumes. The museum contains large collections. The garden and forest cover over 50 acres. The farm has 500 acres under the plough.

Iowa State University is located at Iowa City, on the Chicago Rock Island and Pacific R. R., 57 miles W. of Davenport. It was founded in 1855, and organized on its present basis in 1860. It comprises four departments—the academical, which dates from the beginning; the law, established in 1868; the medical, in 1870; and that of civil engineering, in 1873. The faculty of the university consists of the president and 20 professors, whose work of instruction is supplemented by a large number of assistants. It has a permanent fund of about $22,000, derived from the sale of lands given by the Federal government to the State for the support of a university. The annual income from this source is not far from $20,000. Besides this, the legislature makes a biennial appropriation for the purposes of the institution, and a few thousand dollars are received yearly from the students for tuition and for incidental expenses. George Thacher.

Itagaki Taiske, b. in the province of Tosa, Japan; educated for the military profession; was aide-de-camp to the general of the imperial army during the late revolution; took an active part in the subjugation of the prince of Aidzu; after the war retired to his province, but was subsequently called again into public life; in 1871 was appointed one of the Sangi or privy councillors of the empire; held the office two years and resigned, but was reappointed in Mar., 1875, to the same high position. F. A. P. Barnard.

Ito Hirobumi, b. in the province of Choshiu, Japan, about the year 1840, and received a good education in his native tongue as well as in English; took part in the negotiation of the treaty which called for the payment of $3,000,000 to the four powers; was at one time governor of Hiogo and Kobe; was a special commissioner to the U. S. in 1871 to investigate the coinage system, and his report resulted in the establishment of the mint of Japan; was acting minister of public works in Yedo; one of the ambassadors who visited America and Europe in 1872, and was subsequently connected with the government, taking great interest in all measures calculated to develop the material interests of his country. F. A. P. Barnard.

Iwakura Tomomi, b. in 1825; was an inveterate opponent of the tycoon in the late civil war, and was for several years a prisoner of state before the government was changed; his first audience at the imperial court was in 1858; soon after the formation of the mikado's government he was appointed to the privy council; in 1868 was appointed vice-president of the imperial cabinet; in 1869 the title of *sionii* was conferred upon him, and he received a distinguished mark of the emperor's approbation; in 1871 was appointed minister of foreign affairs, and raised to the rank of junior prime minister; soon afterward visited America and Europe as the head of a special embassy. After his return to Japan a party of desperadoes attempted to assassinate him, and were executed for the crime. He continues to be at the present time the leader of the public men of Japan, and is a man of superior culture in all matters connected with the empire of Japan. He does not speak English, but is an advocate of modern progress, and has manifested his respect for education by sending three of his sons to America to be educated. F. A. P. Barnard.

J.

Jack'son (Mercy B.), M. D., b. in Hardwick, Mass., Sept. 17, 1802; graduated from the New England Female Medical College in 1860; previously practised in Plymouth, Mass., eighteen years; was the first woman admitted to the American Institute of Homœopathy in Philadelphia, June, 1871; was admitted to the Massachusetts Homœopathic Society in 1872 and the Boston Homœopathic Medical Society in 1873; made professor of diseases of children in the Boston University School of Medicine in 1873, which office she now holds (1877); wrote in favor of woman suffrage in 1854, and has ever since been an active worker in that cause.

Jaco'bi (Mary Putnam), M. D., b. in London in Aug., 1842, of American parents; came to New York in 1848;

was educated in the Twelfth street grammar school by Prof. G. W. Greene, and in the Woman's Medical College in Philadelphia, and was the first woman who graduated from the College of Pharmacy in New York. In 1868 she went to Paris, and was the first woman admitted to the Paris Ecole de Médecine, from which she graduated in 1871, receiving the second prize, a bronze medal, for her graduating thesis; returned to New York, commenced practice, and was made professor of materia medica in the medical college established by Elizabeth Blackwell, M. D., a chair she still (1877) holds. In 1873 she was married to Dr. A. Jacobi. Since 1873 many of her papers have been published in the *Medical Record* and *Journal of Obstetrics*. In the spring of 1876 she was awarded the Boylston prize offered by Harvard College for the best essay on the subject, "Do women require rest during menstruation?"

Janse (Anneke) came to this country in the year 1630, with her husband, Roeloff Jansen of Maesterlandt in Holland, his servant, and family, said Roeloff having been sent out by Patroon Van Rensselaer to his colony at Albany as assistant *bouwmeister*, or steward. She subsequently removed to New Amsterdam (now New York) with her husband, where in 1636 they obtained, jointly, a grant of 62 acres of land on the W. side of Broadway, extending from about Warren to Christopher street, in the city of New York, now in possession of Trinity church. Roeloff Jansen dying, his widow married, in the spring of 1638, the Rev. Everardus Bogardus, minister of the Dutch church of said city, who was drowned on his passage to Holland in 1647, leaving her again a widow, with eight children—four by each husband. In 1654, Anneke Janse obtained a patent in her own name of the farm above mentioned W. of Broadway, about which time she returned to Albany, where she died in 1663, and lies buried in the churchyard of the Middle Dutch church. For a century or more her descendants have maintained a claim to the real estate above described, and have intermittently threatened to institute legal proceedings against Trinity church.

Jenckes (Thomas A.), b. at Providence in 1818; graduated at Brown University in 1838; studied law, and became a prominent member of the Rhode Island bar; was clerk of the State legislature 1840–45, and member of the 38th, 39th, 40th, and 41st Congresses. D. at Cumberland Nov. 5, 1875. He was the author and advocate of the bill which established a uniform system of bankruptcy throughout the U. S., and in the 40th Congress he introduced a bill to regulate the civil service of the U. S., and to promote the efficiency thereof.

Johns Hopkins University, Baltimore, Md., was founded by Johns Hopkins of Baltimore Aug. 24, 1867, and at his death (Dec. 24, 1873) endowed by a bequest of over $3,000,000. The only condition he imposed was that the principal should not be used for building. The university will eventually be located at Clifton, the late residence of Johns Hopkins, just outside the city, containing 330 acres, which will be appropriately laid out. Prior to the erection of buildings at Clifton, chemical, physical, and biological laboratories, lecture and recitation rooms, library, etc., have been provided in Baltimore. The philosophical department, comprising the chairs of ancient and modern languages, chemistry, physics, biology, history, etc., was opened Oct. 3, 1876. The faculties of law and medicine will be organized at a later date. The university is entirely unsectarian in its character, and designed to promote special advanced study, which it is enabled to do by its large endowment. In order to give young men opportunities to carry on their studies, the trustees have offered to college graduates from any place twenty fellowships or graduate scholarships for special excellence in either philology, literature, history, ethics and metaphysics, political science, mathematics, engineering, physics, chemistry, or natural history. These are valued at $500, tenable for a year and renewable. Twenty scholarships, freeing the holder from tuition, are open to students from Maryland, Virginia, and North Carolina, and five to students from any place. Mr. Hopkins also left $3,000,000 to establish a hospital, which he desired should co-operate in the advancement of medical science and education. Daniel C. Gilman is the first president of the university.

Joynes (Levin Smith), M. D., b. in Accomack co., Va., May 13, 1819; was educated at Washington College, Pa., receiving there A. B. in 1835, and the same degree subsequently from the University of Virginia, as well as that of M. D. from that institution. He then attended lectures in the University of Pennsylvania, and spent two and a half years in Europe; in 1846 was elected professor of physics and legal medicine in Franklin Medical College, Philadelphia; then professor of the institutes of medicine and medical jurisprudence in the Medical College of Virginia (Richmond) 1856; was also made dean of its faculty. In 1872 he was appointed permanent secretary of the State board of health for Virginia. He has contributed largely to various medical journals. Paul F. Eve.

K.

Katz Awn, b. in the province of Shidznoka, Japan, but known as a Tokio-man; early became attached to the navy; commanded one of the government ships which brought the Japanese embassy to San Francisco in 1861; was assistant minister under the tycoon's government, also a member of the tycoon's cabinet; several years after the close of the rebellion was made assistant minister of the navy under the new government; in 1873 was made a Sangi or privy councillor, as well as minister of the navy, and in 1875 he was appointed a member of the Genro-in or new parliament of Japan. F. A. P. Barnard.

Kawamoora Smiyoshi, b. in the province of Satsuma, Japan, about the year 1835; was well educated, and made the tour of the world for purposes of information; during the late change of government he rendered important service to the cause of the mikado in various capacities, and was subsequently made vice-minister of the navy department, in which position he was still serving as late as the close of 1875. F. A. P. Barnard.

Kel'ly (John), b. in the city of New York Apr. 21, 1821, in the public schools of which he was educated; was apprenticed to the grate and furnace-setting trade, and subsequently engaged in that business; was elected alderman in 1853, member of Congress in 1854 and 1856, sheriff of New York in 1858 and 1864; undertook in 1872 the reorganization of Tammany Hall in opposition to the Ring, and was appointed comptroller in 1876.

Kem'ble (John Mitchell), oldest son of Charles Kemble, b. in London in 1807; graduated at Trinity College, Cambridge; visited Germany in 1829, and became acquainted with the brothers Grimm, Thiersch, and other eminent philologists; devoted himself to the study of the earliest Teutonic dialects, and published in 1833 *The Anglo-Saxon Poems of Beowulf*, with a glossary and translation; edited from 1835 to 1841 the *British and Foreign Quarterly Review*, and published in 1839–40 the *Codex Diplomaticus Ævi Saxonici*, and in 1849 *The Saxons in England*, his best-known work. He made extensive excavations (1849–55) in sepulchral barrows in Hanover for the Hanoverian Museum, and published many essays in both German and English periodicals. His *Horæ Ferales, or Studies in the Archæology of the Northern Nations*, was completed after his death by Dr. R. G. Latham. D. Mar. 26, 1857.

Keo'ta, Ia., p.-v., on the line of Keokuk and Washington cos., has 1 flouring-mill, 1 foundry, 4 churches, Wilson's Park (presented by Hon. J. F. Wilson), good city school, and 2 private banks. Oskaloosa branch of Chicago Rock Island and Pacific R. R. runs through the town. P. 1287. G. L. Reed, Ed. "Keota Eagle."

Key (David M.), b. in 1824 in Greene co., E. Tenn.; graduated at Hiwassee College 1850; admitted to the bar 1853; in the Confederate army 1861–65; was appointed Andrew Johnson's successor in the Senate in 1875; was in Pres. Hayes's cabinet 1877–80 as postmaster-general, and was then appointed U. S. District Judge in Tennessee.

Kido Takayossi, b. in the province of Choshiu, Japan, about 1833. His province was one of the first to raise the standard of revolt against the late tycoon, and he was one of the chief emissaries in organizing the army; after peace was restored he was made a member of the privy council; was a member of the embassy which visited America and Europe in 1872, but returned home before the embassy, and received the appointment of Sangi, which he accepted and held for a time; was next appointed to a distinguished position in the imperial household, and in the early part of 1875 was again elevated to the rank of Sangi. F. A. P. Barnard.

Kin'zua, or **Kenjua,** p.-v. and tp., Warren co., Pa., on Alleghany River, near mouth of Kinzua Creek. P. 318.

Knapp's Leather. In 1855, Belford patented a process for tanning leather with oxide of iron, but the leather produced was of poor quality. The use of solutions

of ferrous and ferric, chromous and zinc salts was also tried, but without success, till Knapp suggested fixing the oxides of these metallic salts in the form of insoluble soaps in the substance of the hides. This he accomplished by immersing the skins in a solution of soft soap (3 to 5 per cent.), and then in a solution of a salt of iron or chromium (5 per cent.). The treatment was repeated till a sufficient quantity of the insoluble metallic soap was produced in the skins. They were then washed in water and dried. Although the appearance of good leather can thus be imitated, its best properties are wanting. (See LEATHER, in CYCLOPÆDIA.)

Knox (THOMAS W.), b. at Pembroke, N. H., June 26, 1835; spent several years as a teacher at Kingston; went in 1860 to Colorado; was for some time editor of the Denver *Daily News*, and subsequently correspondent of the New York *Herald*; accompanied in 1866 an expedition sent to construct a telegraph through Northern Asia, and crossed the Pacific and Siberia from Kamtchatka to the Ural; travelled in 1873 from Vienna through Southern Russia, Turkey, Asia Minor, Palestine, and Egypt; visited in 1875 Spain, Morocco, and the Desert of Sahara, and published, besides numerous articles, *Overland through Asia*, *Backsheesh*, *Camp-Fire and Cotton-Field*, *Underground*, etc.

Knizé (RICHARD E.), M. D., b. at Altenburg, Germany, Apr. 7, 1838; emigrated to the U. S. in 1854; entered the office of Dr. Charles J. Stearns, Plainfield, N. J., in 1856; graduated from the Eclectic Medical College of New York in 1868, of whose board of trustees he subsequently became a member, and published a series of monographs on *Cactus* (1874), *Cereus grandiflorus and Cereus Bonplandi* (1875), *Cereus triangularis and Phyllocactus grandis* (1876), etc.

Kuroda Kiyotaka, b. in the province of Satsuma, Japan; is about forty years of age; was well educated; at the beginning of the late revolution was an aide-de-camp to one of the generals of the army; after the war was made chief assistant of the department for colonizing Yeso; visited England and America in 1871; concluded the arrangement which resulted in the appointment of Horace Capron as an adviser in Japan; in Aug., 1874, was made chief of the Kaitakushi, or colonization department of Yeso, and was also promoted to the rank of Sangi or state councillor, and also made lieutenant-general of the imperial army. Under his orders two steamships were built in the U. S., to one of which his name was given by the government; and it is eminently to his honor that he was the first of his countrymen who proposed and carried out the scheme to secure the education of the women of Japan in foreign lands, the importance of which had greatly impressed him while travelling in America.

F. A. P. BARNARD.

L.

Labyrinth'odon [Gr. λαβύρινθος, a "labyrinth," and ὀδούς, a "tooth"], the typical genus of an extinct order of reptiles, or, more properly, amphibians, the Labyrinthodontia, which appeared in the Carboniferous period, but attained their greatest development in the Triassic, soon after which they seem to have finally disappeared. They are regarded as belonging with the amphibians, but possess characters allying them with the ganoid fishes on the one hand and with true reptiles on the other. The head is defended by a casque of sculptured bony plates, usually hard and polished. There are two occipital condyles. The vomer is divided and supports teeth. The bodies of the vertebræ, as well as the neural arches, are ossified, except in some of the earlier forms, and the former are biconcave. The ribs, when present, are short. There are usually large palatine openings. The body is covered with plates or scales.

The structure of the teeth is peculiarly complicated, and suggested the name for the order. The thin coating of cement upon the exterior of the teeth is striated lengthwise, and from each of the striæ proceeds a vertical fold or duplicature of cement inflected into the dentine, constituting the body of the tooth. This fold runs straight for a short distance, then becomes wavy, and the undulations, at first simple, become exceedingly complex toward the interior of the tooth, until the fold, in the case of the comparatively few that extend so far into the tooth, terminates in a slight dilatation or loop close to the pulp-cavity. The disposition of the dentine is still more complicated. It consists of a slender, central, conical column surrounding the pulp-cavity, and radiating outward from its circumference is a series of vertical plates which divide into two once or twice before reaching the periphery of the tooth. Each of these plates gives off also, through its course, smaller processes, which often divide in turn before they terminate, and their contour is seen in the transverse section of the tooth to partake of all the undulations of the folds of cement which invest the dentinal plates and separate them from one another. From the pulp-cavity fissures also radiate, corresponding in number with the radiating plates of dentine continuing along the middle of each plate, dividing where it divides, and extending with each process to within a short distance of the cement. The main fissures extend nearly to the circumference of the tooth, where they expand into subcircular openings. Throughout every part of this complicated tooth the calcigerous tubes of the dentine obey the usual law, traversing it nearly at right angles to the surface invested by the dentine, forming, as Prof. Owen has said, "the most beautiful and complicated modification of dental structure hitherto known."

Labyrinthodon (*Mastodonsaurus Jaegeri*) has a skull upward of three feet long and nearly two feet broad, and is from the Triassic formation of Würtemberg in Germany. Several other species are found in the same formation of Warwickshire, England. The genus *Metopias* has the skull broad and obtuse, orbits small and distant, and is from the Keuper. *Zygosaurus*, from the Permian beds at Orenburg, has the orbits large and approximate. *Dasyceps Bucklandii*, from the Permian of Kenilworth, England, has the cranium ten inches long. In this country, *Baphetes planiceps*, from the Pictou coal, Nova Scotia, has the head broad, the muzzle obtuse, and the orbits large. *Amphibamus grandiceps* had an elongated tail like a salamander, large orbits, and numerous teeth. The skull is about three-fourths of an inch across. It is from the coal-measures of Illinois. *Raniceps Lyelli*, from Ohio, is named from the similarity of its head to that of a frog. Other labyrinthodons of the Triassic in this country are perhaps indicated by tracks in the sandstone of the Connecticut Valley. These are four- or five-toed, and often hand-shaped. Some of these animals used all four feet in walking; others, only the hind feet. The largest of these supposed labyrinthodons was *Otozoum Moodii*. The length of its track was twenty inches, and its stride three feet. Others were quite small, some tracks being not over one-fourth of an inch in length. Nearly twenty genera of labyrinthodons have been described from the Carboniferous strata of Great Britain and Germany, and more than half as many more from North America. The Triassic species were mostly of large size, and their remains occur in India, South Africa, and Australia, as well as Europe and America. Later than the Triassic very few are known, but *Rhinosaurus* is from the Jurassic of Russia.

O. C. MARSH.

Lacer'tidæ [from *lacerta*, "lizard," and the patronymic affix *-idæ*], a family of the reptile order Sauria, sub-order Pleurodonta, and group Leptoglossa (in which the tongue is elongated and bifid), characterized by the simple premaxillary bones, roofing of the temporal fossæ, the development of the nostril on an intersquamal suture, and the presence on the tongue of oblique pliciæ, which project forward and inward; the head is covered with large and regular plates; the scales on the back and tail are imbricated, those on the sides granular, and those on the abdomen are oblong or squarish and in transverse bands. This family is composed of the typical lizards and those resembling them, and is quite rich in species; most of them are inhabitants of the Old World, and the representatives of the family in America are aberrant. The genera *Lacerta* and *Zootoca* are the best known, as those to which the familiar European species belong; the sand lizard (*Lacerta agilis*), the green lizard (*Lacerta viridis*), and the "common lizard" of England (*Zootoca vivipara*) are examples.

THEODORE GILL.

Lacertil'ia, a name used as the ordinal designation of the Sauria or lizards by some recent authors. (See SAURIA, in CYCLOPÆDIA.)

THEODORE GILL.

Lamm (ÉMILE). See FIRELESS ENGINE, in CYCLOPÆDIA.

Land Law and Ownership in the U. S. The fundamental conceptions in regard to the ownership, acquisition, and transfer of lands in the U. S., while natural and exceedingly simple, form an important and peculiar element of the American jurisprudence, and are most intimately related to the national progress. Originating

among the early colonists, these notions have reacted most powerfully upon the habits of thought, mode of life, and institutions of the entire people, have aided their material and social development, and have contributed much to the successful establishment of a democratic republic. The object of the present article is to show the practical operation and results of this theory in the commercial activities of the country and in the constitution of society. The peculiarities of our American system can be best perceived and understood by placing it in contrast with that which exists in England, the country from which a great part of our jurisprudence was originally derived.

The manners, customs, and institutions of feudalism left deeply imbedded in the common law the principles from which the entire body of doctrines and rules concerning real property were logically deduced by the courts. While these ancient doctrines and rules have been greatly modified by modern parliamentary legislation, the effects which had been wrought upon society during the domination of feudal notions cannot be obliterated by statutes; they remain, and doubtless will remain until the English national character undergoes a radical change. The feudal system itself, and the real-property law which resulted from it, have been fully described in articles under various titles. Its fundamental conception was the double ownership of land and the doctrine of *tenure*, the ultimate absolute property residing in a superior, from whom the beneficial owner *held* his estate, his right being thus derived and subordinate. The practical rules which were deduced from this principle need not be recapitulated. It is sufficient to say that, according to the common-law theory, no occupant or possessor, no owner of the fee even, is clothed with a complete and absolute property in the soil; in the king alone, as the original source, is this right finally vested. The most remarkable and important of the social effects wrought by feudalism are the preference given to land as an object of property, the personal distinction conferred by its ownership, and the consequent desire to hold it in large quantities, and to perpetuate such acquisitions undiminished from generation to generation in the same families. These motives, operating in Great Britain for centuries, have greatly reduced the number of proprietors, have favored the growth of enormous private estates, have impeded the free transmission of land, and practically withdrawn a large part of it from the operations of trade and commerce, and have upheld the overwhelming social and political power of the landed aristocracy. Opposed to the complex and artificial rules of feudalism is the simple and apparently natural mode of ownership termed "allodial." Wherever it prevails every proprietor owns his tract of land absolutely, in his personal right, and not as a tenant from, or subordinate to, any superior. The notion of "tenure" is utterly foreign to the system. Even the state is not regarded as possessing the ultimate right and as the source of title in the feudal sense, but only in a political sense and from reasons of public policy. When all private property in a certain parcel of land fails, the ownership must of course pass to some one, and a political necessity requires that it should at once vest in the state and not in the first occupant of the vacant soil. For this reason and to this extent the allodial theory regards the state as the final proprietor in case of escheat, but not as the original source from which the right of property was derived by the doctrine of tenure. It also admits the right of eminent domain; but this right is political, and not feudal, in its nature; from it is derived the power to take private property by taxation, and for public uses upon making just compensation. (See EMINENT DOMAIN, in CYCLOPÆDIA.) The feudal theory of landed property has exerted, and still continues to exert, a most powerful influence not only upon legal literature, but upon the conceptions and habits of thought of the entire legal profession, upon the judicial opinions of courts, and even upon the form and language of statutes. Although the common law of real estate, as derived from the feudal institutions, has been much modified in its details by modern acts of Parliament, yet the underlying principles of the system have never been abolished in England. Allodial ownership is there unknown; the doctrine of tenure is still retained, and extends to every private estate in the kingdom. The English legal writers necessarily discuss and expound these dogmas. Their works are constantly consulted by the American lawyers and judges, many of them being regarded as treatises of the highest authority; indeed, it is from Blackstone, who sets forth the feudal elements of the common law unaffected by legislation, that a vast majority of our bar obtain their first knowledge of jurisprudence, and his account enters into and colors all their conceptions and opinions. The same mode of treatment is pursued by the leading American writers upon the law of real property. The institutions of the feudal system, its fundamental doctrine of tenure, and its technical terminology, occupy as prominent a place in their writings as in Blackstone's *Commentaries* or Cruise's *Digest*. The American law concerning land is thus represented, in the treatises generally used by the profession, as founded upon and fashioned by the doctrines of feudalism, while the fact is practically ignored that in every State of the Union, by the most solemn modes of legislation, the peculiar principles of that system, its underlying forms and conceptions of property in the soil, have been wholly abrogated, and the simple method of allodial ownership has been substituted in their stead.

The very basis of the land laws prevailing throughout the U. S. is the legislation which abolishes the theory of a double ownership, abrogates the doctrine of tenure, and creates an absolute, personal, underived right in every individual proprietor. It has been expressly adopted by the statutes of many States, and in some of them has even been incorporated into the constitutions which form their organic law. Although these statutes and constitutional provisions may differ somewhat in their language, their meaning and legal effect are everywhere the same. They utterly repudiate the feudal conceptions and notions upon which the common-law rules were constructed, and declare all property in the soil to be purely allodial. The abolition of tenure and the substitution of allodial in the place of feudal ownership have worked a change in every department of the law concerning land, but this change is the most radical and complete in the following general branches or subdivisions of the system: escheat, the doctrine of seizin, inheritance, the liability of land to be taken for debt, and conveyancing, which last branch includes mortgages, land-contracts, and the statutory methods of registration or recording. (For the modifications and amendments which have been thus wrought in these portions of the real-estate law the reader is referred to the various titles in which they are described.)

Before proceeding to describe the practical operation and social effects of the law, I shall briefly explain the "public-land" system of the U. S. government. The importance of this system as an element of our national development cannot be over-estimated. The greater part of the soil throughout the Ohio and Mississippi valleys, and stretching across the continent to the Pacific Ocean, was once or is now the public domain of the U. S., and the U. S. is therefore the source of title to the great majority of private owners in the States and Territories which have been formed within that vast area. There are, however, some exceptions to this general statement. The French, Spanish, and Mexican private grants in the Louisiana purchase, in Texas, in California, and in some other States of the Pacific slope, were protected by the various treaties of cession, so that the present owners of such grants do not derive their titles directly from the U. S. A few of the original thirteen States, claiming to be proprietors of the unoccupied soil lying W. of their boundaries, had granted some portions thereof to private purchasers before they surrendered their rights to the nation; and, finally, large gifts of the public lands have from time to time been made to individual States. With all these exceptions, a very great majority of the private ownerships in the States occupying the Ohio and Mississippi basins, and in the territory extending to the Pacific, are derived from the national government as the first proprietor. At an early day Congress adopted an exceedingly simple and beautiful method of dividing and laying out the public domain, which, with a few local changes, has been pursued to the present time. The following are the general features of this system: Certain "principal meridians" and parallels of latitude are first carefully established by astronomical measurement for the purpose of being used as "base-lines." The entire domain is laid out into squares of six miles on each side by means of meridians and parallels of latitude six miles apart. Each of these squares, containing 36 square miles, or 23,040 acres, "as nearly as may be," is termed a "township." All the townships situated N. and S. of each other constitute one "range;" and it is plain that the land would thus be divided into contiguous ranges each six miles wide, and containing a greater or less number of townships according to its length. These ranges are numbered in order I., II., III., etc., E. and W. from the "principal meridians," which meridians are designated by particular names. The townships in each range are also numbered in order 1, 2, 3, etc., N. and S. from a parallel of latitude established as a "base-line." Thus, taking any given "principal meridian," the ranges would be R. I. E., R. II. E., R. I. W., R. II. W., etc., and in each of these ranges the townships would be T. 1 N., T. 2 N., T. 1 S., T. 2 S., etc. A township is divided by parallels of latitude and longitude one mile apart into 36 squares called "sections," each containing 1 square mile, or 640 acres, "as nearly as may be." The sections in every township

are numbered from 1 to 36, always commencing at the N. E. corner of the township and going W. from 1 to 6, then going E. from 7 to 12, then W. from 13 to 18, and so on alternately to No. 36, which is always at the S. E. corner of the township. These sections are divided into "quarter sections" half a mile square, and containing 160 acres. The quarter sections are sometimes subdivided into halves of 80 acres, and even into quarters of 40 acres. This system of measurement is so simple and perfect that not only may the smallest subdivision be accurately described, but may be readily found and located from the description. Thus, the N. W. quarter of Section 7 in Township 3, N., in Range 4, W., of —— Meridian, describes a certain 160 acres of land without any possibility of doubt, and this 160 acres can be located by the purchaser without any possibility of mistake. The statute provides means for correcting the errors which result from the "convergency" of meridians as they run northwardly, and also special modes for surveying lands bordering upon rivers and the shores of lakes and of the ocean; but as these provisions are somewhat complicated and technical, and do not affect the general features of the system, it is unnecessary to attempt their explanation. The management of the public lands under the various acts of Congress is committed to a bureau of the department of the interior called the general land-office, which is presided over by a commissioner. Each of the Western States and Territories in which the lands are situated is divided into one or more "districts," and in every district is established a "land-office," with two officials, a "register" and a "receiver." The principal duties of the register are the supervision of sales and the entry and location of tracts selected by purchasers or by the holders of warrants and scrip. All payments of purchase-money are made to the receiver. The system as now established by law, and which extends generally to all unappropriated domain except mining and saline regions and the portions within the limits of cities and villages, contemplates public and private sales, the pre-emption of tracts by actual settlers, and the donation of homesteads. The general price fixed for private sale and for the minimum at public sale is $1.25 per acre; but for land situated in townships alternating with those granted to railroads the price is $2.50 per acre. No sale is ever made upon credit. The purchaser either at public or private sale must pay the price immediately. Upon presenting the "receiver's" receipt for this payment to the register, that officer locates and enters the land in the purchaser's name by its range, township, section, and quarter section numbers, and delivers a certificate of such location and entry. This certificate confers an equitable title which is recognized and protected by the courts. The legal title is conveyed by a "patent," which is issued by the commissioner of the land-office in the name of the President. Any citizen, or foreigner who has declared his intention to become a citizen, if twenty-one years of age, who has actually settled upon an unappropriated quarter section and has erected a dwelling-house thereon, acquires a right of "pre-emption;" that is, he acquires the right to purchase that specific 160 acres at the minimum price, although he had not applied to the district office or located the tract before his settlement. Finally, such an actual resident is permitted to take up, without payment of any price except certain fees, 160 acres of $1.25 land or 80 acres of $2.50 land as a homestead; but the patent therefor will not be issued to him until he has resided upon the land for a period of five years. In case of his death before the five years have expired, the privilege extends to his heirs. In addition to its sales and homestead gifts, the government has also adopted the policy of making extensive donations to others than actual occupants. This policy, which was at first acted upon with caution and for very special objects, has of late years been pursued to such an extent that a large portion of the most valuable lands have been recklessly squandered, and vast amounts have fallen into the hands of private owners, who hold them for purposes of speculation. These donations have been made in two forms: (1) of specific tracts, ascertained and described in the statute itself; and (2) of scrip and warrants, which are written instruments issued by the government entitling the holder to a designated number of acres, which may be located by him out of any lands remaining unappropriated. Of the former kind are the cessions made to various Western and Southern States for educational and other purposes and the grants made to railroads; of the latter are the military-bounty warrants issued to soldiers and sailors on account of services during war, and the scrip which was a few years ago distributed in proportional quantities among all the States for the endowment of agricultural schools and colleges. The railroad grants have generally conveyed to the corporations the alternate townships lying on both sides of their projected routes, and as these routes, excepting the Pacific roads, usually run through regions at least partially settled and improved, the lands thus alienated have always been valuable and of a character that would most readily have found a market. Military-bounty warrants and agricultural scrip before location simply represent a right to obtain the designated amounts of land; they do not confer even an equitable title to any specific tracts, but are merely things in action. Upon the presentation of a warrant or scrip to a register the number of acres called for are selected, and the certificate of location and entry is issued, which is consummated by a patent as in cases of ordinary purchase. The original policy of the general government was well adapted to prevent the accumulation of large tracts in the hands of single owners. To this end the statutes provide that at public sales the land must be offered in quarter sections, at private sales in sections or their subdivisions; that no person can obtain a pre-emptive right who already owns 320 acres; and that the right of pre-emption cannot be exercised more than once. It is to be feared that the beneficial effects of these restrictions have been seriously interfered with by the extensive donations to railroad companies and the enormous issue of bounty warrants and land scrip.

As a preliminary or introduction to an explanation of the practical operation of this American theory of land-ownership, I insert a table of exceedingly interesting facts taken from the U. S. census of 1870. It contains for each State the number of farms, the number of acres of improved and of unimproved land therein, the average size of these farms, and the assessed value of all the real estate belonging to private owners. The true value of the latter item would be at least one-half greater. The census returns do not furnish the total number of private ownerships occupied and used for manufacturing and business purposes, for dwellings, and the like, nor the amount or value of the public domain belonging to the U. S. Although it is impossible, therefore, to present the complete results of the national land-system, its necessary and beneficent effects are clearly and sufficiently illustrated by subjoined statistics concerning the present condition of agricultural property:

Table of Farms in the U. S., with the Amount of their Improved and Unimproved Land, and their Average Size—compiled from the Census Returns of 1870.

States, etc.	Number of farms.	Total number of acres.	Do. improved.	Do. not improved.	Average size of farms.	Total value of real estate (assessed).
Alabama	67,382	14,961,178	5,062,204	9,898,974	222	$117,223,043
Arizona	172	21,807	14,585	7,222	127	538,855
Arkansas	49,424	7,597,296	1,859,821	5,737,475	154	63,102,304
California	23,724	11,427,363	6,218,133	5,209,972	482	176,527,160
Colorado	1,738	320,846	95,594	221,752	184	8,840,811
Connecticut	25,508	2,364,416	1,646,752	717,664	93	204,140,509
Dakota	1,720	302,376	42,645	259,731	176	1,695,728
Delaware	7,615	1,052,322	698,115	354,207	138	48,744,783
D. of Columb.	209	11,677	8,266	3,411	56	71,437,468
Florida	10,241	2,373,541	736,172	1,637,369	232	20,197,691
Georgia	69,956	23,647,941	6,831,856	16,816,095	338	143,918,216
Idaho	414	77,139	26,603	50,536	186	1,926,565
Illinois	202,803	25,882,861	19,329,952	6,552,909	128	348,433,906
Indiana	161,289	18,119,648	10,104,279	8,015,369	112	460,120,974
Iowa	116,292	15,541,793	9,396,467	6,145,326	134	226,610,638
Kansas	38,302	5,656,879	1,871,003	3,685,876	148	65,499,365
Kentucky	118,422	18,660,106	8,103,850	10,556,256	158	311,479,694
Louisiana	28,481	7,025,817	2,045,640	4,980,177	247	191,343,376
Maine	59,804	5,838,058	2,917,793	2,920,265	98	134,580,157
Maryland	27,000	4,512,579	2,914,007	1,598,572	167	286,910,332
Massachu'tts.	26,500	2,730,283	1,736,221	994,062	103	901,037,841
Michigan	98,786	10,019,142	5,096,939	4,922,203	101	224,663,667
Minnesota	46,500	6,483,828	2,322,102	4,161,726	139	62,079,587
Mississippi	68,023	13,121,113	4,309,146	8,911,967	193	118,278,460
Missouri	148,328	21,707,220	9,130,615	12,576,605	146	418,527,535
Montana	851	139,537	84,671	54,863	164	2,728,178
Nebraska	12,301	2,073,781	647,031	1,426,750	169	38,365,999
Nevada	1,036	208,510	92,644	115,866	201	14,594,722
New Hamp.	29,617	3,605,994	2,334,487	1,271,507	122	85,231,288
New Jersey	30,652	2,989,511	1,976,474	1,013,037	98	448,832,127
New Mexico	4,480	833,549	148,007	690,542	186	9,917,991
New York	216,253	22,190,810	15,627,206	6,563,604	103	1,532,720,907
N. Carolina	93,565	19,835,410	5,258,742	14,576,668	212	83,322,012
Ohio	195,953	21,712,420	14,469,133	7,243,287	111	707,846,836
Oregon	7,587	2,389,252	1,116,290	1,272,962	315	17,674,292
Pennsylvania	174,011	17,994,200	11,515,965	6,478,235	103	1,074,680,934
Rhode Island	5,368	502,308	289,030	213,278	94	132,876,584
S. Carolina	51,889	12,105,280	3,010,539	9,094,741	233	119,494,675
Tennessee	118,141	19,581,214	6,843,278	12,737,936	166	223,035,375
Texas	61,125	18,396,523	2,964,836	15,431,687	301	97,186,568
Utah	4,908	148,361	118,755	29,696	30	7,047,881
Vermont	33,827	4,528,804	3,073,257	1,455,547	134	80,993,100
Virginia	73,819	18,145,911	8,165,040	9,980,871	246	279,116,017
Washington	3,127	649,139	192,016	457,123	208	5,146,776
West Va.	39,778	8,528,394	2,580,254	5,948,140	214	95,924,774
Wisconsin	102,904	11,715,321	5,899,343	5,815,978	114	252,322,107
Wyoming	175	4,341	338	4,003	25	863,665
Totals	2,659,985	407,735,041	188,921,099	218,813,942	153	$9,914,780,825

This table exhibits at one view, more clearly than can be done by any commentary, the surprising results of a free ownership and commerce in lands—results which are identified with our material development, the stability of our political institutions, and our very national life. It appears that in 1870 there were throughout all the States and Territories 2,659,985 separate farms. (The census also shows that the farmers and planters were 2,977,711.) This enormous number does not include town and city lots

for dwellings, tracts devoted to mining, manufacturing, and business, nor any other lands not exclusively agricultural. With very few exceptions these farms are all owned in fee (either legally or equitably) by their occupants. An exceedingly small proportional part of them are held by lessees, while a very few comparatively are possessed by life-tenants. The average size throughout the whole country is 153 acres. By far the largest average is found in California, 482 acres; the smallest among the States occur in Connecticut, 93; Rhode Island, 94; New Jersey and Maine, 98; among the Territories, in Wyoming, 25, and Utah, 30. The average through the Southern States is somewhat greater than through the Northern, but the difference in this respect is less than it has been usually supposed to be. Alabama, 222; Arkansas, 154; Georgia, 338; Mississippi, 193; South Carolina, 233; Tennessee, 166, may be contrasted with Wisconsin, 111; Vermont, 134; Oregon, 315; New Hampshire, 122; Michigan, 101; Minnesota, 139; Illinois, 128; New York, 103. The census discloses in this connection another very important fact, which demonstrates the irresistible workings of our free system. It has been generally supposed that in the Northern and Western States, especially in the oldest and most populous, the size of individual farms was gradually increasing; that smaller estates were absorbed in the greater; and that the number of separate ownerships was thus growing less as the rich and prosperous became richer and the poor and unsuccessful were obliged to succumb to their more powerful neighbors. The tables tell a very different story. In every State and Territory, with four exceptions, the average size of farms has decreased during the period between 1860 and 1870. The exceptional four are California, where there has been an increase from 466 to 482; Massachusetts, from 94 to 103; Utah, from 25 to 30; and Wisconsin, where the average, 111, was the same in both years. The decrease has been the greatest throughout the Southern States, because the plantations have been to a considerable extent subdivided into small farms and sold to negro owners—a change which will prove to be of incalculable advantage to the South. The following are the averages in several of the former slave States for the years 1860 and 1870: Virginia, 324–246; Tennessee, 251–166; Texas, 591–301; South Carolina, 488–233—the increase in the number of farms being from 33,171 to 51,889; North Carolina, 316–212; Mississippi, 370–193; Kentucky, 211–158; Florida, 444–232; Georgia, 430–338; Alabama, 346–222; Louisiana, 536–247—the greatest amount of decrease being in South Carolina, 255; Louisiana, 289; and Texas, 290 acres. Some other examples of this decrease are—Illinois, 146–128; Indiana, 124–112; Iowa, 165–134; Kansas, 171–148; Maine, 103–98; Minnesota, 149–139; Missouri, 245–146; New Jersey, 108–98; New York, 106–103. These statistics show that notwithstanding all the power of wealth to accumulate and retain, and notwithstanding all the opportunities offered by Congressional grants to mere speculative investments, the social and commercial law of free exchange has thus far proved irresistible in its operation; the tendency to multiplication of owners and diminution of estates has not been overcome, and it probably cannot be overcome until there is a radical change in the customs and habits of thought of the American people or in the circumstances by which they are surrounded.

The effect of this free system of land ownership and transfer upon the business and social activities, the habits of thought, and general plan of life of the American people, cannot be over-estimated. In the opinion of many foreign statesmen, among whom was Macaulay, the vast supplies of virgin soil open to cultivation, and the ease with which it may be acquired, have been the chief elements of security to our political institutions. Without accepting these extreme opinions, it is certain that the democratic republican principles of our government, and the theory of our land law and ownership, mutually correlate and support each other; both are essential to our conception of a free, self-governing people and to the organization of a free society. The feudal customs of entailing inheritances, of accumulating vast estates, and retaining them from generation to generation in the same families, of granting peculiar privileges to landed proprietors, and of withdrawing any considerable portion of the soil from active commerce, would long ago have arrested the national development, and would probably have undermined and overthrown our democratic institutions. In describing the practical operations of the system, the first important feature to be noticed is the fact that land has been brought within the domain of commerce, and, as far as is possible from its physical nature, has been assimilated to personal property. This result is produced by the law and the popular habits of thought working upon each other. There is no tendency to the accumulation of family estates on account of the pre-eminence or social superiority which real property confers upon its possessor. No such pre-eminence and superiority exist. There is no worship of land *as* land. It is regarded like chattels, as a commodity merely. It is bought and used as a means of production or of habitation or of speculation, but most owners are ready to sell at a profit. It is seldom that a farmer or a householder can be found who is not willing to dispose of his estate if he can gain thereby a reasonable advance upon his investment. This assimilation of land to chattels, this mode of treating it as an article of commerce, produces the utmost activity among the people themselves; it prevents stagnation; it affords constant opportunities for individuals to change their residence in order to improve their personal, domestic, or social condition. No communities or persons are rooted to the soil; everything is life, change, improvement, or at least the desire and anticipation of improvement. This is a picture of society which many English writers, under the influence of feudal and aristocratic notions, have severely criticised and harshly condemned; but every intelligent American knows that this very social condition has developed and contained the freedom, enterprise, and energy which subdued the wide domains of the Mississippi Valley and the Pacific slope to civilization, and within the period of fifty years built up populous commonwealths out of an unbroken wilderness. It should be particularly remarked that the freedom in the commerce of lands, and the absence of any tendency to their accumulation in families, which characterize the American social life, are not the results of any compulsory enactment or legal necessity. We have no law, as in France, restraining the owner in the disposition of his property and compelling the equal distribution of his land among his heirs. The great family estates in England, handed down from father to eldest son, are not, as a matter of fact, the result of ancient entails nor of the rule of primogeniture. They are invariably created and preserved by voluntary family settlements, by which the power of alienation may be suspended during lives in being. The same law prevails in every State of the Union, with the single modification in some of them that the suspension must be during *two* lives in being. The statutes, however, are a dead letter so far as they have produced any appreciable effect upon the ownership of land. The national habits of thought and customs, and the democratic principles which form a part of our social life, are opposed to the withdrawal of land from the activities of trade and commerce. These habits and principles have been efficient to prevent the evil, which has grown to such an enormous extent in England that the only adequate remedy which can be suggested for it by the most thoughtful economists and statesmen is legislation which shall deprive owners of their power of free disposition, and shall prevent the creation of any partial or future estates. The statistics of one county are given to illustrate the ease and frequency of transfer which characterize the ownership of land in the U. S. The county of Monroe is a wealthy agricultural district of New York, and includes the city of Rochester. Its farming population is remarkably intelligent and prosperous. The county was created in 1821. Its population was 49,855 in 1830, and has steadily increased, until in 1870 it was 117,868. From the first entry made in 1821 to the present day the records of deeds preserved in the registry office completely fill 295 folio volumes of 500 pages each, one deed, except in a very few instances, occupying a single page. Ten additional volumes are partly filled. During the fifty-five years since the organization of the county at least 147,500 different transfers of land lying within its boundaries have thus been made; of this enormous number a large portion were conveyances of lots in the city of Rochester. Another remarkable and necessary effect of our land-system is the enormous number of owners. The statistics already quoted show that in 1870 there were 2,659,985 farms, and that their average size had somewhat decreased, while their aggregate number had steadily and rapidly increased, during the last three decades. The law of free property has wrought the same result in the ownership of land occupied and used for all other purposes besides agricultural. In Great Britain a very few hundred thousand persons hold the fee of the entire kingdom; the millions are content to occupy the soil as tenants for life or for years; no one, as a general rule, acquires an absolute title by ordinary purchase unless he is already wealthy and wishes to enlarge his ancestral domain, or is ambitious to found a family which shall take its place among the landed gentry. In the U. S. a widely-different sentiment pervades all ranks and classes of society. Although land is regarded as an article of commerce, the desire to obtain its absolute ownership is universal. Farmers, merchants, professional men, mechanics, and even the common laborers, become proprietors. The American must at least own the tract on which he resides—his dwelling and its appurtenances;

without this his life would seem to have been a failure. The mechanic, artisan, or workman, with no resources but his wages, upon attaining his majority or upon marriage enters into an agreement for the purchase of a lot; the possession is given at once; the price is distributed into small instalments extending over several years, so that a homestead is finally secured by an annual payment saved from the daily wages not greatly exceeding the sum which would otherwise be expended for rent.

JOHN NORTON POMEROY.

Lane (JONATHAN HOMER), A. M., b. at Geneseo, Livingston co., N. Y., Aug. 9, 1819; graduated at Yale College in 1846; was appointed an assistant examiner of patents in 1848, and a principal examiner in 1851.

Lay (JOHN L.), b. at Buffalo, N. Y., Jan. 14, 1832; entered the U. S. navy in 1861 as assistant engineer; invented and designed the torpedo device with which Lieut. Cushing destroyed the Confederate ram Albemarle; and went, after the fall of Richmond, up the James River in the Spuyten Duyvel, removing the obstructions in advance of Admiral Porter's fleet. After the close of the war he entered the service of Peru, and while engaged in preparing fixed mines and placing suspended torpedoes in order to prevent the Spanish fleet from approaching the harbor of Callao, he first conceived the idea of a locomotive torpedo. In 1867 he returned to the U. S., and his idea then ripened into the invention of the so-called "Lay electro-travelling torpedo," which can be sent from shore or from shipboard to any point within its range, all its movements being under the control of the operator. H. L. STUART.

Leadville, city, cap. of Lake co., Col., is situated on the N. side of California Gulch, which was one of the first containing free gold discovered in the State. It was first settled in 1859, and for several years thereafter placer-mining was carried on by a great number of men; at one time fully 8000 persons were settled there. It has been estimated that $3,000,000 in placer gold has been taken out of California Gulch. Leadville is within 5 miles of the head of the Arkansas River, and the altitude of the place is about 10,300 feet. In 1878 carbonate ores were discovered here, and it has the distinction of being the first place in Colorado where carbonates in paying quantities were found. In Mar., 1879, the population was fully 12,000, and was increasing at the rate of 100 per day. About 400 good discoveries of carbonate ores have been made, and from them, or a portion of them, over $5,000,000 worth of ore has been taken out during the eight months previous to Mar., 1879. Its growth is and has been truly wonderful, and it bids fair to have a population of 40,000 within a very short period. Three railroads are being built, that will reach Leadville during the coming year. There are 3 daily and 3 weekly papers published here. The ores are principally carbonates, being silver and lead. There are now running and building 30 furnaces, that will each reduce about 50 tons of ore to base bullion in twenty-four hours.

W. F. HOGAN, "DAILY AND WEEKLY ECLIPSE."

Leath'er-Board, an article much used in the manufacture of boots and shoes. It is made of old manila rope, hemp rope, jute or linen canvas, and leather scraps, to which are added certain chemicals and a cement which makes it more impervious to water than leather. The rope or canvas and leather scraps are first ground to a pulp, the same as in the manufacture of paper. The pulp is then run off by a wet-cylinder machine and cut into sheets, usually 2½ by 3 feet; these sheets are then dried either in the sun about ten hours or by steam two hours, and are run through calendering-machines to smooth them, and are afterward pressed by still heavier machines to give an even surface and still greater solidity. It is also pressed into different forms convenient for use, among which are counters or stiffenings for boots and shoes, which by a patent process are made perfectly waterproof. These forms, being pressed by machines into a perfect fit for the various sizes, are considered superior to leather, as they hold their form better, and after being wet retain their original shape. The larger the percentage of manila rope or jute and linen waste, the better will be the quality of the board. This will be apparent when it is considered that manila retains its fibre, while leather does not. Although much used in the manufacture of boots and shoes, it is not confined to this industry alone, but is used considerably in the manufacture of toys, chair bottoms, etc. It was first manufactured in this country in Exeter, N. H., about thirty years ago. There are at present about 20 factories in the U. S., more than half of which are in Massachusetts, the largest being in Leominster, Groton, and Sudbury. There are also a few small factories in Canada, and an inferior article is made in England, but in limited quantities. Large quantities are annually exported, principally from Boston, to England, Germany, France, and elsewhere. The value of leather-board made in the U. S. in 1876 was about $1,600,000. There are about $1,000,000 invested in the business, employing about 500 men, to whom are paid wages to the amount of $300,000 annually. NAHUM HARWOOD.

Leather, Knapp's. See KNAPP'S LEATHER.

Lighthouse Construction. Three additions to the "lighthouses of the world," important specimens of engineering construction of "sea-rock lighthouses," have called for notice since the article in the CYCLOPÆDIA was written. On the Great and Little Bassas (or Basses; see note Vol. III. p. 19) rocks, lying off the S. E. coast of Ceylon, in the direct path of vessels plying between the Suez Canal and ports of India, China, Japan, etc., the Trinity House Corporation has constructed two lighthouses. The former (Dec., 1876) is completed, and the latter nearly so. "The Great Bassas rock is about 6 feet above mean water-level, and the Little Bassas is only awash at low water, and is 7 miles from the shore. These reefs, which are composed of hard red sandstone, are exposed to the full fury of the sea during the N. E. and S. W. monsoons, so that the days available for working are few, and these are almost exclusively during the prevalence of the N. E. monsoon, which commences in November and terminates in April; and even of this short period only half of it can be relied upon as safe for working. The towers are built of Scotch granite, the blocks of which were fitted together in the quarries before shipment. The blocks forming the walls and floors of both lighthouses are dovetailed together, both vertically and horizontally, upon the system adopted by Mr. Douglass in the Wolf Rock and Hanois lighthouses." To land the stone "a strong mast 45 feet high, and supported by chain-guys, was shipped into the rock in a vertical position, and from this was supported a derrick which could be swung over toward the tower by means of a chain and a crab. The steamer was moored at a distance of 180 feet from and parallel to the rock, and the blocks of granite contained in the hold were ranged on two tiers of rollers, so as to facilitate their being brought under the hatchway, where an iron lifting, working in guides, conveyed them to the level of the deck." The method of transference to the shores with the aid of the shore derrick cannot here be described. "By the very ingenious contrivance by which the stones were conveyed from the ship to the rock below the surface of the water they were out of the influence of the wind, and at the same time more than two-fifths of their weight was taken off, due to the difference between the specific gravities of granite and water. As these two lighthouses are but 20 miles apart, and very similarly situated, it was of the utmost importance to prevent the one being mistaken for the other either by day or night. Hence, a difference in the forms of the heads of the two towers, and also a difference in their lights. The Great Bassas light is distinguished at night by giving red flashes at intervals of 45 seconds, the duration of each flash being about 7 seconds, and that of the eclipses about 38 seconds." The illuminating apparatus of the Little Bassas lighthouse is of a novel character, being upon the very beautiful "group-flashing" system of Dr. Hopkinson, whereby flashes in groups of two or more are given in quick succession, instead of single flashes at stated intervals of time. (For a full description of the arrangement see *Engineering*, Oct. 27, 1876.)

A still more interesting engineering construction is that of the "Phare d'Ar-Men." The rock called Ar-Men, but 5 feet above the extreme low tide (which here rises — feet), is a part of a reef (Chaussée de Sein) stretching seaward 8 miles from the Isle of Sein, 20 miles S. of the port of Brest (France). The Chaussée de Sein had long maintained a sad celebrity amongst nautical men. "To anchor a floating light at its extremity had been recognized to be impossible, owing to the great depth of water and to the bottom being thickly studded with rocks. An iron structure was considered impracticable, since the boring of holes (of 0.18 m. or 0.20 m. in diameter) for receiving the posts would be one of the most tedious and difficult operations. Moreover, it was feared, owing to the principal planes of rock-cleavage being vertical, that the structure would not resist the shocks it would be subjected to; besides, it would be almost impossible to land the cumbrous pieces of the iron framing." The dimensions of the rock were ascertained to be 7 or 8 mètres in breadth by 12 to 15 mètres in length at the level of ebb-tides; the surface was very unequal, and divided by profound fissures. The surface descended gradually on the western side, but almost perpendicularly on the eastern. "The following mode of construction was therefore decided upon—viz. to bore holes 30 centimètres in depth and 1 mètre apart all over the site, and other holes outside this limit, in order to hold the ringbolts necessary for craft coming alongside, and to fasten the shrouds. The object of the first set of holes was to receive wrought-

iron gudgeons, to fix the masonry to the rock, and to make the construction itself serve to bind the different parts and fissures, and thus consolidated a base the precarious nature of which gave rise to some misgivings. It was proposed that in addition to these gudgeons others should be added, and strong iron chains introduced horizontally into the masonry as it rose, to prevent any possible disjunction."

The services of the fishermen of the Isle of Sein were resorted to for boring the holes. "Two men from each boat landed on the rock, and, provided with their cork belts, lay down upon it, holding on with one hand and using the jumper or hammer with the other; they worked with feverish activity, the waves constantly breaking over them. . . . At the close of the season seven landings had been effected, and eight hours of work accomplished, during which fifteen holes had been bored in the highest parts of the rock. . . . In the following year sixteen landings were effected, eighteen hours of work accomplished, forty new holes bored; and they even succeeded in partially levelling and preparing the work for the first course of masonry. The construction, properly so called, was undertaken in 1869. The galvanized wrought-iron gudgeons, 0.06 mètre square and 1 mètre in length, were fixed in the holes, and the masonry was commenced with small undressed stone and Parker-Medina cement. In fact, a cement of the most rapidly-hardening character was essential, for the work was carried on in the midst of waves breaking over the rock, and which sometimes wrenched from the hand of the workman the stone he was about to lay. . . . When a landing was practicable, the stones and small bags of cement were landed by hand, and care was taken to dress the surface of the masonry before commencing a new course. At the close of the season of 1869, 25 cubic mètres of masonry had been executed, and these were found intact the following year." At the date of the account quoted the masonry was raised 2.60 mètres above the highest tides. "The success of the undertaking may therefore be looked upon as assured, and at this stage the work may be expected to advance more rapidly."

From the foregoing, the Phare d'Ar-Men is *sui generis* among sea-rock "lighthouses;" it is the only one in which, instead of massive blocks dowelled and dovetailed into cohesive continuity, small irregular stones have, through necessity, been made to serve. (The foregoing is taken from *Notices sur les Modèles, Cartes et Dessins*, etc., kindly furnished the writer by M. Lavoinne, delegate of the French minister of public works to the Exposition at Philadelphia. In the same work are to be found notices of the lighthouses of Barges d'Olonne and Héaux de Bréhat, mentioned in LIGHTHOUSE CONSTRUCTION, in CYCLOPÆDIA.) J. G. BARNARD.

Lock'wood (BELVA ANN BENNETT), b. at Royalston, N. Y., Oct. 24, 1830; educated in a district school; taught school at fifteen for $5 per month and "boarded round;" was married at eighteen, but lost her husband next year; wrote for papers and magazines; graduated at Genesee College, Lima, N. Y., at twenty-seven; taught school eleven years; was married to Dr. E. Lockwood in 1868; studied law; graduated at the National University at Washington, D. C., and was admitted to the bar of the District in 1873. SUSAN B. ANTHONY.

Long (CRAWFORD W.), M. D., b. Nov. 1, 1815, in Danielsville, Madison co., Ga.; educated at the University of Georgia, graduating with honor in 1835; began to study medicine under Dr. George R. Grant in Jefferson, Ga., in 1836; graduated at the medical department of the University of Pennsylvania in 1839; soon after began to practise medicine in Jefferson, Ga. In 1842 he conceived the idea of using sulphuric ether as an anæsthetic in surgery, and on Mar. 30, 1842, performed the first operation on a patient fully etherized that the world has any account of. He performed other operations on etherized patients in 1842, 1843, and 1845. His discovery of anæsthesia in surgery antedates the claims of Horace Wells two years and eight months, and those of Morton four years and six months. (For a more circumstantial account of Dr. Long's claims see article WELLS (HORACE), in CYCLOPÆDIA.) J. MARION SIMS.

Long'shore (HANNAH MYERS), b. May 30, 1819, in Ohio; married and moved to Philadelphia, where she began the study of medicine; entered the Woman's Medical College in Philadelphia in 1849; graduated with honor, and began practice. SUSAN B. ANTHONY.

Lophobran'chii [Gr. λόφος, "tuft," and βράγχια, "gills"], an order of fishes distinguished by the fibro-cartilaginous skeleton; the development of the bones of the head, and especially by the presence of but a single large operculum on each side; the production of the snout and lower jaw into a tube, at the end of which is the mouth, which is formed above by the intermaxillaries, behind which are the supramaxillaries; and especially by the gills, which (instead of being laminated, as in other fishes) are developed in the form of a row of tufted lobes on each of the branchial arches. The air bladder is simple and closed, having no duct communicating with the intestinal canal. In all the species the dermal skeleton is largely developed, and composed of numerous angular plates in longitudinal rows. The muscles are mostly very little developed. This order, distinguished from all others by a peculiar modification of the gills, is represented by two types, which differ so much from each other as to have been elevated into sub-orders—viz. (1) Syngnathi, in which there is only a single dorsal fin and ventrals are entirely absent; and (2) Solenostomi, in which there are two distinct dorsal fins, the spinous one being developed, and ventral fins are present, and inserted near the scapular arch and under the spinous dorsal. Both groups are distinguished by peculiarities in the care which the parent fishes take of the eggs. In the Syngnathi the male receives from the female her eggs, and carries them on different parts of his body—*i. e.* on the breast or under the tail, either in a modification of the integument or a special pouch; while in the Solenostomi the female carries the eggs in a pouch formed by the coalescence of the ventral fins at the inner sides with the integuments of the breast. The family Pegasidæ, formerly included in this order, is now regarded as a teleocephal. THEODORE GILL.

Lo'zier (CLEMENCE HAMED), M. D., b. Dec. 11, 1812, in Plainfield, N. J.; moved to New York 1814; taught a school for young ladies for eleven years; studied medicine, and graduated at the Syracuse College 1853; helped to found the New York Medical College and Hospital for Women and Children in 1863, and is dean and professor at that institution. SUSAN B. ANTHONY.

Lub'bock (FRANK R.), b. at Beaufort, S. C., Oct. 16, 1815; went to Texas in 1836; was chosen secretary of the house of representatives in the extra session of the first congress 1838; was twice appointed comptroller; held the position of county clerk of Harris county from 1843 to 1856; was elected lieutenant-governor in 1856 and governor in 1861; joined the Confederate army; took part in all the actions on Red River; served on the staff of Pres. Davis in Richmond; was captured, and imprisoned at Fort Delaware from Apr. to Dec., 1865; is at present (1877) treasurer of the city of Galveston. C. G. FORSHEY.

Lu'kis (WILLIAM COLLINGS), b. in England in 1817; graduated at Trinity College, Cambridge; held several benefices, and became rector of Wath juxta-Ripon, Yorkshire, and rural dean of the deanery of Catterick East, which he now fills; is a member of various antiquarian societies, and published, besides other works, *Church Bells and Bell Foundries* (1858), *Danish Cromlechs and Burial Customs compared with those of Brittany, Great Britain, etc.* (1861); contributed articles on cromlechs, tumuli, and barrows to the *Journal of the British Archæological Society*, and written on "The Stone Avenues of Carnac," "Brittany Sepulchral Chambers, and their Chronological Order," and other antiquarian researches.

Lycod'idæ [from *Lycodes*—one of the genera—λυκώδης, "wolf-like," and the family termination], a family of fishes of the order Teleocephali and sub-order Jugulares, whose representatives have an elongated, eel-like body, with the soft-rayed dorsal and anal fins confluent with the pointed caudal, and invested, like the body, in a loose skin; the anus submedian or anterior, and with a raised margin; the branchial apertures more or less restricted to the sides; minute jugular ventral fins or entirely wanting; and, generally, two rudimentary pyloric cæca. The family embraces three sub-families—(1) Zoarceinæ, (2) Lycodinæ, and (3) Gymnelinæ, the first of which is represented by a species along the coast of the U. S. (*L. anguillaris*), and the second and third by a number of species in the polar and especially Greenland seas. THEODORE GILL.

Ly'man (JOSEPH BARNWELL), b. Oct. 6, 1829, in Chester, Mass.; graduated at Yale College in 1850; was admitted to the bar in New Orleans, La., in 1856. Near the close of the civil war he came to New York, adopted journalism as a profession, and had been at the time of his death (Jan. 28, 1872) for several years agricultural editor of the New York *Tribune*. He was the author of several treatises on agricultural subjects, and with his wife wrote *The Philosophy of Housekeeping*.

Lyman (LAURA ELIZABETH BAKER), b. at Kent's Hill, Me., Apr. 2, 1831; graduated at the Wesleyan Academy, Wilbraham, Mass., in 1849; was married to Joseph B. Lyman July 14, 1858; in 1870 became known by a series of articles published in *Hearth and Home* under the *nom-de-plume* of "Kate Hunnibee." For years she has been editor of the "Home Interest" department in the New York *Tribune*; now edits also the *Dining-Room Magazine*, and is a contributor to several periodicals.

M.

McAdoo (William Gibbs), A. B., A. M., b. Apr. 4, 1820, near Knoxville, Tenn.; graduated at East Tennessee University, Knoxville, 1845; was a member of the Tennessee legislature 1845–46; an officer in the Mexican war 1847; entered the law; was attorney-general of the Knoxville judicial district 1851–60; removed to Georgia in 1862; was captain in the Confederate service: appointed judge of the 20th judicial district of Georgia 1871; is author of published addresses, etc., and with Prof. H. C. White of Georgia, of *Elementary Geology of Tennessee*. Resides at Milledgeville, Ga. In 1857 he married Mary Faith Floyd, b. Sept. 8, 1832, who wrote *The Nereid*, a romance, and contributed largely to Southern periodicals.

McCal'lum (Daniel Craig), b. at Johnston, Renfrewshire, Scotland, Jan. 21, 1815; came to America with his parents at an early age: settled at Rochester, N. Y., and became an architect and builder; in 1851 invented the "inflexible arch truss bridge:" was general superintendent of the New York and Erie R. R. 1855–56: on Feb. 11, 1862, was appointed military director and superintendent of railroads in the U. S. Though to no individual belongs the credit altogether of the military railroad operations, McCallum was the acknowledged efficient head, and "for faithful and meritorious services" was brevetted brigadier and major-general. In June, 1865, he was mustered out of service, and in 1866 made a valuable report upon the military railroads under his charge during the war. D. at Brooklyn, N. Y., Dec. 27, 1878.

McCra'ry (George W.), b. at Evansville, Ind., Aug. 29, 1835: removed very early to that part of Wisconsin Territory which afterward became the State of Iowa; was educated in a Western academy; studied law at Keokuk, and was admitted to the bar in 1855; was elected to the State legislature in 1857, and served in the State senate from 1861 to 1863, holding the position of chairman of the committee on military affairs; devoted himself chiefly to his profession from 1863 to 1868, when he was elected to Congress, and re-elected four times in succession, serving on the naval committee, the committee on the revision of the laws, and as chairman of committee on elections; he was Secretary of War 1877–79, and then U. S. circuit judge.

McLa'ren (Edward William), A. B., A. M., S. T. D., b. Dec. 13, 1831, at Geneva, Ontario co., N. Y.; graduated at Jefferson College in 1851, and at the Western Theological Seminary, Pittsburg, in 1860; was ordained to the Presbyterian ministry in the same year, and went to South America as a missionary; returned in 1863, and became pastor to the Second Presbyterian church, Peoria, Ill.; moved in 1866 to Detroit, Mich., as pastor to the Westminster church; entered the Episcopal Church in 1872: became rector of Trinity church, Cleveland, O., and was elected bishop of Illinois in 1875.

Maclean' (John), D. D., LL.D., b. in Princeton, N. J., Mar. 3, 1800; was graduated at the College of New Jersey in 1816, and at the Princeton Theological Seminary in 1821; in 1822 was made teacher of mathematics and natural philosophy at the College of New Jersey; in 1823 professor of mathematics, in 1829 professor of ancient languages and vice-president, and in 1853 president, from which position he retired in June, 1868. He has contributed articles to the *Princeton Review*, and published a number of pamphlets on education, temperance, and other subjects. Since his retirement he has devoted his leisure to the preparation of a *History of the College of New Jersey*, which is now ready for publication. Henry C. Cameron.

McLeod' (Hugh), b. in Georgia about 1814; graduated at West Point Military Academy in 1836; joined Texas in her struggle with Mexico, and commanded a company in the battle with the Cherokees in 1839. In 1841 he commanded as brigadier-general an expedition to Santa Fé, sent out by Pres. Lamar to open trade with New Mexico, but was betrayed into the hands of the Mexicans, and held a prisoner for nearly a year, until released by intercession from the U. S. In 1842–43 he was a member of the congress of the republic; in 1861 commanded the 5th Texas, and took part in the battle of Manassas; contracted pneumonia at Dumfries, and d. in Feb., 1863.

McPher'son (John Roderic), b. in Livingston co., N. Y., May 9, 1833; engaged in farming and stock-raising, and settled in 1858 in Hudson City, N. J., where he dealt in stock and established a new stockyard in 1863. He was the originator, designer, and constructor of the great buildings used by the Central Stockyard and Transit Co. at Harsimus Cove, N. J.; also of the abattoir and stockyard of Philadelphia; and the inventor of a new stock-car, and the great improvements he introduced soon attracted the attention of sanitarians and philanthropists. He was alderman of Hudson City 1863–69, and State senator from Hudson county 1872–74. Elected U. S. Senator for New Jersey Jan. 24, 1877. H. L. Stuart,

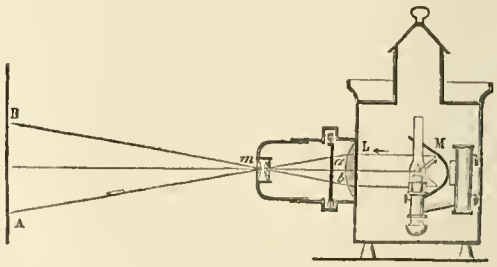
Macroscel'idæ [from *Macroscelis*—μακρός, "long," and σκελός, "thigh"—and *-idæ*], a family of typical Insectivores of mouse-like appearance, clothed with soft hair, and adapted for leaping, the hind limbs being much elongated. The skull has a transversely convex muzzle; orbits open behind; the lachrymal foramen within the margin of the orbit, and a suboptic foramen; the teeth are I. $\frac{3}{3}$ or $\frac{1}{3}$, C. $\frac{1}{1}$, P. M. $\frac{3}{3}$, M. $\frac{3}{3}$ or $\frac{3}{4} \times 2$: the upper molars are quadricuspid, the anterior and posterior cusps connected by transverse ridges. The intestinal canal has a long cæcum. The family is peculiar to Africa, and its representatives are distributed into two sub-families and three genera—viz. Macroscelidinæ, with the genera *Macroscelides* (Africa generally) and *Petrodomus* (Mozambique), and Rhynchocyoninæ, with genus *Rhynchocyon* of Mozambique.

Theodore Gill.

Macru'ridæ [from *Macrurus*—μακρός, "long," and οὐρά, "tail"—and the family suffix], a family of fishes of the order Teleocephali and sub-order Jugulares, distinguished by a body which gradually terminates in a tapering, long, and compressed tail, and which is covered by keeled or ornamented scales: the first dorsal is near the head, and short, the second very long, and like it is the anal, the two encompassing the tail without the intervention of a differentiated caudal. There are numerous pylorie appendages. The family is related to the Gadidæ or codfishes, and is divided into three genera, with species in the Mediterranean and contiguous regions of the Atlantic, Chino-Japanese seas, Australia, and the North Atlantic (Greenland, etc.), viz.—(1) *Macrurus*, (2) *Coryphænoides*, and (3) *Malacocephalus*. The North Atlantic or Greenland species are *Macrurus rupestris* and *Coryphænoides norvegicus*. T. Gill.

Mag'ic Lan'tern, an optical contrivance, the device of Father Athanasius Kircher, a German Jesuit, of the seventeenth century, for producing enlarged images of transparent or translucent objects, usually paintings, drawings, or photographs on glass. Optically considered, it consists of two distinct parts, an illuminating apparatus, and a magnifying apparatus. The illuminating apparatus embraces a source of light (in the original construction, a lamp), enclosed in a tightly-shutting box or chamber opening on the side, a condensing lens some inches in diameter adapted to an opening in the front of the box, and a concave mirror behind the light within, and opposite to the lens. This is properly the lantern; the magnifying apparatus is external to it, and consists of one or more converging lenses fixed in a sliding tube. Fig. 1 shows the entire

Fig. 1.



The Magic Lantern.

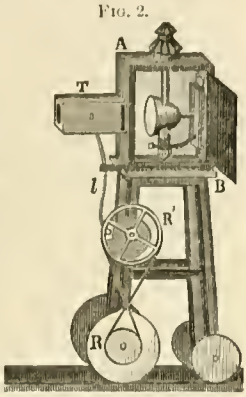
apparatus in section. M is the mirror, here shown as attached to the oil-chamber of the lamp, which is secured to the back of the lantern by means of bracket-hooks; L is the condensing lens; *a b* is a figure upon a glass plate, supported by a frame which slides in the grooves or ways shown in the diagram; *m* is the magnifying system of lenses; and A B is the magnified image as received upon a plane white surface, or screen. In order to give distinctness to this image, the tube carrying the lenses *m* is drawn

out or pushed in till the true focus is found. The mirror, M, in this design, is parabolic, and is supposed to be perforated, or notched, at top to accommodate the lamp-chimney; but in the simpler forms it is of spherical curvature, and is entirely behind the lamp.

In order to exhibit the optical effects of this apparatus, the room must be darkened; and inasmuch as there must be provision for the admission of air to the lantern, and for the escape of the gaseous products of combustion, care must be taken that the apertures so provided are screened against the escape of light into the apartment.

For a very long time after its invention, the magic lantern was employed for no more important purpose than to surprise or to amuse. It was in high esteem with professional conjurers and jugglers, who found in it a means of producing very startling effects. A construction much employed by them was the phantasmagoria lantern, represented in Fig. 2. This is a lantern supported by a stand on wheels, and designed to run upon a horizontal table. One of these wheels carries a pulley, R, which is connected by a band with another pulley, R′, higher up. On the axis of the pulley R′ is a cam, against which rests one extremity of a lever, *l*, the other extremity acting on a sliding tube carrying the magnifying lenses within the larger tube, T. The proportions of the cam and lever are such that if, when the magnifiers are at the nearest practicable approach to the object, and the size of the image is therefore maximum, the lantern be placed at the distance from the screen which gives a distinct image, then on rolling the apparatus toward the screen, the magnifiers will be drawn backward at precisely the rate necessary to preserve the distinctness of the image, while this will rapidly diminish in size till it vanishes in a point. In preparing designs for phantasmagorial displays, the ground is made absolutely black, so that no light may pass except that which exhibits the figures. The lantern is also placed behind the screen, so as to be invisible to the spectators of the display, the screen being of dampened or varnished muslin, and translucent. Under these circumstances, the sudden increase of size of the image creates irresistibly the impression that the object represented is rapidly approaching the observer; and the sudden diminution of size of the same image causes the object to seem to recede. It contributes to the force of these impressions, that, by means of another simple contrivance, not here represented, the aperture of the lantern is gradually closed as the image diminishes in size, and gradually reopened as it again increases, so as to preserve a harmony, such as we see in nature, between the brightness of the image and the imagined distance. The exhibitor often avails himself of the opportunity when the image has dwindled to so minute a point as to be unrecognizable, to change the slider in the lantern; so that when the object, after apparently receding into the distance, returns again, it appears with a new and often formidable aspect. Thus, a being of angelic beauty may seem to fade away almost to the point of vanishing, and then come suddenly rushing back in the character of a gorgon or a fiend.

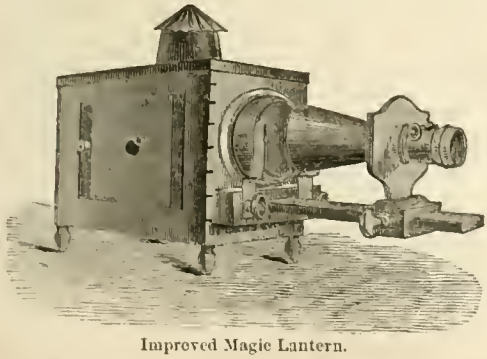
Fig. 2.



The Phantasmagoria Lantern.

Within the last half century the magic lantern has been very greatly improved. Designs on glass of objects of every kind in nature and art are so expeditiously, accurately, and cheaply produced by means of photography, as almost indefinitely to have increased its resources, and to have made it an invaluable auxiliary to the teacher and public lecturer. The substitution also of the oxyhydrogen or calcium light, or, better still, of the electric light, for the oil lamp, as a source of illumination, has added immensely to the power and brilliancy of its displays. Both the mechanical and the optical arrangements have, moreover, been carried to a high degree of perfection. Fig. 3 presents a very usual form of the modern improved instrument. The object is held in place by the spring clamps shown in the figure, and the magnifying apparatus is sustained by a single upright which slides along a projecting bar.

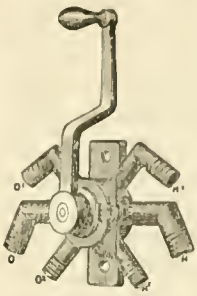
Fig. 3.



Improved Magic Lantern.

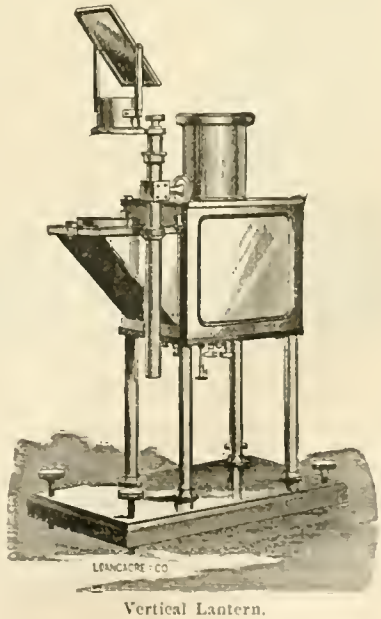
A very popular use of the magic lantern is for the production of the optical illusions called "dissolving views." For these, two lanterns are necessary, placed either side by side, or one above the other. They must be adjusted in position so as to have a common luminous field upon the screen. Each has a different object, and the two images when superposed to a great extent obliterate each other. A sliding or rotating stop placed before the lanterns is so constructed as, on being moved to left or right, to close the aperture of the one while it opens that of the other. At the mean position, both are half open and half closed; at either extreme position, one is wholly open and the other wholly closed. The movement of this stop, therefore, causes the images alternately to come out distinctly and to melt away. Advantage is taken of the moments when the lanterns are successively closed to change the objects, so that each dissolution is followed by the presentation of a new picture. When the calcium light is used, a stop is not necessary for the dissolving effect; but this is produced more simply by gradually and alternately shutting off and turning on the gases which feed the light in the lanterns severally. For this purpose, a six-way cock is employed, originally introduced by B. G. Malden, Esq., of the Royal Polytechnic Institution, London, called the "Malden tap." It is represented in Fig. 4. The gases enter from the reservoirs through H and O; they pass to one of the lanterns through H^1 and O^1, and to the other through H^2 and O^2. When the lever is upright, as in the figure, the gas flows to both lanterns freely; when it is turned down to the right the supply to the left-hand lantern is cut off; when to the left, the supply to the right is cut off. A small cock at C allows a small quantity of hydrogen to flow constantly into either lantern, serving to prevent extinction when the light is cut off.

Fig. 4.



The Malden Tap.

Fig. 5.

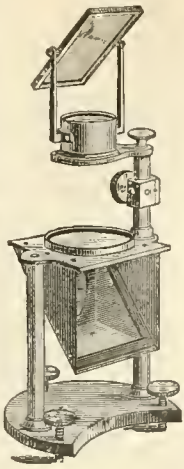


Vertical Lantern.

In the illustration of scientific subjects by means of lantern views, it is frequently desirable to present objects

which cannot be secured in a vertical position, as, for instance, objects immersed in a liquid. This case may be provided for by removing the magnifying apparatus from the lantern, Fig. 3, and placing before the condensing lenses a diagonal mirror mounted as in Fig. 6, by which the illuminating beam is thrown vertically upward, passing through a horizontal stage of glass, intended to receive the objects. Immediately above this is fixed the magnifying apparatus, as represented: and above this still is a second diagonal mirror which restores the beam to the horizontal direction.

FIG. 6.



Prof. Henry Morton, of the Stevens Technological Institute, Hoboken, N. J., has constructed a lantern which admits of being used either as a horizontal or vertical lantern at pleasure, the transformation being effected very expeditiously and easily. This is shown in Fig. 5, arranged as a vertical lantern. Since the introduction of this improvement, most constructors have adopted it, and it has come into general use.

F. A. P. BARNARD.

Magne'to-Electric'ity. Magneto-electricity is electricity which is produced by means of magnets. Like thermo-electricity, voltaic electricity, frictional electricity, etc., the term has reference solely to the means employed to generate the electricity, the electricity itself being identically the same from whatsoever source it comes. Magneto-electricity is the correlate of electro-magnetism; and precisely as magnetism is developed in an iron bar when an electric current flows through a coil surrounding it, on the one hand, so does the disappearance of the magnetism in the bar give rise to an electrical current in the coil, on the other. This, obviously, is a magneto-electric current.

The conditions under which magneto-electric currents are produced are simple. A magnetic field is commonly defined as the space surrounding a magnet: but since magnetic fields exist where there is no magnet, it is better defined as a space where a freely-suspended magnet will take up a definite direction. This directive tendency of the field is clearly due to the magnetic force pervading it; and since a force is known when its direction and magnitude are known, the properties of the field are due to the direction and intensity of the magnetic force which it contains. To facilitate reference, the direction is generally replaced by a number of parallel or non-parallel lines called lines of force. A magnet free to move will, when placed in a magnetic field, place itself parallel to a line of force. Now, the only condition necessary for the generation of a magneto-electric current is that a conductor should move through a magnetic field in such a way as to cut the lines of force. It matters not whether the field be produced by a magnet or by an electric current: if a metallic wire move through it so as to cross its lines of force, a current will flow through the wire. Of course, if the conductor be at rest and the lines of force move across it, the effect will be the same. This latter result takes place whenever the strength of the magnetic field is varied; because, since the strength of the field is proportional to the number of lines in it per unit of area, any change in this strength must cause a variation in the position of the lines, they either separating or closing up as the field is weakened or strengthened. In general, then, a current may be generated in a conductor placed in a magnetic field, either by motion of the conductor, the strength of the field remaining uniform, or by an increase or decrease in the strength of the field, the conductor remaining at rest, or by both causes combined. Hence, the only two things needed to produce a magneto-electric current are a magnetic field and a metallic conductor, one of which must be in motion.

The strength of the current generated, it is evident, depends in the first place on the number of lines of force which are cut by the conductor in a unit of time. Hence, for a given field it is increased by increasing the velocity with which the conductor or the field itself moves; and for a given velocity of motion it is increased by increasing the strength of the field—*i. e.* the closeness of the lines of force. If E represent the electro-motive force, H the strength of the magnetic field, L the distance moved, and T the time occupied by the motion, the relations of these quantities show that $E = H\frac{L}{T}$. But since $\frac{L}{T}$ represents the velocity with which the conductor moves, we may say that the electro-motive force per unit of length is equal to the strength of the field, multiplied by the velocity of the motion. (*Jenkin.*) If the resistance of the circuit be constant, as in the case of a given machine, this increase of electro-motive force with the velocity necessarily increases the strength of the current in the same ratio. In the second place, the strength of the current generated is proportional to the sine of the angle which the line of force cut makes with the axis of the conductor, and hence has its maximum value when the one is perpendicular to the other. From this relation it also follows that no current at all is produced when a conductor moves parallel to a line of force.

The direction of the current is a joint function of the direction of the motion and the direction of the lines of force, and may be readily deduced from the law of Ampère or from the law of Lenz. Ampère's law, which has reference primarily to the production of electro-magnetic phenomena, asserts that if a person places himself parallel to and facing a magnetic needle, and supposes the electric current to flow from his feet toward his head, the motion of the north-seeking end of the needle will be toward the left hand. As a wire conveying a current experiences, when placed in a magnetic field, a force which is at the same time perpendicular to its length and to the lines of force, it follows that if the current is from foot to head, and the lines of force—the pole being north-seeking—run from before backward, the force experienced by the wire will be a force to the right. So, on the other hand, if, under the same circumstances, a wire be placed in a magnetic field the direction of whose lines of force is from before backward, then a motion of this wire to the right generates a current in it passing from head to foot, and motion to the left an opposite current. If the conductor be at rest, and the lines of force—whose direction is from front to back—move from right to left, the current in the conductor will be from head to foot. It also follows from Ampère's law that if a watch be laid face upward upon the upper end of a vertical bar of iron surrounded by a coil, this upper end will be a south-seeking pole if the current flows through the coil in the direction in which the hands move, and a north-seeking one if the reverse. So, also, if a north-seeking magnetic pole be introduced into the upper end of a coil of wire whose axis is vertical, a current will be generated in the coil instantaneous in character, whose direction will be opposite to that of the hands of the watch; or in the inverse direction to that in which it would be necessary to send a current through the coil to produce a pole of the same name. Lenz's law states that the currents induced by the relative movement of a wire and a magnet are always in such directions as to produce mechanical forces tending to oppose the movement. If, for example, a bar of iron surrounded by a coil be approached to a north-seeking pole, the current flowing through the coil under the influence of magnetic induction will be in the direction required by the law of Ampère to make the forward end of the iron bar also a north-seeking pole; since the two north-seeking poles, being similar, will repel each other, and will in this way tend to oppose the movement.

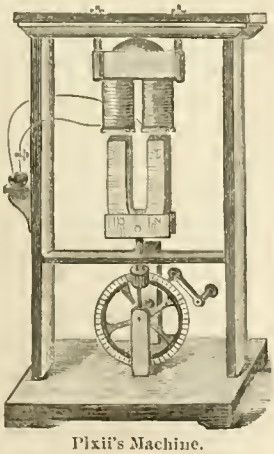
The discovery of electro-magnetism by Oersted in 1819, and its rapid development during the next decade by Arago, Henry, and Ampère, prepared the way very naturally for the converse discovery of magneto-electric induction by Faraday in 1831. The experiment which led to the discovery is thus described: "A welded ring was made of soft round bar iron, the metal being seven-eighths of an inch in thickness and the ring 6 inches in external diameter. Three helices were put round one part of this ring, each containing about 24 feet of copper wire one-twentieth of an inch thick; they were insulated from the iron and each other, and superposed in the manner before described, occupying about 9 inches in length upon the ring. They could be used separately or conjointly; the group may be distinguished by the letter A. On the other part of the ring about 60 feet of similar copper wire in two pieces were applied in the same manner, forming a helix B, which had the same common direction with the helices of A, but being separated from it at each extremity by about half an inch of the uncovered iron. The helix B was connected by copper wires with a galvanometer 3 feet from the ring. The helices of A were connected end to end, so as to form one common helix, the extremities of which were connected with a battery of ten pairs of plates 4 inches square. The galvanometer was immediately affected, and to a degree far beyond what has been described when with a battery of tenfold power helices *without iron* were used; but, though the contact was continued, the effect was not permanent, for the needle soon came to rest in its natural position, as if quite indifferent to the attached electro-magnetic arrangement. Upon breaking the contact with the battery, the needle was again powerfully deflected, but in the contrary

direction to that induced in the first instance." The experiment was then varied by introducing into a helix formed of 220 feet of copper wire, first, an iron bar with which magnets were brought in contact; and second, the magnets themselves. In both cases currents were generated, flowing in the inverse direction to those which by Ampère's law would be required to produce a magnet of the same name. The cause of these phenomena is thus clearly stated in a subsequent paper, read Jan. 12, 1832: "If a terminated wire move so as to cut a magnetic curve, a power is called into action which tends to urge an electric current through it; but this current cannot be brought into existence unless provision be made at the ends of the wire for its discharge and renewal;" the "one simple condition" of the production of a current being "that all parts of the mass shall not move in the same direction across the curves and with the same angular velocity."

Early in the year 1832, and entirely without knowledge of Faraday's discovery, Joseph Henry, then at Princeton, performed the following experiment: "A piece of copper wire about 30 feet long and covered with elastic varnish was closely coiled around the middle of the soft-iron armature of a galvanic magnet, which, when excited, would readily sustain between 600 and 700 pounds. The wire was wound upon itself, so as to occupy only about 1 inch of the length of the armature, which is 7 inches in all. The armature thus furnished with the wire was placed in its proper position across the ends of the galvanic magnet, and there fastened, so that no motion could take place. The two projecting ends of the helix were dipped into two cups of mercury, and there connected with a distant galvanometer by means of two copper wires each about 40 feet long. The arrangement being completed, I stationed myself near the galvanometer, and directed an assistant at a given word to immerse suddenly in a vessel of dilute acid the galvanic battery attached to the magnet. At the instant of immersion the N. end of the needle was deflected 30° to the W., indicating a current of electricity from the helix surrounding the armature. The effect, however, appeared only as a single impulse, for the needle, after a few oscillations, resumed its former undisturbed position in the magnetic meridian, although the galvanic action of the battery, and consequently the magnetic power, was still continued. I was, however, much surprised to see the needle suddenly deflected from a state of rest to about 20° to the E., or in a contrary direction, when the battery was withdrawn from the acid, and again deflected to the W. when it was reimmersed." During the year 1832 these experiments were repeated and varied by other observers, and the strength of the current was so much increased by Faraday, Nobili and Antinori, J. D. Forbes, Henry, and Saxton, that sparks were obtained from permanent steel magnets.

This step having been taken, and electric sparks produced at the ends of a wire coil surrounding an iron armature whenever this was rapidly removed from or brought near to the poles of the magnet, it was an easy matter to contrive a mechanical method of making the motion continuous, and so to produce a continuous current. In Sept., 1832, Pixii, an instrument-maker of Paris, mounted a steel horseshoe magnet upon the end of the arbor of a lathe, and caused it to revolve with its ends opposite to those of a piece of soft iron bent into the form of a U and wound with 400 mètres of silk-covered copper wire. When the ends of this wire were placed in a vessel of water, oxygen and hydrogen gases were evolved from them during the rotation of the magnet, and the more rapidly the quicker this rotation. Subsequently, a larger machine was constructed by Pixii for Ampère's lectures at the Sorbonne. (Fig. 1.) In this machine the magnet—which was powerful enough to lift 100 kilogrammes—was supported on a vertical axis and revolved by bevel gear. Above it a fixed electro-magnet was placed, wound with 1000 mètres of covered wire. The machine when in action gave vivid sparks and strong shocks, diverged gold-leaves, and decomposed water rapidly. The currents produced by it, however, were alternately direct and inverse, and hence when water was decomposed the collecting tubes contained both gases. To remedy this defect, the maker added Ampère's balance or rocker, working automatically, by which the current, reversed every half revolution of the magnet, was re-reversed at the same intervals, thus making the current uniform in direction.

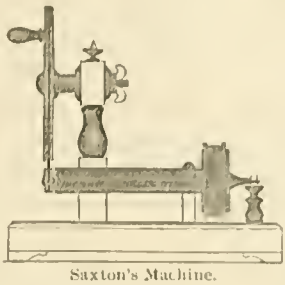
Fig. 1.



Pixii's Machine.

In June, 1833, Joseph Saxton of Philadelphia, then residing in London, constructed a magneto-electric machine having marked improvements. (Fig. 2.) In place of a rotating magnet and a fixed armature, he used a fixed magnet and a rotating armature, since the armature was lighter than the magnet. The plane of the magnet was horizontal, and contained the axis of rotation of the armature. In this machine there was used for the first time the principle discovered by Henry, that for currents of high tension a fine wire must be used on the armature, and for currents of low tension a coarse wire was necessary. This machine was provided, therefore, with a double armature, one pair of coils being wound with fine wire, the other pair with coarse wire. The two coils of each pair were wound in opposite directions, their ends terminating, the one in a copper disk on the axis of rotation, and beyond the armature, the other in an acute rhomb, also of copper, placed beyond the disk, and insulated from it and from the axis. A mercury cup placed below received the disk and the rhomb, the former continuously, the latter intermittently; the rhomb being so adjusted that its points left the mercury at the instant of maximum current, thus producing a strong spark. By means of a switch on the axis either pair of coils could be brought into action at pleasure, and by using the fine coils, in connection with a mercury cup divided into two parts by a vertical partition, in one of which the disk ran, and in the other the rhomb, the two portions of mercury being made the terminals of the external circuit, strong shocks could be obtained every time that contact was broken by the rhomb. If the rhomb were replaced by a disk, the current was uniform, though alternating in direction, and could be used for the decomposition of water, for the production of magnetic phenomena, and other similar experiments.

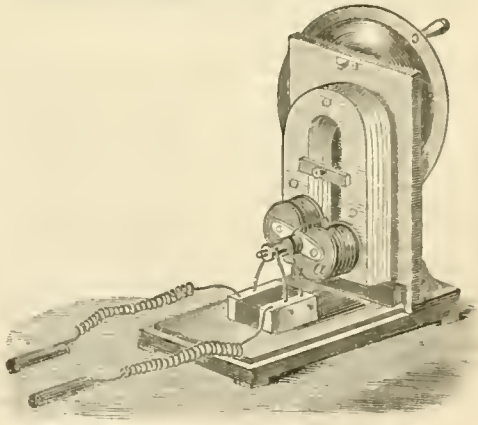
Fig. 2.



Saxton's Machine.

In 1836, Clarke, an instrument-maker of London, described a machine essentially similar to that of Saxton, but with some variations of detail. (Fig. 3.) The magnet in this machine was placed vertically, with its poles downward. The armature with its coils was placed in front of these poles, and revolved about a horizontal axis passing between them, being driven, as in the machine of Saxton, by a multiplying-wheel. One end of the wire constituting the armature coil was connected with one of two brass rings or ferules upon the prolongation of the axis in front, the other end with the other ferule. Both ferules were insulated from the axis, and they were arranged to give at will the various modifications of the current desired. Two armatures were provided, one wound with coarse, the other with fine, wire.

Fig. 3.



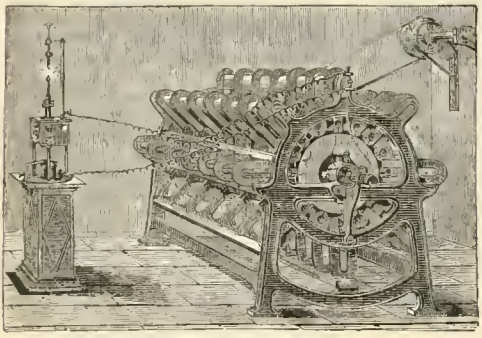
Clarke's Machine.

In 1845, C. G. Page of Washington contrived an improved form of Saxton's machine, in which he used two large compound U-magnets, placed horizontally, instead

of one, their poles being reversed in direction. Two separate coils of covered copper wire, with cores of iron wire, revolved between these magnets about a vertical axis, the speed being increased by means of a multiplying-wheel. The currents from these coils were made uniform in direction by means of a commutator or pole-changer of the following simple construction: Upon opposite sides of the axis of rotation, and just above the coils, two semi-cylindrical segments of sheet silver were placed, insulated from the axis and from each other, the vertical spaces separating the two segments being perpendicular to the line joining the centres of the coils. Two springs, also of silver, pressed upon these segments, so placed that at the instant when the coils began to leave a pole to go to the next the springs changed from one segment to the other. In this way, although the current flows in opposite directions through the coils at each half revolution, the springs through which it issues are also changed to the opposite segments every half revolution. Hence, the current through the springs, and through the wires connected with them, is always in the same direction, though it is intermittent, having two maxima and two minima every revolution.

In 1849, Nollet, professor of physics in the Military School of Brussels, proposed to construct a magneto-electric machine on a large scale, the general details being the same as in Clarke's machine, but very greatly improved. His death prevented him from realizing all his expectations, but the machine he had devised, extended and perfected by Berlioz and Van Malderen, constitutes what is known to-day as the "Alliance machine," because it is constructed by the Alliance Co. of Paris. This machine, which has been for some years employed in several of the lighthouses on the French coast, is the only one in use on the large scale for the production of the electric light, in which the field of force is generated by permanent magnets. (Fig. 4.)

Fig. 4.



Alliance Machine.

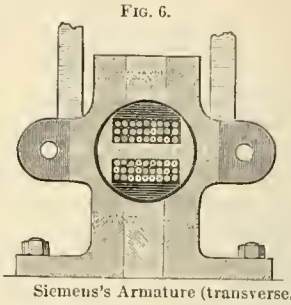
It consists of 48 compound U-magnets of steel, arranged in 6 rows of 8 each. The 8 magnets are arranged radially in a circle, their poles facing inward and alternating, thus forming a circle of 16 alternate poles, and in all a cylinder of 96 alternate poles. On a horizontal axis passing through this cylinder 6 bronze disks are placed, upon the periphery of each of which are 16 coils of copper wire, each having a tubular core of iron slit lengthwise, the axes of the coils being horizontal and parallel to the axis of rotation. The length of a coil is such that it will just pass between the poles of two successive circles of magnets. The coils upon a single disk are united alternately right and left, the first end of one coil being joined to the last end of the preceding one. When the disks are rotated the coils are brought alternately between opposite magnetic poles at both ends, the current generated being reversed by each successive pair of poles. These alternating currents are re-reversed and given a uniform direction by means of a commutator devised by Serrin, which is simply a multiple pole-changer of Page's. Experiments made by Jamin and Roger with a four-disk machine carrying 96 coils showed that when the coils were connected consecutively, or for tension—in which case the resistance was equal to that of 655 Bunsen cells—the electro-motive force of the current produced by a speed of 200 revolutions per minute was equal to that of 226 Bunsen cells. When the coils were connected in parallel series, or for quantity, the resistance then being that of only 18 Bunsen cells, the electro-motive force was equal to that of 38 such cells. Used to produce the electric light, this machine gave a light equal to that of 230 Carcel burners, equivalent to 1610 candles, the cost of the light in motive-power being 1.1 francs per hour. This is less than one-tenth the cost of the same amount of light obtained from the battery, and about one-seventh the cost of this amount of light obtained from oil.

Up to this time the magneto-electric machines had all been constructed on one general plan, this being that of the original Saxton machine. In 1857, Werner Siemens of Berlin made an important advance by devising a new form of armature, since known as the "Siemens armature." To construct it, a cylinder of soft iron whose length is five or six times its diameter is deeply grooved on opposite sides longitudinally, so as to make its cross-section nearly the shape of an I. Covered copper wire is then wound lengthwise in the grooves, and the two ends of the cylinder are furnished with bearings on which the armature can rotate. The ends of the wire coil communicate with a commutator placed on the axis at one end. (Figs. 5 and 6.) The advan-

Fig. 5.

Siemens's Armature (longitudinal).

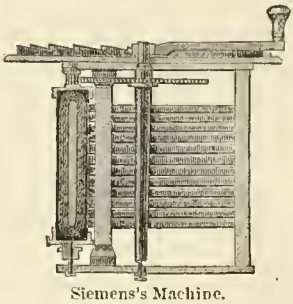
Fig. 6.



Siemens's Armature (transverse.)

tages of this form of armature, which are decided, consist chiefly in its compactness, the magnetic surface being large, and at the same time capable of complete action within a very intense and uniform magnetic field. Moreover, from its construction the coils cut the lines of magnetic force nearly at right angles. In Siemens's machine a series of from 12 to 30 steel U-magnets were fastened together in a row, but not in contact, their planes being parallel. A cylindrical space was made between the poles of these magnets, and in this space the armature revolved, being driven by a belt running to a pulley on one end of the axis. One of the forms of the Siemens machine is shown in Fig. 7.

Fig. 7.

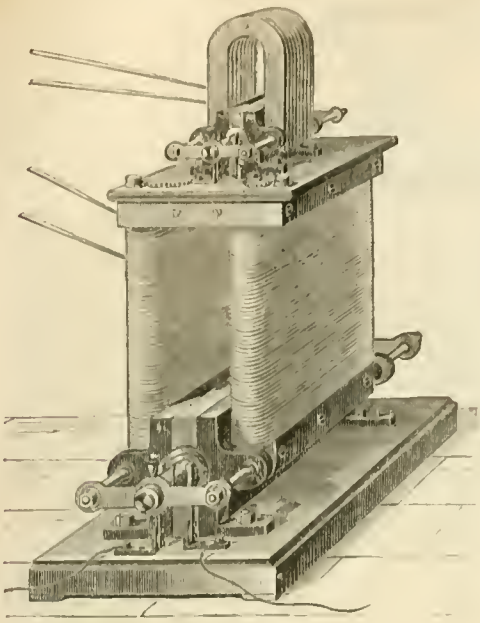


Siemens's Machine.

In 1866, Wilde of Manchester produced the first magneto-electric machine in which permanent steel magnets were replaced by the vastly more powerful electro-magnets. To charge these magnets the current from a small Siemens permanent-magnet machine was used. The machine represented in Fig. 8, which is the size adopted for the Scotch lighthouses, consists of the Siemens machine, slightly altered in its details, placed above, and of the electro-magnet machine placed below. The former, or Siemens machine, contains from 12 to 16 U-steel plates, each weighing 1.5 kilogrammes, with their poles downward, attached to two cheeks or poles of iron, separated by a thick brass plate, and bored through from end to end for the reception of the armature. This armature was covered with 50 mètres of copper wire three millimètres in diameter, wound lengthwise and forming an elongated coil 6 centimètres thick, the ends of which passed to a commutator on the axis. The latter, or electro-magnet machine, is made of two vertical wrought-iron plates, 91 by 66 centimètres in area and 2.5 centimètres thick, bolted above to a horizontal iron plate, and each wound with 500 mètres of covered copper wire, No. 10, arranged in seven parallel strands, the ends being connected to the springs, which press upon the commutator of the upper machine. The lower ends of these iron plates, like the magnets above, are extended by two massive cheeks or poles of iron, separated by a thick plate of brass, and having a hollow cylinder through them lengthwise. In this cylindrical space revolves a Siemens armature of proportionate size, being 1 mètre long and 18 centimètres in diameter, wound with 30 mètres of copper wire 6 millimètres thick. The entire weight of the machine is 1500 kilogrammes. To drive it at full speed, which is 1700 revolutions per minute for the smaller armature and 1500 for the larger, requires about three horse-powers. The energy developed by this machine was astonishing; pieces of iron rod 6 millimètres in diameter and nearly 40 centimètres long

were at once melted by it. By carrying the principle involved in this machine one step further, and causing the second current to magnetize a third and still larger electro-

Fig. 8.



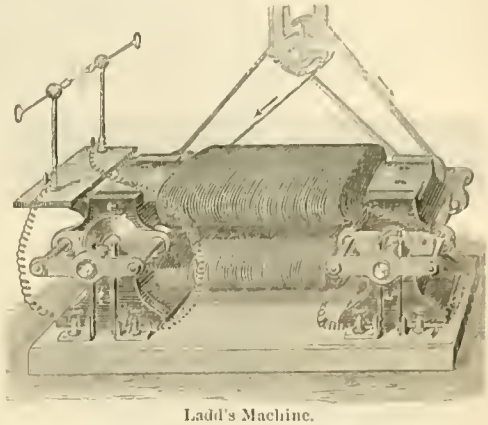
Wilde's Machine.

magnet similarly arranged, Wilde succeeded in vastly increasing the effect. The machine which he constructed on this plan consumed fifteen horse-powers of force, and gave a current which melted a bar of platinum 60 centimètres long and 6 millimètres in diameter. The principle seemed capable of an indefinite extension in this direction until Wilde showed that it was limited.

In February, 1867, C. W. Siemens of London read to the Royal Society a paper received from his brother, Werner Siemens of Berlin, in which he proposed a very important but obvious modification in these machines.* He proposed to do away with the permanent magnet machine, and to place the terminals of the coils surrounding the electro-magnet which produced the field of force in direct communication with the springs which pressed upon its own commutator. To start the current, Siemens at first proposed to introduce momentarily into the circuit a small battery. On revolving the armature the small amount of magnetism developed by the battery-current would react on the armature coil to produce a magneto-current in it. This passing round the electro-magnet would in its turn increase its magnetism, which again would react on the revolving coil, the current increasing in a geometric ratio until the iron reaches its maximum of saturation and the power applied is balanced by the resistance. The battery being removed, the machine itself will continue to furnish the current necessary for its own magnetization. He also suggested, to start the machine, the momentary placing of a steel magnet against the iron of the electro-magnet while the armature was revolved. The small amount of magnetism thus produced becomes the starting-point of a series of actions and reactions similar to those above mentioned, until the full power of the machine is reached. It was soon found in practice, however, that this auxiliary assistance, whether battery or magnet, was entirely unnecessary. The purest commercial iron after magnetization always retains residual magnetism, which is sufficient to start the current. Moreover, the position of the iron cores of the magnet with reference to the lines of dip always causes their magnetism by induction from the earth. But a new difficulty now arose. The field of force being in the main circuit of the machine, whenever the external circuit was broken the magnetism at once disappeared from the magnets and the machine lost its power. In some cases—as, for example, in heating wire for blasting, where the external circuit is always complete—no difficulty is experienced from the above cause. The magneto-electric or dynamo-electric machines of Farmer, which have been for several years in use in the U. S. navy for firing torpedoes by the ignition of fine platinum wire, have precisely the construction above given. Siemens, however, remedied the defect by placing upon his blasting machines an automatic arrangement by which the current was diverted into the external circuit at regular intervals. The same result, practically, was attained by Wheatstone by dividing the current, and sending one portion around the magnets, while the other part was utilized for the performance of external work.

In March, 1867, Ladd, an instrument maker of London, described a new form of machine, in which the difficulty arising from having the field of force in the main circuit was very ingeniously obviated. In this machine only one electro-magnet was used, but its peculiarity consisted in its having two Siemens armatures upon it, one at each end, both being simultaneously driven. (Fig. 9.) This machine,

Fig. 9.



Ladd's Machine.

the first large machine in which residual magnetism was used as the starting-point, was called a dynamo-electric machine, the name magneto-electric machine being restricted to machines with permanent magnets. In the Ladd machine the current produced in the smaller of the two armatures charged, through its commutator, the electro-magnets of the field of force. The current from the larger armature was utilized externally. This machine was exhibited by its inventor at the Paris Exposition of 1867, and excited much attention. Although the plates composing the cores of the magnets were only 60 centimètres long, 30 wide, and 1.5 thick, the machine developed a current equivalent to that from 25 or 30 Bunsen cells, and maintained in a state of incandescence a platinum wire more than a mètre long and half a millimètre in diameter. Ruhmkorff, into whose hands the French patent for this machine passed, improved its construction by placing the magnets vertical instead of horizontal, and by using only one armature. This armature, however, was divided into two sections of unequal length, each having its own coil and commutator, the two coils being in planes at right angles to each other. The current from the smaller coil excited the field of force, as in Ladd's machine. The larger coil furnished the useful current. Schellen and Gaiffe appear to have suggested a similar improvement about the same time, though in their plan the same armature-core carried two separate and distinct coils wound over its whole length, and of course parallel. Since one-third more wire can be carried by an armature wound in this way, the results obtained with this armature are proportionally greater than with the one devised by Ruhmkorff.

The machines which have now been described, and which use the Siemens armature for the production of the current, have all of them a serious defect which has prevented their coming into general use. Since the polarity of the armature is reversed twice every revolution, there are several thousand magnetizations and demagnetizations effected every minute. But as the magnetizing and reversing of polarity develops heat in the iron, as Joule has shown, the result is an enormous development of heat in the armature. This is not only so much actual loss of power, but it actually endangers the safety of the machine, the cotton covering of the wire in one of Siemens's machines having been completely charred from this cause. In the machines both of Wilde and Ladd the portion surrounding the armature is of necessity made hollow, so that a stream of water can

* Wheatstone also communicated a paper to the Royal Society on the same day upon the same subject. But as Werner Siemens's paper had been read to the Berlin Academy as early as the middle of January, and the machine had been exhibited in that city in Dec., 1866, there can be no more doubt of Siemens's priority of publication than there is of Wheatstone's independence of discovery. Farmer of Salem, Mass., in a letter to Wilde received in Nov., 1866, states that the same idea had occurred to him, and that he had constructed a machine in which a thermo-battery furnished the current to start it, and then a branch of the main current sustained the magnetism.

be passed through it to keep it cool. Moreover, the currents produced in the armature-coil are alternately positive and negative in direction. For the electric light this is of no practical importance, provided the lamp is constructed accordingly. But for many purposes, as in electro-plating, this alternating current is inadmissible: then it becomes necessary to use a commutator to render the direction of the currents uniform. Under these circumstances there is produced, whenever the spring passes from one segment to the other, a long vivid spark or flame which heats and burns the surfaces in contact, thus lessening the conductivity at these points, and consequently the current-strength. But even then the current is not uniform in strength, but is intermittent—a defect fatal to its use for many purposes, as in telegraphy.

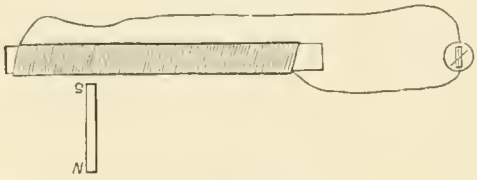
In July, 1871, Z. T. Gramme, an artisan of Paris, presented to the French Academy of Sciences a description of a new form of magneto-electric machine, in which an entirely novel principle appeared. Like all other similar machines, an iron armature surrounded with coils was caused to revolve in the vicinity of a magnet; but, unlike all others, this armature was shaped like a ring, its plane coinciding with that of the U-magnet to which it was attached, and its rotation in that plane being continuous in one direction. The principle involved in the Gramme machine may be illustrated by means of the annexed cut. (Fig. 10.) Let N S represent a bar magnet, and X a coil of

Fig. 10.

Coil and Bar Magnet.

copper wire, if the coil be made to approach the end of the magnet marked N, a current of electricity will be developed in it which will continue in the same direction until the coil reaches M, the neutral point; then it will change, continuing inverse until the coil passes off the bar at S. If the current produced when the coil moves from N to M be called positive, it will become negative as the coil moves from M to S. If the coil move from right to left, the current will be positive from S to M, and negative from M to N. To this magnet let a second one be now added, S' N', the two similar poles S and S' being placed together. If now the coil move over this double bar as before, the current developed from N to M will be positive, from M to S negative, from S' to M' negative, and from M' to N' positive; all these currents being reversed when the coil moves back again. Substitute now in place of the magnet an iron bar surrounded with a permanent coil (Fig. 11), and place at a little distance from it a steel magnet

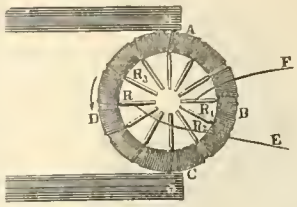
Fig. 11.



Magnet, Coil, and Iron Bar.

with its axis perpendicular to that of the bar. Whenever the magnet is moved to or fro along the bar, being kept parallel to itself, a current of electricity will flow through the coil, which under the circumstances given is due to three separate causes acting together—first, to the magnetization and demagnetization of the bar due to the approach and the recession of the magnet; second, to the constant change in polarity in the bar as the magnet moves along, while preserving constantly the same distance from it; and third, to the current which is generated in the coil itself when it cuts the lines of force of the moving magnet. The first of these currents may be demonstrated by moving the magnet to and from the bar in the direction of its own axis; the second, by keeping the magnet and the coil at rest, and moving the bar through the coil only; the third, by removing the bar entirely, and then moving the coil alone before the magnet, or the magnet before the coil. If the bar be annular, however—if it be in the form of a ring instead of a straight rod—the currents first named will, as Gaugain has shown, disappear entirely. Suppose now such a ring of iron be caused to rotate in its own plane between the poles of a U-magnet, the plane containing these poles coinciding with that of the ring, and the axis of rotation being of course perpendicular to this plane. (Fig. 12.) It is evident that upon the ring at the points A and C, opposite to the poles of the magnet, there will be double poles or consequent points; the S. pole of the magnet developing a double N. pole at the point C, and the N. pole developing a double S. pole at the point A. The ring may therefore be considered as made up of two semicircular magnets reversed in direction, so that the two N. poles are together and the two S. poles together, the neutral points being halfway between the poles, or on a line perpendicular to that joining the two poles. If now we suppose this ring to be covered with a series of coils of copper wire all wound in the same direction, it is obvious that as the coils move from B to A in the quadrant B A, a current will be generated in them, at first feeble, but gradually increasing in strength as the pole is approached. As above stated, this current will be due to two causes—first, to the fact that the spires of wire cut the lines of force of the magnet as they rotate; and second, to the fact that the iron nucleus is changing the distribution of its polarity constantly. Since these two currents flow in the same direction, they will of course reinforce each other. In the second quadrant A D the former of the two currents will remain unchanged in direction, since the lines of force are cut in the same way; the latter will, because the direction of motion of the ring with reference to the polarity of the magnet remains unchanged. The four currents thus developed in the two quadrants will therefore unite to produce a single current, the direction of which will depend on the polarity of the magnet, the direction in which the coils are wound, and the direction of rotation, following the laws of Lenz and Ampère. In the case assumed above the coil in moving from B to A approaches a N. pole. By Lenz's law the direction in it of the current will be such that the advancing end will be a N. pole, and thus oppose the rotation. In moving from A to D the coil is moving away from a N. pole. By the same law there will be developed S. polarity at the end of the coil nearest N, since this, by its attraction, will resist the motion. But the direction of the current which makes one end of a coil N. necessarily makes the other S.; hence the current is the same in both quadrants—*i. e.* from B to D. The same phenomena go on, of course, in the lower half of the ring, but the currents here flow in the opposite direction. It is clear, therefore, that corresponding to the two neutral magnetic points of the ring there are two neutral electrical points where no current flows, situated one on each side of the ring and halfway between the poles of the magnet; on the one side of the line joining these points a current flows through the coils in one direction, and on the other in the opposite. If no arrangement is adopted for removing these currents, they simply flow into and neutralize each other. But if to each wire between two consecutive coils—representing, therefore, the end of the previous coil and the beginning of the succeeding one—a piece of metal be attached, R, R_1, R_2, R_3, placed radially to the ring, and upon these two metallic springs F and E, placed on a line normal to that joining the poles, be allowed to press, it is evident that metallic contact will take place at the neutral points, and that these springs will represent the electrodes. The positive current will flow in one direction from all the coils on that half ring, and will accumulate at the one spring; the negative current will flow in the other direction from all the coils on the other half ring, and will accumulate at the other spring. The minimum number of coils which could act at all is therefore two; but, since the radial arms from them would make contact with the brushes only near the neutral line, the current from them would be weak, and of course intermittent. The best effect is obtained when the number of coils, and therefore the number of radial arms, is such as to allow contact of the springs with the succeeding arm before their contact with the preceding one is broken. Increasing the coils beyond this number increases the effect only by increasing the electro-motive force, which follows the same law as in the battery, where it increases directly as the number of cells.

Fig. 12.

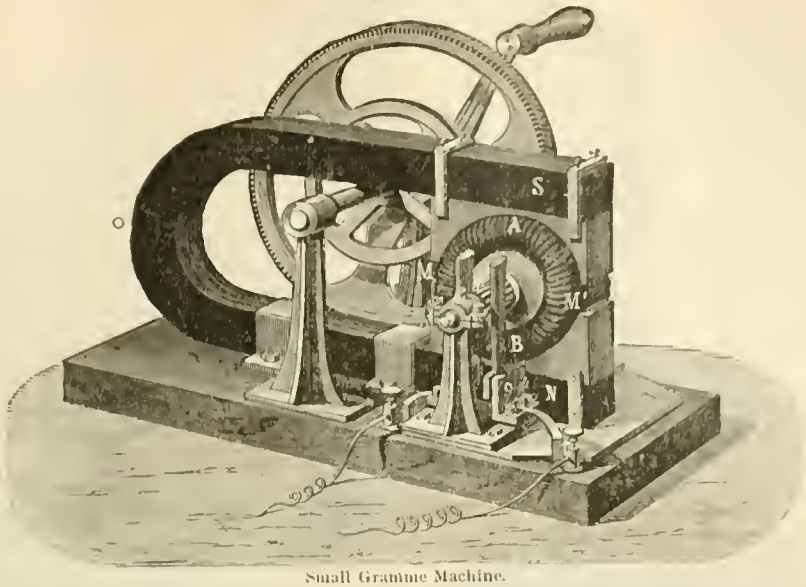


Gramme Ring.

The Gramme machine as first constructed is represented in the annexed wood-cut. (Fig. 13.) The field of force was produced by permanent steel magnets N O S. The armature was an iron ring A B, wound with coils as above described. Its construction is shown in detail in Fig. 14, where A represents the iron wires composing the ring, and B the coils of copper wire. A loop of wire is taken out between each coil and attached to a strip of copper R, which passes first radially, then turns at right angles, and passes through the ring parallel to the axis of rotation, each strip being insulated from the next and from the axis.

A cylinder of copper strips is formed in this way around the axis, each representing the end of one coil and the beginning of the next. Upon opposite sides of this cylinder two brushes formed of moderately fine copper wire p[illegible] at the neutral points, thus constituting the electrodes. It was not long, however, before Gramme adopted the dynamo-

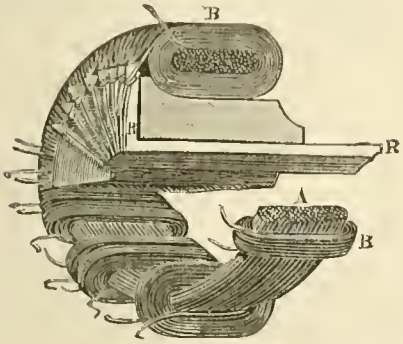
Fig. 13.



Small Gramme Machine.

principle of Siemens, and used electro-magnets in place of steel ones. The form of machine exhibited at the Vienna

Fig. 14.

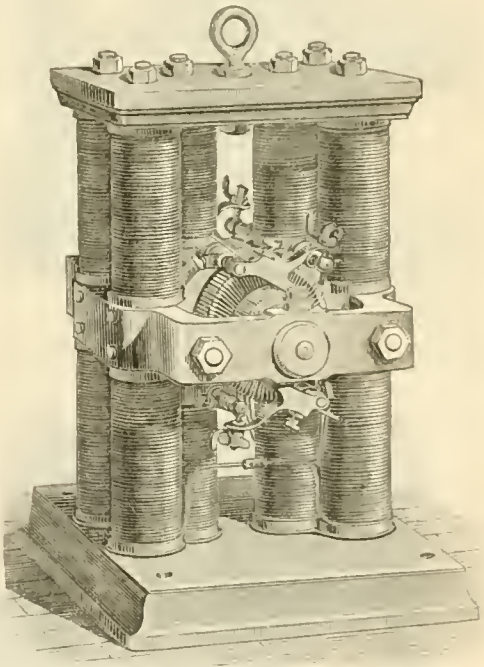


Bobbin of Gramme Machine.

Exposition of 1873 (Fig. 15) involved the principle which Ladd had devised—*i. e.* that of two separate rings or bobbins, one to magnetize the field, the other for external work. The largest of these machines had twelve electro-magnets—six above and six below—arranged in sets of three. It had also two separate rings or bobbins, as above mentioned. It weighed 700 kilogrammes, was 90 centimètres high by 65 centimètres square, had 180 kilogrammes of copper wire on the magnets and 40 kilogrammes on the bobbins, and gave from 3500 to 7000 candlelights, according to the speed. It consumed six horse-powers.

In 1874, Gramme communicated a paper to the French Academy in which he described several important improvements in his machines. In the smaller or magneto-electric machines he substituted Jamin's laminated magnet, formed of a large number of thin plates, for the thick-plate compound magnets before used, and otherwise improved their construction. (Fig. 16.) In the larger or dynamo-electric machines the bobbin for generating the current to charge the magnets was suppressed, and the electro-magnets were included in the main circuit of the machine; Gramme believing, and justly, apparently, that when the magnetic equilibrium was once obtained, its maintenance would not require the expenditure of work. According to the purpose for which the machine is to be used the number of coils on the bobbin is small or large (of course never falling below the minimum number determined as above), and the wire with which they are wound is coarse or fine. As in all rheomotors, so here: the maximum current strength is obtained when the external and internal resistances are equal, when the resistance of the machine itself is equal to that of the circuit outside of it. Hence it follows that for low external resistance the number of coils on the bobbin must be a minimum, and these, as well as the field of force-coils, must be wound with very coarse wire. Where the external

Fig. 15.

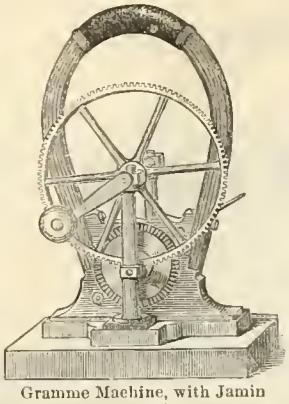


Gramme Machine for Light (early form).

resistance is high the number of coils must be increased (to increase the electro-motive force), and the wire used on them and on the field of force must be proportionally fine. In the plating-machines of Gramme, for example (Fig. 17), the magnet is wound with broad strips of sheet copper, as wide as the core of the magnet is long, and the bobbin consists of twenty coils wound with narrow flat copper strips. In the lighting-machines, the resistance of the electric arc being considerable, the electro-motive force is increased by increasing three or four fold the number of coils on the bobbin, and the internal resistance is increased by winding both the bobbin and the field of force with wire. An excellent machine of the newer construction, imported by the writer in Feb., 1875, for the University of Pennsylvania, and which continues still to be the largest light-machine on Gramme's principle in the country, is represented in Fig. 18. It is 55 centimètres square at the base and 60

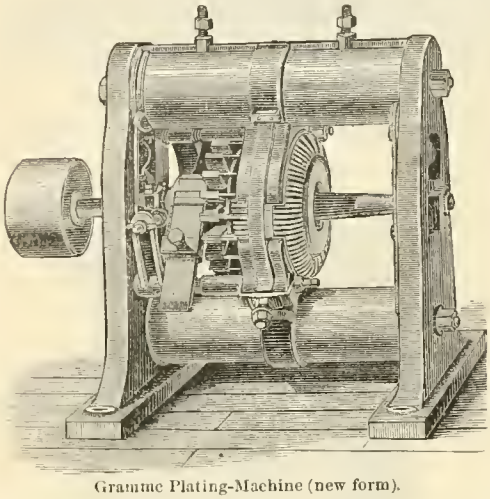
centimètres high. It weighs in all 183 kilogrammes, has 47 kilogrammes of copper wire on the magnets, and 4.7 kilogrammes on the ring. The peculiarity of the instrument lies in the construction of the bobbin. Upon the ring of iron wires ordinarily used two distinct sets of coils are wound, the entire number on the ring being 80. The loops of wire between these coils come out alternately upon the right and the left side of the ring, and are attached to two separate break-pieces on the axis, one on either side of the bobbin. The total resistance of the machine at rest is 1.57 ohms, that of the field of force being 1 ohm, and that of the bobbin 0.57 ohm. The electro-motive force developed at a speed of 600 rotations is about 50 volts. From the above description it will be seen that this machine is really two machines in one; it is therefore capable of various modifications. If the field of force be connected with two alternate brushes, and the external circuit with the other two, the current from both coils traverses the entire circuit, external and internal, and the maximum electro-motive force is developed, producing an electric light of from 1400 to 2000 candles, according to the speed. If one-half the field of force be connected with one set of coils, and the other half with the other, both being independent, two separate currents are generated, and two electric lights can be simultaneously produced. If the entire field of force be connected with one set of coils, the other set furnishes a strong continuous current, admirably adapted for working an induction coil or for telegraphy. If the two sets of coils be connected in parallel circuit—technically, in multiple arc—with the field of force and the external circuit, the electro-motive force lessens, but so also does the resistance, and to a greater degree; so that when the external resistance is small a considerably stronger current is obtained. Finally, if the bobbin-coils be connected together in the way just stated, a portion of the current may be sent through the field of force and a portion be diverted to external use. By means of these various combinations a double machine of the sort mentioned may be made to produce five quite different results. Since there are no rapid magnetizations and demagnetizations in the armature, the machine does not develop appreciable heat in the bobbin. Moreover, the sparks at the break-pieces are insignificant.

Fig. 16.



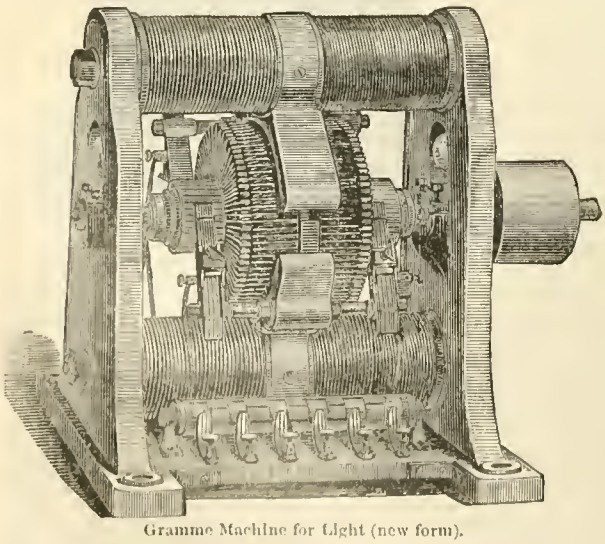
Gramme Machine, with Jamin magnet.

Fig. 17.



Gramme Plating-Machine (new form).

Fig. 18.



Gramme Machine for Light (new form).

The question of the absolute efficiency of the Gramme machines has been pretty thoroughly investigated. Tresca has made a series of experiments with the machines for light, in which he used two machines of different sizes. The larger machine had eight electro-magnets, each wound with 24 kilogrammes of wire 3.3 millimètres in diameter. The bobbin was double, and was wound with 140 kilogrammes of wire 2.6 millimètres thick. The smaller machine had four magnets, each wound with 14.32 kilogrammes of copper wire 3.8 millimètres thick, and a single bobbin having on it 4.65 kilogrammes of wire 2 millimètres in diameter. The large machine gave a light of 1850 Carcel burners, of seven candles each, and consumed 7.68 horse-powers; the small machine gave a light of 302.4 burners, and consumed 2.81 horse-powers. The former machine, therefore, required an expenditure of 0.31 kilogrammètre per burner per second, the latter of 0.69 kilogrammètre, showing a large economy in favor of the larger machines. To produce the amount of light given by the larger machine by means of coal-gas would cost 50 times, and by means of oil 100 times, as much. Hagenbach, using a still smaller machine, and measuring not only the light produced and the power consumed, but also the current-strength developed, obtained the following results:

Number of rotations per minute.	Luminous intensity in standard candles.	Current strength in c. c. of gas per minute.	Electro-motive force in Deleuil cells.
1700	506	119	40.8
1800	567	126	43.2
1900	628	133	45.6
2000	689	140	48.0

The Deleuil cell here used as a unit is a Bunsen cell equivalent to 1.6 Daniell cells. Moreover, he found that to give 1800 revolutions per minute, and therefore to produce 567 candlelights, equivalent to 80 Carcel burners, a force of 90 kilogrammètres (1.2 horse-powers) was required, or 1.1 kilogrammètres per Carcel burner—a result agreeing well with those of Tresca when the size of the machine is taken into the account. The power used in these experiments was water-power, the cost of the light being only 3 francs 40 centimes per hour. To give the same amount of light with Deleuil cells which the machine gave with 1700 rotations would require 72 cells; with 2000 rotations, 86 cells.

The plating-machines in their most recent form have a weight of 117.5 kilogrammes, are 60 centimètres high and 55 centimètres wide, and have upon them 47 kilogrammes of copper wire. Driven with a force of 50 kilogrammètres per second—two-thirds of a horse-power—they have deposited 600 grammes of silver per hour.

The exhibit of the Gramme Magneto-electric Machine Co. of Paris at the International Exposition at Philadelphia in 1876 consisted of five large machines for light, ranging in power from 500 to 20,000 candles, one large low-resistance machine for electro-plating, and two smaller hand machines, constructed with the Jamin laminated magnet. One of the large light-machines was put in operation almost daily, the Serrin regulator being used with it.

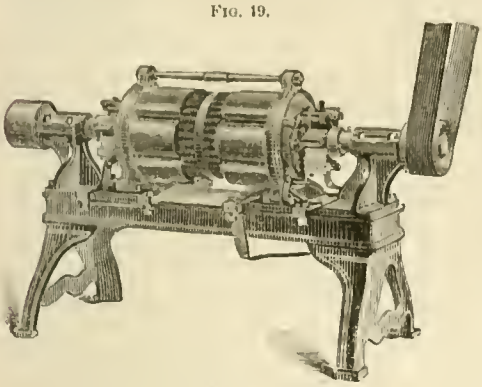
In 1873, Siemens and Halske exhibited at the Vienna Exposition a powerful dynamo-electric machine for light, in which the iron armature was at rest, the coil being supported upon a frame of brass, and revolving in the annular space between the armature and the magnets.

In April, 1873, Wilde proposed a new form of dynamo-electric machine, in which he sought to obviate the inconveniences arising from the high speed at which the Sie-

mens armature requires to be driven. The field of force consists of two sets of cylindrical electro-magnets, 16 in each set, their axes being horizontal and their poles facing each other, firmly bolted to a circular framing placed vertically. In the cylindrical space enclosed by these magnets runs, on suitable bearings, a horizontal shaft carrying an iron disk at its centre, near the periphery of which, and opposite to the poles of the electro magnets, are 16 iron cores with their axes perpendicular to the disk, and extending through it about two inches on each side. These cores are wound with wire, and constitute the bobbin. When driven at 1000 revolutions per minute the machine consumes about ten indicated horse-powers, and produces a current which fuses 12 feet of No. 15 B. W. G. iron wire (.075 inch diam.), and gives a light of 9600 candle-powers, thus yielding twice the power with one-quarter the weight of materials of the earlier Wilde machine. Though the machine did not produce serious heating of the armature, yet the commutator difficulties were not altogether overcome in it.

In April, 1875, a patent was taken out in the U. S. by Farmer, then of Newport, for a machine essentially similar in mechanical construction to that of Wilde, just described. The form of the plating-machine is shown in Fig. 19. It

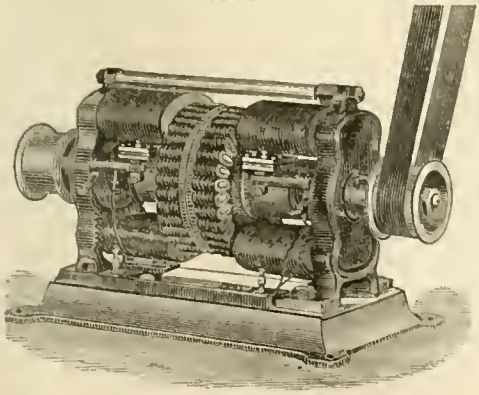
Fig. 19.



Farmer-Wallace Plating-Machine.

had two sets of electro-magnets of 6 each, facing inward for the field of force, and 17 coils on each face of the disk for the bobbin. The machine was 61 inches long, 12 wide, and 16 high, and stood on a table 2 feet from the ground. These machines have undergone considerable modifications and improvements in the hands of the manufacturers, Wallace & Sons of Ansonia, Conn., and have come into very general use, especially for electro-deposition of metals. In the newer forms of the Wallace machine eight of the field-of-force coils are dispensed with, and the machine is made duplex by placing a break-piece upon each side of the bobbin. One of these machines, 39 inches long, 14 inches wide, and 19½ inches high, at 425 revolutions per minute has deposited 64 ounces of copper per hour, working day and night with but little attention. A huge machine of this description has recently been completed (Nov., 1876) which is 60 inches long, 48 inches high, and 33 inches wide, weighs nearly three tons, and at a speed of only 230 rotations per minute, gained with the expenditure of ten horse-powers, it deposits 15 pounds of copper per hour, and

Fig. 20.



Farmer-Wallace Machine for Light.

heats to incandescence 17 feet 3 inches of copper wire, 0.226 inch in diameter, and 2¼ feet of ¾-inch iron gas-pipe; and this for months together without producing any heat in the bobbin or coils, and without giving sparks at the break-piece. The magnetic field of this machine is so intense that a 5-inch iron spike held 7 feet distant is so strongly magnetized as to sustain an ordinary tenpenny nail.

The machines for lighting have also been similarly modified. In place of 12 magnets in the field of force, only 4 are used, though these are somewhat larger than formerly. Fig. 20 represents one of the four machines employed in lighting the grounds of the Philadelphia Exhibition of 1876. It had 25 armature coils on each side, wound with wire 0.045 inch in diameter, the wire on the field-of force coils being 0.188 inch in diameter, and the total resistance of the machine being 4.62 ohms. The total weight of this machine is about 1500 pounds (680 kilogrammes), and with a speed of 800 revolutions it consumes five horse-powers and gives a light of 5000 candles. The sparks at the break-piece were not serious, and the heating was inconsiderable. Wallace has also built a machine for light in which the armature has 200 coils, and which with 800 rotations gave a light of 15,000 candles, being 85 candles per pound of copper wire used in its construction.

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Malthe'idæ [from the genus *Malthæa* and the suffix *-idæ*], a family of fishes of the order Pediculati, distinguished by the large depressed, heart-shaped (pointed forward) or orbicular anterior part and slender subcylindrical but tapering posterior part of the body, which is naked or covered with scattered spinous disks or tubercles; no lateral line is developed; the head is covered by the integument in common with the shoulder-girdle, and this combination forms the anterior disk, which is abruptly distinguished from the small posterior region; the mouth is inferior, and the cleft mostly transverse; the teeth are villiform, and at least on both jaws; the branchial apertures are small dorsal slits, and in the upper axillæ of the pectoral limbs; there are five branchiostegal rays; the dorsal fins are peculiarly developed—(1) the first being represented by a tentacle on or under the snout, and (2) the second is a small but true fin (with four rays) on the slender body; the anal is like the dorsal; the pectorals are

at the end of the long arms, which appear to have elbows, and are flexed outward and to some extent forward; the ventrals are small, but perfect (with a spine and five rays), and far forward on the throat; the skeleton is fibro-cartilaginous, and has seven or eight abdominal and ten or eleven caudal vertebræ; no air-bladder or pyloric appendages are developed. The very singular and grotesque fishes belonging to this family are found chiefly in warm waters. Only three genera are known, which represent, however, two very distinct types of structure or sub-families—viz. (1) Maltheinæ, with the genus *Malthe*, whose several species inhabit the Atlantic coast waters and the Gulf of Mexico; and (2) Halieutæinæ, with the Japanese and Chinese genus *Halieutæa* and the rare Caribbean genus *Halieutichthys*. They are able to progress on the ground by clumsy leaps by means of the arms, which are *far behind* the ventrals or representatives of the hind legs of land vertebrates. The *Malthe*, or bat-fish, is sometimes caught from the wharves of New York, and the *Halieutæa* often comes in boxes of Chinese insects and other "curiosities."

THEODORE GILL.

Manumis'sio, in Roman law, the form by which slaves were made free, took place in three different ways—namely, by *vindicta*, a word signifying the liberating rod or staff, by *census*, and by *testamentum*. In the first case the master brought his slave before the magistratus and stated the grounds of the intended manumission. After certain ceremonies the master pronounced the words, "*Hunc hominem liberum volo*," turned the slave around, and let him go, *emisit e manu*. Manumissio by census took place by the slave enrolling his name as a citizen of the *census lustralis* with the consent of his master.

Manid'idæ [from *Manis*, the typical genus, and the suffix *-idæ*], a family of mammals of the order Bruta or Edentata and the sub-order Squamata. These animals are at once distinguished from all other mammals by the peculiar modification of the integumentary appendages, which are developed as large leaf-like scales arranged in regular rows and simulating the appearance of a pineapple or pine-nut: the body is elongated, with a long flattened tail, and the scales extend on the tail as well as the head, and sometimes the feet; so much do they mimic lizards that the older authors confounded them with the latter under the name *Lacertus*; the feet are normal in form, and the digits are developed in full number—*i. e.* five to each foot—but the external are much shortened: the animals, however, are club-footed, and walk on the *outer side* of the feet. The skull is quite peculiar, depressed conic in outline, with small intermaxillaries; maxillaries short, and with the malar processes declivous; the palatines expanded in front; no malars or lachrymals; a large lachrymal opening; and the zygoma deep, thin, and "pushed downward to the anterior and inferior angle of the squamous portion" (*Turner*); teeth are entirely wanting. The family has about eight species, which differ among themselves in the size, form, and extension of the scales, the length of the tail, the size of the digits, etc. They have been by some combined in a single genus, and by Gray divided among five—viz. (1) *Manis*, (2) *Phatagin*, (3) *Pholidotus*, (4) *Pangolin*, and (5) *Smutsia*; the representatives of the first and second (genus *Manis*), as well as fifth groups (genus *Smutsia*), inhabit Africa, and those of the third and fourth (genus *Pholidotus*), India. They feed upon termites, ants, and other insects.

THEODORE GILL.

Mardi Gras. See NEW ORLEANS, in CYCLOPÆDIA.

Marseilles', p.-v., La Salle co., Ill., 77 miles S. W. of Chicago, on the N. bank of Illinois River, and upon Chicago Rock Island and Pacific R. R., has a fine water-power, 5 churches, 2 graded schools, a national bank, 1 weekly newspaper, 4 grain-elevators, 3 paper and 2 grist mills, and 2 agricultural, plough, and other factories. P. 758; in 1877, 2000.

J. H. GOODELL, ED. "HISTORY MARSEILLES."

Mar'shall (WILLIAM R.), b. in Boone co., Mo., Oct. 17, 1825; was educated at Quincy, Ill.; went to Minnesota (then Wisconsin Territory) in 1847; was a member of the first legislature of Minnesota in 1849; founded the St. Paul *Daily Press* in 1861, together with J. A. Wheelock; entered the army in 1862 as lieutenant-colonel of 7th Minnesota Vols.; commanded a brigade in the battles of Nashville (Dec. 15 and 16, 1864); was elected governor of Minnesota in 1865, and re-elected in 1867.

Mastacembel'idæ [from *Mastacembelus*, the typical genus, and the suffix *-idæ*], a family of fishes of the order Opisthomi. The body is eel-like (but comparatively much less elongated than in the eels), the tail being stout and tapering gradually; it is covered with very small cycloid scales; the lateral line is distinct; the head is elongate-conic and declivous, and the snout produced into a flexible appendage; the mouth is inferior, the cleft narrow, and the jaws little movable; the teeth are minute and pointed; the branchial apertures limited to the inferior portion of the head; branchiostegal rays six; the rayed portions of dorsal and anal fins are equal, and limited to the posterior half or third of the body; there are also numerous free dorsal spines and three anal ones; the caudal is either separately developed (in *Rhynchobdella*) or united, as in the eel, with the dorsal and anal (in *Mastacembelus*): the pectoral fins are normally developed; ventrals wanting. The vertebræ are in large number (in *Rhynchobdella* 32 + 40); there are two pyloric cæca. The family has two genera, *Mastacembelus* and *Rhynchobdella*, confined to Asia and West Africa, and best represented in the fresh waters of the East Indies. Under the name of "eels" they are esteemed by the English residents of India.

THEODORE GILL.

Mastieu'ra [from Gr. μάστιξ, "whip," and οὐρά, "tail"], a sub-order of Raiæ, distinguished by the attenuated caudal region or quasi whip-like tail, and the absence of a rayed terminal fin, thus contrasting strongly with all other fishes, in which that region is more or less fleshy and forms a considerable portion of the body. All the systems (osseous, muscular, etc.) are atrophied in this region in the Mastieura. The sub-order is represented by three families—viz. Trygonidæ, "sting-rays;" Cephalopteridæ, comprising the "devil-fish" of our southern coast; and Myliobatidæ, or eagle and cow-nose rays. (See also PACHYURA and RAIÆ, in CYCLOPÆDIA.)

THEODORE GILL.

Matile' (GEORGE AUGUSTE), b. at La Chaux-de-Fonds, canton of Neufchâtel, Switzerland, May 30, 1807; was educated in the colleges of Neufchâtel and Berne; studied law in Berlin, Heidelberg, and Paris, and was admitted to the bar in Neufchâtel in 1830. He served several terms in the legislature of his canton, and was appointed professor of law at the University of Neufchâtel in 1838, and one of the judges of the supreme court; emigrated in 1849 to the U. S.; was naturalized as an American citizen in 1856, and appointed professor of history at Princeton, N. J., in the same year, and professor of French literature at the University of Pennsylvania in 1858. From 1863 to 1876 he held various positions in the state department in Washington. The principal of his works are *Points de Coutume* (1838), *Autorité du Droit romain de la Coutume de Bourgogne et de la Caroline dans la Principauté de Neufchâtel* (1838), *Musée historique de Neufchâtel* (3 vols., 1841–59), *Monuments de l'Histoire de Neufchâtel* (2 vols. fol., 1844–48), *Histoire de la Seigneurie de Valangin* (1852), *La Loi Gombette* (4to), *Collégiale de Neufchâtel* (fol.), *Political Economy* (translated from List), etc.

A. GUYOT.

Meek (FIELDING BRADFORD), M. N. A. S., b. at Madison, Ia., Dec. 10, 1817; educated in the city school of that place, and became at an early age interested in the study of the Silurian fossils, which are very abundant there. At majority, by advice of friends, but against natural inclinations, he engaged in commercial pursuits, continuing, however, his scientific studies. In 1848 and 1849 he was employed as an assistant in the U. S. geological survey of the upper Mississippi country, under D. D. Owen. From about 1852 to 1858 he worked as an assistant of Prof. Hall at Albany on the palæontology of New York, but meanwhile engaged two summers with the State geological survey of Missouri. In 1853, assisted by Dr. F. V. Hayden, he brought a valuable collection of vertebrate and other fossils from the *Mauvaises Terres* or "Bad Lands" of Dakota for Prof. Hall. In 1858 he took up his residence at Washington, D. C., and devoted most of the time while living there to investigating and reporting on organic remains brought in by government exploring expeditions. His labors have been largely published jointly with others; his minor papers on palæontology and geology were successively given in *Trans. Albany Inst.*, *Am. Jour. Sci. and Arts*, *Proceed. Acad. Nat. Sci.* (Philadelphia, 1856–74), *Smithsonian Contr. to Knowledge*, *Proceed. and Trans. Chicago Acad. Sci.*, *Proceed. Am. Philos. Soc.*, etc.; his most important are in *Paleont. California* (vol. i., 1864), *Reports Ill. State Geol. Survey* (vols. ii., 1866, iii., 1868, and v., 1873), *Paleont. State Geol. Survey of Ohio* (vols. i., 1873, and ii., 1875); and, last and above all, *A Report on the Invertebrate Cretaceous and Tertiary Fossils of the Upper Missouri Country* (Washington, 1876, liv. 629 pp., 45 pl.). On the completion of this last great work he rested from his labors, and was on the eve of starting for Florida to spend the winter there, when he was attacked by a hæmorrhage of the lungs, and shortly afterward died on Dec. 28, 1876, at the Smithsonian Institution.

THEODORE GILL.

Megalosau'ridæ [from the generic name, *Megalosaurus*], a family of the extinct order of dinosaurian reptiles, established by Huxley in 1869 for those gigantic reptiles of the Triassic epoch characterized by the want of dermal armor or scales; the deep and thick mandibular rami which meet by rounded ends in the symphysis; the

sharp-pointed maxillary teeth, whose crowns have severally a longitudinal serrated ridge, either on the middle of the posterior face only or on the middle of its anterior face as well, its serratures being directed at right angles to the long axis of the tooth; the teeth not worn by mastication; the ilium with its anterior prolongation about as large as the posterior; the femur with its proximal end flattened, curved, and twisted in such a manner that its plane is oblique to that of a flat surface on which the condyles rest. By Huxley the genera *Teratosaurus*, *Palæosaurus*, *Poikilopleuron*, *Iguanodon*, and provisionally *Euskelosaurus*, are referred to the family. (See also MEGALOSAURUS, in CYCLOPÆDIA.) THEODORE GILL.

Melani'idæ [from *Melania*—μέλας, "black"—the typical genus], a family, or rather a group of families, of gasteropod mollusks of the order Diœcia, characterized, in common with the Cerithiidæ, Vermetidæ, etc., by the absence of a distinct copulatory organ (penis or verge), and comprising an immense number of fresh-water shells found in all parts of the globe. These have been united together with the following common characters by the Adams Brothers: Lingual membrane long and linear; teeth in seven series (3.1.3), the lateral teeth uncinate, multicuspid. Rostrum broad, annulated. Tentacles subulate, with the eyes on bulgings at their outer sides. Mantle margin produced into a rudimentary siphonal fold in front. Gill simple and pectiniform. Foot broad and short, angulated in front. Operculum horny, ovate, subspiral. Shell spiral, turreted, covered with a thick, dark-colored epidermis; aperture often channelled or emarginate in front; outer lip simple. These characters, however, are not strictly applicable to all, or diagnostic; the group, indeed, is rather a heterogeneous one, which has been differentiated into several groups equivalent to families by Troschel, and named (1) Ancyloti, (2) Thiaræ, (3) Melaniæ, and (4) Pachychili, and have been chiefly distinguished by differences in the lingual dentition.

I. The Ancyloti of Troschel (Ceraphasiidæ) are oviparous animals, with a plain or unfringed mantle, and with the snout projecting beyond the foot; they have the median or rhachidian tooth broader than high, round behind, and swollen out before; the laterals have a rhombic form, with the outer posterior angle somewhat drawn out; the uncini are narrow, but dilated at their apices and multidentate, the outer having more numerous teeth than the inner; the shell has generally a more or less canaliculated aperture; the operculum is paucispiral. This group includes all the species that have been confounded under the name Melania, distributed so abundantly in the streams of the U. S. Nearly 500 species have been admitted by Mr. Tryon in a recent monograph of the family, but this number will undoubtedly have to be reduced. The species have been arranged under nine genera by Tryon—viz. *Pleurocera*, *Angitrema*, *Lithasia*, *Strephobasis*, *Eurycodon*, *Goniobasis*, *Schizostoma*, *Menetchizu*, and *Anculosa*. These, however, are not natural sections. *Anculosa prærosa*, *Mudalia dissimilis*, *Schizostoma ovoidea*, *Goniobasis depygis*, and *Io fluvialis* seem to be the most differentiated (but not the only) types, around which the various species of our waters can respectively be grouped.

II.–III. The Thiaræ and Melaniæ of Troschel (Melaniidæ proper) are viviparous animals, with a fringed border to the mantle, and with the snout also projecting beyond the foot. They have the median tooth broader than high, and angulated behind; the laterals are long and cleaver-like, or sigmoidal, with the bases extended far sidewise; the uncini are elongated, triangular, and crenulate or dentate. To this group belong most of the species of the rivers of the Old World, and which are especially abundant in Southern Asia.

IV. The Pachychili of Troschel (at least embracing the Melanopidæ) are animals with a plain margined mantle, and with the foot in progression normally projecting beyond the snout; the median teeth of the radula are in general quadrangular, and broader than high, and with rounded angles; toward the base in the middle are four characteristic lines of insertions, etc., more or less concave toward the base of the tooth; the lateral teeth are rhombic; the uncini moderately developed in length and width. The group as distinguished by Troschel includes the tropical and sub-tropical American genus *Pachychilus* and the Old World genera *Melanopsis*, *Vibex*, etc. THEODORE GILL.

Michel' (Sir Jons), b. in 1804; entered the British army as ensign 1823; served in the Kaffir wars of 1846–47 and 1852–53, and nominated a C. B. in the latter year for his distinguished services; for service with the Turkish contingent was nominated to the second class of the Medjidie, and for the Indian campaign of 1858–59, when he defeated the rebels at Beorora, pursuing and dispersing them and capturing twenty-seven guns, he was created a K. C. B. In the China campaign of 1860 he commanded a division. He became a colonel in 1854, major-general in 1858, lieutenant general 1866, general 1874; colonel of the 86th Foot since 1862. In 1875 he was appointed to the command of Her Majesty's forces in Ireland.

Miles (JAMES BROWNING), D. D., b. in Rutland, Mass., in 1823; graduated at Yale College 1849; studied theology at Andover and New Haven; tutor in Yale College two years; ordained and installed pastor of the First Congregational church in Charlestown, Mass., in 1855; chaplain of the senate of Massachusetts 1866–67; in 1872 resigned his pastorate to take the office of secretary of the American Peace Society. In this position he became identified with the Association for the Reform and Codification of the Laws of Nations, and was made its general secretary. D. in Worcester, Mass., Nov. 13, 1875.

Mil'ler (JOAQUIN), b. in Cincinnati, O., in 1841; in 1851 ran away from home and went to the California mining regions; was taken prisoner by the Modoc Indians, and lived with them five years, learning their language and fighting their wars with them; left them in 1858, and went to San Francisco; in 1860, after studying law a short time, was admitted to the bar in Oregon; in 1862 edited a newspaper for a short time; in 1866 was elected district judge of Oregon, and served in that position four years. His poetical works are—*Pacific Poems* (1873), *Songs of the Sierras* (1873), *Songs of the Sun Lands* (1873), *Ship in the Desert* (1875), *Adrianne, a Dream of Italy* (1876); his prose works are—*Unwritten History* (1874), *First Families of the Sierras*, a novel (1875), *One Fair Woman*, a novel (1876). J. B. BISHOP.

Mi'nor (VIRGINIA L.), better known as Mrs. FRANCIS MINOR, b. in Virginia; resides in St. Louis. She started the woman suffrage movement in Missouri 1866; organized the Woman Suffrage Association in 1867; presided over the convention of woman suffragists in St. Louis, 1869; and brought in 1872 the proper suit for woman suffrage which finally reached the Supreme Court of the U. S., and was decided adversely. SUSAN B. ANTHONY.

Mitsukuri Rinsho, b. in Tokio, Japan, about the year 1844; was of the Samuari class; when only fifteen years of age had acquired considerable reputation as a scholar, and was not long in acquiring a knowledge of the Japanese, Chinese, Dutch, French, and English languages, and before ever leaving his native land was considered a better English scholar than any of his fellow-countrymen who had studied abroad. Just before the abdication of the late tycoon he visited Europe, and with the Japanese minister was present at the French Exposition. Both before and after that date he had translated many foreign books into Japanese, among which was the *Code Napoléon*. By the mikado's government he was appointed a professor in the European college of Tokio; was also secretary to the council of state; and of late years has been a tutor of foreign languages in the imperial household. He belongs to what is called the fourth rank in the judicial department; and it is a remarkable fact that his father, an uncle, and a brother are all distinguished for their scholarly attainments. F. A. P. BARNARD.

Mnioltiltidæ. See WANDLENS.

Mon'ument, the general term for any architectural structure, from a complete building to a simple heap of stones, erected or arranged in commemoration of some person or event, will be found treated under the headings ARCH, ARCH TRIUMPHAL, COLUMN, CROMLECH, MAUSOLEUM, OBELISK, PYRAMIDS, in CYCLOPÆDIA.

Morell (GEORGE W.), b. at Cooperstown, N. Y., Jan. 8, 1815; graduated at the U. S. Military Academy 1835; resigned 1837; studied law, and began practising in New York in 1842; served with the New York State militia in the civil war, and became major-general in 1862.

Mor'row (THOMAS VAUGHN), M. D., b. in 1804 in Kentucky; founded a reformed medical school at Worthington, O., under the auspices of Bishop Chase, and on the close of that institution in 1845 he established the American Eclectic School of Medicine at Cincinnati, O., which became the nucleus of the American Eclectic system of medical reform. D. July 16, 1850. ROBERT S. NEWTON.

Mor'tars, short cannon for throwing shells, usually fired at angles from 35° to 45° elevation, called "vertical fire," in contradistinction to the fire of long cannon, usually made at low angles. *Mortars*—so called from their similarity of form to the mortar for pulverizing, which has retained its familiar shape from the earliest ages—are believed to have been the first guns used, and, though changed from age to age frequently in form of chamber, size, and projectile, all ages have found them too useful in their special way to suppress or to essentially alter them. The "Cochorn" mortar—so called from the famous Dutch engineer, Gen. Cochorn, who first proposed them in 1671—is

to-day in use, of the same pattern and for the like service then suggested. Monster mortars have been constructed from time to time, in the hope of producing immense destruction in bombardments with single shells containing a large quantity of powder. (See BOMBARDMENT, in CYCLOPÆDIA.) The most recent of these, the monster mortar made by Mallet for the British government, weighing 114,000 pounds, with a bore of 36 inches and a shell of 2912 pounds, failed to be of any service: 13-inch sea-coast mortars and 8-inch and 10-inch siege mortars are the calibres now in use in our own and some other services. Mortars to the present time have been made with smooth bores to fire spherical projectiles, but it has been proposed, here and elsewhere, of late years, to rifle the bore and to fire elongated projectiles. P. V. HAGNER.

Mott (LYDIA), b. at Manhasset, Long Island, in 1807, of Quaker parentage; moved to Albany, N. Y., in 1823; taught school for a few years; opened, with her two sisters, a furnishing store for gentlemen's clothing, and kept a boarding-house during the sessions of the legislature. Being an abolitionist and an advocate of temperance and woman suffrage, she planned and secured many hearings before the legislature for woman's civil and political rights. D. Aug. 20, 1875. SUSAN B. ANTHONY.

Mun'dy (Sir RODNEY), b. 1800; entered the British navy in 1818, and served in the various grades of his profession in every quarter of the globe; was promoted to flag rank in 1857, and as second in command in the Mediterranean was stationed with his division in Italian waters during the revolution of 1860, and off the coast of Syria in 1861 after the Lebanon massacres; was appointed vice-admiral in 1863, and in Jan., 1867, commander-in-chief in North America and the West Indies, which command he held until 1869, when promoted to be admiral, and in 1872 became commander-in-chief at Portsmouth. He was created a C. B. at the close of the Russian war, and K. C. B. in 1862. In May, 1875, he was placed on the retired list.

Mur'phy (JOHN MCLEON), b. at Northcastle, Westchester co., N. Y., Feb. 14, 1827; entered the U. S. navy as midshipman in 1841; served in the war with Mexico; as hydrographic assistant on Maj. (now Gen.) Barnard's survey of the Isthmus of Tehuantepec 1851; resigned from the navy 1852; was on mission to Mexico 1853; city surveyor of New York 1855; constructing engineer New York navy-yard 1856–57; member of State senate of New York 1860–61; colonel 15th New York (Engineers) Vols. 1861–63, and in the campaigns of the Army of the Potomac; acting lieutenant U. S. navy 1863, and in command of the Carondelet during Vicksburg campaign. Resigned Aug., 1864, resumed his profession of civil engineering, and contributed frequently to the press of New York and various periodicals. D. at New York June 1, 1871.

Murphy (WILLIAM MITCHELL), b. in Granville co., N. C., in 1806; was educated in the schools of Tuscaloosa and at the University of Virginia; read law at Tuscaloosa; commenced practice at Erie, Greene co., Ala., about 1828; represented his county in the legislature 1840; was defeated as a Whig candidate for Congress 1847; served in the State senate 1849–51, and removed in 1852 to Austin, Tex., but soon returned and settled at Selma, where he d. in 1855.

Mur'ray (DAVID), PH. D., LL.D., Oct. 15, 1829, at Delhi, N. Y.; graduated at Union College in 1852; was successively a professor and principal of the Albany Academy from 1853 to 1863, and from 1863 to 1873 professor of mathematics and physics in Rutgers College. In 1873 he entered the service of the Japanese government as foreign adviser to the department of education, which position he now (1877) holds under a renewed engagement. He is the author of a *Manual of Land Surveying* (New York, 1872), a contributor to Mori's *Education in Japan* (New York, 1872), and the editor of an *Outline History of Japanese Education* (New York, 1876), prepared for the Philadelphia Exhibition, to which he contributed the introductory chapter.

Mütter (THOMAS DENT), M. D., b. in Richmond, Va., Apr., 1811; graduated at Hampden-Sidney College; studied medicine under Dr. Semmes of Alexandria, Va.; became a pupil of Dr. Samuel Jackson of Philadelphia, and took his degree from the University of Pennsylvania in 1830. He then went to Paris, where he became an *interne* under Dupuytren. On his return home he settled in Philadelphia, and in 1841 was elected professor of surgery in the Jefferson Medical College. He wrote an account of the salt-sulphur springs of Virginia, an essay on club-foot, and issued an American edition of Liston's *Surgery*. His health failing, he resigned his professorship, and again visited Europe, but soon returned, worn out by gout, etc. D. in Charleston, S. C., Mar. 16, 1859. His pathological collection he bequeathed to found the Mütter Museum in the Philadelphia College, which he endowed with $30,000, and left $20,000 more to provide a ward for the incurable.

N.

Nematisti'idæ [from *Nematistius*—νῆμα, -ατος, "thread," and ἱστίον, "standard"—*i. e.* dorsal fin], a family of teleocephalous fishes, related to the mackerels and dolphins, with the body oblong and compressed, covered with cycloid scales; the lateral line simple and unarmed; the head compressed; the opercula unarmed; the nostrils double, in front of the eyes: the mouth with an oblique cleft: the jaws little protractile: the teeth villiform on the jaws as well as palate; branchiostegal apertures extensive; branchiostegal rays six: dorsal fins two, folding in a deep sheath, the first short (with eight filamentous spines), the second elongated; anal shorter than the second dorsal; caudal forked; pectorals with branched rays; ventrals thoracic, each with a long spine and six rays, the internal of which is wide and composed of several branches. The family thus distinguished is represented by a single species, *Nematistius pectoralis*, an inhabitant of the Pacific coast of Mexico. It is especially distinguished as the type of a family by the composition of the ventral, as well as structure of the other fins. THEODORE GILL.

Nematoi'dea [Gr. νῆμα, "thread," and εἶδος, "like"], an order of helminths whose species are also known under the name of "thread-worms," distinguished by their simple thread-like form. The body is not segmented, and usually tapers toward each end; the integument is non-ciliated and dense; under it are the muscles, which vary in several groups; the mouth is at one extremity, and the anus at or near the other: the alimentary canal is differentiated into a thick-walled pharynx, and the intestinal canal a simple tube, there being no differentiation into stomach and intestine, a narrow œsophagal portion connecting the pharynx and the canal; (in some entozoic forms the intestinal canal is entirely atrophied;) the nervous system is developed in the form of a ring of fibres and nerve-cells encircling the gullet, but no certain organs of sense have been detected; the sexes are generally differentiated in different individuals, but occasionally united in the same; in the females the genital aperture is near the centre of the body, but in the males at or near the posterior extremity; the spermatozoa are cell-like and amœboid in their movements. The order has been separated by Prof. Huxley into three primary groups, distinguished by their muscular system—viz. (1) Polymyarii, (2) Meromyarii, and (3) Holomyarii. In the first "the muscles of the parietes of the body are divided into many series, each made up of many muscle-cells." In the second "there are only eight longitudinal series of such muscle-cells, two between each lateral area and the dorsal and ventral lines." In the third "the muscles are not divided into series of muscle-cells." The representatives of the order are quite numerous; some of them live in a free state, and others, at least during a part of their life, in the interior of other animals. About a dozen species are the guests of man, the most injurious being the TRICHINA SPIRALIS (see in CYCLOPÆDIA). THEODORE GILL.

Nerit'idæ [from *Nerita*], a family of gasteropod mollusks of the order Rhipidoglossa, whose shells are generally readily distinguished by their form as well as by the shape of their apertures. The animal has its visceral part stout, and coiled almost in a plane upon itself; the mantle is little developed; the head ends in a broad and short muzzle; the tentacles are elongated and slender; the eyes situated at the extremities of rather long peduncles arising at the outer base of the tentacles; the teeth of the radula are in numerous rows, and in each transverse series are (1) a small central tooth varying in form according to the genera; (2) a transverse inner lateral tooth expanded obliquely outward; (3) two very small outer lateral teeth; (4) a wide plate with an adze-like apex; and (5) numerous approximated slender and elongated pectiniform teeth, incurved at their tips; the foot is oblong and quite broad. The shell is more or less thick, semiglobose, with a depressed spire and a semi-lunate aperture, the columellar lip being expanded, flattened, and nearly rectilinear; the interior is always more or less absorbed as the animal increases in age. The operculum has a process on its inner side arising near the nucleus and interlocking with the columella.

The family is rich in species, containing over 200 generally-recognized species. Most of these are found in the tropical seas, but many also in fresh or brackish waters. They are generally distributed among the genera *Nerita*, *Neritina* or *Neritella*, *Navicella* or *Catillus*, and these severally into a number of sub genera, several of which, however (*e. g. Dostia*, *Alima*, *Clithon*, etc.), are rather of generic rank. The family was early introduced into the ancient fauna, species apparently belonging to it being found in rocks of the Carboniferous epoch, and typical species occur in the Jurassic period—*e. g. Neritella Nebrascensis* in Nebraska. Several genera also have been especially established for extinct species supposed to belong to the family—*e. g. Velates*, *Neridomus*, *Deshayesia*, *Neritoma*, and *Pileolus*. THEODORE GILL.

Neritop'sidæ [from the generic name, *Neritopsis*], a family of gasteropods, chiefly represented by extinct species and of long disputed affinity, but which has very recently been shown to be related to the Neritidæ. The animal resembles the Nerita in form, the visceral sac being an incurved cone; the mantle moderate (with a fimbriated free edge); the head very broad and slightly emarginated in front; the tentacles tapering, and the eyes on short peduncles at the outer base of the tentacles; the lingual ribbon has numerous rows, but is especially distinguished from that of the Neritidæ by the want of (1) the median or rhachidian tooth, as well as of (2) the inner lateral; (3) the two outer laterals are larger than those generally developed in Neritidæ, and the inner margin is broad, with an expanded recurved apex; (4) the uncini are (as in the Neritidæ) very numerous and closely approximated, pectiniform and incurved at their extremities. The shell is ovate, like that of the Neritidæ, with a short spire and semicircular aperture, but the columellar lip is flattened and emarginated or broadly notched toward the middle. The operculum corresponds to the aperture, and is vertically semi-oval, but with its inner edge produced and describing the three sides of a hexagon. The family is represented by but a single known living species—the *Neritopsis radula*—but has more extinct representatives. For a long time the affinity of the type was in dispute, some (Grateloup and Desmoulins) having referred it near the Nerita, and others near the Natica, but most (Gray, Adams, Deshayes, etc.), with Vanicoro, to a peculiar family. It has, however (July, 1875), been shown by Fischer to be closely related to the Neritidæ, as by some suspected. In former geological epochs species flourished in seas which covered what now forms Europe, and the type is supposed to have existed as early as the Triassic epoch. THEODORE GILL.

Nesodon'tidæ [Gr. νῆσος, "island," and ὀδούς, "tooth," in allusion to the insular folds of enamel in the teeth], a family of mammals of the order Toxodontia, distinguished by the dentition. The teeth are 44 in number (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$); those of the opposite jaws are quite dissimilar; in the upper jaw the molars are for the most part (P. M. 3, 4, M. 1) oblong, moderately narrowed backward, with two folds (the anterior of which is divided) re-entering from the inner side; the incisors have simple fangs; those of the first pair are largest, compressed, and widely separated; the second molar and trihedral; the third lateral, behind the second, and rudimentary; in the lower jaw the molars are comparatively broad and complex; the canines moderate; the incisors implanted in a curved row. The family includes but a single known genus (*Nesodon*), which flourished in the later Tertiary epoch in South America. The species attained a moderate size, being at least larger than the ass. THEODORE GILL.

New'ton (ISAAC), b. in New York in 1838; educated at New York University, where he studied civil engineering; subsequently studied practical mechanical engineering; commissioned engineer U. S. navy in 1861, and at Mr. Ericsson's request assigned as chief engineer of the original Monitor, which position he held during her combat with the Merrimack, and commended for coolness, skill, and energy; shortly after was ordered on duty as superintendent of construction of iron-clads and principal assistant New York office, where drawings, specifications, etc., were prepared for iron-clads building on Atlantic seaboard; resigned from navy at close of war, and entered the employ of a large coal and iron company; was principal assistant engineer department of docks of New York 1871–72, and as such planned and built the 100-ton floating derrick and superintended the construction of the masonry pier near the Battery; member of board to examine the condition of the navy 1869.

Newton (ROBERT SAFFORD), b. in Gallia co., O., Dec. 12, 1818; was educated at the academy of Lewisburg, Va.; studied medicine under Dr. Navet, Gallipolis, O., and at the Medical University of Louisville, Ky., whence he graduated in 1841; commenced immediately to practise at Gallipolis; removed in 1843 to Cincinnati; joined the American Eclectic School of Medicine founded by Dr. Morrow; devoted much attention to the subject of cancer, and laid the results of his researches before the National Eclectic Medical Convention in 1848, and before the public in the *Eclectic Medical Journal* of 1849; was appointed professor of surgery at the Eclectic Medical College of Cincinnati in 1851; removed in 1863 to New York, where he established in 1866 the Eclectic Medical College and the Eclectic Medical Dispensary, and started, in connection with H. L. Stuart, the *American Eclectic Medical Review*. WILLIAM P. STRICKLAND.

Nich'ols (CLARINDA HOWARD), b. in Townshend, Windham co., Vt., Jan. 25, 1810; for ten years edited the *Windham County Democrat*, published by her husband at Brattleboro', Vt.; in 1847 began to speak on the laws of that State in regard to the property disabilities of married women, and was influential in securing the first bill that passed the Vermont legislature (1848) recognizing the civil existence of wives. In 1854, with her two eldest sons, she joined a company of 225 men, women, and children, emigrants from the East to Kansas. Helping her two sons to locate and prepare a home, she remained in Kansas one year, and then returned for her husband and younger children, and in company with another party of 250 emigrants went back to Kansas in 1855 and took claims in the vicinity of Baldwin City. She now resides with a son in Pomo, Cal., actively engaged in farm-life.

Nie'mann (AUGUST), b. in Hanover June 27, 1839; entered the Hanoverian army in 1857 as a lieutenant, and fought against Prussia in 1866; settled at Geneva as a teacher of history, geography, and languages after the annexation of Hanover to Prussia, but returned in 1868 to Germany as editor of the *Almanach de Gotha*; took part as a captain in the Franco-German war 1870–71, and published *Military Description of the French Campaign* (translated into English by Col. E. Newdigate, 1872), *Spezial Supplement zu Meyers Konversations-Lexikon* (1873), *Geschichte des 95 Infanterie-Regiments* (1871), *Militär Handlexikon* (1871); also several novels.

Nile, Sources of the. The sources of the Nile, considered among the ancients as the greatest geographical problem, and so long sought for in modern times, are no longer a mystery. Thanks to the daring of the latest explorers of equatorial Africa, Speke and Grant, Sir Samuel Baker, Stanley, Gordon, and others, we now know that they are found in a high plateau forming a part of the main axis of Africa, on its eastern border, and situated between the equator and the 5th degree S. lat. Here, at an elevation of 3800 feet above the sea, lies the great lake of Ukerewe, or Victoria Nyanza, with an area, as far as known, of about 27,000 sq. m., or little less than Lake Superior, and whose northern border is under the very equator. This vast basin receives the waters from all the surrounding heights. From the Unyamwesi plateau on the S., 4500 feet in altitude, flows the Shimiyu, the southernmost source of the Nile, discovered by Speke; the Kagera, explored by Stanley, the most abundant in water, descends from the high chains of mountains on the W., with peaks of 10,000 and 15,000 feet elevation; and from the plateaus on the E., where rise the snowy peaks of Kenia and Kilimanjaro, several other streams find their way into the same reservoir. From the middle part of the northern shore of the Victoria Nyanza these waters now issue as a rapid and powerful stream, the true Nile, flowing down toward the N. and N. W. into another great sheet of water, Lake Mwutan, or Albert Nyanza, of 2500 feet elevation, which it enters at its lower or northern end. Along this descent of 1300 feet it forms the cataracts of Ripon Falls, near Lake Victoria Nyanza, expands into Lake Kabeki or Ibrahim Pasha, and rushes through Murchison Falls into Lake Mwutan. From this last lake, which was circumnavigated in 1876 by Gessi, by order of Col. Gordon, for the Egyptian government, and was seen in the same year by Stanley, the Nile resumes its rapid course to Duffiee, 2300 feet in altitude. Soon after it leaves the regions of plateaus and enters the great plains of Central Soudan, where it receives from the W. the waters of a vast network of rivers, collected by the Bahr-el-Arab and the Bahr-el-Gazal, and those of the eastern plateaus through the Sobat. After the junction of these rivers it follows again a northern course between the table-lands of Kordofan and the plains of Sennaar to Khartum, where the Abyssinian or Blue Nile, the Bahr-el-Azrek, brings to it the united waters of the Abyssinian plateau and its snowy mountains.

The waters of the Nile, which cause that wonderful and so long mysterious inundation of Egypt, are gathered from three distinct regions—that of its head-waters in the plateaus of the great equatorial lakes, that of the great plains

of Central Soudan, and that of the plateaus and alpine regions of Abyssinia, all situated within the domain of periodic and abundant tropical rains. It is well known that below the Atbara, the last of the Abyssinian rivers, the Nile does not receive a single tributary for the last 1400 miles of its course. Well may the inhabitants of its rainless valley have wondered whence came those abundant waters which converted it temporarily into a flowing sea. A. Guyot.

Nov'el, in the English language, means any fictitious prose narrative which pretends to describe real life, past or present, while "romance" is generally applied only to narratives of a more or less fantastic character. In the other European languages the distinction between the two terms is another, "novel" meaning simply a small romance, a short, light tale of an every-day character, not much different from what we might call "news;" whence its name. Here, however, where we simply propose to give a supplement to the main article on the subject, and mention some of the most prominent novel-writers of continental Europe, we use, of course, the term in its special English signification.

The novel originated in Italy in the fourteenth century with *Il Novellino*, a collection of stories by unknown authors, and *Il Decamerone*, by Boccaccio. Its success was immense, and hundreds of writers cultivated with eagerness this new branch of literature during the following two or three centuries. Also in Spain, whither it was transplanted very early, the novel produced excellent fruit in the works of Cervantes, but it has subsequently almost died out in both countries, or at least sunk very low, Manzoni's *I Promessi Sposi* being nearly the only Italian novel which in the last hundred years has found its way across the Alps.

At present it is France which takes the lead in this field of literature. Not that the French novels are much imitated in other countries, but almost every kind of novel has reached its highest perfection in French literature. In the historical novel Alfred de Vigny, Prosper Merimée, and Victor Hugo may be called disciples of Walter Scott, but they are all superior to him in that one point in which every pupil ought to surpass his master: they are nearer to us; their conception of history conforms better to ours; they have utilized the advance which the study of history has made since the days of Walter Scott. They have a firmer grasp on the spirit of the age they describe: they are more true. In the psychological novel—that is, in the analysis of human characters and destinies, such as they develop from certain natural dispositions and under certain social circumstances—Balzac has no equal, and *La Comédie humaine* no counterpart. In the tendency novel, which purports to propagate certain social views or moral ideas, Rousseau, Madame de Staël, George Sand, Émile Souvestre are the first names, and have remained the greatest. Finally, besides producing a great multitude of writers—Jules Sandeau, Henri Murger, Ernest Feydeau, Octave Feuillet, Edmond About, Erckmann-Chatrian—whose drawings after life, correct, elegant, and spirited, fulfil in a satisfactory and often in a noble manner the general object for which art exists, France has at one time—Eugène Sue, Alexandre Dumas, Maquet, Frédéric Soulié—furnished the whole civilized world with that kind of material which through the imagination exercises the same influence on the mind as alcohol exercises on the body through the stomach.

In Germany the novel flourished abundantly during the great literary period of which Goethe was the founder and the centre. His own novels, *Wilhelm Meister* and *Die Wahlverwandtschaften*, are solutions of speculative problems. What is it to live? what is it to love? has the author asked himself, and his novels are his answers. The novels of Tieck, and many other remarkable productions from the same time—Jacobi's *Waldemar*, Schlegel's *Lucinde*, etc.—bear the same character of having originated from some moral, æsthetic, or metaphysical problem. But besides this, the truly German novel, many excellent novels were written which pretended to be nothing more than true conceptions of real life—Heinrich von Kleist, Töpffer—or the free creations of an impassioned imagination—Hoffman, Richter. After the middle of this century, however, the novel degenerated rapidly. Minor sketches of great sweetness, of exquisite humor, of fine sense of character, are still written—Auerbach, Klaus Groth, Fritz Reuter, Hackländer, Paul Heyse—but the novel on a great scale, attempting to give a comprehensive view—Gutzkow, Freytag—has become overstrained, hollow, and pretentious; and the historical novel, which once occupied a very respectable place—Willibald Alexis, Zschokke—has sunk with Mügge and Louise Mühlbach into mere trash.

From the Scandinavian countries several novels by Fredrika Bremer, H. C. Andersen, M. A. Goldschmidt, F. H. Ewald, Björnstjerne Björnson, and Magdalene Thoresen, have of late attracted considerable attention.

Clemens Petersen.

Noyes (Edward Follansbee), b. at Haverhill, Mass., Oct. 3, 1832; graduated at Dartmouth College in 1857, and removed to Cincinnati, graduating a year later from the law school there. The outbreak of war in 1861 found him successfully engaged in the practice of his profession, but abandoning law, he turned his office into a recruiting head-quarters, and in July, 1861, the 39th Ohio Infantry was organized with Noyes as its major; a year later he was promoted lieutenant-colonel, and Oct. 1, 1862, succeeded to the colonelcy of his regiment, which he led until July, 1864, when he was incapacitated from further active field-service by the loss of a leg. Upon his convalescence he was assigned to the command of Camp Dennison, which position he held until Apr. 22, 1865, when he resigned. The brevet of brigadier-general was bestowed upon him for gallantry. While in the army he had been chosen city solicitor of Cincinnati, which office he accepted upon resigning from the army. In Oct., 1866, he was elected probate judge of Hamilton county, and in 1871 was chosen governor of Ohio on the Republican ticket. In 1873 he was renominated, but defeated by William Allen. Minister to France 1877.

O.

Ogi Takalo, b. in the province of Hizen, Japan; was highly educated; at the commencement of the late revolution was appointed one of the Sanyo, which position was afterward called Sangi; in 1870 he became vice-minister of the home department, afterward minister of education, then a councillor of state or Sangi, and in 1873 was reappointed to that office, in conjunction with the position of minister of justice. F. A. P. Barnard.

Okuma Shigenobu, b. in the province of Hizen, Kiusiu, in 1837; was well educated in a local high school, and early noted for his superior talents; studied the Dutch language at Nagasaki, and also English, and became a good scholar in both, but held no public position before the revolution. In 1868 he was appointed chief assistant in the department of foreign affairs; in 1869 was made an assistant or secretary in the then joint departments of the interior and finance, in which he displayed ability; in 1870 was made a councillor of state or Sangi, still having charge of the finance department, the interior department having been organized separately. In 1871 he was superseded as head of the finance department, but still held the position of Sangi; was appointed president of the commission that attended the Vienna Exposition; took a leading part in the expedition to Formosa, and in the latter part of 1872 was again made minister of finance, and is still a member of the Japanese cabinet or privy council. F. A. P. Barnard.

Onosan'der, or **Onesan'der** [Ὀνόσανδρος, also Ὀνήσανδρος], is described by Suidas as a Platonic philosopher, who wrote on tactics (Τακτικά), military stratagems (περὶ Στρατηγημάτων), and commentaries on the *Republic* of Plato. No one of these has come down to us under the title given by Suidas, but there is a treatise extant, ascribed to Onosander, much used by later military writers, entitled Στρατηγικὸς λόγος, no doubt the same with or a part of the *Tactica*. Onosander lived about the middle of the first century A. D., as his work is dedicated to Q. Veranius, consul 49 A. D. The treatise is divided into 42 parts, and gives instruction on the duties of a commander; the style is based on that of Xenophon, and imitates its model with considerable success. The work was first published in a Latin translation, often reprinted; the 1st ed. of the Greek text was by N. Rigaltius (Paris, 1599); best editions by Schwebel (Nuremberg, 1762, fol.) and A. Köchly (Leipsic, 1860). Henry Drisler.

Oracan'thus [Gr. ὡραῖος, "beautiful," and ἄκανθα, "spine"], a genus of defensive fin-spines worn by sharks which lived in the Carboniferous age. They are usually conical in form, broad at the base, and ornamented with numerous pustular tubercles. J. S. Newberry.

Orbil'ius Pupil'lus, a somewhat celebrated grammarian and teacher at Rome in Horace's boyhood, b. at Beneventum. He served at first, as stated by Suetonius, who mentions him in his list of distinguished grammarians,

as an attendant on the magistrates of his native place, then in the army in Macedonia. In his fiftieth year he removed to Rome, in the consulship of Cicero, where he taught school for many years, and had among his pupils the poet Horace, who recalls in his *Epistles* the severity of his master. He seems to have been the prototype of Dr. Busby, and could boast of the distinguished men he had flogged in their youth. His teaching brought him more fame than profit, for he died poor at a very advanced age. His fellow-townsmen erected a marble statue to his honor in Beneventum. (See Teuffel, *Lat. Lit.*, § 187; Estré, *Prosopogr. Horat.*, p. 437.) HENRY DRISLER.

Ordnance. The progress made in the construction of ordnance, even since the preparation of our article on that subject in the CYCLOPÆDIA, calls for a notice of the more remarkable guns recently produced, and which have rapidly gone from 38 to 81, and even to 100, tons, while those of much heavier weights are proposed. As these guns are all of the class described as tubed and banded of the English system—that is to say, are constructed with steel tubes for the bore and large wrought iron coils for the body of the gun—we shall confine our remarks to the largest yet made, the 100-ton gun constructed for the Italian government.

The central steel tube has a diameter of bore of 17 inches, and is 30 feet 3 inches long, 6 inches thick at the powder-chamber, and 3½ inches thick at the muzzle. The breech portion of the tube is enveloped in three coils. The trunnion coil, with two others, come next, and four single coils, with the tube enclosed, form the chase of the gun. These coils are made to interlock with and overlap one another at their junction, in order to hold them together in a longitudinal direction. At the trunnion coil the gun has a diameter of 5 feet 4½ inches, at the breech 6 feet 5 inches, and at the muzzle 2 feet 5 inches. The extreme length of the gun is 32 feet 10½ inches. The rifling consists of 27 grooves, with a twist increasing from 1 turn in 150 calibres at the chamber to 1 turn in 50 calibres, or say from 1 turn in 212 feet to 1 turn in 70 feet at the muzzle.

The following is one of the results obtained on the firing of this gun:

Charge of powder	375 pounds.
Weight of projectile	2000 "
Velocity at muzzle	1512 feet.
Indicated pressure	21.4 tons.

Three targets were employed in testing the penetrating power of the projectile of the 100-ton gun. No. 1 was composed of two steel plates, each 22 inches thick, 4 feet 8 inches wide, 12 feet long, placed one above the other, and the whole supported by a wood backing 28 inches thick. No. 2, wrought iron plates of same dimensions and arrangement as No. 1. No. 3, upper half, wrought iron plates, one 12 and one 10 inches thick; lower half, 8-inch wrought iron plate outside, and 14 inch cast iron chilled plates inside. These targets were placed 100 yards from the gun, and proved quite inadequate to resist the destructive effect of the projectile. The steel was somewhat superior to the wrought iron, and the cast iron proved utterly unfit for the purpose of protection.

The gun was mounted with the trunnions resting upon a slide, and in the rear of each trunnion was placed a water-cylinder with pistons, and by means of which the recoil could be controlled. The gun was carried into battery loaded, and elevated by hydraulic power worked by a small engine. For such guns it need not be repeated that a special powder of large grain, and capable of developing its power slowly in comparison with ordinary powder, is absolutely necessary.

In regard to their construction, there is no difficulty which could not be readily overcome in this country. Large bands of coiled wrought iron have long been successfully made here for cannon, and more recently the coiled wrought iron tubes for the conversion of smooth-bore into rifle cannon have been manufactured at the West Point Foundry, and have sustained thorough and satisfactory tests. On this system the 10-inch Rodman and the 11-inch Dahlgren guns have been converted into rifle cannon of 8-inch bore, and have fully sustained the charge of 35 pounds of powder and projectiles of 180 pounds, which is the "battering charge" of the 8 inch Woolwich gun of 9 tons—a weight exceeding that of either of the first-named guns. This plan of constructing a cast-iron body with wrought-iron tube has proved so successful that it is now proposed by our ordnance department to construct a 12-inch gun on the same system; and it is probable that larger calibres will follow.

Without discussing the theory of the subject, we may conclude that the interposition of a material so little liable to fissures as wrought iron, and which by its position is subjected to the most severe strains of the discharge, permits only such a degree of it to reach the cast iron as this material is perfectly able to resist. In the naval service the application of the French plan of closing the breech of rifled cannon has been made to 20-pounder howitzers and the 100-pounder rifle gun with satisfactory results.

R. P. PARROTT.

P.

Paixhans Guns. See ARTILLERY and COLUMBIAD, in CYCLOPÆDIA.

Palpita'tion [Lat. *palpitatio*; Fr. *palpitation*; Gr. παλμός; Ger. *Herzklopfen*]. The heart usually performs its important work without attracting any attention, the person, to use a common phrase, "not knowing that he has a heart." The perceived and forcible beatings are called "palpitation." It may occur in a healthy as well as in a diseased heart, caused by physical exertion, mental excitement, the use of tobacco, flatulent dyspepsia, a watery state of the blood (*anæmia* or *hydroæmia*), or a sense of palpitation may arise from increased nervous sensitiveness, without any real increase in the force of the heart-beats; while, on the other hand, in enlargement of the heart the beats may be very strong, and yet not be recognized, except by an external examination. In hypertrophy and in fatty degeneration of the heart palpitation is a common occurrence, generally coming in paroxysms, lasting from a few minutes to some days, with equally varying intervals. The extract of nux vomica and the tincture of aconite are much relied on to subdue the excited heart when it is diseased, while secondary palpitation in the healthy heart is treated by removing the cause. ALONZO CLARK.

Pang'horn (Z. K.), b. at Peacham, Vt., July 31, 1829; graduated at the University of Vermont in 1850; became principal of the Lamoille Academy in Johnson, Vt., and subsequently of the St. Alban's Academy; was editor of the *Vermont Tribune* for some time, and subsequently established the *Teacher's Voice*, an educational periodical; removed in 1855 to Worcester; became editor of the Boston *Daily Bee*; served during the civil war as paymaster of volunteers; visited Europe in 1864; became editor of the Jersey City *Daily Times*, and established in 1867 the *Evening Journal*, of which he is still editor and senior publisher. H. L. STUART.

Parsons College, situated at Fairfield, Ia., at the crossing of the Chicago Burlington and Quincy with the Chicago and South-western R. R., was founded by the late Lewis B. Parsons, a citizen of Iowa, who died in Keokuk, Ia., in 1856, and in his will directed his sons and executors to locate and found a college, to be under the control of the Presbyterians of Iowa. On Feb. 21, 1875, Gen. L. B. Parsons, having selected a board of trustees and transferred to them the legacy, valued at $40,000, founded the college in accordance with the provisions of the will. The citizens of Fairfield contributed to the institution for its location $27,000. A tract of 20 acres, with a large brick residence, was purchased, and during the summer of 1875 an additional brick building, 40 × 52 feet, of two stories, was erected. A course of three years for the preparatory department and four years for the collegiate was arranged, at the end of which the degree of bachelor of arts is conferred. The preparatory department opened Sept. 8, 1875, and in 1876 there were on the roll 62 students. The college was tendered to and accepted by the Presbyterian Synod of Iowa, South, Oct. 22, 1875. A freshman class was organized in Sept., 1876. The college grounds, buildings, etc., are valued at $25,000; the productive funds amount to $22,500, and there are unmatured notes and unimproved lands valued at $20,000. JOHN ARMSTRONG.

Pa'terson (WILLIAM SLEIGH), b. at Haddington, Scotland, Mar. 6, 1844; came to New York in 1848, where he was educated in the common schools; taught school for a short time; served a seven years' apprenticeship at printing; devoted himself to proof-reading, and became familiar with technology and with various languages under the tuition of Rev. Dr. W. A. Muhlenberg and others; and has occasionally contributed to journals and society reports.

Pat'ton (FRANCIS LANDEY), D. D., b. on the island of Bermuda Jan. 22, 1843; educated at University College, Toronto, Canada; studied theology at Knox College, To-

ronto, and at Princeton, graduating in 1865: was ordained by the presbytery of New York, and became successively pastor of Presbyterian churches in Eighty-fourth street, New York, Nyack on the Hudson, and Brooklyn, and in 1872 was chosen prof. of didactic and polemical theology in the Theol. Sem. at Chicago. In 1873–76 he edited the *Interior*, at Chicago; published a *Treatise on the Inspiration of the Scriptures*, *A Summary of Christian Doctrine*, and is (1877) engaged on *The Doctrine of a Future Retribution*.

Patton (William), D. D., b. in Philadelphia Aug., 1798; educated at Middlebury Coll. and Princeton Theol. Sem.; was pastor of the Central and Spring st. Presb. and Hammond st. Cong. churches in New York; was the original proposer of the Union Theol. Sem., New York, and of the Evangelical Alliance. He has published *The Wines of Scripture*, prepared the American edition of *The Cottage Bible* and *The Village Testament*, was one of the editors of the *Christian Psalmist*, put forth editions of *Edwards and Finney on Revivals*, and recently a series of lectures on *The Destruction of Jerusalem by Titus*. D. Sept. 9, 1879.

Patton (William Weston), D. D., son of the preceding, b. in New York Oct. 19, 1821; educated at the University of the City of New York and at Union Theological Seminary; became successively pastor of Cong. churches in Boston, Hartford, and Chicago; afterward, for five years, principal editor of the *Advance*, at Chicago, and is now lecturer in the theol. seminaries at Chicago and Oberlin. He has published *Slavery and Infidelity*, *The Young Man*, and *Prayer and its Remarkable Answers*.

Pearse (John Barnard), A. M., M. E., b. in Phila. Apr. 19, 1842: graduated at Yale in 1861; studied chemistry till June, 1863, with Booth and Garrett, Phila., and had charge of the chemical division of the U. S. army laboratory in Phila. till July, 1865; spent over two years in practical studies of mining engineering at schools of mines at Freiberg (Saxony) and Leoben (Styria), and made a specialty of metallurgy, particularly iron and steel, visiting and working at German works and mines. In Jan., 1868, he connected himself with the Pa. Steel Co. at Harrisburg, and in 1870 became its gen. manager. Here he improved the design and product of Bessemer steel plant, made various inventions (cupola, improved steel plant, etc.) since generally adopted, and was instrumental in first making Bessemer pig iron from native N. J. and Pa. ores. In June, 1874, he was appointed a com. and the sec. of the second geol. survey of Pa. He published in 1869 a *Treatise on Roll-Turning for Manufacture of Iron*, translated with additions from the German of P. Tunner, and prepared a *History of the Iron Trade of America* from its inception in 1621.

Phonograph, an ingenious instrument invented in the spring of 1878 by Mr. Thomas A. Edison of Menlo Park, N. J., for impressing upon a metallic surface an exact copy of the vibratory movements of a stretched membrane acted on by sonorous undulations in the air; so that, by using this impression to react upon the membrane as a fiddle-bow acts upon the string, the vibrations, and consequently the sounds, are reproduced in their original order. The instrument considerably resembles in construction the *phonautograph* of Scott and Koenig, of which a figure is given in art. Acoustics, Vol. I., p. 33 (which see). The principal differences are—first, that the so-called "pen" in that instrument is placed so as to vibrate laterally, whereas in the *phonograph* its motion is perpendicular to the surface of the cylinder; and, secondly, that the cylinder of the phonograph, instead of being covered with smoked paper, is wrapped with a smooth sheet of tinfoil hardened by a slight admixture of antimony.

When the instrument is used to record articulate sounds, the large funnel is removed, and the mouth of the speaker placed very near to the membrane (which itself should be much closer to the cylinder than is represented in the figure). The operator then turns the crank uniformly, and enunciates his words in a bold tone while turning. The record being completed, the mouthpiece is withdrawn from the cylinder, and the crank turned backward until the original position is reached. The mouthpiece is then restored to its place, the large funnel attached to it for the purpose of reinforcing the sound, and the crank is turned forward as before. The words previously spoken by the operator are now repeated by the instrument with all their peculiarities of accent, emphasis, and pitch. Musical tones, the cries of animals, laughter, falsetto notes, and sounds of every description, are imitated by the instrument with the same exactness as the articulations of human speech.

F. A. P. Barnard.

Pleu'ra [Gr. πλευρά, the "side," a "rib"], a thin membrane that lines the cavities of the chest, extending over the external surface of the lungs. It consists of two closed sacs. The portion lining the chest is distinguished as the costal pleura, and is a sheet of elastic cellular tissue loosely attached to the ribs, muscles, and adjacent parts. That lining the lungs, known as the pulmonary pleura, is composed of a superficial layer of fine cellular tissue and a second elastic layer of coarser fibrous tissue, which materially assists in expiration. Both portions of the pleura are covered inside with a delicate layer of epithelium, and the narrow spaces enclosed in each sac are known as the pleural cavities, and are kept constantly supplied with a serous vapor which enables the opposite layers to glide easily upon each other in the movements of respiration. These pleural cavities may become distended in disease by an excess of water, as in hydrothorax, or they may become obsolete by the adhesion of the surfaces, as in plastic inflammation or pleurisy. In entomology the pleura is the side of the stethidium between the thorax and pectus. C. V. Riley.

Po'lo. The game of polo, introduced into America by Mr. James Gordon Bennett in 1876, is a modification of a recreative exercise indulged in by the officers of the British army in the East Indies, chiefly by those of the cavalry service. The game came into vogue in India through the practising of foot-ball, which game it has superseded there. The officers, finding the climate unfavorable to physical exertion necessary in playing foot-ball, substituted polo by using ponies and having a long stick to hit the ball, instead of kicking it with their feet. Briefly, polo is simply playing the English game of "hockey"—called in this country "shinny"—or the Scotch game of "golf," on horschack. In hockey the game consists of knocking a ball, with a stick having a crook at its end, from one goal to another. Polo is a similar game, except that the players, instead of being on foot, are mounted on ponies. By the club rules as played at Jerome Park the height of the ponies is limited to fourteen hands, and the "mallets" to be used must be four feet four inches in length. The ponies used are what is called "hog-maned," and have their tails cut short. In this country Mexican mustangs are now trained for polo-playing, and the game is rapidly attaining popularity out West. It is a dangerous game, especially for those not well up in horsemanship, severe injuries having been sustained, not only from accidental blows by the mallets, but from being thrown from the ponies and coming into rapid collision. At present the game is confined to the wealthy class of the larger cities of the country. Henry Chadwick.

Porce'lain, Japanese. (The new facts stated in this article are due to a special official report which was addressed to the judges of Groups I. and II. of the International Exhibition of 1876 at Philadelphia, by Henry Wurtz, one of the judges of Group II. (*Ceramics and Glass*), attached also as a delegate-judge to Group I. (*Minerals, Mining, and Metallurgy*).)

The unprecedentedly magnificent display of Oriental Japanese porcelain—unprecedented in the beauty, variety, novelty, and delicacy of the forms and artistic decorations, as well as in the grandeur of dimensions of individual pieces—made at the International Centennial Exhibition of 1876 has passed into history; but there was nevertheless one element of this display, most striking and interesting of all to the man of science and the ceramic expert, which was naturally passed over by the mass of visitors. To those competent to form an intelligent opinion the most surprising and pleasing part of the display was an extensive suite of the crude *native mineral materials* from which these inimitable fabrics are produced by this skilful people. This special exhibit was made by the department of the imperial government of Japan which had charge of the affairs of the Japanese contributions, called the "Kuwangiyo-Riyo," or "Imperial Board of Agriculture, Industry, and Commerce," and was designated as "minerals used in the manufacture of the pottery and porcelain of Hizen, Owari, and Ise." In the minds of the writer and others this was perceived to offer the best opportunity yet found, in the history of ceramics, by the nations of the West to learn with some degree of scientific precision the nature of the materials employed under the highest developments of this art in the far Orient, near where the art itself was born. The writer at once suggested to his associates that the occasion for obtaining this information and putting it on record should not be lost. The suggestion met with unanimous approval, and the result was a quite extended chemical investigation of these minerals, in connection with analyses of the wares made from them, together with the collection of a number of items of information regarding the ceramic technology of Japan never before brought to the knowledge of the world in general.

Porcelain Quarries of Japan.—A very complete collection of these minerals came from the neighborhood of the small town of Arita, province of Hizen (now called Nagasaki), the chief centre of the porcelain manufacture in Japan. This province of Hizen, or Nagasaki, lies almost at the S. E. extremity of the empire, separated from the Corean penin-

sula only by the Straits of Corea, and constituting the most westerly portion of the large island of Kiusiu. According to information received by the writer from Prof. H. S. Munroe of the Imperial University of Tokio, accompanied by a map, Arita lies on a small bay, and is within the borders of what he calls the *Karatsu coal field*; but the porcelain-stone quarries lie some miles distant from Arita, in an area marked by him as "feldspathic rocks, sandstones, etc." The principal quarries of porcelain stone, as exhibited at Philadelphia, are at a locality known as Idzumi-Yama, described as a high mountain-valley surrounded by hills, in which irregular diggings are made for the several qualities of mineral used, whose names and composition are given below. In the famous work of Stanislaus Julien, entitled *Histoire et Fabrication de la Porcelaine chinoise*, there is given, as an appendix, a short *Mémoire sur la Porcelaine du Japon* by Dr. J. Hoffmann, professor at Leyden, and "Interprète du Gouvernement des Indes Néerlandaises pour la Langue Japonaise," in which these quarries are mentioned as follows: "The *terre blanche* which is used for the fabrication of the porcelain comes from the mountain Idzumi-Yama, and forms the principal article of commerce of the province of Hizen. No mountain in the whole empire is comparable to this one. This material is white, but as hard as rock, and has to be broken with hammers and pulverized in mills." The information obtained from the sources available at the Philadelphia Exhibition agreed essentially with this.

Historical Facts about Japan Porcelain.—It appears that the higher developments of ceramic art in Japan were not altogether indigenous, but received important aid from the earlier experience of Chinese and Corean artisans, and that the first impulse was given about 300 years since. Real porcelain was first made under the direction of Gorodayu-Shonsui, a native of Ise, somewhere about 1580. After studying in China, he settled in the province of Hizen and used the Idzumi-Yama porcelain-stone. He made the *some-tsuki*, or blue ware painted with cobalt under the glaze, the *kanyu* or *hibiki* (craquelé ware), the *seidji* or *sei-ji* (seladon ware), the *akai* (red ware), and the *gosai*, also called *nishikide* (porcelain painted with various colors on the glaze). In 1592 also, after a war with Corea, a Japanese prince, Nabeshima Naoshige, brought Corean workmen to Hizen, who contributed to the improvement of the new art. Other Coreans were also at this time brought as captives to Kagoshima, a point somewhat farther S. than Arita, in the province of Satsuma, who originated the "Satsuma-ware."

Preparation and Use of the Idzumi-Yama Minerals.—The machinery for crushing this stone is very rude, consisting merely of large wooden hammers worked by water-power, the iron-shod heads falling into stone mortars. The powder is sifted, and the finer parts washed out with water, the proportion thus obtained being from 40 to 50 per cent. of the whole. This material, which can have but very little plasticity compared with true clays and clay compositions, they have the skill to fashion into vases of six and seven feet in height! Vases are chiefly made in Arita, whereas porcelain tables, painted slabs, fireplaces, and similar articles are mostly made in Owari. The throwing and shaping of the mass is said to be accomplished on the common potter's wheel, which at Arita consists of a fly-wheel and a working-disk, the latter twelve or fifteen inches above the former. These are united by a sort of hollow wooden prism, so as to form one system, which has at its lower extremity a hollow socket of porcelain running on a pointed stick set in the ground, their expedient to lessen friction. By means of this lathe the workmen in Arita turn out large dishes of three feet in diameter, as well as the so-called egg-shell porcelain, not thicker than paper. For very heavy and large pieces the lathe is turned by means of a driving-cord. Moulds are also used made of ordinary clay, and it seems that it is only since the Vienna Exhibition that they have learned the use of *gypsum* moulds, which are now being introduced. When the pieces have been sufficiently dried in the open air they are shaped with sharp iron tools on the same lathe on which the first throwing has been done, and are then coated with a pure white mineral called *kudaru-yama-tsuchi*, or *kesso-tsuchi*, of which the analysis is given below. This gives the finished ware a better appearance, and brings out with more intensity the fine blue color of the cobalt. After this coating the ware receives the preliminary baking in small special kilns. It is then painted with cobalt-oxide, and afterward glazed in the same way as in European factories; then baked finally. The glazes are composed of certain felsitic minerals, of which three, called *shiro-kawa-tsuchi*, *uwa-kuszuri-tsuchi*, and *sei-ji-tsuchi*, were exhibited, and have been analyzed, as below. These are mixed with wood-ashes, previously freed from alkali by careful lixiviation, which imparts fusibility. The proportion of ashes depends on the places which the pieces are to occupy in the kilns, the heat of which is not uniform.

Three minerals quarried at Idzumi-Yama, called *tsuji-tsuchi*, *shiro-tsuchi*, and *sakaime-tsuchi*, are the principal materials for the body of the wares (in washed form, as above described), the first being the purest and whitest, while at the same time the most refractory, and is used therefore for the thin egg-shell ware to the extent of 70 per cent., the other 30 per cent. being usually *shiro-tsuchi*. The latter, with equal parts of *sakaime-tsuchi*, constitutes a common composition for thicker wares. It is understood that the termination *tsuchi* is regarded as equivalent to our own generic word *clay*, but the analyses and other examinations of the Idzumi-Yama minerals show that there are among them no true clays. In fact, it seems that in the wares made from these minerals nothing of the nature of *kaolin* enters as an ingredient—a remarkable result developed by this investigation.

The Kilns.—The Japanese kilns are peculiar in construction, and are always built on the slope of a hill, in sets of from four to twenty, according to the importance of the locality. The base of each kiln lies about three feet higher than the base of the preceding one, so that, if all the kilns were uncovered, the whole of them would present the aspect of terraces formed by a series of platforms each three feet high. The ground-plan is trapezoidal, the kilns growing wider and wider as they extend up the hill. The walls on the four sides of the ground plan, being vertical to the height of a few feet above the base, gradually form a vault above of a peculiar form and structure, difficult to explain without drawings. The wall facing the lower end of the set of kilns is pierced on the level of its floor by a series of vents 8 to 12 inches high and 3 to 4 inches wide; and in the opposite wall, which, on account of the trapezoidal ground-plan, is a little longer than the front wall, there is a second series of similar holes, but at three feet above the floor, and consequently opening upon and level with the floor of the next kiln above. Thus, a series of draughts is established through the whole line of the kilns, which ends in a range of short chimneys, corresponding to the vents of the last kiln. There are no separate furnaces or fire-spaces, the fuel—pine wood, barked and dried in ovens—being thrown directly into the kilns, into narrow fire-spaces which are constructed on the front side of each kiln, next the indraught vents, by placing thick fire-clay slabs perpendicularly. These fire-spaces are from 2 to 3 feet wide, and communicate with the outside by means of narrow openings in the side walls, the latter being about 20 inches high by 6 inches wide. Through these openings the wood is thrown in with such dexterity that kilns which are sometimes 26 feet in length are heated uniformly throughout. The draught reaches the wood through the holes in the front wall after passing through the lower kilns, and the flame, deflected by the perpendicular fire-clay slabs, does not strike the pieces directly, but follows along the vault, eddying around, by reason of the back wall of the vault being made steep, as as to take the pieces in the rear. The flame passing through from the lower kiln, where the firing is actually going on, into the following kiln, produces sufficient heat to render this latter red by the time the firing of the first is finished. At this moment the opening through which the first kiln has been fired is closed with fire-bricks, and the firing begins in the second one.

By this arrangement, the principle of which is very similar to that of the circulating furnaces for burning bricks, the draught is made to pass through kilns that have already been fired, and strikes the fresh fuel, already at a high temperature. The effect is therefore cumulative along the line of kilns, the last kiln of a set being of course the hottest. Hence, the practice of gradually increasing the width and size of the succession of kilns. The kilns at Arita increase gradually from 7 feet long, 6 deep, and 6 high, to 27 feet long, 18 deep, and 15 high. The usual maximum time of firing is fourteen hours. The details of setting the pieces in the kiln and other manipulations are too voluminous to be admissible here. The more especial object of this article is to set forth the results of the chemical examinations of the Idzumi-Yama porcelain-stone in its different varieties, or rather of the materials prepared from it, as used in compounding the body and glaze, together with the composition of the porcelain itself.

The Minerals.—In order to obtain useful analyses, it was necessary to imitate as nearly as possible the manipulation of the Japanese operatives in preparing the materials. This was done by crushing by blows of a pestle in a mortar, sifting, and washing. The materials thus obtained were analyzed with great accuracy by a method of the writer which he calls *absolute analysis*, which consists, first, in making a set of analyses simultaneously and under uniform conditions, all the reagents being weighed and measured; and second, in conducting a simultaneous *blank* analysis, in which no material is started with. The figures obtained from the blank analysis serve to eliminate all the

errors from the other analyses. The alkali-determinations were made by a modification of the original method of the writer, first published in the *American Journal of Science* for Nov., 1850, by fusion with chloride of calcium. The chloride of calcium is used in the form of thick, syrupy alcoholic solution, measured out from a burette, mixed with the mineral, and the alcohol burned off, the mass being then fused. Water extracts then all the alkali. This is the simplest and surest method known for alkalies in silicates. A parallel blank analysis has also been made in this case, as in the former, in order to obtain absolute results, free from errors arising from traces of alkali in the chloride of calcium itself.

The following table gives the results of such *absolute* analyses of some of the Idzumi-Yama minerals, the first four being from this locality, the other two, used as glaze materials, being from other localities in the same region. These minerals all contain a small percentage of combined water, but, for convenience of comparison with the porcelain, the figures are here given as computed for the anhydrous minerals:

	(1.) Tsuji-tsuchi, washed.	(2.) Shiro-tsuchi, washed.	(3.) Sakaime-tsuchi, washed.	(4.) Kudaru-yama-tsuchi, washed.	(5.) Uwa-kuszuri-tsuchi, washed.	(6.) Seiji-tsuchi, raw.
Silica	80.652	80.920	81.141	54.072	81.772	80.101
Alumina	16.194	15.822	14.542	41.951	15.059	13.901
Ferrous oxide	.684	.932	1.060	1.713	1.471	1.574
Lime	None.	.152	.196	None.	.102	None.
Magnesia	.102	.100	.242	.223	None.	.316
Soda	1.799	1.530	1.789	1.565	1.447	} 4.108
Potash	.569	.530	.909	.476	.149	
Manganous oxide	Trace.	.014	.031			

Of the above, No. 4 is the only one which presents any approach in composition to a clay. The entire composition of the washed kudaru-yama tsuchi, with the water, is given below, together with that of the tsuji-tsuchi, the first one in the table above:

	Kudaru-Yama.	Tsuji.
Combined water	7.607	2.409
Silica	49.931	78.491
Alumina	38.738	16.016
Ferrous oxide	1.582	.669
Magnesia	.206	.098
Soda	1.445	1.761
Potash	.440	.556
	99.949	100.000

It was found that a small percentage of the silica in each of these was present in the form of opal, and deducting this, the remainders, which may be called *kudarnyamite* and *tsujilite*, give essentially the following compositions:

Combined water	7.79	2.4
Silica	47.95	79.1
Alumina	40.82	16.0
Ferrous oxide	1.67	.7
Soda	1.77	1.8
	100.00	100.0
Densities at 32° F	2.651	2.699

This brings *kudarnyamite* under the group of minerals called by Dana *pinites*. It gives the constitution $O_{129}Si_{37}Al_{36}FeNa_4.20H_2O$, and the volumic formula (see VOLUMES, MOLECULAR) is, most probably,

$$O_{129}.37^{Si}_{20}.36^{Al}_{20}\cdot^{Fe}_{24}.20^{H\delta}_{24}.4^{Na}_{36} = 2.658.$$

Tsujilite has the volumic constitution

$$O_{142}.59^{Si}_{20}.14^{Al}_{20}\cdot^{Fe}_{42}.6^{H\delta}_{24}.4^{Na}_{41} = 2.6971.$$

The following table gives the figures obtained by *absolute analysis* of the body or "biscuit" of two of the porcelains, the glaze having been carefully ground off:

	Egg-shell ware, stated to be tsuji-tsuchi 70 p. c., shiro-tsuchi 30 p. c.	Thick-body porcelain, stated to be shiro-tsuchi 50 p. c., sakaime-chuchi 50 p. c.
Silica	78.763	74.545
Alumina	17.847	19.315
Ferrous oxide	.638	1.916
Lime	.213	.106
Magnesia	.029	.176
Soda	1.975	2.832
Potash	.203	.566
	99.668	99.456
Densities at 32° F	2.3367	2.3079

The volumic formulæ of these compute very beautifully to the same molecular type:

The egg-shell porcelain to $O_{146}.60^{Si}_{24}.16^{Al}_{24}.4^{Na}_{33} = 2.331.$

The common porcelain to $O_{150}.60^{Si}_{24}.18^{Al}_{24}.9^{Fe}_{24}.6^{Na}_{33}$ 2.3.

Comparisons with the volumic formulæ of kudarnyamite and tsujilite show that the transformations which occur in the burning of this porcelain consist mainly in an *expansion* of both the *silicon* and the *aluminum* molecules through 4 diameters. The *sodium* molecules, however, undergo *contraction*, those of the tsujilite—the main constituent of the egg-shell body—through 2 × 4, or 8 diameters.

Whether the facts in this case represent the *general* theory of the molecular changes in the baking of porcelain cannot of course be asserted as yet, this being the first investigation of this kind as yet made.

It may be remarked, on comparing the figures of the analyses, that those from the egg-shell ware support very satisfactorily the specification of the manufacturers as to its components, but that this is not the case with the commoner porcelain, about which there has been possibly some small mistake in stating the component minerals. It seems, indeed, a conclusion that must be drawn from the facts, that this latter body (at least the sample analyzed) contains, besides the shiro- and sakaime-tsuchi, some of the more aluminous kudaru-yama-tsuchi incorporated with it—more than can be attributed to a mere coating or ground for the colors, such as the latter mineral is stated to be used for solely. Nevertheless, the substantiation, by the analyses, of the specification of the manufacturers regarding the finer egg-shell ware, is of the utmost interest and importance, as establishing the fact that we have here proof of the manufacture of porcelain of a quality unrivalled elsewhere in the world without the use of the special mineral *kaolin*, which has been generally deemed indispensable as a component of porcelain-pastes, both to impart plasticity during the shaping and to confer the refractory character needed in the kiln. The Chinese have a proverbial expression, that while the *petuntse*, the felsitic or petro-silicious constituent, constitutes the *flesh* of the porcelain, *kaolin* is essential to form its *bones*. This is evidently totally inapplicable to the finest of porcelain, made from the Idzumi-Yama porcelain-stones in Japan. HENRY WURTZ.

Presidential Electoral Commission, a board appointed during the second session of the 44th Congress of the U. S. to determine questions arising out of the presentation of two or more discordant certificates of the votes of the electoral colleges of certain States in which the election of Presidential electors had been contested. The canvass had been one of the most exciting in the history of the government, and at its close the vote was almost evenly balanced. The result depended on the voice of three States, Florida, Louisiana, and South Carolina, in which both parties claimed the victory; and of a fourth, Oregon, in which one elector was claimed to have been elected by a minority, in consequence of a constitutional disqualification affecting one of the candidates of the majority. From Louisiana, Oregon, and South Carolina the certificates presented were in each case twofold, and from Florida threefold. An angry controversy arose as to the constitutional mode of deciding between these competing certificates. The dispute assumed proportions which even threatened the peace of the country. With a view to avert the impending danger, a joint committee of the two houses was appointed early in January, 1877, to devise, if possible, some means satisfactory to all of ascertaining the legal result of the election. This committee consisted of Senators George F. Edmunds of Vermont, Frederick T. Frelinghuysen of New Jersey, Roscoe Conkling of New York, Allen G. Thurman of Ohio, Thomas F. Bayard of Delaware, Matthew W. Ransom of North Carolina, and Oliver P. Morton of Indiana; and Representatives Henry B. Payne of Ohio, Eppa Hunton of Virginia, Abram S. Hewitt of New York, William M. Springer of Illinois, George W. McCrary of Iowa, George F. Hoar of Massachusetts, and George Willard of Michigan. On the 18th Jan. this committee almost unanimously—Senator Morton only dissenting—reported a bill providing for the creation of a tribunal to be composed of five Senators, five Representatives, and five associate justices of the Supreme Court of the U. S., four of the latter being designated by their districts in the bill itself, the fifth to be subsequently chosen by these four; to which tribunal should be referred the conflicting certificates and accompanying documents from the contested States, and all questions relating to the powers of Congress in the premises, with the authority to exercise the same powers in ascertaining the legal vote of each such State. The bill further provided that the decisions of such tribunal in every case should stand, unless rejected by the concurrent vote of both houses. Also that objections which might be made to any votes from States not presenting double certificates should be considered, not by the commission but by the houses separately, and unless sustained by both should be of no effect.

The bill, after a sharply-contested debate in both houses, passed the Senate Jan. 25, and the House of Representatives Jan. 26. In the former the vote was 47 yeas to 17 nays; the Republicans voting 24 yeas to 16 nays, and the Democrats 23 yeas to 1 nay; absent or not voting, 9 Republicans and 1 Democrat. In the House there were 191

yeas to 86 nays; the Democrats voting 158 yeas to 18 nays, and the Republicans, 33 yeas to 68 nays; absent or not voting, 7 Republicans and 7 Democrats.

On the 31st Jan. the commission was elected, three Republicans and two Democrats being taken by agreement from the Senate, and three Democrats and two Republicans from the House. The commissioners elected were Senators George F. Edmunds, Frederick T. Frelinghuysen, Oliver P. Morton, Allen G. Thurman, and Thomas F. Bayard; and Representatives Josiah G. Abbott of Massachusetts, James A. Garfield of Ohio, George F. Hoar of Massachusetts, Henry B. Payne of Ohio, and Eppa Hunton of Virginia. The justices designated by the bill were Nathan Clifford of Maine, Samuel F. Miller of Iowa, Stephen J. Field of California, and William Strong of Pennsylvania. The fifth justice, who was promptly selected by these, was Joseph P. Bradley of New Jersey. The commission perfected its organization on the 1st Feb., and on the same day received the certificates of the first disputed State, which was Florida. Those of Oregon, the last disputed State, were not reached until Tuesday, 27th Feb., and the decision was communicated to the joint convention of the houses of Congress on Thursday, Mar. 1. The convention then proceeded with the count, which, with much interruption, was pursued to its completion, which took place at 4*h.* 10*m.* A. M. of Friday Mar. 2, at which hour the president of the convention, Hon. Thomas W. Ferry of Michigan, the president *pro tem.* of the Senate, announced that Rutherford B. Hayes of Ohio had received 185 electoral votes, being a majority of the whole number, and had been duly elected President of the U. S.; and that William A. Wheeler of New York had received a like majority, and had been duly elected Vice-President of the U. S. F. A. P. BARNARD.

Projec'tion, Method of, in geometry [Lat. *pro*, "forward," and *jacere*, to "throw"], in general, such a delineation of an object upon a plane surface as would result were the contours of points of the object *thrown forward* upon it by lines drawn from some fixed point assumed as the point of vision. If the point be supposed infinitely distant, and in direction perpendicular to the plane, we have the usual orthographic projection; if the direction be not perpendicular, we have *oblique projection*; if the point is at a finite and proper distance for ordinary vision, we have *perspective projection*, or *linear perspective*. Other systems of projection are used for delineating the earth's surface (see MAP, in CYCLOPÆDIA). In geometry the object projected is a geometrical figure, the fixed point is called the *vertex*, the joining lines form a *cone*, and the section by which the cone is cut by any plane (*plane of projection*) is called the *projection*. Important conclusions, by which from a particular theorem the general one under which it is contained may be inferred. The method is due to Poncelet, whose *Traité de Propriétés projectives* (1822) "may be regarded as the foundation of modern geometry." By this method theorems concerning infinitely distant points may be extended to finite points on a right line; theorems concerning systems of circles may be extended to conics having two points common; and theorems concerning imaginary points and lines may be extended to real points and lines. In this last postulate we have the PRINCIPLE OF CONTINUITY as applied by Poncelet in the work named; in virtue of which, certain properties of a figure in which certain points and lines are real, are asserted equally to obtain when some of those points or lines are imaginary. J. G. BARNARD.

Prokesch-Osten, von (ANTON), BARON, b. at Gratz, Styria, Dec. 10, 1795; studied law and philosophy at Freiburg; entered the Austrian army in 1813, and made the campaigns in France; was appointed professor of mathematics at the military academy of Olmütz in 1816; accompanied Prince Schwartzenberg as aide-de-camp in 1818 to Dresden; travelled from 1824 to 1827 in Greece, Asia Minor, and Egypt; distinguished himself as a diplomat in the Austrian negotiations with Turkey, Greece, and Egypt 1827–33; and was sent as ambassador to Athens in 1834, to Berlin in 1849, to Frankfort in 1853, and to Constantinople in 1855, whence he retired in 1867. He has written *Erinnerungen aus Ægypten und Kleinasien* (3 vols., Vienna, 1829–31), *Das Land zwischen den Katarakten des Nil* (Vienna, 1832), *Reise ins Heilige Land* (Vienna, 1831), *Geschichte des Abfalls der Griechen vom türkischen Reich* (4 vols., Vienna, 1867). D. Oct. 26, 1876.

Proofs, Etchers' and Engravers'. See ETCHERS' AND ENGRAVERS' PROOFS.

Propon'tis, the present Sea of Marmora, between Thrace and Asia Minor, forming an intermediate sea between the Ægean and the Euxine, with the latter of which it communicates through the narrow strait of the Thracian Bosphorus, and with the former through the Hellespont.

Pros'per of Aquitaine, SAINT, commemorated June 25, was b. in the S. W. part of Gaul about 400, and d. about or not long after 455. Little is known of his personal history, but he was certainly only a layman, and, though he visited Rome during the pontificate of Celestine (in 431), was probably never secretary to Leo the Great. The greater part of his life appears to have been spent in Marseilles, where he came in contact with Semi Pelagianism, and wrote those tracts against it on which his fame now principally rests. His *Carmen de Ingratis*, in defence of Augustine and his anthropology, shows him to have been a poet of considerable merit. He was author also of a *Chronicon Consularе*, in continuation of Jerome, reaching down to 455. The standard edition of his works is by the Benedictines Le Brun de Marette and Mangeant (Paris, 1711; Rome, 1758). R. D. HITCHCOCK.

Proterog'lypha [Gr. πρότερος, "in front," and γλυφίς, "a notch"], a sub-order of ophidians or serpents, containing the poisonous snakes. The superior maxillary bone is horizontal and supports venom-fangs anteriorly, and is posteriorly more or less elongated. The serpents thus distinguished are differentiated into the families (1) Elapidæ and (2) Najidæ, in which the tail is conical, and (3) Hydrophidæ, in which the tail is compressed and adapted for swimming. THEODORE GILL.

Psychom'etry. [Concerning this subject we submit to our readers the following paper, prepared by DR. BUCHANAN, who first developed the science, and still is its principal investigator.—EDS.] The word *psychometry*, which etymologically signifies "soul-measuring," was introduced by the undersigned in 1843 to represent the science and the process just discovered, by which the soul or mind may measure and estimate correctly any soul or mind, investigated by means of its emanations and the impressions which it has left upon physical objects. The form in which this power was first displayed and brought before the public in his lectures at New York and Boston in 1843 was that of appreciating and describing the character of any one by means of his autograph, the impression or conception being obtained by a sensitive person from contact with the manuscript alone, without seeing it or knowing anything of its contents or its source. But the scope of the science and its philosophic and practical applications have been much more extensively developed in his lectures and in his essays in *Buchanan's Journal of Man*.

The first step of the discovery was taken in 1841, by ascertaining that persons of a sensitive or impressible temperament were capable of feeling the influence of anything with which they were brought into contact, so as to recognize metals, when touched for a few minutes, by their influence on the nerves, including those of the sense of taste. Substances generally of any distinct taste were recognized in the same way, and medicinal substances were felt, in the same manner as if they had been swallowed, in all their constitutional influences. In following up this line of investigation, the writer, as a medical professor, would distribute medicinal substances among the members of his medical class, sealed up in paper envelopes (the contents unknown to the pupil), to be held in their hands until they felt the peculiar medical impression of the substance, as a narcotic, a stimulant, a tonic, an emetic, etc., the effects becoming so distinct in ten or twenty minutes as to enable them to recognize the substance, if they had ever taken it, by the identity of the effects. Frequently, they would lay it aside to stop an unpleasant influence. Different persons would experience similar influences from any medicine, with such variations as might be expected from their peculiar temperaments or idiosyncrasies. The general result of his experiments was that about one-third of the members of a medical class were sufficiently sensitive or impressible to succeed in this experiment.

The next step was the discovery that persons of the highly impressible temperament could feel the influences of contact with living persons as distinctly as with medicines, and thus, by placing the hand or the fingers on different parts of the head, could realize the action of the subjacent convolutions or organs of the brain: and not only perceive them understandingly, but feel them, in powerful effects upon themselves, in proportion to their own impressibility, giving them amiable and happy feelings from the upper surface of the brain, animal energy from the occiput, and intellectual brightness from the forehead. With higher endowments of impressibility, his pupil, Mr. Inman, could not only feel the influence of each organ or portion of a convolution, but describe accurately its power, influence, direction, and cultivation in the individual examined by this sympathetic diagnosis of psychometry. By the same process all the physiological and pathological conditions of the person were ascertained, making a complete medical diagnosis.

The investigation of the human constitution by this method, in addition to the direct excitement of the organs of the brain, resulted in the discovery of the functions of the cerebral organs, correcting and vastly enlarging the discoveries of Gall and Spurzheim, and explaining in a novel manner the relations and sympathies between the mind and body—constituting, therefore, a complete "system of anthropology," as taught in 1842–43 and published at Cincinnati in 1854.

This development of the cerebral functions was achieved before *autographic psychometry*. The writer found that the influence of a cerebral organ was a portable reality; that it could be imparted to many substances held in contact with the head, and afterward recognized by the sensitive: that the influence of an organ could be transmitted to the hand of the sensitive through a metallic conductor. He inferred that the emanations of nervous force in writing would in like manner become attached to the paper, and might be recognized by the impressible. His first experiment in the winter of 1842–43 at the Astor House, New York, fully verified this opinion, Mr. Inman describing with great accuracy the characters of four distinguished gentlemen, whose letters were placed in his hands or held on his forehead, without his having the slightest knowledge of their source.

In the exercise of psychometry the faculty of intuition is brought into play, and the revelations made are often truly wonderful. As everything with which human beings have been in contact—not only letters, but clothing, pictures, works of art, houses, amulets, and relics of all kinds—is a prolific source of impressions, it is apparent that psychometry may be used extensively in illuminating all history and ascertaining the conditions of the ancient world, as well as the characters of its prominent personages. Psychometers of superior powers enter so thoroughly into sympathy with the mind investigated as to determine the sphere or position in life the person occupied, his leading opinions or sentiments, and the outlines of his career. What is still more remarkable, they often discover whether he is living or dead, and speak of his sentiments and his situation as he is at the moment. Of course these highest manifestations are not very common, but a moderate degree of psychometric power may be found, according to the writer, in at least 5 per cent. of our population, and in warm climates in from 25 to 50 per cent. It is most abundant among the refined, emotional, amiable, and sensitive. There are many public practitioners of psychometry in this country who give opinions upon any writing sent them or upon any personal relic. There are many practitioners who prescribe for patients at a distance, guided only by the psychometric impressions derived from their letters or a lock of hair. The psychometric or intuitive perception is indeed essential to any great skill in medical practice. Without this intuitive perception at a glance of the condition of his patient, the most learned physician fails to exhibit curative skill, while with this power very illiterate physicians have been remarkably successful.

The psychometric faculty is so closely connected with clairvoyance, and even prevoyance, as to lead to very marvellous revelations. In the *Journal of Man*, vol. i., the writer says: "The ancient manuscripts, paintings, and other works of art which still exist, the crucifixes, garments, armor, and other ancient relics still preserved, are doubtless still instinct with the spirit that produced them, and capable of revealing to psychometric exploration the living realities with which they were once connected. At present these relics are barren of significance. Their hidden meaning lies waiting the future explorer, as the hieroglyphics of Egypt awaited the arrival of Champollion, to interpret their significance. . . . *The past is entombed in the present.* The world is its own enduring monument, and that which is true of its physical is likewise true of its mental career. . . . The discoveries of psychometry will enable us to explore the history of man, as those of geology enable us to explore the history of the earth." The truth of these propositions has been illustrated by the remarkable experiments of Prof. William Denton, given in his three interesting volumes entitled *The Soul of Things* (published at Boston, 1873–74). Mr. Denton is an able geologist, a popular and eloquent lecturer, and a vigorous, independent, philosophical thinker. In *The Soul of Things* he claims for psychometry even more than the writer in the way of geologic and cosmic revelations, which are in fact scientific clairvoyance. The subjects of Prof. Denton practice their clairvoyant psychometry by taking any mineral specimen in their hands and describing the situation from which it was brought and the surrounding strata and scenery, as though the mineral had received an impression of surrounding things, such as the letter receives from the mind of the writer, the descriptions being so full and accurate as to be of utility in geological and mining explorations, in some of which psychometry has made profitable revelations. Marvellous as the doctrine seems, there need be no difficulty in verifying its practical value, as the subject who investigates a specimen of known origin must inevitably fall into error if he has no other guide than his imagination. When two different subjects describe the same specimen (of which they know nothing) in the same manner, and correctly describe its origin and surroundings, the experiment has all the precaution and accuracy demanded by science.

In the *Soul of Things* Prof. Denton describes extensively the geology, ethnology, domestic life, and historic scenes of ancient America, ancient Europe, Egypt, and Syria. The cave-dwellers, lake-dwellers, Romans, Pompeians, and Carthaginians of antiquity, the mound-builders and copper-miners of ancient America, are described as if just seen by a traveller, while Mars, Jupiter, Venus, the moon, and the sun are described by clairvoyant vision.

The practical utilities claimed for psychometry are—(1) The demonstration of a complete anthropology; (2) the perfecting of the materia medica; (3) the accurate diagnosis of health and disease; (4) the accurate description of character; (5) the investigation of geology and of many other sciences to which experiments show its adaptation.

J. R. Buchanan.

Pteran'odon [Gr. πτερόν, "wing," ἀν-, "without," and ὀδούς, "tooth"], a genus of pterodactyls, or extinct flying reptiles, from the Cretaceous of Kansas, distinguished from all previously known genera of the order by the entire absence of teeth, and hence regarded as the type of a new sub-order, Pteranodontia. The typical species, *P. longiceps*, has the skull about thirty inches long and the lower jaw nearly two feet. The rami of the lower jaw are closely united for more than half their length, as in the *Rhynchops*, or skimmer. *P. comptus* is a small species, while *P. ingens* was very large, and the skull must have measured nearly four feet.

O. C. Marsh.

Q.

Quar'ry [Old Fr. *quarré*, "square"], an excavation made for procuring building-stone—sandstone, granite, marble, etc. Quarries are more generally open to the day, but are sometimes completely subterranean. The ordinary processes of quarrying are so simple and so frequently seen that they do not demand detailed description. As the stone is usually required to be of symmetrical form, it is generally split out in large quadrangular blocks, a series of drill-holes or shallow pits being sunk along a line parallel with the face of the ledge, and in these wedges are placed which are driven simultaneously. Wooden wedges are also sometimes used; these are subsequently wet, and by their expansion, which develops almost irresistible force, the rock is split. Blocks of granite of immense size are sometimes detached in this way, and the nations of antiquity, especially the Egyptians and Assyrians, seem to have taken great pride in quarrying and using in their structures masses of unusual size. The largest of these which have been described are those at Baalbec, some of which are 17 feet square and 70 feet long. The quarrying of marble as now practised in this country has been carried to great perfection, and, as it is conducted in a peculiar way, it merits a few words of description. As this rock is very crystalline in texture, and liable to be shattered by any violence, and as it is also much more valuable than other building-stones, and hence is carefully economized, the blocks are all *cut* from the quarry, and never blasted or wedged out. This is, for the most part, done by machinery. After removing the unsound surface-rock, a piece of several thousand square feet is smoothed off, and this is called the quarry-floor. Upon this steam channelling-machines are set, which move on temporary railroad tracks, and carry one or two ranges of long and heavy drills or chisels. These, alternately lifted and dropped, cut narrow channels to the depth of six feet on either side of the track. When the floor is thus all channelled in one direction, the machines are turned and made to cut channels at right angles to the first. The quarry-floor is thus all divided into blocks. One of these blocks is now broken out, and the others are cut across at base by horizontal drills, a process called *gadding*. They are then wedged free, and lifted out by cranes. The diamond drill is also successfully employed in quarrying marble, both for channelling and gadding. (See also Blasting, in Cyclopædia.)

J. S. Newberry.

R.

Railroad Laws in the U. S. RAILROADS are treated under that title in CYCLOPÆDIA wholly as works of engineering science, and are considered solely from the standpoint of the engineer. The articles on CARRIERS, COMMON, and on NEGLIGENCE contain many doctrines of the law applicable to railroad companies, and describe many of their obligations and liabilities toward the shippers of goods, passengers, and other persons who may be injured or may suffer loss through the careless or wrongful conduct of their servants and employés. There remain, however, a large number of legal rules concerning the creation, organization, and operation of railroads in the U. S. which constitute a peculiar and most important department of its jurisprudence, and which will be collected and arranged in the present article. The subject-matter may be conveniently divided into two general heads: I. The creation and organization of railway companies; II. The operation of railroads as means of transit and transport.

I. *The Creation and Organization of Railway Companies.*—This head contains several subdivisions which will be separately considered. 1. *Their Corporate Existence.*—In order that a railroad may be possible a legislative authority is indispensable. Without such permission the necessary lands could not be acquired, while the very structure itself and the methods of its operation would at the common law constitute both a public and a private nuisance. Although the States might undoubtedly build the railways within their territory as works of public improvement, without the intervention of private enterprise and aid, as the Erie and many other canals were constructed, it has become the settled and universal practice for them to act through corporations, which they create and to which they delegate the requisite authority. Even in those cases where some governmental interest exists, and some direct governmental control of the management is retained—as, for example, in the Pacific Railway—this has been accomplished by means of directors or trustees appointed by the legislature or the executive, who act in concert with those chosen by the stockholders. Railway companies may either be incorporated by special charters, or may be organized and acquire their corporate existence under general statutes. While the former mode was once universal, and is still employed, the tendency of late years has been very strongly in favor of general statutes, enabling private persons to associate themselves and assume the corporate character without any direct appeal to the legislature, and several of the recent State constitutions expressly prohibit the granting of special charters. This modern legislation is substantially the same in all its essential features wherever it has been adopted. The following are the provisions of the New York statute prescribing the manner in which individuals may form themselves into a railway corporation, and thereby acquire all the corporate rights and franchises conferred by the law; and they may be taken as the common type of all similar statutory enactments throughout the country: Any number of persons not less than twenty-five sign articles of association, which must state the corporate name, the termini of the road, the counties through which it will run, the length as near as possible, the amount of capital stock (which must be at least $10,000 per mile of length), and the names of thirteen directors. At least $1000 per mile of the capital must be subscribed in good faith, and 10 per cent. thereof must be actually paid in cash. To this instrument must be annexed an affidavit of at least three directors showing that the required amount of capital stock has been subscribed and paid in cash. These papers are filed in the secretary of state's office, and are there recorded. The persons subscribing the articles, and all others who become shareholders, thereupon constitute a railroad corporation under and by virtue of the statute. It will be seen that certain facts are made the necessary conditions of the incorporation, and their existence must be established by certain proof which the statute makes adequate, and a public record of this evidence must be made and deposited in some department of the State executive. These fundamental and essential facts are—(1) The termini of the projected road, with the general course and direction through which it is intended to run, so that its length can be approximately (at least) determined at the outset, and it can thus be ascertained whether the capital stock subscribed, and the portion thereof paid in, reach the minimum amount per mile of length required by the law. (2) A certain amount of capital stock must have been subscribed in good faith, equalling at least a specified sum for every mile in length of the contemplated road, and of this stock a designated percentage at least must have been actually paid in cash. Both the object and the wisdom of this requirement are plain. The construction of any railroad must largely interfere with private rights; private domains are invaded, lands are taken, farms are cut through and injured, all the ordinary industrial pursuits along the route are deranged; and although these private inconveniences and losses must be endured for the sake of the higher good to the whole commonwealth, yet it would be a grievous wrong if such damage to individuals should be inflicted *without* producing the ultimate benefit to the many which is expected to follow the completed work. The legislature endeavors, therefore, by requiring a fixed minimum of capital stock, to secure the completion of every railroad that is commenced, and thus to prevent the injury to private interests, without any compensating advantage, which would result from partially-finished and abandoned enterprises. In many instances, however, this precaution has proved unavailing. The minimum amount established by the statutes is undoubtedly too small, and the legislatures have often been persuaded to lessen this meagre sum by special acts in behalf of corporations organized under the general laws. Companies have been formed and extensive lines projected and commenced with capital stock hardly sufficient to defray the cost of a thorough preliminary survey; the enterprises have been carried through and the works completed, if at all, by means of funds raised upon mortgages of the corporate franchises and property, and by means of aid obtained through the vicious system of municipal bonding. To this cause is largely due the sudden and complete collapse of all railroad construction and extension which occurred in the year 1873, and which prostrated the entire business activities of the country. The theory of general statutes under which railroad corporations may be formed is doubtless the correct one, and is peculiar to the legislation of the U. S.; it is one of the many and great improvements upon the old common-law principles and methods which characterize our jurisprudence. The theory, however, requires that the safeguards contained in the general laws should be sufficient to protect private owners and communities, by demanding in every case a capital stock subscribed in good faith adequate for the completion of the work, and that all attempts to remove these safeguards or to lessen the requirements by special acts passed in behalf of particular companies should be effectually defeated. The truth of these views has been so fully demonstrated by the experience of the past twenty-five years that the most stringent provisions have been added to the constitutions of several States in their recent revisions, restricting the powers of their legislatures, prohibiting all special charters and special legislation in behalf of railroads, and requiring the passage of general statutes under which all new corporations must be created and by which their organization and management must be regulated. In addition to the clauses already described, which relate to the association of persons for the purpose of acquiring a corporate character and capacity, these general statutes also contain a great number and variety of rules for the government of the companies when thus organized—rules prescribing the methods of electing directors and other officers, and their functions, powers, and duties; the proceedings for the acquisition of lands under the right of eminent domain; the mode of constructing the track and other works belonging to the road; the arrangements to be made for the benefit of adjacent proprietors; the safeguards against accidents from the running of trains; the manner in which shares of stock may be transferred, and many other powers, capacities, or limitations which have seemed expedient to the legislatures of the different States. Some of the most important of these statutory regulations will be referred to under a subsequent head.

2. *Nature of the Corporations.*—At the very commencement of the railroad system in this country the question was presented, upon the answer to which depended its development and its very existence, Whether railroad companies were to be regarded as purely private corporations, or whether they were not, to a certain extent at least, and for certain purposes, public in their nature? This question first came before the courts in connection with the exercise of the right of eminent domain. In the case of one of the very first railroads incorporated by the legislature of New

York, which was authorized in its charter to take lands of private owners upon payment of a just compensation, the court of last resort determined, after great consideration and in the face of a strong dissent, that a railway company is not strictly and solely a corporation created for private purposes to subserve the private ends of the shareholders. On the contrary, the business which it carries on is a public use; it is created and operated for the public benefit; and its nature is therefore public, so far at least as certain of its functions are concerned. As the State provides ordinary highways which are public, as it has constructed canals which are public, so it might itself construct a railroad which would be public. That it sees fit to delegate its power to a corporation does not change the nature of the functions which are entrusted to such artificial body. Receiving this *quasi* public character from the legislature, a railway company also holds by derivation, and may exercise, the State's right of eminent domain, and may thereby take the lands of private owners upon paying them the just compensation required by the constitution. Probably no more important and far-reaching decision was ever pronounced by a State tribunal, for upon it depended the very existence of the railroad system throughout the country. Although it has been often questioned and its reasoning severely criticised, yet it has been followed in all the other commonwealths, and has become the settled law of the land. It is plain that this conception of railroads as in some sense public corporations was necessary, if it was intended that they should be used at all as means of intercommunication and traffic, for without it there was no possible ground upon which they could acquire and exercise the right of eminent domain, and the possession of that right was absolutely indispensable. It is equally plain that the conception is directly opposed to another necessary class of facts, which show that railroads are private in their nature, objects, purposes, and management. They are certainly not public in the sense in which municipal corporations are public; they are not subordinate parts of the local government, like towns, cities, and counties. In fact, from the necessities of the case, and in order that they might be legally clothed by delegation with the governmental right of eminent domain, railroad companies in the U. S. were declared by the courts to be public; on the other hand, from their organization, operation, and purpose as a means of investing capital and of obtaining profits therefrom, they are naturally and necessarily private. They thus possess a double legal nature. It may be stated as a general proposition that, in respect to many of the powers and functions with which they are clothed, and their obligations toward the State, they must be regarded as public or *quasi* public bodies, while in respect to their duties and liabilities toward individual citizens, shippers, passengers, and others who come into relations with them through contract or tort, and in respect to their stockholders, they are private corporations. This dual character gives rise to some complications, since the line which separates the two capacities has never been accurately defined. As it may be found expedient to place railroad corporations under a more direct control by the States, in order to prevent extensive combinations and oppressive monopolies, it is probable that, through the action of the courts and the legislatures, their public nature and uses will be brought into greater prominence and be more definitely established. The relations between railroad companies and the State already present a problem of great difficulty and importance, which, it would seem, can only be solved by holding these artificial bodies to be public in respect to their duties and liabilities, as well as in respect to their powers.

3. *Legislative Control.*—In recent charters and general laws railroads are subjected to numerous regulations, partly restrictive and partly mandatory, all intended to secure the welfare of the public, the safety of shippers, passengers, and persons crossing the tracks, and the convenience of adjoining proprietors. These provisions are peremptory in their nature and minute in their detail, and their violation may render a company liable sometimes to a fixed penalty, sometimes to an action for damages on the ground of negligence. One class of them defines the manner in which the road itself must be constructed, with sufficient fences, farm-crossings, gates opening into fields, cattle-guards, guards and signs at highway crossings, ditches, culverts, watercourses, and the like; another class is concerned with its operation, prescribing the rates of speed for trains, the ringing of bells, the blowing of whistles, the use of signals, the employment of watchmen, and many other precautions intended to prevent accidents to or by the trains when in motion. There can be no doubt that a State legislature, in the exercise of its general police power and for the protection of its citizens in their persons and property, may establish such a code of rules limiting and defining the mode of operating railroads, even though the original charters or acts of incorporation might have left the companies entirely free from any such restrictions. All private persons are subject to the police authority of the government, and railway corporations possess no attributes which relieve them from this common subjection for the general welfare. While the legislatures have thus uttered many positive commands as to the manner of building and working railroads, much is still left to the voluntary action of the companies themselves. Such action on their part is enforced, however, by a legal principle which has proved to be more efficacious than statutory mandates. This principle, which has been universally approved by the State courts, is briefly expressed in the following proposition: If any accident—*e. g.* the breaking of an axle or of a rail, or the running off the track—which was not immediately occasioned by carelessness or violation of rules on the part of employés, could certainly, or even with reasonable probability, have been prevented by the adoption and use of any known means, instrument, or improvement in the construction of the track or of the rolling stock, or in the manner of operating the same, the absence thereof or failure to adopt or use such means may be regarded as a negligence on the part of the company which renders it liable to all the damages and losses caused by the accident. Certain cases hold that such a failure is negligence as matter of law; others say that it is a sufficient ground from which the jury may infer negligence; the practical result, however, is the same in whichever mode the rule is stated, for juries always hold railway companies to a most rigid accountability. Special charters and general laws, especially the recent ones, frequently prescribe the maximum rates of fare for passengers and of freight for the carriage of goods, and prohibit all discrimination in favor of any classes of shippers or passengers, or in favor of through as compared with local traffic. Thus, the legislature of New York, in a statute authorizing the different companies between Albany and Buffalo to consolidate and form one corporation, the New York Central R. R., imposed as a condition that the fare for passengers travelling any distance except a fraction of a mile should not exceed the rate of two cents per mile. A legal question has recently arisen from an attempted exercise of this legislative control of the utmost practical importance both to railroads and to the public—to those who are either directly or indirectly concerned in their use and management. It has been the occasion of a bitter forensic controversy, and in some of the States has even passed beyond the domain of the courts and has entered the region of partisan politics. This question may be put into the following general form: Where an existing charter or statute under which a railroad has been organized contains no clauses regulating the rates of fare and of freight, or placing any limits upon their amount, or restricting the company in respect to its transport of goods and passengers, or prohibiting any discrimination between the through and the local traffic, can the legislature by a subsequent law enact provisions of such a character and impose them upon the railroad which it had previously incorporated? Can it prescribe the maximum rates of compensation which shall be demanded for the carriage of goods and passengers, require the same rates for through and local traffic, or in any manner directly or indirectly interfere with, control, limit, or reduce the revenue which the railway company would receive from the conduct of its ordinary business of transportation? The power is now invariably reserved, either in the charters themselves or in general laws, for the legislature to repeal, alter, or amend the acts of incorporation from which the railroad companies have derived their existence. This reservation has become thus universal in consequence of the judicial construction put upon that clause of the U. S. Constitution which prohibits the States from passing laws which impair the obligation of contracts. A charter of incorporation is held to be an executed contract, and without such reservation it is beyond the reach of legislative interference. (See OBLIGATION OF CONTRACTS, in CYCLOPÆDIA, in which this subject is fully explained.) In discussing the legal question above mentioned, it is argued, on the one hand, that by virtue of this reservation a State legislature has absolute control over all the affairs, internal and external, of every railroad corporation to which it applies; that the fixing a statutory rate of compensation for the business done, or the establishment of statutory modes or limitations for that business, is one method of altering and amending the charter; that if a legislature may repeal the charter, and thus entirely deprive the stockholders of this means and instrument for the acquisition of private property, much more may it enact any law which will simply have the effect to modify that instrument, and at most lessen its efficiency and diminish the amount of private property acquired by its use; in short, that the broad language of the reservation includes every possible subordinate measure,

no limit upon the legislative authority being either expressed or implied. On behalf of the companies it is urged that, while a legislature has retained a complete power over the franchises which it had itself bestowed, and may not only alter but even wholly withdraw them, it cannot, by reason of other constitutional prohibitions, deprive the corporation or the stockholders of their private property so long as the franchises are permitted to remain in existence; that the income and profits of the business—the revenue received by the company—are in every sense of the term the private property of the individual stockholders; that a law purporting to reduce the rates of fare and freight, or interfering with the management in respect to the earning of revenue, operates directly upon the means and facilities of acquisition which had been granted to the corporators, and so far deprives them not only of the property which they would receive, but also of their existing property by diminishing the permanent value of their railway shares. It is said that if a legislature may thus assume to fix the rates of compensation for services performed, it may place them at such a low point that no profits whatever would be earned, and even that the road would be operated at a loss. This argument, it will be seen, is based upon the conception already described, that a railroad corporation possesses a double character, that it is partly public, partly private, and that while the former functions are subject to legislative interference, the latter are protected therefrom by the constitutional safeguards of private property. In certain of the Western States the grave constitutional question thus presented by their recent statutes has been considered by the local tribunals and decided in favor of the legislative authority; it has yet to be passed upon by the national court of last resort. It might be supposed that the rates of fare and freight would be settled by the natural laws of trade, of supply and demand, and would be kept down to the lowest possible point by the competition between rival lines. Experience, however, has thus far shown that, while at occasional and short intervals such a competition exists and produces sudden and large reductions in freights and fares, yet, as a general practice and during the long intervening periods, a combination is perfected among the great companies which control the transportation business of the country between the East and the West, whereby the natural effects of competition are obviated, and the highest prices are fixed and maintained among the associated parties. The relations between several rival railways have sometimes been made most intimate, and their interests for the time being rendered almost identical, by the adoption of a system for which the name "pooling" has been invented. Under this arrangement, and during its continuance, the gross receipts from all the lines which are parties to the agreement are collected and combined into a common fund, the "pool," which is placed in the hands of a committee representing all the interests involved. After defraying the expenses of their operation, the residue of this "pool" is distributed among the various railroads according to some plan or ratio of allotment established by the contract. These combinations, interfering with the natural laws of trade, of supply and demand, and maintaining the freights and fares at an artificial and exaggerated standard, were a principal cause, or at least occasion, of the restrictive legislation above described recently resorted to in certain of the Western States. Whether this legislation will accomplish the object proposed, or whether it does not itself violate well-settled principles of political economy, are questions which I shall not discuss, and which, perhaps, can only be determined by time and experience. Although the railroads situated within the territory of the various States are the creatures of State laws, the enormous magnitude and increasing complications of the system as a whole have suggested the inquiry whether they may in any circumstances and to any extent be brought under the control of the U. S. government. Over a railroad whose line is wholly within a single State, and whose business also is confined to the same limits, it is plain that no such national jurisdiction exists. Congress, however, has power "to regulate commerce among the several States." The transit of merchandise by land as well as by water is commerce. If, therefore, the line of a single railway company extends into the territory of two or more States, or if, being situated wholly within one State, it forms through its connections a link in a chain of railroads over which traffic is continuously carried on from State to State, it then becomes a means and instrument of inter-State commerce, and as such is subject to regulation by Congress. This general principle, that the traffic or transportation by land from one State into or through another, and the railroads over which it is conducted, may be regulated by the national legislature, has been definitely established in an abstract form by several recent decisions of the U. S. Supreme Court. What particular measures may be enacted as specific modes of regulation has not, however, been determined. Congress has exercised its power in a very few instances only, and has not interfered to any considerable extent with the management and operation of railroads incorporated by the States. That some general system of control, containing uniform rules applicable at least to the great through routes of the country, will ere long be adopted, is probable. Such a system might be as advantageous to the associated and connected companies as to the public, since it would relieve them from the discriminating and often conflicting enactments imposed by the different States. Perhaps the difficulties thus far experienced in dealing with the more powerful railroads in respect to their rates of freight and fare, and to their preference given to through over local traffic, can only be met and overcome by the interposition of Congress. Whether railroad corporations may be created within the territory of the States by the national legislature—or, in other words, whether Congress has the power under the Constitution to grant charters of incorporation which shall become operative within State jurisdiction—is a much more doubtful question. It is certain that Congress may pass acts of incorporation for Territories, which are under its immediate legislative authority, and it may extend its aid, by donations of public lands or of the public credit or of money, to companies created by the States.

4. *The Power to acquire Property.*—As has already been mentioned, the doctrine is now well settled that the State's right of eminent domain may be delegated to railroad corporations, and by its exercise they are enabled to acquire from private owners the lands reasonably necessary for their purposes. The charters or other statutes establish certain special proceedings through which the lands are condemned and the compensation therefor is ascertained. The law of some States provides for a commission—generally of three—appointed by the court, to determine the amount awarded to the proprietors, while that of the others leaves this function to a jury. According to the doctrine generally adopted, the compensation includes the fair market-value of the land actually taken, and also damages for the injury caused to the remaining portion (if any) of the same farm, lot, or other tract. In several of the States the estimated benefits to the land may be applied in reduction or total extinguishment of these damages, but in the others all such benefits are wholly rejected and cannot be used to reduce the award of compensation. (See EMINENT DOMAIN, in CYCLOPÆDIA.) The extent of this power is limited only by the legitimate objects contemplated in the charter. Not only may the lands of individual owners be taken, but the property of other corporations, even that which had itself been acquired by an exercise of the right of eminent domain, may in like manner be appropriated. For example, the legislature may authorize a second corporation to construct its line across the existing tracks of another company, or even to use a portion of such track for the running of its own trains. In these and all similar cases compensation is of course necessary, for there is a taking of private property. The legislature may also permit a railroad to occupy a highway without compensation to the State or to any local public authorities or municipalities; but compensation must then be made to the abutting proprietors who own the fee of the highway. The authority to acquire and hold property by negotiation and purchase depends upon the provisions of the charters or of the statutes which stand in the place of charters. No corporation possesses attributes beyond those conferred by the organic law of its creation, and this doctrine should apply with special force to railroads. Under all ordinary acts of incorporation, therefore, the property acquired must be reasonably adapted not only to the general uses and purposes of a railroad, but to those of the *particular* railroad created by the legislature. As illustrations, a railway company cannot without express authority purchase and hold lands for the mere purposes of speculation, or of carrying on manufacturing operations, trades, or any other business enterprises having no direct connection with the objects for which it was incorporated. There are, however, many instances—some of them very prominent ones—in which railroad corporations have been clothed with extraordinary powers and functions, and have therefore been enabled to hold property not necessary for their business of transportation, and even to combine several distinct industries and sources of revenue under one single management. Companies incorporated in one State have been permitted to acquire by purchase or by lease the franchises and property of other roads created perhaps by the laws of different States, and by this means to extend a trunk-line with numerous branches, all controlled by one board of directors, across the territory of several commonwealths. Other companies have purchased or leased coal-lands, and have even made the business of transportation subsidiary to that of mining. One great corporation—the Delaware

and Hudson Canal Co.—now owns or holds by perpetual lease and operates lines of railway extending from the interior of Pennsylvania across New York to Albany, and thence by several branches to the northern extremity of that State and into Vermont, a canal reaching from Honesdale in Pennsylvania to Rondout on the Hudson River, and vast tracts of coal-lands which it mines, and for the products of which its railroad lines and canal serve as the outlets. I shall not discuss the financial wisdom of such combinations, regarded merely as means for investment, nor the policy of permitting such enormous accumulations of property and powers in the hands of single corporations; these cases are mentioned simply to show the present condition of the railroad system in the U. S.

5. *Funds for the Construction of Railroads.*—The principal sources from which the funds have been obtained to construct the existing railroads of the U. S. are the following: the capital stock of the various corporations, subscribed and paid in by the shareholders; bonds issued by the companies themselves, often secured by mortgages of their franchises and property; municipal bonds, issued in aid of particular enterprises by cities, towns, and counties; farm-mortgages, given or loaned by the landed proprietors along the route of a projected road; and land-grants or donations of public lands, made to many roads situated in the Western States and Territories. At the commencement of the railroad system, and during the earlier periods of its development, the requisite funds for construction were contributed by the shareholders in the form of capital stock. After a time resort was had to borrowing upon the security of bonds and mortgages, and this practice finally became universal. In all or nearly all the Western roads, and in very many of those at the East, the cost of construction is represented by a capital stock, and by a bonded debt secured by a mortgage of the corporate franchises and property. Successive series of bonds based upon successive mortgages are often issued by the same company, and sometimes this form of indebtedness exceeds in amount the capital stock. It has been the fate of many a railroad corporation to have its capital extinguished by a foreclosure and sale, and a reorganization with the bondholders as corporators. In New York, and perhaps in other States, a species of bonds has been invented, issued by some of the roads, and sanctioned by the legislature, termed "convertible," which the holder may at his option exchange for or convert into shares of the capital stock, and by their means such capital may be augmented. Hardly any contrivance has furnished greater facilities for ruinous and fraudulent management by boards of directors. The mortgages usually include in express terms the "rolling-stock" as well as the lands of the companies; and the prevailing doctrine established by the courts regards the articles embraced in that description—locomotives, cars, and the like—as fixtures, and not as chattels, so that the ordinary railroad mortgage is held to be wholly one of real estate. The practice of aiding railroad enterprises by means of city, town, and county bonds donated or loaned to the companies has for many years been quite common in the Western States, and even at the East this vicious method has recently been adopted to a considerable extent. The evils resulting from it, however, are so great that in all the latest revisions of State constitutions prohibitions have been inserted which render any further municipal bonding impossible in those commonwealths; and it is probable that the system has been completely abandoned. Farm-mortgages executed by private owners along the contemplated lines have been resorted to in one or two Western States as a means of obtaining funds, and have invariably caused great trouble, and even distress, when the time for enforcing payment arrived. The railroad system at the West has been largely developed and built up through land-grants made by the U. S. government. The policy has been steadily pursued by Congress for a number of years of donating lands to corporations created by the States whose lines traverse the public domain. These gifts have generally embraced the alternate townships lying within a designated distance on each side of the contemplated route; and they have been made upon certain conditions, which have usually required a speedy completion of the road, and that the lands themselves should be located, surveyed, and brought into market before the expiration of a specified period. The aggregate amount of the public domain thus granted to different companies is enormous. The donations to the two corporations forming the Pacific Railway include several millions of acres, of which, however, a large part is at present worthless.

II. *The Operation of Railroads.*—Although this general division is of great practical importance, considered from a legal point of view, yet little remains to be said concerning it in the present article. The law relating to the capital stock, the subscription, transfer, and ownership of shares is sufficiently explained in STOCKS, in CYCLOPÆDIA. The rules which determine the rights, powers, duties, and responsibilities of railroads as carriers of goods, of passengers, and of baggage will be found in CARRIERS, COMMON, in CYCLOPÆDIA. In NEGLIGENCE, in CYCLOPÆDIA, are given those principles and doctrines which are the foundation of all liability for injuries done to persons and property through the carelessness or unskilfulness of servants and employés. One or two special points, however, remain to be briefly considered. Passenger tickets are sometimes issued containing a notice printed on their face that they are good only for one continuous trip, commencing on the day and on the train for which they are sold. This notice is expressed in different terms, but the gist of it is always to warn the passenger that he cannot stop at any intermediate station and then resume his journey upon the same ticket. The validity and effect of these notices upon the purchaser have been frequently discussed by the courts. The question generally arises in the following manner: A passenger having purchased such a ticket stops off for a while at an intermediate place, and resumes his journey by another train and on a subsequent day: the conductor declines to accept the offered ticket and demands the ordinary fare; payment thereof being refused, the passenger is put off the train, and thereupon brings an action for assault and battery against the conductor, or for damages against the company. It has been uniformly decided that when a person is found on a train without a valid ticket and refusing to pay the lawful fare, he is a trespasser and may be put off by the conductor and other servants, they using no more force than is reasonably necessary. Statutes have sometimes limited this right of putting off a trespasser in respect to time and place, but have never denied it. Such a suit, therefore, directly presents the question whether the notice contained on the ticket is valid and constitutes a justification for the act of the conductor. The doctrine, as now established by a great preponderance of judicial authority, may be summed up in the following propositions: Railroads, like other corporations, may make all by-laws or rules for the conduct of their business which are reasonable, and these by-laws may apply to their transactions with passengers as well as to their dealings with servants and employés; for many plain reasons a by-law requiring tickets to be used upon the trains for which they are sold is exceedingly reasonable and proper, and in fact may be necessary to the keeping of correct accounts and the preserving of any check upon conductors, while it does not impose any burden or hardship upon passengers; and, finally, the notice of such regulation placed upon the ticket is sufficient to charge the purchaser with knowledge. It is tacitly, if not expressly, conceded that without the by-law and notice the contract between the railroad and the passenger is a continuing one, and having paid the consideration the holder of the ticket is entitled to a full performance by the company; but the by-law, being reasonable, enters into and becomes part of the agreement, and cannot be violated by the passenger except at his own peril. On the same principle, a rule requiring the passengers to purchase their tickets at the offices of the company, and adding a certain amount to the ordinary fare when it is paid to a conductor, is held to be reasonable and lawful.

JOHN NORTON POMEROY.

Rampoor', in lat. 31° 31′ N., lon. 77° 37′ E., at an elevation of 3398 feet above the sea, is the capital of Bisser (Biss-ahir), a feudatory state in the British Himalaya which stretches on both sides of the Sutlej River, borders N. on Chinese Thibet, and has 90,000 inhabitants. The country cannot be easily approached except from the river; the valleys opening toward Thibet offer good hunting-grounds; the lower parts contain many villas belonging to Englishmen who have removed hither from Simla. The inhabitants are mostly engaged in commerce with Thibet. The religion is Brahmanism; the first caste, the Rajpoots; the language, a corrupted Hindoo. The dependency on British India dates from 1815. The town of Simla is built on ground ceded by the rajah of Bisser; his annual income amounts to £7000, the tribute to £400.

E. SCHLAGINTWEIT.

Regela'tion [Lat. *re* (particle inseparable), "again," and *gelatio*, "freezing"], a freezing together, after rupture, of ice-surfaces in contact, a principle much employed in theories of glacial motion. In June, 1850, Faraday brought to the notice of the members of the Royal Institution the fact that moistened surfaces of ice at 32° F. freeze together, even when the surrounding air is very warm. No such effect is observable in ice at a much lower temperature. Many experiments made subsequently by Tyndall, and also by Huxley, prove that crushed masses of ice, at or near the freezing-point, when subjected to pressure powerful enough to bring their surfaces into contact, become frozen into a solid mass of translucent ice,

assuming the form of their mould. A bar of ice passed through a series of moulds may be changed into a semiring; vast masses of glacial ice moving down their channels are forced in the same way, by the presence of enormous superincumbent masses of snow and ice which every year accumulate on the mountain tops, into a series of moulds, the channels of the glacial stream. Rupture takes place each instant at a thousand points, a thousand new surfaces are brought into contact and freeze together; so that the mass, while conforming itself to its bed, does not become wholly disintegrated. The theory of regelation is as follows: Just as particles on the free surface of water attain their gaseous liberty sooner than those in the interior, because the molecular motion which constitutes the vapor is, at the surface, least controlled by the surrounding molecules of water, in the same way, and for the same reason, particles of ice upon the surface attain their "liberty of liquidity" first. Let two pieces of ice at 32° F., and, in consequence of the temperature, melting on their surfaces, be placed in contact. The surface particles are now virtually transferred to the interior of the mass, and the molecular motion, by virtue of which the ice has assumed a liquid state, is arrested by the controlling power of the surrounding ice-particles. The liquid, in consequence, becomes instantly frozen. The fact that ice is, in effect, plastic to pressure, but not at all so to tension, is conclusive against the viscous theory of Rendu and Forbes and the plastic theory of Agassiz. (For application of these facts to glacial motion see GLACIER, in CYCLOPÆDIA.) S. B. HERRICK.

Repoussé, a French term for the art of producing reliefs, and even rounded forms, in metal by beating thin plates from behind (Ger. *das treiben*; Eng. *embossing*). The metals employed are those that by their malleability lend themselves most easily to the work—gold and silver, brass, copper, tin, and lead. This is a very ancient art: the Egyptians, Cypriotes, and Etruscans practised it, and specimens of their skill in the art are preserved. The Hebrews brought the knowledge of this "beaten work" with them from Egypt, and employed it in some of the furniture of the tabernacle, on the cherubim and the candlestick (Ex. xxv. 18, 31, 36). It may be noted that in the description of the temple and palace built by Solomon there is no mention made of "beaten work," only of casting and of overlaying—*i. e.* gilding. In the Middle Ages it was widely employed both in Europe and in the East, and it has continued in use down to our own times. Some splendid pieces of repoussé work were produced in Italy in the fifteenth century; these were chiefly for the decoration of altars and shrines and for use in the ceremonies of the Church. The art was in a flourishing state in Europe in the seventeenth and eighteenth centuries, but the design was artistically inferior to that of an earlier time. The aim was rather magnificence than art. In the best times repoussé ornament was rarely used alone: it was combined with chasing, niello-work, or enamel. Until lately the art had fallen into disuse, but it has shared in the general revival of the arts, and is now much in fashion. In Italy, France, England, and America much repoussé work is now produced, and, so far as mechanical excellence is concerned, American smiths are not behind the rest of the world. The vase made by Tiffany & Co. of New York to commemorate the eightieth birthday of the poet William Cullen Bryant is an extraordinary exhibition of mechanical skill in repoussé. The results produced by this process are superficially similar to those attained by casting, but the effects are more artistic and free, and in the best work, whether of semi-barbarous or of civilized peoples, there is more individuality expressed than any casting could give. In the old repoussé work, the coarse as well as the fine, the relief is distinguished by softness of outline and the design has a look of spontaneity. The workman has used his tools as if they were the pencils of a painter or the dab-sticks of a modeller in clay. In the Castellani collection of antique jewelry exhibited at Philadelphia in 1876 were specimens of Etruscan repoussé work which, though small in size and minute in execution, had all the largeness of antique sculpture. These were extraordinary pieces, but much of the Japanese, Indian, Arabic, Persian, and Moorish work of modern times has the same quality, though more rudely manifested. The repoussé work of modern French, English, and American smiths is chiefly applied to gold and silver, and is distinguished by great sharpness and decision of line, so that the work is scarcely to be told from casting. Here the spirit of our age has triumphed, as in other fields, and we see an art with qualities and characteristics of its own striving to emulate another and different procedure. Repoussé work is a process by itself, and the application of it is limited, or ought to be, to work which it alone can do. The modern smiths have produced some specimens of repoussé that are remarkable as exhibitions of mechanical skill, but in honesty less must be said of their artistic excellence. Less mechanics, however, and more art, is the widespread want among us; and therefore it is not surprising that it should make itself felt here as everywhere else. The true art of the *repoussoir* is as little mechanical in its methods or in its aims as can be conceived of any art, and the nearer it can be kept to the simplicity of its origin and to the practice of the ancient craftsmen, the more satisfactory will be the result. Here, as in works reckoned higher—in a painting or a statue—we want to see the human hand the direct minister of the mind. A piece of true repoussé work ought neither to demand in the making nor to suggest to the spectator more aid from machinery than does an Indian shawl, a piece of old Italian lace, or the air-drawn fancy of a goblet of Venice glass. CLARENCE COOK.

Reproduction in Animals, a term used to designate the phenomena observable in the numerical development of animals from pre-existing ones, and the immediate antecedents and sequels thereof. Reproduction may be the result either of the concurrence of two dissimilar elements (the male or female sexes) or of outgrowths from or division of an already developed body. In the lowest forms of animal life (*e. g. Monera*, etc.), where there is no true organization, and where, of course, sexes are undistinguishable, under certain conditions two individuals come together and combine into a single one, which assumes a subglobular form, becomes segmented, and finally gives origin to a number of new and independent beings. In all the regularly-organized forms (*i. e.* those in which various organs are differentiated) there is a development of sexes, which may be either combined in one individual or separated among two. The germs, or female elements, are specialized as eggs—the sperms, or male, as spermatozoa. The conjunction of the two, resulting in the fertilization of the eggs by the spermatozoa, is necessary for the growth and development of the embryo. The egg is a spheroidal body whose essential constituent is the vitellus or yolk, and in the central portion of this is generally a distinct cell known as the germinative vesicle, or vesicle of Purkinje.* This is either transparent or contains spots, one or more in number, designated germinal dots: the vitellus is enclosed in an envelope of various consistency called the vitelline membrane. The albumen, so prominent in birds' eggs, in which it forms the "white," is a subordinate and superadded element, and is wanting in some types. The male elements consist of a liquor (the seminal liquor), in which are innumerable filiform or worm-like corpuscules, generally inflated at one end and attenuated at the other, and which move about with great rapidity in the liquor: these are the so-called spermatozoa (for which see STERILITY).

When the eggs have been fecundated by the conjunction or penetration into their substance of the spermatozoa, a course of development commences which finally results in the production of an organism like the parent; but this development may be either consecutive and gradual, as in mammals, birds, etc., or distributed into several stages of more or less persistency. In the latter case the adult form may be ultimately either (1) evolved by a modification of all the parts of the preceding state, as in amphibians, insects, etc.: or (2) developed by a peculiar growth, analogous to birth (exhibiting thus the phenomena of "alternation of generations"), as in most acalephs, etc. The future course of the egg is various. In the lowest forms frequently an amœbiform body is a first result—*i. e.* a creature like a mass of jelly, but with an interior vesicle; in the higher, the egg becomes segmented, and successively divided and subdivided into "blastomeres" or cells, and forms a mulberry-like mass (hence called *morula*). Often these cells become differentiated into two kinds, of which a few retain their spheroidal form, but most become elongate and prismatic, and furnished each with a cilium, thus resembling the planula of an acaleph (and hence receiving the name as indicative of the stage). Generally, the cells become differentiated into the roundish ones and the prismatic ones, and an involution of the mass takes place by which a cavity is formed, the inner roundish cells remaining unfurnished and forming an endoderm, and the outer prismatic ones becoming ciliated and forming an ectoderm: this stage has been named *gastrula*, and is by some supposed to recall the ancestral condition of most or all of the higher animals. The terms thus indicated—*amœba*, *morula*, and *gastrula*—are employed for the brief characterization of the correspondent stages through which the embryos of different types manifesting them pass. The notices of the various phases of reproduction in the several classes of the animal kingdom must necessarily be very brief and general.

Some late systematic writers (*e. g.* Haeckel and Huxley)

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*The germinative vesicle and germinal dots have not been detected in Tubularia, etc.

divide the animal kingdom into two primary divisions, distinguished (1) by the homogeneity of the mass, or (2) by its differentiation into cells or organs and tissues, (1) the former being called Protozoa and (2) the latter Metazoa. These divisions are based upon, or at least supported by, considerations derived from the observation of the generative system and embryology.

In the Protozoa much remains to be learned concerning the details of sexual reproduction. In the Infusoria, according to Gegenbaur, sexual reproduction is manifested, "in which the nucleus as well as the nucleolus, a smaller body situated by the side of the first, takes part in the economy. The nucleus is a solid body, of very variable form, sometimes encircled with an exterior envelope. It is situated in the cortical substance of the body, or, if it is lodged more deeply in its mass, it is still surrounded by an expansion of this substance. It is oval or round, or has the form of a sinuous ribbon or that of a cane provided with regular constrictions. The nucleolus appears to differ from the nucleus only by its size, which is less; nevertheless, its substance appears, in the course of differentiations, to have another functional value. The act of reproduction is, as a rule, preceded by a complete or partial fusion of two individuals, a conjugation which gives the impulse to the transformations of different parts. The nucleus becomes the seat of a segmentation which gives origin to distinct spheres. They, reuniting anew, produce a body which, by a new segmentation, develops so-called 'embryonal spheres,' in the interior of which is formed a new individual. The nucleolus also undergoes modifications in consequence of conjugation: it increases in size, and develops in its interior elements of a thread-like form which are comparable with the seminal elements of the higher animals. It seems to be the male element, the nucleus representing the female organ. It is, however, impossible at present to compare specially the parts which are developed from this last with the female products of other animals, because data respecting the sexual conditions of the Infusoria are still very far from being sufficient to permit us to arrive at a satisfactory conclusion."

The Metazoa all propagate by means of ova; the ovum in every case undergoes segmentation into "blastomeres," and assumes the *morula* stage, already described; the morula next becomes invaginated or pervious, and converted into a *gastrula* in all except certain intestinal worms (Acanthocephala and Cestoidea). The subsequent development varies according to the type. The morulæ and gastrulæ also differ in details of structure and development. There is always, however, a differentiation of the blastomeres or cells into two sets or membranes, one forming the walls of the alimentary cell, and called by Haeckel the endoderm or gastral lamella, and the other limiting the exterior, and known as the ectoderm or dermal lamella.

The sponges, formerly regarded as Protozoa, are true Metazoa in the sense indicated. The eggs and sperm-cells are irregularly developed among the cells of the inner walls of the mature sponge, and combined in the same individual: they are, in fact, developed from endodermal cells. After fecundation the eggs undergo development into, first, the morula state, and finally the gastrula state: the walls of the gastrula subsequently become perforated, and inhalent ostioles and canals are the result, while the primitive aperture and canal are converted into an exhalent aperture. Thus it assumes its sponge-like characteristics. (See also SPONGES.)

In the development of numerous mouths and convergent canals the sponges differ from all other types, and have been consequently isolated as representatives of one of two primary divisions of the Metazoa, which has been named Polystomata. In all the other forms only one oral aperture is developed, which may be either identical with the aperture of the gastrula, or a subsequent development or perforation of the body-wall. These forms, characterized by the single oral aperture, have been designated Monostomata.

In the acalephs the sexes are differentiated in distinct individuals. The sexual products are variously placed, according to the type to which the species belong, but generally arranged coincidently with the rays. (See HYDROIDA, etc., in CYCLOPÆDIA.)

In the polyps the sexes are also distinct, and closely correspondent in form and superficial appearance. The eggs as well as sperm-cells are developed in leaflets attached to the radiating partitions between the outer wall and stomach of the animal, and are discharged through the intestinal canal and mouth.

In the echinoderms the sexes are in distinct individuals in most forms, but united in the same in the Synaptæ. The two genital products are alike superficially, but distinguishable at maturity by color and general appearance, as well as, of course, by microscopical characters. They are arranged in masses in a radiated manner, corresponding with the external form, and chiefly between the rays in one or two masses between approximated rays. There are no specialized intromittent or other organs, the eggs being fertilized by the semen through the medium of the water, and yet certain species are viviparous.

In the forms thus referred to the organs of generation are reduced to their simplest elements. In the lower worms are the first indications of complexity by specialization and combination in distinct sacs of the eggs and spermatozoa, and the development of deferent canals. These organs differ greatly in detail in the several groups, but the enforced limits of this article forbid a specification of such modifications. It can only be stated that the development of the sexes in the same or distinct individuals is, in at least some of the orders, of very little systematic significance, and closely-related forms may be different in this respect, some being diœcious and others monœcious or hermaphrodite. Thus, the turbellarians, trematods, cestods, chætognaths, and chætopods are all, so far as known, monœcious; the leeches are mostly so, but a few are diœcious; the few known gephyreans and acanthocephali are diœcious; so are most of the nematoids and polychæta, but some of each order are hermaphrodite. (See WORMS.)

The arthropods (crustaceans, arachnids, insects) for the most part exhibit a further degree of complexity in the structure of the organs of generation. The sexes, too, are almost always distinct, although in some (*e. g.* most cirripeds and tardigrades) they are combined in a single individual. In most of the cirripeds they are, as just indicated, united in one and the same individual; in others of the cirripeds (*e. g. Ibla, Scalpellum, Alcippe*, and *Cryptophialus*) they are in distinct individuals, but singularly disproportioned. The males are entirely unlike the females, often exceedingly minute and destitute of mouth and stomach, and live (sometimes as many as fourteen at a time) on a single female; "they may, in fact, be said to exist as mere bags of spermatozoa," says Darwin, who first made known the remarkable features of the sexual economy of these animals. In some of the spiders, too, there is a great dissimilarity in size at least between the sexes. As for the sexual organs, they vary much, and are to a considerable degree characteristic of the several types—classes, subclasses, or orders—of the different animals. They are either simple or in pairs. The females have a sort of uterus, resulting from an enlargement of the canal for the outlet of the eggs, and in this the eggs undergo further development and receive their coverings or shells; the males have deferent canals as reservoirs of the sperm, and intromittent organs, which, however, vary in position, in extent, and in complexity.

The true mollusks also vary greatly in their generative organs, as well as in the combination or separation of the sexes in different individuals. The conchifers exhibit the organs in their simplest condition, and they are incapable of copulation, the males being destitute of anything like intromittent organs. The gasteropods and cephalopods have the organs much complicated, and impregnation is effected by copulation of the sexes (although the males are often destitute of special intromittent organs), and even when hermaphrodite, different individuals conjoin and mutually impregnate each other. In the gasteropods generally the male as well as female organs are situated on one side (usually the right), well forward, and often at the base of the tentacle, and sometimes (*e. g.* Viviparidæ) the intromittent organ is adnate with the tentacle itself; sometimes, however (*e. g.* heteropods), it is near the anal orifice, and exceptionally (in Polyplacophora) there are two deferent canals, discharging at the respective sides far backward. The cephalopods have, of all the mollusks, the most complicated organs. They are much alike in both of the sexes, and the testes as well as ovary are enclosed within sac-like envelopes. The most notable feature in the economy is, in certain dibranchiates, specialization and separation, elsewhere unparalleled, of one of the members of the male, which becomes a spermatophore and wanders forth to be attached to a female. It is one of the arms (sometimes one, sometimes another) that becomes thus specialized: this originally is enclosed within a sac, which it at length ruptures, and being then filled with spermatozoa, it becomes liberated from the body and assumes the functions for the time being of an independent organism. It was at first supposed to be a parasitic worm, and described under the name of *Hectocotylus*, and this has been retained to designate the modified organ.

The relations of the sexes are of various systematic value in the mollusks. In the conchifers some types are monœcious or hermaphrodite, and some diœcious. In the gasteropods the systematic value of the character is greater, hermaphroditism and bisexuality being co-ordinate with morphological characters. Thus, of the typical gasteropods as a whole, the inferior orders are hermaphrodite, the

superior bisexual; yet the Valvatidæ are distinguished among their diœcious relatives by a monœcious generative apparatus. In the cephalopods all the species have the sexes developed in distinct individuals.

In the vertebrates, although there is a wide range of variation, there is traceable a more graduated homological resemblance than in the other primary groups of the animal kingdom. In all the types the sexes are normally differentiated in distinct individuals, although some high fishes (species of Serraninæ and Lutjaninæ) are hermaphrodite. In the lower types the ovaries and male organs are sac-like envelopes containing in one case eggs and in the other sperm. In the leptocardians (*Amphioxus*) the eggs are discharged through the mouth; in all the other forms, through an aperture near the end of the abdominal cavity. In some fishes the eggs are discharged at first in the abdominal cavity, and thence through an aperture into the water, but in most they are carried by a special duct outward. Most fishes are destitute of organs of copulation, and the eggs of the female are impregnated by the sperm of the male discharged over them in the water; but some fishes are viviparous, and intromittent organs developed which vary in type in the several families they characterize. The selachians are quite peculiar in their economy. In the higher vertebrates with the ovaries are connected ducts developed from certain embryonic structures (the so-called Müllerian ducts), known as the Fallopian tubes. Through these the eggs are discharged; the ducts remain separate in all the types except the monodelphous mammals: in these they unite behind, and a single vagina is the result, with which a double uterus in the lower forms, and a single one in the higher forms, communicates. The male organs are highly specialized, and are developed to a large extent *pari passu* with the female. Thus, the ovaries are homologically represented by the testes, the penis by the clitoris, the uterus by the rudimentary uterus masculinum, etc. Such is a brief and imperfect résumé of a few facts respecting the organs of reproduction and their relations. (For further details other articles and works must be consulted.)

Asexual Reproduction.—The higher forms of animal life are reproduced solely in course of generation, but in many of the lower forms reproduction is effected by peculiar processes—*i. e.* either (1) by the subdivision of a given organism into distinct entities (scissiparity or fissiparity), or (2) by an outgrowth of buds from the surface of an organism, and the subsequent development thereof into animals similar to the primitive form, which may either remain connected with it, or become liberated and assume an entirely independent existence.

Fissiparity is manifested by many of the lower forms of animals. The polyps, acalephs, at least in certain stages, and many worms, exhibit this phenomenon. The unlimited power of multiplication of *Hydra* in this manner is well known. The medusiform acalephs in their strobiliform stage thus increase. Certain worms also increase in this manner, a strangulation taking place at certain intervals, head and eyes developing, and finally independent worms resulting.

Gemmiparity is also of common occurrence in the inferior animals, and is the mode of increase and development of the colonies of coral animals, hydroid acalephs, polyzoans, tunicates, etc. (More details may be found by reference to the articles on these groups.)

Reproduction by other means than generation is very limited in the higher animals, and becomes less and less so as a whole in ratio to the specialization and high organization of the type. In vertebrates it is manifested to a very slight extent. In some fishes the tail may, at least in part, be reproduced. In amphibians, as salamanders or newts, the members, with their bones, muscles, blood-vessels, and nerves, have been reproduced after destruction. It is well known that lizards often reproduce their tails after they have been lost. In mammals, however, the power of reproduction is only manifested to the extent of repairing wounds to a limited extent.

The bibliography of this subject is very extensive. The student may consult with most profit Carpenter's *Principles of Comparative Physiology* (various editions); Duvernoy's *Fragments sur les Organes de Génération de divers Animaux* (1850); H. Milne-Edwards's *Leçons sur la Physiologie et l'Anatomie comparée de l'Homme et des Animaux*, t. viii. (1863), ix. (1870); and Gegenbaur's *Manuel d'Anatomie comparée*. (See also the articles Egg, Embryology, Hydroida, and Individuality, in Cyclopædia, and Sterility.) Theodore Gill.

Rhinophrynidæ. See Toad, in Cyclopædia.

Ring, Tammany. See Tweed (W. M.), in Cyclopædia.

Rio Grande College, situated at Rio Grande, Gallia co., O., was founded by the bequests of ground and funds for the erection of buildings by Mr. and Mrs. Atwood, and comprises a classical course of four years and a scientific course of four years, conferring the degrees of A. B. and B. S. It also gives preparatory instruction and instruction in the ordinary English and commercial branches. Its main building, a three-story edifice of brick, was dedicated Aug. 30, 1876, and Sept. 13 of the same year the first term was opened under the presidency of Ransom Dunn, D. D. A second building for dormitory and study-rooms has since been erected. According to the articles of incorporation, two-thirds of its board of trustees shall be members of the Free-will Baptist denomination.

Rob'erts (Oran M.), a native of South Carolina; educated in Alabama; settled in 1841 in the practice of law in San Augustine, in the republic of Texas; was appointed district attorney in 1844, and district judge in 1846. In 1857 he was elected to the supreme bench as associate justice, which he held till the civil war began in 1861. He was then elected president of the convention of secession, and commanded a regiment in the Confederate army 1862-64, when he was recalled from the field to assume the chair of chief-justice of the supreme court. In 1866 he was elected to the U. S. Senate, but denied his seat, in common with all Senators from the South. C. G. Forshey.

Rob'inson (Lucius), LL.D., b. at Windham, Greene co., N. Y., Nov. 4, 1810; educated at Del. Academy, Delhi; studied law, admitted to the bar in 1832; appointed master in chancery in 1843, and reappointed in 1845; joined the Republican party on its formation; elected to legislature in 1859, and appointed comptroller of the State in 1861, and again in 1863; nominated by the Democrats in 1865 to same office, but was defeated; was a member of constitutional commission 1871-72; elected comptroller of the State on the Democratic ticket in 1875, and governor in 1876; nominated for governor of N. Y. by the Democrats in 1879.

Roden'tia [Lat. *rodere*, to "gnaw"], or **Gli'res** (plural of *glis*, a kind of gnawing animal), an order of mammals of the sub-class Monodelphia or Placentalia, comprising the gnawing animals, such as the rats, mice, squirrels, rabbits, etc. These may be briefly defined as ineducabilian placentiferous mammals, with the incisors in pairs in the upper and lower jaws, rootless and ever-growing, and in their growth describing the segment of a circle or open spiral. In more detail they are distinguished, on comparison with one or other of the related orders, by the following characters: The skull has the facial or rostral portion quite produced and enlarged; the pteriotic and tympanic elements are ankylosed with each other, and together form a unit separable from the contiguous bones; the temporal and orbital fossæ are confluent into each other; the lachrymal foramen opens within the orbits; the teeth are diphyodont, and are limited to molars and incisors; the molars have tuberculated or flattish crowns, and are especially adapted for attrition of food; the series is composed chiefly of the true molars, the premolars sometimes being absent, though generally developed in small number; the incisors are long, and continuously reproduced and shoved outward from their bases; in the typical species they are covered with enamel on their outer faces, but not on the inner ones, and hence the latter are soft; a trenchant anterior edge is the result, produced by the unequal wearing away of the teeth; the canines are entirely absent, and a wide interval exists between the incisors and the molars; the members are completely developed, and their proximal joints are mostly confined within the common integument; the feet are well developed, and provided with callous pads on the soles; the digits are generally four or five in number; the claws moderately curved, and generally of the unguiform type, but sometimes almost hoof-like; the scapula is narrow, and has a deep notch, a small coracoid, and a more or less divided acromion; the clavicles are diversiform, sometimes being completely developed and at others rudimentary; the scaphoid and lunar bones generally coalesce, but sometimes are separate; the tibia and fibula are either distinct or ankylosed toward their distal extremities; the intestinal canal is long; the cæcum generally large, sometimes, however, rudimentary; the placenta is deciduate and of the discoidal type. The order thus defined is the most numerous in species of the class of mammals, and between 800 and 900 species are known. Two well-defined sub-orders are recognizable: (1) the Simplicidentati, and (2) the Duplicidentati. The Simplicidentati have the incisors strictly limited to two in each jaw, and the enamel is entirely confined to their anterior faces; the skull has a true alisphenoid, as well as an external alisphenoid canal; the bony palate is well developed; the fibula never articulates with the calcaneum; the testes are abdominal, but descend periodically. To this sub-order belong nineteen families—viz. 1 Lophiomyidæ, (2) Pedetidæ, (3) Dipodidæ, (4) Merionididæ, (5) Muridæ, (6) Myoxidæ, (7) Saccomyidæ, (8) Geomyidæ, (9) Castor-

idæ, (10) Sciuridæ, (11) Anomaluridæ, (12) Haploodontidæ, (13) Spalacopodidæ, (14) Hystricidæ, (15) Dasyproctidæ, (16) Caviidæ, (17) Hydrochœridæ, (18) Chinchillidæ, and (19) Dinomyidæ. Of these, the first to sixth represent the super-family Myoidea; the seventh and eighth, the super-family Saccomyoidea; the ninth, the super-family Castoroidea; the tenth and eleventh, the super-family Sciuroidea; the twelfth, the super-family Haploodontoidea; and the thirteenth to nineteenth, the super-family Hystricoidea. The Duplicidentati are distinguished by the presence of four incisors above, but two below; the external incisors are, however, very small, and situated behind the principal ones: in early life even six incisors are present in the upper jaw: the enamel is developed behind as well as in front, although behind it is in a very thin layer; the skull has no true alisphenoid canal; the bony palate is represented by a simple bridge between the alveolæ; the fibula articulates distally with the calcaneum; the testes are external. Of this sub-order two families are known—viz. (1) Lagomyidæ and (2) Leporidæ. These are the only groups represented by species now living. A third and apparently distinct sub-order has, however, been established by Mr. Alston for an extinct type. This sub-order has been named Hebetidentati: the incisors were two in the upper and four in the lower jaw; the supernumerary pair in the lower jaw were very small, and placed rather behind the principal ones; the enamel was continuous around the teeth, and their crowns were transversely hollowed and had a chiselled edge; the fibula articulated with the calcaneum. But one family has been distinguished—viz. Mesotheriidæ, represented by a species whose remains have been found in the Pliocene of South America. Several peculiar families have been also constituted for the reception of typical forms of simplicidentate rodents now extinct. (See also the names of the different families.) THEODORE GILL.

Romantic School, The, was at first simply the name of a peculiar movement in German literature, but as this movement spread to other countries and over other fields, revolutionizing the fine arts, forming new issues in history, philology, and philosophy, and influencing even theology, the name assumed a broader signification, and was applied to a general tendency in modern civilization. A cause, however, capable of such an expansion in its effects must itself be the product of large general powers which met in this point and took life; and the romantic school, although it originated simply as an opposition to the reigning pseudo-classical taste in literature, was indeed the result of many, much more comprehensive spiritual agencies which gathered in the genius of Goethe, and were organized there into a form fit for action. The first author who set forth a romantic view of life with any degree of consistency and decisiveness, though still in a somewhat dreamy and flickering condition, was Rousseau (1712–78). But with him romanticism is a moral rather than a literary opposition. It is the revolt of a passionate nature against a false spirit, the protest of sentimentalism against rationalism. Rousseau felt that in spite of all its proud conquests, real and imaginary, the philosophy of the eighteenth century was a huge lie, which brutalized and depraved mankind; but his longings remained vague and his despair grew sickly. His opposition ended in an inarticulate cry. His *Confessions* make the reader smile and shudder; they remind him of the lunatic asylum; they are unfit for action. In Germany, Rousseau found two disciples, Lavater (1741–1801) and Pestalozzi (1746–1826), far inferior to him in genius, but purer and stronger characters, and thereby enabled to connect his views with real issues in practical life. Lavater's religious mysticism turned into fanaticism, and passed by with but small effect, but his *Physiognomical Fragments* are a powerful conception, the result of much love and true enthusiasm, and they exercised a widespread influence in modern life. It is only necessary to compare the love-poems from any European literature of the nineteenth century with those of the Latin literature from the period of Augustus, and it is at once apparent that a thousand lines and movements of the human body, which to the ancient poet were nothing but forms of abstract beauty or incitements to sensual pleasure, have become so many spiritual revelations to the eyes of the modern man. This, with the myriads of small but omnipresent consequences involved in it, is due to Lavater. Still more palpable was the influence of Pestalozzi's attempts at finding the true educational method; a new idea of human destiny loomed up amidst his new ideas of human nature. Both these men were from Switzerland; an influence as powerful and tending the same way came at the same time from Northern Germany, from Kant (1724–1804). It must be confessed that there was nothing romantic either in Kant's personal life or in the æsthetic impression of his reasoning. Personally, he was a pedant, and in literary respects he is as stiff as the philosophers of the mathematical method whom he superseded. Nevertheless, no Kant, no romantic school. His opposition was not directed against rationalism, but against dogmatism. By showing that nothing can enter the human consciousness unless representing itself under certain forms or categories of time and space, quality and quantity, etc., which have nothing to do with the thing itself, he crushed a mountain of prejudices and made a reconstruction of all science necessary; and by showing that the only certainty man can find by himself are those postulates which he finds inherent in his own nature, of the existence of God, the immortality of the soul, and the necessity of duty, he laid an emphasis on moral freedom and responsibility which became an emancipation of the human personality. A moral enthusiasm burst upon Germany, and the connection between this movement and the romantic school became very apparent when Kant's nearest disciple, Fichte (1762–1814), gave that singular demonstration of the relations between the Ego and the non-Ego of which the romantic school afterward made so surprising an application. Meanwhile, a multitude of minor movements brought this whole commotion to concentrate itself on the field of literature. By his wonderful illustrations of classical art, its history, its artistic methods, its æsthetic aims, etc., Winckelmann (1717–68) had already earlier thrown a peculiar light on the pseudo-classical reproduction which was the pride of the French nation and the rule in all European literatures; and now came Lessing (1729–81), and attacked this very same ideal in a most unceremonious manner from another side. He showed that it often stood in direct opposition to human nature, being nothing but a conglomerate of conventionalities, and simply ridiculous in the moment these conventionalities lost their prestige; Shakspeare served him as evidence. At the same time Herder (1744–1803) demonstrated theoretically and practically, and with the happiest applications, that nationality is a necessary element in all that is truly great in literature and art; while Klopstock (1724–1803), with a peculiar excitement which nevertheless caught the heart, called his countrymen back from all worship of the foreign and bade them stay with their own. Under these influences Goethe wrote in 1773 *Götz von Berlichingen*, the foundation-stone of the romantic school.

The principle of the old pseudo-classical school was *beauty*: that of the new romantic was *life*. The classicist represented the ideas *metaphysically*, and he seldom reached beyond a logical explication which might or might not strike the understanding with its pointed antitheses; the romanticist represented the ideas *lyrically*, as they ring in the raptures or agonies of the human heart, and by thus appealing directly to the sentiment he gave them a force which hitherto they had had only in religion. The classicist represented the passions *plastically*, as fixed systems of reflections, and his highest creation was a statue of ambition, love, jealousy, honor, etc.; the romanticist represented the passions *picturesquely*, as they may burn in an individual character belonging to a certain age, race, stage of life, etc., and by thus painting a broad picture of infinite suggestiveness he gave them a presence which hitherto men had experienced only in actual life. The new principle commanded an enormous wealth of new impressions; and it was only natural to apply this magic wand also on other fields. In architecture the Greek temple was considered the absolute norm, and the Gothic cathedral was looked upon as a wild eccentricity of a barbaric taste; but only a few years elapsed before it was generally felt that Gothic architecture contains some of the most powerful and most delicate forms which the human imagination has ever produced. In painting the enthusiasm engendered by the French revolution for the ancient republics, and the marvellous energy and fertility of David (1748–1825), had made the representation of the heroic in its sublime but distant magnificence the acme of the art; and when Géricault (1790–1824) painted *The Wreck of the Medusa*, people were startled; but soon followed Ary Scheffer (1795–1863), Horace Vernet (1798–1863), Delaroche (1797–1856), and others. In music the brilliant but abstract Italian melody still held the sway, in spite of Gluck and Mozart, and only the more refined minds felt that it was vague and without character, though not without passion; but when Weber (1786–1826) and Boieldieu (1775–1835) made the popular song the basis of their operas, everybody understood them, and Auber (1782–1871) actually ransacked the whole of Europe from Naples to Drontheim to find characters for his compositions. Still more surprising were the results which the new principle produced in science. Languages ceased to be considered as systems of signs, and were studied as productions of nature; history ceased to be narrated as a game of bodily force, shrewd tricks, and chance, and was depicted as an evolution of life; Nature herself ceased to be studied as a mechanical workshop, and her

philosophy became in the hands of Schelling a kind of psychology.

Nevertheless, in the midst of all these splendors an internal decay very soon became visible, and the decline was owing to the principle itself. The partiality which the romantic school showed for the Middle Ages has often been set forth as one of its most essential characteristics and as the principal reason of its rapid decay. But this is a mistake. *Life* was the principle of the school, but of the whole history of mankind the Middle Ages was that period which presented the most powerful forms, the most brilliant colors of life. Hence the predilection of the school for this period. It was not inborn with it, but simply a consequence of its principle, which becomes evident by a study of the different literatures. In England, whose mediæval history is very rich and interesting, the romantic school, after a quiet transition of nature-worship, represented by the poets of the Lake school, especially by Wordsworth (1770–1850), naturally settled down with Walter Scott (1771–1832) in an enthusiastic representation of the Middle Ages. But in the Scandinavian countries, whose mediæval history presents a picture only of decay and stagnation, Ohlenschläger in Denmark (1779–1850) and Geijer (1783–1847) and Tegnér (1782–1846) in Sweden did not draw their materials from the Middle Ages, but from a somewhat earlier period, when the spirit of the *Vikinger* had not yet died out, but either struggled against Christianity or entered into its service. And in France, where actual life was so noisy that it could not well be overheard, mirrorings of the time being are visible not only with the precursors of the romantic school, Madame de Staël-Holstein (1766–1817) and Chateaubriand (1769–1848), but still more with its master, Victor Hugo (1802). Just in the same manner the decay of the school was a simple consequence of its artistic principle. *Life* is not the highest principle of art; the highest principle is *truth*. Whenever *life*—that is, life-like representation of the phenomenon—is set up as the highest goal of art, as its principal aim, art is apt to swerve into particularism, to mistake that which strikes by its extraordinary peculiarity for that which is truly living, to exhaust itself on singularities and fill its galleries with curiosities; just as in actual life a one-sided emphasis on the rights of the individual leads men to mistake anarchy for liberty, and dissolves society into chaos. In Germany the romantic school fell very soon into this mistake (see HOFFMANN (ERNST), MÜLLNER, GRILLPARZER, etc.), and the life-likeness which it opposed to the lifeless beauty of the classical school was a revolting hideousness. The question then arose, What is it which in actual life secures general freedom by restricting individual liberty? or what is it which in artistic representation secures beauty to the whole by restricting the impressiveness of the parts? It is of course *truth*. But what is truth? The romantic school attempted a double answer, but failed in them both. In Germany the romanticists (see A. W. and F. SCHLEGEL) said, Truth is only a symbol, and the highest symbols mankind possesses are the Roman Catholic Church and the absolute monarchy. Hence followed political reaction, conversion to Romanism, extravagancies, eccentricities, insanity, and suicide. In England the romanticists said, There is no truth outside of the individual; take away all those abstract generalities which enslave the individuality, and the unbound Prometheus will show himself the truth. The result was disgust at life, despair at all; and although Byron (1788–1824) and Shelley (1792–1822) found disciples among the Jews and among the Slavic nationalities, this branch of the romantic school has now also withered. CLEMENS PETERSEN.

Rose (ERNESTINE LOUISE LASMOND POTOWSKY), b. in Peterkoff, Poland, Jan. 18, 1810, of Jewish parents; abandoned early the Jewish creed; visited England in 1829; became a disciple of Robert Dale Owen, and was married to William E. Rose. In 1836 she came to New York, and circulated the first petition for the property rights of married women, as there was a bill pending in the New York legislature, introduced by Judge Hurtell in 1837. She lectured in all the chief cities North and South; was a delegate from the National Woman Suffrage Association to the Woman's Industrial Congress, held in Berlin Nov. 9, 1869, and subsequently attended all the woman's right conventions, and frequently addressed legislative assemblies. Of late years she has spent most of her time in France and England, speaking on many public occasions on religious topics, temperance, and the enfranchisement of woman. SUSAN B. ANTHONY.

Rougemont', de (FRÉDÉRIC CONSTANT), b. in the canton of Neufchâtel, Switzerland, July 28, 1808, by his mother a descendant of J. F. d'Osterwald, the translator of the Bible into the French language; educated at Neufchâtel, Berne, and the universities of Göttingen and Berlin; studied law under Savigny, theology under Neander and Schleiermacher, philosophy under Hegel, comparative geography under Karl Ritter; on his return to his own country from extensive travels he soon began a series of publications in the French language on a great variety of topics, which exhibit an extraordinary erudition as well as a deep philosophical and wonderfully acute mind. His principal works are—*a Geography and Statistics, or an Essay on the Geography of Man* (2 vols., 1837), which began in Switzerland the reform of geographical teaching according to Ritter's method; *Description of the Holy Land* (1837); *History of the Earth according to the Bible and Geology* (1856); *The Primeval People, or Essay of Comparative Mythology and Key to the Symbolic Language* (3 vols., 1857); *The Age of Bronze, or the Shemites in Occident* (1866); *The Two Cities, or Philosophy of History in the Various Periods of Mankind* (2 vols., 1874), reviewing all the systems of philosophy of history published both in Europe and America, etc. D. Apr. 3, 1876. Rougemont was a man of profound religious convictions, and wrote several works which place him in the first rank among the apologists for evangelical Christianity: *A Commentary on the Minor Prophets* (1841), *Explanation of the Book of Ecclesiastes* (1844), *Christ and His Witnesses, or Letters on Revelation and Inspiration* (2 vols., 1856), *A History of Astronomy in its Relation to Religion* (1865), *Revelation of St. John explained by the Scriptures, and explaining History* (1866), *Human Life with or without Faith* (1869), *A Mystery of the Passion and Theory of Revelations* (1876). Most of these works have been translated into several languages of Europe. Rougemont was no less powerful as a political writer against the all-invading radicalism now prevailing in Switzerland. At the time of his death he was writing what he considered the work of his life—*The Two Cities*, of which the two volumes published were but the prolegomena. A. GUYOT.

Ruth'erfurd (LEWIS MORRIS), b. Nov. 25, 1816, at Morrisania, N. Y.; graduated in 1834 at Williams College; studied law with W. H. Seward; admitted to the bar 1837; entered into partnership with Hamilton Fish; visited Europe 1849–52; has devoted his leisure hours to science, and is one of the original corporators named in the act of Congress passed in 1863, creating the National Academy of Sciences. For the last twenty-five years he has been engaged in making original investigations, particularly in connection with the subject of astronomical photography, of which he may properly be considered the father. The following are a few of the papers published by him: In July, 1862, a short article on the companion to Sirius, which had then just been discovered; measurements are given; in May, 1863, a series of observations upon the fixed lines exhibited by the moon, also on the lines and bands of Jupiter and Mars; maps of the spectra of seventeen of the fixed stars are given; in the same year, a second article on the companion to Sirius, also observations on the stellar spectra and on the spectroscope, which at that time was a new instrument; also remarks on the two Ds, between which he observed seven lines. In the same year he published criticisms on different forms of the stellar spectroscopes which had been used by Secchi, Airy, and Donati; in 1865 gave an automatic form of a six-prism spectroscope, which still continues the best in use. In the same year he published an article on astronomical photography, and described the method by which he had succeeded in constructing an achromatic telescopic objective eleven and a quarter inches in aperture, and corrected for the photographic rays; this was the first successful attempt to produce a lens of this kind; in 1872 an article on the stability of the collodion film, in which he proved by measurements that the film underwent no alterations, such as would vitiate it as a record for astronomical observations; in Aug., 1876, an account of a glass circle for the measurement of angles, accompanied by a series of observations which proved that in the instrument as constructed by him the probable error of any single reading was considerably less than one-half a second of arc. In 1870 he perfected a small dividing-engine, by which he was able to rule diffraction-gratings on glass (see RULING-MACHINE, in CYCLOPÆDIA) surpassing those of Nobert. Some of these plates furnished larger spectra than spectroscopes with nine prisms. They are now used as the most efficient means in possession of the astronomer for the study of the spectra of celestial objects. He has also devised and constructed a very admirable micrometer for measuring the photographs taken with the telescope. (See MICROMETER, in CYCLOPÆDIA.)

Ry'an (JOHN GEORGE), brother of Gen. W. A. C. Ryan, "the martyr of the Virginius," b. at Toronto, Canada, June 18, 1841; educated to the law; colonel in the Confederate army during the civil war, and many times wounded. In 1865, having been arrested in Memphis, Tenn., by mistake for J. H. Surratt, one of the conspirators concerned in

the assassination of Pres. Lincoln, and carried to Washington in chains, he attained an unexpected and national notoriety, being styled "the mysterious prisoner."

Ryan (William Albert Charles), b. in Toronto, Canada, Mar. 28, 1843; educated in Buffalo; in 1861 entered the army in the civil war, and rose from the rank of private in the 132d New York to that of captain in the 192d New York; in 1869 espoused the Cuban cause; was chief of staff and inspector-general under Jordan, and distinguished for gallantry; returned to the U. S. repeatedly, and took part in several hazardous expeditions for the relief of Cuba. His last adventure, which proved fatal, was in the noted Virginius, which sailed from Kingston, Jamaica, Oct. 23, 1873, and was captured on the 31st by the Spanish war-steamer Tornado, and carried into Santiago de Cuba, where the whole company of passengers and crew, to the number of 151, were court-martialled by Gen. Burriel and condemned as pirates. Fifty-two of these, including Gens. Ryan, Varona, Del Sol, and Cespedes, and also Capt. Fry, the captain of the Virginius, were shot, the first four on the 4th, and the others between the 4th and 8th of November, when the British man-of-war Niobe steamed into port, and her commander, Sir Lambton Lorraine, interposed to arrest the slaughter.

S.

Sabine' Pass, p.-v., Jefferson co., seaport-town of Eastern Texas, is the terminus of St. Louis and Mexican Gulf R. R., and is also in communication with the interior of Texas and Louisiana by the Neches and Sabine rivers; has the best bar and harbor on the Gulf of Mexico, and will be among the most important seaports on the completion of St. Louis R. R. The water in its inner harbor is 25 to 40 feet deep. W. F. McClanahan, Ed. News-Beacon.

Saf'ford (Robert), b. July 7, 1767, in Worcester, Mass.; emigrated in his twenty-second year to the North-western Territory, then an unbroken wilderness from the Ohio River to the lakes; did much to reclaim the Western wilderness; was appointed judge over a vast district, embracing nearly all of what is now known as the State of Ohio; filled nearly all the offices of honor and trust which could be conferred at that time, taking an active part in the Indian wars, being commissioned colonel by the then governor of the Territory, Gen. St. Clair, and fought gallantly under the late President, Gen. William Henry Harrison, at the battle of Tippecanoe and others, until Tecumseh, at the battle of the Thames, was killed. D. at Gallipolis, O., July 26, 1863. Robert S. Newton.

Sa'hara [properly *Eç-Çahrâ*, an Arabic substantive meaning "a reddish waste plain deprived of vegetation"], the name of the great desert of North Africa, which extends from the Red Sea on the E. to the Atlantic Ocean on the W., and from the last ranges of the mountains of Berberia on the N. up to the fertile regions of the Negroland on the S. It covers 15° in latitude and 49° in longitude—about 8,530,000 square kilomètres, or 3,293,000 American sq. m., the half of which fall S. of the tropic of Cancer. The eastern part of the Sahara has a northerly slope. This is cut by the Nile, a river which, fed by the rains of the equatorial belt, receives a constant supply of water and pours it into the Mediterranean after forming a long oasis, Egypt. With that exception no other river cuts through the breadth of the Sahara. Westward from the Nile Valley various ranges, clumps of mountains, and table-lands occupy the central parts of that desert on its whole length. Among these the mountains of Wanyanga and of Tou or Tibesti, the table-land of Mourzouk and the table-land or Tassîli of Âzjer, the mountains of Azben and those of Âhaggar, the Tassîli of the Ahaggar, the table-lands Tân Ezroûft and Warân, and lastly the mountains of Adrâr, following one after the other from E. to W. on a sinuous line, form what might be called the spinal bone of that extensive country, and separate the two principal northern and southern watersheds. The Sahara has not been a desert from the date of its emersion out of the sea-waters. During the period that preceded the present aspect and life of the earth's surface, the valleys of the Sahara were real rivers, and extensive low tracts of that country were true lakes. A complete change in the climate of the whole of North Africa brought a diminution of the quantity of rain, stopped the flow of the rivers—some of which were as large as the Tennessee or the Platte—and caused the Sahara to be what it now is. The height of the soil varies considerably, according to the places. In the Algerian Sahara there is a large tract of country at a lower level than that of the sea, and that country, filled with the beds of salt lagunes, called *shott*, was about twenty-five centuries ago a part of the Mediterranean, which it joined at Gâbes. Another tract, lower than the level of the sea, extends in the eastern half of the Sahara S. of the table-land of Barga or Barca (anc. *Cyrenaica*); it includes the oases of Sîwa and Awjela. This last low country was probably also united to the Mediterranean a little W. from the modern delta of the Nile and in the bottom of the gulf of the Syrtis Major. The highest parts of the Sahara are the mountains of Tou, the Tassîli of Azjer, and, above all, the mountains of Âhaggar, which cover the centre of that desert, and form there properly three different knots of one raising, equally distant from the Red Sea and from the Atlantic. Some parts of the mountains of Tou are 2300 mètres high, and these are the basis of still loftier peaks. The table-land of Mourzouk, between Tou and the Tassîli of Âzjer, ranges from 560 to 580 mètres. The Tassîli, itself a table-land falling from S. to N., may be 1500 mètres, or perhaps 2000 mètres, above the sea-level in the highest parts, and the Âhaggar evidently exceeds the height of the Tassîli. Extinct volcanoes, masses of lava, basaltic rocks, show here and there the first cause of the rising of these mountains, which are mostly composed of sandstone and of limestone, but whose oldest fossiliferous banks are a submarine formation of the Devonian period.

From the Âhaggar, seemingly the highest point of the Sahara, come down in the plains, three large valleys, formerly rivers—the Igharghar, which had its mouth in the western desiccated gulf of the Mediterranean; the Tîrhehêrt, which was apparently a tributary of the Dhra'a River in Morocco; the Tâfasâsset, which flowed through the Kwâra or Niger into the Atlantic Ocean, like the last-named dry river. The waters of the Tassîli of Azjer went partly to the first and to the third of those rivers. The waters of the Tou Mountains fell in the direction of the Tsâd Lake, S., and on the opposite side they took the direction of the oasis of Ghehabo and Awjela. Another remarkable feature in the hydrography of the Sahara is the bed of a large river called Fêdé. That river acted to the waters of the Tsâd as a channel of derivation into the eastern Sahara or Libyan Desert, where they were first received in the hollow of Bodelé N. E. from the Tsâd. Although none of the *wâdi*, or valleys, of the Sahara, save perhaps one in the Âhaggar, has a constant flow, and although they are almost destitute of fountains, yet the supply of the rains—generally tropical rains, falling in the central Sahara only once about every nine, twelve, or even twenty years—is drained into these wadi or valleys, where, after an ephemeral flowing, it soon disappears, being absorbed by the loose sandy soil forming the beds of the valleys. Henceforth the waters are protected from evaporating by the alluvial ground, and reaching below an impervious stratum, they either become stagnant, or, shielded from the sun's rays, assume a subterranean course along the valley and nourish the wells digged on its extent, as well as the scarce shrubs and trees which are to be found only in such places.

At present the climate of Sahara is the genuine desertic, a climate of extremes, of sudden leaps from hot to cold, and of constant dryness. During the winter the temperature of the air falls sometimes to even more than 2° C., and that of the soil to 4° or 5° below the freezing-point. During the summer the temperature of the air in the shade reaches up to 44°, 45° on the table-lands, and to about 50° in some low countries; on such days the heat of the soil under the sun's rays may surpass that of the air, about 28°. In the short space of a few days the air itself shows differences of 28° in the shade. And the dryness of the atmosphere is such that the simultaneous indications of the dry and of the wet thermometer give differences of more than 23°. Under the influence of these meteorological processes operating through centuries, the particles composing the sandstone and other rocks are disintegrated, and these particles, carried away by the mighty winds that sweep the soil, wander afar till they come to a standstill in the hollow parts. Such is the origin of the extensive sandy tracts of the Sahara, which, although an exception in the general features of the North African desert, form there a large belt extending from close to the Gulf of Gâbes up to the Atlantic, and cover also other considerable spaces in the Libyan Desert, as well as in the N. of the Senegal. In these belts or strips the sand, halting against the smallest obstacles, accumulates around them, and generally the downs thus created assume the form of the waves of the sea, their ab-

rupt fall and their slow motion being with the direction of the prevailing wind. But the effects of these meteorological and physical phenomena are not confined to the Sahara. The heating of that immense mineral surface produces there an atmospheric current from S. to N. toward Europe (the *sirocco*), whose calorific action is felt upon the glaciers of the Alps; a current from N. E. to S. W. toward Senegambia (the *harmattan*); and a current from E. to W. (the *este*), which acts with the same scorching effects upon Madeira as the harmattan upon Sierra Leone.

The natural productions of the Sahara are not many. Salt, alum, saltpetre, natron, iron, sulphur of antimony, among the minerals, are the most common. Although in some places the strata both inferior and superior to the Carboniferous are met with, up to the present no mineral coal has been found in the Sahara. Peculiar plants compose its flora, and the natural families represented by the greater number of species are the Cruciferæ, Zygophyllæ, Leguminosæ, Compositæ, Globularieæ, Salsoleæ, Gramineæ; whereas other families, the Capparideæ, Rhamneæ, Tamariscineæ, Asclepiadeæ, Solaneæ, Salvadoraceæ, and Coniferæ, show species not so varied or common, but as much peculiar, or even more remarkable. On account of the similarity of soil and climate, the flora of the Sahara shows greater affinities with the flora of Arabia and Persia than with any other. Strange it is that plants growing in the neighborhood of Montpellier (France), and one growing in the island of Java, are met with in the Central Sahara. In the oases the date-palm tree (*Phœnix dactylifera*) and S. the *Cruciferæ thebaica*, the indigo, wheat, barley, sorghum, panicum, penicillaria, tomato, and some other edible plants, as well as a little cotton, are cultivated. Of the animals none are more copiously represented than the insects, and among these the coleopters prevail. A quantity of species of lizards and snakes, even the python and the horned adder (*Ceraustes*), the Naja haje, deserve notice among the reptiles. As a living proof of the past existence of the large rivers, the crocodile is found in some lakes in the higher part of their valleys. Rather few species of birds inhabit the Sahara; vultures and other birds of prey, small insectivorous birds, are the most frequent, and the large ostrich the most remarkable. The principal wild Mammalia are the hyæna, the jackal, several descriptions of antelopes, the mufflon, the hare, *Ctenodactylus*, jumping rats, and other kinds of rats. The one-humped camel, introduced after the beginning of our era, is the most useful of all the domestic Mammalia; without that animal life would be now impossible for man in the Sahara. The other domestic Mammalia are the horse, the ass, the dog, sheep, and goats.

Negroes were the first inhabitants of the Sahara, and it seems very likely that, at the time when water was plentiful, as shown by the contour of the country and the presence of semi-fossil water shells, men of the negro races alone lived in the Sahara. Subsequently, branches of that primeval population sought a refuge in the lowest, hottest, less dry, and more fertile parts of the country, in Wâd Righ, in Fezzân, to pursue there a life of agriculture. Another branch of that race, the Tibbou or Tédâ, with the Terawiyé, turned toward the centre of the country, where, unlike their brethren, the Barâbra of Nubia, they became nomads, and as herdsmen remained masters of the eastern portion of the North African desert. Those of the Saharian negroes who settled in the oases have accomplished certain improvements in agriculture, and particularly in the management of water. In flat-bottomed hollows they dug artesian wells, and on slopes gallery wells, to irrigate the oases.

Two migrations of the white races afterward scattered over the western Sahara its present inhabitants, the Berbers and the Arabs. The Berbers, whose first dwellings seem to have been on the N. coast of Africa, on the borders of Egypt, where they had kin, and whence they received the beginnings of civilization, and in the mountains of Morocco, passed into the Sahara, and since, under the names of Zenâga, Zenâta, and, above all, under the Arabic surname of Touâreg, they peopled the largest part of its territory now kept by the white race—viz. the western half. The nomadic Arabs followed; coming over Egypt, they spread the religion of Mohammed over the whole Sahara, and now their tribes are scattered on the borders of the Nile and on all the most northern and western districts of the Sahara, close to the Berber tribes, or intermixed with these.

With respect to the part it plays in the intercourse of mankind, the Sahara, wanting almost all the elements of richness, and even of comfort, is principally a mere thoroughfare. The numerous tracts that cut its surface are used not only by shepherds to convey the herds and flocks to the scanty pasture-grounds, but also by small and large caravans, which carry, between the Mediterranean and the countries of the Negroland, the European or Asiatic wares asked for in the last countries, and the natural products of these which are employed in the first and in Europe.

In a commercial point of view the Sahara is a country of transit much more than a country of production. From early times there existed commercial transactions between the states bordering the Mediterranean and the Negroland, and after ages—even now that African trade has found many outlets on the Kwâra, on the Guinea coast, and in Senegambia—the commerce by caravans across the Sahara has not ceased. These caravans convey into the Negroland various products coming from Barbary, from Europe, inclusive of the Turkish empire, and from America, such as calico, cloth, muslin, silk wares, wool carpets, red caps, sugar, coffee, tea, needles, paper, guns, powder, sword-blades, looking-glasses, copper, coral, essence of rose or of geranium, ancient Spanish and Austrian dollars, and new French dollars. They bring back cotton garments manufactured in the Negroland, very fine red or yellow leather bags and cushions, sandals, yellow or red tanned sheepskins, gooro-nuts (fruit of the *Sterculia acuminata*), and slaves destined for the markets of the Sahara; beeswax, frankincense, civet, ostrich-feathers, ivory, indigo, gum-arabic, and gold, either in dust or worked into rings; which last wares are partly consumed in Barbary and partly forwarded to Europe. Formerly, the merchants of the Sahara were much engaged in the slave-trade, and furnished with negro slaves the countries of Barbary. They discovered that, on account of the deaths occurring when crossing the Sahara—probably, also, in consequence of the scarcer demand resulting from prohibitions—slaves were not remunerative enough, and now their sale is an exceptional sight in the Sahara. Many white slave-dealers of Ghadâmés and Sôkna confess that the slave-trade is not agreeable to Allah, and that there is a curse upon the merchant. Cruelties against the slaves brought across the Sahara are most frequent among the Tédâs, who are themselves negroes.

Eleven principal routes are used at present by the caravans which exchange goods from the Mediterranean or the Atlantic with those of Negroland. These are, beginning at the E.—the road from Çiyoût in Egypt to El-Obiïd in Kordofân; the road from Dongola to El-Fâsher in Fôr, and that from Siwa to the same city; the road from Ben-Ghâzy to Wâra and Abêshé in Wâdâï; the road from Tripoli to Koûka in Bornou; the roads from Tripoli and Tunis to the celebrated manufacturing town of Kanô in the Houssa country, and another passing, like the former, by Ghadâmés, then by In-Çâlah, and joining Timbuctoo; the roads from Oran and Algiers to Gourâra and In-Çâlah, with no present direct extension of the trade farther S.; and, lastly, the Morocco roads from Mogador and from Tangiers, this, *viâ* Tafilêlt, to Timbuctoo. Almost the whole of the trans-Saharian exchanges take place by these routes or by their ramifications, which must be considered as the arteries of the meagre international life of the Sahara.

The Sahara proper produces for exportation salt, alum, natron, asses, camels, sheep, and wool, in the northern parts. Of these products, sheep are exported to Barbary, and wool even to Europe, while salt is the only object of a very extensive and important commerce in the markets of the western half of Nigritia, where there is a great demand for that article of first necessity. In Bilma, in Amadghôr, in Teghâza, in Taodenni, and in Ijil are the inexhaustible mines which have furnished, or still furnish, with salt the numerous inhabitants of the basins of the Tsâd and of the Kwâra or Niger, whose territories are deprived of that mineral. These natural circumstances have apparently been the first cause of the trans-Saharian commerce. Even in the eastern part of the Sahara we see, by the valuable reports of Herodotus, that the routes of the Ammonians and Libyans to the W. went along a chain of salt-mines, and, although the father of history does not mention its digging and sale, the salt of this region must have been in his time an object of trade. The richest of the salt-mines known in the Sahara, that of Amadghôr, is found in its western half, below the N. E. slopes of the table-land of Âhaggar. The salt of Amadghôr was anciently carried S., to Azben and to the Houssa country, by caravans, which exchanged at the fair of Amadghôr the merchandise of the Negroland against the wares brought by the caravans from Warglâ, and which had always the certainty of finding at Amadghôr at least one product wanted in the Negroland. No certain date can be ascribed to this trade, which slackened, and afterward ceased, in the sixteenth century, in consequence of political changes, causing the fall of the commercial importance of Warglâ, and the suspension of the part Algeria had played in the commerce of Nigritia. At present the inhabitants of the basin of the Tsâd draw their stores of salt from the mines

of Bilma, and the inhabitants of the basin of the Niger from Taodenni.

The commerce of the interior of Africa across the Sahara has become a subject of attention in our days. Three French projects for a railway from Algeria to the Niger River were published in 1875—one from Tougourt, *viâ* Warglâ and Wâd Mîya, to Timbuctoo, proposed by M. Duponchel; the second from Algiers, *viâ* El-Golea'a and In-Çâlah, proposed by M. Soleillet; the third from Oran, *viâ* Wâd Ghîr (or Wâd Es-Sâwra), proposed by M. Du Mazet, this last scheme being perhaps the least difficult of execution in the Saharian northern part on account of the long watered valley it follows to the southernmost villages of Tonât. It would be too soon to discuss the remoter parts of the projected lines toward Timbuctoo, for no traveller has brought home even the slightest sketch of an itinerary in that country, which has a calcareous table-land, without wells, extending for about 95 kilomètres in its narrowest part. It seems necessary to wait until the whole tract is explored by a geographer before submitting the question to railway constructors; yet M. Duponchel, a practician, quite prematurely calculates upon a length of 2535 kilomètres, an expense of 400,000,000 francs, and an advance of the work at the rate of 3 kilomètres a day for the line he proposes.

Of the ordinary commercial routes that, more probably than railways, are destined to serve to revive the commerce of Algeria in the southern direction, we mention the ancient trans-Saharian route *viâ* Warglâ and Amadghôr to Kanô, which made the fortune of Warglâ, and offered a steady source of benefits to the Âzjer and Âhaggar Touâreg, and the routes *viâ* Touât to Timbuctoo. In the mean while, England might establish a port and colony close to Cape Bojador, in order to get a much more healthy land-route to the countries of the Niger than the river-route is known to be.

Closely related to the commercial questions are the projects of submersion of large parts of the Sahara, which originated during the French geodetic survey conducted by Capt. Roudaire, S. of Biskra, into the Shott Melghîgh. Capt. Roudaire was commissioned in 1874 to complete the topographical survey of the depression existing in the Sahara of Constantine, and he found upon the French territory an inundable space of 6000 square kilomètres, which forms a part of the dried-up *Tritonitis Palus*, anciently communicating with the Mediterranean near Gâbes (*Tacape*). Westward from the boundary of Tunisia, the soil is higher than the level of the Mediterranean for 18 kilomètres, and the depression begins again in the Shott El-Gharsa. The distance eastward of the depressions extending in the 10,000 square kilomètres of the Tunisian shotts is still unknown; yet there exist some indications that the Shott El-Gharsa is not connected with the Shott El-Jerîd, and the soil of the last may have a greater elevation than the first. On the other hand, an Italian scientific commission has verified what former travellers had already noticed—viz. that the coast of the Gulf of Gâbes is the result of an elevation of the soil that shut up the entrance of the *Palus Tritonitis*, and left it to dry for want of a sufficient alimentation by the rivers falling into it. M. Fuchs, another practician, has ascertained that the breadth of the bank of chalk and sandstone now shutting the entrance of the ancient bay is 20 kilomètres, and he has calculated that the cost of a canal across that bank only would amount to 300,000,000 francs.

Much more plausible than the almost impossible restitution to the Mediterranean of its ancient Bay of Triton is the conception according to which Messrs. Mackenzie and Skertchly dreamed to inundate the western portion of the Sahara, from the coast facing the Canary Islands as far as the country of Azawâd and Timbuctoo. The whole of that fallacious scheme rests upon a misconception—viz. that there exists a large hollow called El-Joûf westward from Timbuctoo. El-Joûf is a depression with regard to the table-lands surrounding it, but certainly not in comparison with the sea, and a river, Belta, by which it would communicate with the ocean in the latitude of the Canary Islands, does not exist at all. On the contrary, broad table-lands, and even mountains, extend for 700 kilomètres between El-Joûf and the Atlantic.

A similar conception had its origin in the nature of a considerable depth of the soil of the Sahara at the oasis of Sîwa or *Ammon*, which is a part of the Egyptian territory. It was thought possible that the whole of the Libyan Desert could be converted into a lake or a sea. But the results of the recent work of an expedition sent for that object by the Egyptian government, with M. Rohlfs as chief, demonstrate that the only result would be the inundation of an insignificant portion of the country from Sîwa (−29 mètres) to Aradj (−75 mètres) and Sittra (−15 mètres), E. S. E. from the first oasis: in other words, the enormously difficult, expensive, useless, and therefore criminal, destruction of some of those rare places of the North African desert where sedentary life is now possible to man.

As far as it may be guessed, considering the condition of Sahara and of its inhabitants, improvement can take place solely by perfecting the modes of cultivation, of travelling, and of commerce in practice there for the last sixteen centuries, and by giving to the inhabitants a more regular national life, which will result from material improvements. Such are the sure ways of progress for the Sahara and for the Saharians. HENRI DUVEYRIER.

Saigi'idæ, or **Saigi'inæ** [from *Saiga*, the Latinized form of the proper name], a peculiar family of antelope-like ruminants, or perhaps a sub-family of the Bovidæ, distinguished by the peculiarly enlarged muzzle and the co-ordinated modifications of the nasal region of the skull. The form is that of the antelopes or sheep; as in them, too, the skull has the auditory bullæ produced downward, especially toward the inside, and applied behind to the paroccipital processes; the styloid processes are deflected more or less forward, enclosing oblique folds on the outer surfaces of the auditory bullæ, and the palatine axis is declivous from the occipito-sphenoid axis; the horns are also persistent, and developed as osseous cores originating from the frontal bones. The peculiar characters are dominant in the olfactory organ, which is extremely expanded and inflated above, and the nasal bones are much shortened, directed upward, and entirely separated from the supramaxillaries, as well as the lachrymals, by the projection of the frontals between the lachrymals and the nasals; the supramaxillaries and intermaxillaries are reduced and attenuated forward; the posterior nasal cavity has its walls inflated outward. The form thus distinguished is represented by but a single species, *Saiga tartarica*, which was made known by Pallas in 1777 under the name *Antilope saiga*. The species is an inhabitant of the plains of Northern Asia, especially in the region of Mount Altai, but it extends also into Eastern Europe as far as the Crimea. It is about the size of a small deer, and its body is yellowish above and whitish below. It associates in large herds. When it wishes to drink, it is said to plunge its entire snout into the water, and to take in the liquid through the nostrils. The flesh is very disagreeable, but is eaten in winter, although in summer it is rejected, because then there is found under the skin the larva of a gad-fly. (See, among other articles, James Murie, *On the Saiga Antelope, Saiga tartarica*, in *Proc. Zool. Soc. London*, for 1870, pp. 451–503.) THEODORE GILL.

Sale, in Law. By the term "sale" is meant the transfer of the property in a thing, whether real or personal, for a price in money, and not in goods or other property. Owing to the peculiar theories of the English law concerning real estate, the rules governing the sale of land are not the same as those governing the transfer of chattels, though bearing a general resemblance. They are accordingly treated separately by law-writers, the doctrines governing in real property law being usually found under the head of "vendor and purchaser." A convenient arrangement, therefore, will be to treat the subject under two general divisions, one of them referring to sales of real estate and the other to personal property.

DIVISION I. SALES OF GOODS OR CHATTELS.—This is one of the most important branches of the law of contracts (see CONTRACT, in CYCLOPÆDIA, where will also be found the articles referred to below), and extremely fruitful in distinctions. Only a very general survey of the subject can be made. As there is an important statute, first enacted in England, and generally adopted in this country, affecting the subject, and termed "the statute of frauds" (see FRAUDS, STATUTE OF), the subject will be considered both at the common law and as affected by this statute.

I. *Sales at Common Law.*—As a sale is a contract, it must have all the ordinary ingredients of an agreement. There must be parties competent to contract, mutual assent, and a thing of which the ownership or property is transferred from the buyer to the seller, and a price in *money*. If no money be paid or promised to be paid, the transaction is a barter or exchange instead of a sale. An exchange is for most purposes governed by the same rules prevailing in the law of sales, but not in all respects. In discussing this topic it will not be necessary to consider in detail such matters as are generally applicable to contracts, as they have been sufficiently considered under the articles CONTRACT, CONSIDERATION, FRAUD, etc., to which reference is made. The special rules governing this division of the present article will be treated under the following heads: *First*, the effect of the contract in passing the ownership of the goods to the buyer; *second*, the general duties of each party as created by the contract; *third*, remedies against each in case of their violation.

First. An important distinction must be taken at the

outset between an executed and executory contract of sale. The former passes the title in the subject of the sale to the purchaser; the latter gives no title, but simply creates a right. The buyer in this case has a right to have the ownership of the thing contracted to be sold, but if that be wrongfully denied to him, he has his remedy only in damages. The same rule is applicable to the seller should the buyer refuse, without cause, to take the article at the stipulated time. In an executed sale the buyer, though the goods are not yet delivered to him, takes all the responsibilities of ownership. In case of destruction by fire or other casualty the loss falls on him. In the executory contract, as ownership remains in the seller, he must bear all such losses.

To constitute an executed contract of sale independent of the statute of frauds the assent of the parties is only necessary. As soon as the minds of the seller and buyer concur the title passes to the latter. This is not necessarily true of the possession. Where the sale is not understood to be upon credit, it is a ready-money sale. If the price is not paid, the seller has a lien (see LIEN) upon the goods so long as they remain in his possession, and can thus retain the goods until the price is paid. On the other hand, if the sale be upon credit, the purchaser is entitled to immediate possession, and if he receives it the seller has lost all control over the goods, and his claim assumes the form of a debt. Still, if the seller happens to retain possession until the credit expires, his lien will revive. It thus appears that under the rules of the English common law delivery of the goods is not a necessary element in a sale. It will be enough that there be sufficient subject-matter, a price, and mutual consent. Delivery may become important for other reasons. There is an ancient rule of law, still in full force, that an inference of fraud may be derived from the fact that delivery does not accompany the transfer of ownership. This does not mean fraud entering into the sale as between the parties to it, but refers to third parties likely to be affected by the transaction, such as subsequent purchasers from the vendor in good faith and his creditors. There has been much controversy upon the point whether the fraud must necessarily be inferred as a rule of law, or whether it must be treated as a question of fact, so as to make each case depend upon its own special circumstances. If the latter view should be taken, evidence might be offered to repel the presumption of fraud, so that the good faith of the transaction might thus become a question of fact for a jury. After much vacillation of judicial opinion the latter view has gained the preponderance, and is likely to become generally recognized. It is still true that if no affirmative evidence of good faith be offered a presumption of fraud may be derived from the mere fact of the detention by the vendor of the goods beyond a reasonable time. It is a fundamental rule that the seller must be the owner of the goods or no title will be conferred upon the purchaser, though he act in good faith. There is an exception to this rule recognized in England, though not in this country, where the sale is made in open market (market overt). Accordingly, a thief or a bailee cannot in the U. S. by any devices so cover up the defects in his title as to transfer the ownership to a purchaser. The single exception to this rule which has general prevalence is found in the case of money and its substitutes in the nature of credit passing from hand to hand in the ordinary course of business.

The thing sold must have an actual or potential existence. By the expression "potential" is here meant, within the range of ordinary possibility. Thus, a vine-grower may make a valid sale of the grapes to grow in his vineyard during the coming season, but he cannot make a strict sale of property which is to be hereafter acquired; as, for example, in the instance just supposed, of grapes to grow in a vineyard which he has not yet planted. Such a transaction would amount to an executory contract of sale, and would, as already pointed out, confer no ownership, but only a right of action. Some have gone so far as to maintain that it is illegal, as contrary to public policy, to offer to sell what one does not own, but can only acquire by subsequent purchase. This view is deemed to be extreme, and is not sustained by modern authority.

A rule of much importance requires that the subject of the sale should be a specific chattel. If not, the agreement is executory. An illustration or two may be given: Thus, a sale of twenty tons of oil from the seller's stock in his cisterns or of fifty hogsheads of sugar (more being mentioned), or of ten tons of hemp out of thirty, belongs to the class of executory contracts. The general ground is, that where there is a bargain for a certain quantity to be taken from a larger quantity, with a power of selection in the vendor to deliver which he thinks fit, the right does not pass to the vendee until the selection is made. "There is no *individuality* until there has been a division." There may, however, be another theory in such a case. Although there be no selection, the purchaser may become the owner of an undivided share of the property. For example, it is possible to conceive that an owner of thirty tons of hemp might sell ten tons from the mass in such a way as to make the purchaser owner of an undivided third. Should this be conceded, the whole question would be narrowed down to a consideration of the intent of the parties. This view has of late become somewhat prevalent in this country.

But if the chattel be specific, there will not necessarily be a sale. There may something remain to be done to put the chattel in a condition fit for delivery. A distinguished English writer and judge, Blackburn, has laid down two general rules as applicable to this subject. One is, that in case the vendor by the agreement is to do anything to the goods for the purpose of putting them in that state in which the purchaser is bound to accept them, the performance of the thing will presumptively be taken to be a condition preceding the vesting of the ownership in the purchaser. The other rule requires that if any act, such as weighing, measuring, or testing, remains to be done by the seller to the goods, for the purpose of ascertaining the price, which is made to depend on quantity or quality, such act shall in like manner be deemed a condition precedent. These rules are adhered to with much rigor by the English courts, though they have been to some extent relaxed in the courts of a number of our States. Thus, in the State of New York it has been decided that if the owner of a large mass of wheat stored in a specified place gives the vendee a receipt acknowledging that he holds a parcel of it (*e. g.* 6000 bushels), sold for a specified price, subject to the purchaser's order, the title passes. (*Kimberly* v. *Patchin*, 19 New York Reports, 330.) This case proceeds upon the ground that the seller and buyer may be regarded as the joint owners of the entire mass, one of the 6000 bushels and the other of the residue, provided there is sufficiently clear evidence of the intention of the parties to the contract. It will be observed that in the case referred to the ends of justice did not require any selection, as all the grains of wheat must be assumed to have been of equal value. If articles of unequal value were so mingled together as to require an act of selection in order to ascertain them and separate them from the mass, a different rule might prevail.

Assuming, however, the correctness of the English decisions, and that in such cases as have been considered the sale is executory, and that no title passes, it may pass into an executed transaction, by *a subsequent act of appropriation* by the parties, without any new contract. The element that was originally wanting to make the sale complete is by this means supplied. Though the sale is made by two successive acts, it is, after all, but one contract. The case seems very clear when the act of "subsequent appropriation" is performed by both parties. Thus, if a vendor had agreed to sell to B 1000 bricks, not yet counted from a pile, but to be selected by the buyer, the sale might at that point be deemed to be executory. Should B subsequently send his carts for the bricks, and they should be counted out by him and set apart as his own, it would be difficult to maintain that the contract was not executed. The matter, however, would assume a much more complex form if the act of appropriation were to be done by the seller. In that case it might not be easy at first sight to determine when the appropriation was actually made. The seller might, for example, make a selection, and then change his mind and choose others *ad libitum* until he had done some overt act called for by the contract which would make his election irrevocable. This rule will become more clear by applying it to an instance frequently occurring in the ordinary course of business. By the terms of an executory contract the vendor is to despatch unspecified goods to the vendee. As soon as he *despatches* them the act is irrevocable; the sale is complete, and the title is vested in the vendee. Before the act of despatching the goods is performed no evidence of intention on the vendor's part to send particular goods will have any bearing on the question. Under these rules, if a vendor delivers goods to a carrier by order of the purchaser, the appropriation is absolutely made, and the ownership of the property vests in the latter. It may not be out of place to add, by way of qualification, that if the act of appropriation be in its own nature conditional, the sale will partake of the same character. Accordingly, the vendor may make the appropriation dependent upon payment, and may take the bill of lading from the carrier to himself with a view of retaining the ownership in himself until payment is made or some other act performed. Presumptively, it would appear that the appropriation is absolute, unless there is some evidence of intention to the contrary. Cases of this kind present questions of great difficulty and complexity, of which an example may be found in the recent English case of *The Calcutta Company* v. *De Mattos*, the most eminent judges showing an extraordinary diversity of opinion. (See 32

Law Journal (Queen's Bench) *Reports*, 322; 33 *Id.*, 214.) Of course, no appropriation can be forced by the seller upon the buyer which does not accord with the terms of the contract. He cannot, for instance, compel him to take a larger quantity than he has contracted for. A single special application of the doctrine of appropriation may be referred to. This is the case of an article manufactured by special order, and perhaps paid for in whole or in part. The point in controversy will be, whether the title remains in the builder, or whether, by reason of the payment, it has vested in the buyer. The decision, in the absence of special agreement, will turn upon the point whether the manufacturer has so fully performed an act evincive of his intention to appropriate the goods to this particular order as to make his election irrevocable. In one case it was said, "A tradesman often finishes goods which he is making in pursuance of an order given by one person, and sells them to another. If the first customer has other goods made for him within the stipulated time, he has no reason to complain; he cannot claim the goods from the purchaser to whom they were in fact sold." Where the payment is made by specified instalments a question may arise whether it was the intention of the parties that the ownership should be transferred upon payment of one or more instalments. If so, it will be carried into effect. This intention may be exhibited by their acts as well as by words. Thus, it has been laid down that if there be a provision in the contract for payment regulated by particular stages of the work, with a view to give the purchaser the security of certain portions of the work for the money he is to pay, this is equivalent to an express provision that on payment of the instalment the general ownership of so much of the chattel as is then constructed shall pass to the purchaser. In the absence of evidence of intention the manufacturer remains owner until the chattel is completed and appropriated to the purchaser.

There is an important qualification of the rules concerning "subsequent appropriation" which must now be noticed. This is, that owing to special circumstances, notwithstanding a complete and certain designation has been made, the seller desires to remain owner until a particular act on the part of the purchaser has been performed. A common instance is where the seller and buyer transact business in different places, and the former desires to secure himself against the possible insolvency of the latter. This is commonly done by means of a bill of lading (see BILL OF LADING), taken from the master of the ship on which the goods are transported. If the intention were to cause the transaction to be unconditional, the bill of lading would be so drawn as to declare that the goods were to be delivered to the purchaser on his order. On the other hand, if the seller, as in the case now under consideration, desires to retain ownership, he would have the goods, notwithstanding they had been so set apart as to make his election in favor of the purchaser irrevocable, deliverable to himself or to his own order, or to some other specified person; *e. g.* one who, not being the buyer, had advanced the money to pay for the goods. In either event the goods would regularly be delivered to the purchaser, and his ownership would become complete on direct payment for the goods or of a bill of exchange drawn on the buyer in favor of the money-lender for the price. In such instances the seller is said to retain the *jus disponendi*, or power of disposal. The whole question is resolved into one of intention. In some instances the evidence of intention is such as to lead to much doubt, in which case the matter must be disposed of on a view of all the circumstances of the case, and might become a question of fact for a jury. It follows from these principles that there is an important distinction between the case of a mere delivery of goods pursuant to an order of purchase to a carrier, and the case where a bill of lading accompanies the transaction. In the first instance, the carrier may properly be deemed the agent of the purchaser, and the delivery accordingly complete, subject to the vendor's right of *stoppage in transitu* in case of the former's insolvency. (See STOPPAGE IN TRANSITU.) In the second instance, he is the bailee (see BAILMENT) of the person pointed out in the bill of lading. If the seller is that person, the presumption is that he reserves to himself the power of disposal or control, and the transaction is not complete; and the same rule would be applied to any act made requisite by the seller, such as the acceptance of a bill of exchange by the buyer. This presumption may be overthrown by evidence that the seller did not, in fact, intend to reserve any control over the property. So, on the other hand, where the goods are delivered on board of the purchaser's own ship: while the general rule is that this is a delivery to the buyer, it may be shown that the seller intended to reserve the "power of disposal," even though the bills of lading declare that the goods are free from freight or "free on board" because they are the ship-owner's property.

A distinction must next be pointed out between an absolute and a conditional sale. An absolute sale is readily understood, and is one where the title passes to the purchaser free from all restriction or limitation. A conditional sale may be one where, owing to some condition (see CONDITION) or restriction, the title does not pass at all, or if it does vest in the purchaser, it is liable, on the happening of some event, to be defeated and to revest in the seller. One of these would be a precedent, and the other a subsequent, condition. An important instance of a precedent condition is the ordinary mercantile contract of "sales to arrive" or "on arrival." Such a contract is in general conditional, and does not take effect as a complete sale unless the goods arrive at the place and in the manner designated in the contract. If the stipulation concern their arrival by a particular ship, they must come in the ordinary course of navigation upon the ship specified, and no other. On the other hand, if the arrival takes place in the manner designated, the sale is absolute. Sometimes there is a clause in such a contract, where no ship is specified, that the vendor shall give notice of the name of the ship on which the goods are expected to arrive as soon as it becomes known to him. Such a clause must be strictly complied with. The contract must be treated as in the outset executory, to become executed on the arrival of the ship. The goods must accordingly be merchantable, and the rule of *caveat emptor* (see CAVEAT EMPTOR) is not applicable, since the purchaser at the time the contract was entered into had no opportunity to inspect the goods. There are other contracts having in them a like conditional element, such as "sales on trial" or "approval," or a "sale or return." These will become absolute on the failure on the part of the vendee to observe the conditions, and by his retention of the goods beyond the time mentioned in the contract as allowed to him for the purposes specified. Quite a common case of a conditional contract is one where the goods are delivered to the buyer before they are paid for, with a stipulation that no title shall pass until payment is made. An illustration may be found in the case of a safe sold to a banker. Though he might under such a contract have free use of the article, he would have no interest which he could so sell or otherwise dispose of as to prejudice the rights of the original owner. One of the most important instances of a sale upon a condition subsequent is a mortgage of chattels. This so-called mortgage is really a sale, which the original owner may defeat by performing the condition at the appointed time. If not performed, the transaction becomes absolute in the view of a court of law, and the mortgagor has only a right in a court of equity to redeem. The transaction is quite different from a pawn or pledge, as in the latter case no title passes to the pledgee or pawnee, but only a special property, the general ownership still remaining in the pledgor. It is a species of bailment rather than a sale. The chattel mortgage has become in modern times an important contract, and is much resorted to. There are important rules governing it bearing upon the question of fraud. One of these, of a statutory nature, is, that if the goods continue, as they commonly do, in the possession of the mortgagor, the mortgage deed, or a copy of it, must be filed in a specified office (*e. g.* in that of the clerk of the town where the mortgagor resides), and if it continues in force beyond a fixed time, the amount remaining due must be stated by endorsement on the mortgage or otherwise. A failure to observe these regulations may avoid the mortgage as to such third persons as creditors of the mortgagor and innocent purchasers from him, while the transaction may still be upheld as to the parties to it. A further rule of general application prevents the mortgagor, as far as creditors are concerned, from retaining the power to sell the goods and apply the proceeds of the sale to his own use. This would be evidence of an intent to defraud creditors by interposing a nominal mortgage between himself and his creditors to delay the enforcement of their claims. The correct course in such a case would have been to have provided that any surplus beyond necessary expenses should be applied to the reduction of the debt. A like question may arise as to the case where a mortgage should be so drawn as to embrace not only property then owned by the mortgagor, but such as he should thereafter acquire. While this transaction might be upheld, as between the parties, as an executory contract to be enforced by a court of equity when the property was obtained, it would in general be regarded as inoperative as to creditors of the mortgagor. Assuming the mortgage to be valid, if the debt is not paid at the appointed time, or, if demand be necessary, after demand, the mortgagee may proceed to sell the property after giving due notice, or he may foreclose in a court of equity, in each case yielding any surplus, beyond what is necessary to pay his debt and legal expenses, to the mortgagor.

Second. The leading duty of each party to the contract is to perform it according to its terms. If there are any conditions to be observed, they are to be strictly followed, unless there is good ground for excuse, either in the failure of the opposite party to fulfil his duties or in the intervention of some act of God or of the law. More specifically, there may be on the part of the seller such obligations as warranty of the title or quality of the goods on delivery, and on the part of the buyer acceptance of the goods and payment or tender of the price. These will now be considered.

A. *Warranty.*—This may as to its substance be twofold, either of title or quality, and in each case, as to its form, may be either express or implied. A warranty is to be regarded as a collateral contract accompanying the principal contract of sale. Where it is not implied by law it may or may not exist at the pleasure of the parties. If an express warranty be broken, and there be no fraud, the principal contract will still remain. The sale is valid, and the only remedy of the buyer is an action upon the collateral contract of warranty. This is not true of the implied contract of warranty. This enters by a rule of law so completely into the main contract that it forms an ingredient in it, and if it be broken the buyer, if acting promptly, may rescind the contract of sale itself. Considering, in the first instance, the implied warranty, it may be remarked that there has been much discussion among jurists whether in a sale of chattels the law will imply a warranty of title. The English authorities are not so distinct upon this point as the American. It is well settled in this country that there is in every sale where the chattel is in the possession of the seller an implied warranty of ownership. If it be out of his possession, the buyer is put upon his guard and the implied promise does not exist. As to warranty of quality, there is a close accord between English and American views. There is in general no implied warranty of quality where the goods are open to the purchaser's inspection, as he must look out for himself (*caveat emptor*). A single distinct exception is found in case of the sale of provisions for domestic use. The rule itself has no application to a case where there is no opportunity on the part of the purchaser for inspection, as in the case of a sale by sample (the bulk of the commodity being absent), or where an article is made by a manufacturer to fulfil an order, or where the selection of an article fitted for a particular purpose is undertaken by the seller, or where goods are sold "to arrive." In all of these last cases the risk is thrown upon the seller (*caveat venditor*). If he does not supply the requisite article, the buyer may reject what he presents him. The rule of *caveat emptor* has no application in the case of fraud or undue concealment. (See FRAUD and CAVEAT EMPTOR.) If there be no implied warranty and no fraud, the buyer has no redress if the goods are of an inferior quality, even though he may have paid the price, except he have an express warranty. It will sometimes be quite difficult to determine whether words of commendation constitute an express warranty or not. A certain amount of unwarranted praise on the part of sellers is tolerated by the courts as being an exaggerated expression of opinion on which purchasers have no right to rely. On the other hand, if there is an assertion on which the seller knew, or had reason to know or to suppose, that the buyer would rely, the question will be left to the jury whether there was not a warranty intended. A similar question arises as to the effect of a statement in a bill of parcels—*e. g.* "sold to A B — cases of indigo." Such a statement would be in general held an affirmation by the seller that the article sold was indigo, and if it turns out to be a different commodity the seller is answerable.

B. *Delivery.*—It has been well remarked by a recent writer on the law of sales that there is no branch of the law of sales attended with so much confusion as this. The word "delivery" is used in various senses. Sometimes it is employed in reference to the origin of the contract itself under the provisions of the statute of frauds. This point of view will be regarded hereafter. At other times it refers to the performance of a contract which is conceded to have been properly entered into. Again, a delivery is sometimes assumed where in point of fact none has been made, and hence termed "constructive." The matter at present to be considered is delivery so far as it concerns the performance of the contract.

The general rule of law is, that the buyer is not entitled to the possession of the goods until the price is paid, delivery and payment being concurrent acts. If, however, the sale is on credit, the buyer may in general insist upon immediate possession, unless he be insolvent, when the vendor may retain them, as he might under the same circumstances detain them in the hands of a carrier in the course of transportation to the buyer under the exercise of the right of "stoppage in transitu." (See STOPPAGE IN TRANSITU.) Assuming that there is no ground of detention, and that the seller is bound to deliver, his duty will in general be discharged by placing the goods in such a position that the buyer is free to take them at the place where the sale is made. There may, however, be special terms in the contract imposing further obligations upon the seller. He may, for example, agree to carry them to the buyer's residence or place of business, or to put them in the possession of a carrier or other middleman to be transported to the buyer. In such a case the law will infer that they are to be sent within a reasonable time, which will be made to depend upon all the circumstances of the case. If the time be specified—*e. g.* twenty days—the rules are somewhat complicated. Much will depend upon the point whether the place is also fixed. If it be not, then, the goods being deliverable to the buyer *anywhere*, the seller must find him within the specified time and make tender of the goods at some "convenient" hour before midnight of the last day. The word "convenient," as here used, would imply that the tender should be made long enough before midnight to give the buyer sufficient opportunity before the time specified in the contract expired to examine the goods for the purpose of determining whether they complied with the contract. If the *place* be fixed as well as the time, then it is the duty of the buyer to attend as well as the seller. It would be inconvenient to require that this attendance should take place on every day named in the contract. The rule is, accordingly, that it will be enough if the buyer is present on the last day at some "convenient" hour *before sunset*, that the whole transaction may be completed by daylight. It follows that if the seller makes the tender of the goods at this hour, it will suffice whether the buyer be present or absent. Should the buyer happen to be present at other hours on the last day, the delivery may be made to him down to a convenient hour before midnight, as before. The delivery, when made, must correspond with the contract. More goods than are called for must not be sent, nor must they be mixed with other chattels. The seller has no right to impose upon the buyer the duty of unpacking the goods and separating those that he had purchased from others. A difficult question arises when the seller delivers a less amount than the contract requires. It is agreed that the buyer is not bound to accept the smaller parcel. The perplexity is occasioned by his acceptance, and the consequent inquiry whether he must pay for what he has received so long as he demands the entire fulfilment of the contract. On this point the authorities are hopelessly at variance. While the English courts under such circumstances hold the buyer liable, the New York tribunals emphatically repudiate this view, and urge that on an entire contract the seller can recover nothing so long as a substantial part of it remains unperformed. The rigor of the general rule will be lessened by the insertion in the contract of the words "more or less" or their equivalents, showing that the parties do not intend to be bound to any specific number or amount.

When the contract requires that the goods shall be sent by a carrier, the usual precautions must be observed. If none be specified, regard must be had to the usual course of trade, the nature of the articles, etc. If a carrier be named, delivery must be made to him, using due care as to directions, packing, etc. Delivery to the carrier is in general delivery to the buyer, subject to the seller's right of stoppage *in transitu*. However, it may be agreed that delivery be made to the buyer personally, in which case the carrier will be the seller's agent.

Symbolical delivery is in some instances recognized as equivalent to actual delivery. Thus, if goods are bulky and actual delivery is not convenient, there may some act be done evincing the intention which will be deemed equivalent to delivery; as, for example, delivering the key of a warehouse in which the goods are stored. This notion has in some cases been pushed to an extreme, and the tendency of modern decision is to confine it within reasonable limits. There may perhaps be a symbolical delivery sufficient to constitute performance, which would not be enough at the time of the formation of the contract to satisfy the provisions of the statute of frauds, as considered hereafter in this article.

C. *Acceptance by the Buyer.*—Most of the points under this subdivision have been anticipated in considering delivery. The duty to accept arises only when the corresponding duty on the part of the seller to be ready to make delivery has been properly discharged. When this exists, if the buyer does not accept on his part, he has committed a breach of duty. The law allows him a reasonable time for inspection, as well as to remove the goods, where that act devolves upon him, from the seller's possession. There is a distinction between a *receipt* of the goods and an *acceptance* of them. The latter word implies an assent of

the buyer to the fact that the goods correspond with the contract. This assent may be in so many words, or it may be inferred from the buyer's act; *e. g.* by keeping the goods, without returning them, beyond a reasonable time.

D. *Payment and Tender.*—The duty of payment in money usually arises at the time of the delivery, so that they may be regarded as concurrent acts. However, by agreement credit may be given, or payment be made conditionally. An instance of this is found in the case where a negotiable note or bill of exchange is accepted by the seller. In such a case it is generally conceded that there is a presumption of law that the note is taken simply as a means of payment, and if not paid the seller has his claim against the buyer on the original contract. The seller may, however, agree to take the note in absolute payment, in which case he has no remedy against the buyer upon the contract, but can only enforce the note. The buyer may tender payment, and if this be not accepted he has done an act which is equivalent to payment so far as to enable him to sue the seller for non-delivery or to successfully resist an action for non-acceptance, provided that he properly presents the fact of the tender to the attention of the court. (See TENDER.)

Third. Remedies for breach of the contract must be presented under two aspects: A. for the seller; B. for the buyer. (A) The seller's remedies are either in the nature of an action for damages for non-acceptance or for the price, or else they are proceedings directly affecting the goods which are the subject of the contract. The only remedy in the case of an executory contract is an action for damages for non-acceptance. If the sale is executed, there may be an action for the entire price, on the principle that the ownership has vested in the buyer. This will be the only remedy in case the goods have been unconditionally delivered to the buyer. There may be intermediate cases in which the ownership has vested in the buyer, but he has not yet taken possession, or the delivery has been to a carrier, or is in some form conditional. From these circumstances spring various rights of the seller over the goods themselves, such as the vendor's lien, stoppage *in transitu*, and the right of resale. The lien of the vendor (see LIEN) exists wherever he retains possession and the price has not been paid, unless credit has been given. If credit has been given, the lien is lost except under special circumstances, as where the vendee is insolvent. If the goods are not taken away by the vendee before the credit expires, the lien will revive. After delivery the lien will expire unless there be an agreement between the parties to the contrary. So the lien may be lost under the doctrine of estoppel (see ESTOPPEL), where the vendor permits the vendee to sell to a second or sub-vendee under the supposition that the lien no longer exists. In regard to the right of resale when the buyer fails to perform his contract, there is considerable variety of opinion, so that the English and American decisions are not in accord. The English view now is that there is no strict right of resale unless that is expressly reserved in the contract. If such a reservation is made, the contract is rescinded by the act of resale. If there be no such reservation, the title is in the vendee in such a sense that the vendor by selling is guilty of a breach of contract for which he is liable in damages—viz. the difference between the contract-price and the market-value. Still, as the vendee is in default, he can bring no action for the goods themselves or their value, as he could have done had he performed his side of the contract. In this country the rule is, that the vendor may sell the property, acting as the agent for the vendee, and recover the difference between the contract-price and the amount realized upon the resale, or he may, at his option, retain the goods as his own, and recover the difference between the market-value at the time and place of delivery and the contract-price. This theory is maintained, although there is no reservation in the contract of the right of resale. The final right of the unpaid vendor is stoppage *in transitu*. This is sufficiently considered under that article. (See STOPPAGE IN TRANSITU.)

(B) The remedies on the part of the buyer. It is necessary here also to distinguish between the executory and the executed contract. In the case of the executory contract the only remedy is an action for damages, except in some special cases, where a court of equity will order that the contract be specifically performed; *e. g.* pictures, statues, etc. If the contract be executed, the title passes, and the vendee has the usual remedies appertaining to owners whose property is wrongfully converted by others to their own use. (See CONVERSION.) There are cases where the buyer has the right to reject the goods, though the property in them has passed to him, as where they are not of the kind called for by the sale. As already stated, this right does not exist in the case of a breach of an express warranty of quality.

II. *Sales of Goods as affected by the Statute of Frauds.*—In the reign of Charles II. (A. D. 1677) a statute of great importance was enacted, requiring evidence in writing or of some outward act as to certain contracts, as a substitute for the common-law rule which permits nearly all contracts to be made orally. (See FRAUDS, STATUTE OF.) This statute in its application to sales of goods over £10 requires as a preliminary to the formation of the contract that there should be either delivery of the goods or a part of them, and acceptance by the buyer, or earnest or part payment of the price, or else a memorandum in writing to be signed by the party to be charged or by his authorized agent. This statute has generally been re-enacted in this country, with some variation in some of the States as to details, such as the amount or mode of signature, etc. The practical result is, that there is one rule for the formation of the contract where the price of the goods is under $50, and another where it is of that amount and upward. In the first instance only consent orally expressed is necessary, while in the other one of the statutory requisites must be superadded. After the contract in the latter instance has once become valid, the same general rules as to its effect, the duty of performance, and the remedies in case of breach will be applicable, as have been already stated. The statute has been fruitful in producing nice legal distinctions, some of which are still under discussion. (For a brief statement of some of these see FRAUDS, STATUTE OF.) It may be added to what is there stated that a troublesome question frequently arises where the contract is made by a broker (see BROKER) through the medium of a so-called "bought-and-sold note." (See BOUGHT NOTE.) It is the practice of brokers when negotiating such sales to sign two "notes" or memorandums of the sale, giving one of them to the buyer and the other to the seller. He has authority to do this, as being agent for both parties. It is a well-settled rule that if the two notes do not in substance correspond the statute of frauds is not complied with, and the sale is void. The regular course of business is for the broker to make an entry of the sale in a book kept for the purpose, of which the bought-and-sold notes, if regular, would be a transcript. If they all agree, the contract is established beyond dispute. The difficulty occurs when the notes differ from the entry, or when one agrees with it and the other does not, or when there is no entry and the notes differ, or when there is an entry and no notes are issued. The underlying principle governing these supposed cases is, that the entry, where it exists, constitutes the contract. Accordingly, where there is an entry alone the parties are bound. If the notes vary from each other the entry will govern. If the notes agree, but vary from the entry, these will be evidence from which the jury may find that a *new* contract has been made by way of substitution for that found in the entry. If there be no entry whatever, the contract will be valid if the notes agree, but will be void if they differ. In order that the variation may have this effect, it must be one of substance, and the use of different but equivalent words will not be fatal. Similar rules will be applicable where the contract is claimed to have been made through the medium of letters passing between buyer and seller. If the letters fail to correspond in substance, the contract is void, and they must contain the entire contract, nothing being left to be supplemented by evidence of oral stipulations between the parties.

DIVISION II. SALES OF REAL ESTATE.—The subject here referred to is an executory contract for the sale of land. Its actual transfer falls under the head of deeds (see DEED), and is governed by special and technical rules appertaining to the law of real estate. The executory contract to sell is a branch of the ordinary law of contracts.

The executory contract in important transactions almost uniformly precedes the conveyance of land. One important reason for this is, that the purchaser will desire to have the title investigated before accepting the deed. There may not only be a flaw in the vendor's title, but there may be various liens or incumbrances upon the land, such as mortgages, judgments, claims of mechanics, taxes, assessments, etc. Most of these are created by statute law, and the statutes of the respective States must be consulted. After the executory contract is entered into the purchaser commonly employs persons skilled in the law to make an investigation as to the condition of the title. In doing this a so-called "abstract of title" is prepared, in which the conveyancer in writing traces the title to some well-established source, and then gives in chronological order an account of all facts materially affecting it. Should it appear on this examination that the title is defective, the purchaser will refuse to take a conveyance unless the defect is removed, as the law does not compel the purchaser to take a doubtful title. The advantage of having an executory contract before making this investigation is, that if the title is good the purchaser can insist, as will hereafter be seen, on hav-

ing the very thing contracted for; and on the other hand, if it turns out to be bad, he has an action for damages, including his necessary expenses in conducting the investigation.

The statute of frauds is applied to this case, and the contract must regularly be in writing, and either signed or subscribed by the party to be charged as the statute may happen to require. Where this is done by both parties, each has a remedy against the other. The remedy is twofold—either an action for damages for breach of contract, known as an action at law, or a suit in equity for specific performance. By this term is meant a direction by the court that the party in default shall do the very thing which he has agreed to do, instead of paying damages for the violation of his contract. Applying this rule to the vendor, he would be compelled to make a deed or else would be punished for contempt of court. Of course, this remedy would fail if the vendor should be unable to make a conveyance. Where he can partly perform the contract specifically the vendor may accept that as far as it goes, and for the rest have compensation in damages. The remedy by specific performance proceeds upon the ground that as the contract is for specific property, the remedy in damages does not afford adequate relief, as it is assumed that there were special reasons why the land in question was selected as the subject-matter of the contract.

Notwithstanding the statute of frauds, an oral contract for the sale of land will sometimes be specifically enforced. This will happen where writing has been prevented by the fraud of one of the parties, or where one of the parties has been induced by the other to so change his position that he cannot otherwise be restored to his original condition. An illustration is where a vendor having gone into possession under an oral contract has expended his money in buildings, etc., the value of which he would lose if the transaction were regarded as void. While the courts of the various States agree upon the general principle, they differ as to the question whether substantial expenditure is necessary, some holding that the mere act of taking possession under the terms of the contract will withdraw the case from the operation of the statute of frauds. An oral contract must be clearly proved in all its terms, and possession must have been taken under its provisions, and not in spite of them. As a rule, the remedy by specific performance is mutual, so that where the vendee can insist upon performance the vendor can also. The oral contract in the case supposed will not be recognized in a court of law. Accordingly, no action for damages can be maintained upon it.

It is necessary to a clear comprehension of the subject to refer briefly to the theory prevailing in a court of equity as to the nature of the executory contract. The vendor in that court is no longer deemed to be the owner of the land, but only to have a right to the price. In other words, his interest is regarded as personal property. On the other hand, the purchaser is deemed to be the owner of the land, although the formal title remains in the vendor. The vendor is thus a trustee of the vendee as to the land, and the vendee a trustee for the vendor as to the purchase-money. So, if the vendee dies, his interest descends as real estate to his heirs, while the vendor's right to the unpaid purchase-money passes as personal estate to his executors or administrators. On this view "specific performance" of the contract is but the enforcement of a trust. The same remedies may be had against the representatives of the respective parties as would have prevailed had the parties themselves lived. One of the consequences of this view is, that it is not in general material in a court of equity though the contract be not performed on the appointed day. The trust remains, and it may be enforced at one time as well as another. This rule is expressed by the maxim that "time is not of the essence of the contract." It may, however, be made so by express agreement, or in case of a default by one of the parties by reasonable notice from the other insisting upon performance. If this is not complied with, the contract may be broken off.

A question may arise as to the effect upon the executory contract of the deed given according to its provisions. The usual rule is, that the contract is merged in the deed. Still, if there be evidence of an intent that any of its provisions shall continue in force notwithstanding the conveyance, there will be no merger to that extent. A party may thus have a right to enforce certain provisions in the contract, while as to others he must refer to his deed.

(For further information as to sales of personal property see Blackburn on *Sales;* Benjamin on *Sales*, Am. ed.; Long on do.; Story on do.; Langdell's *Leading Cases;* also the works on *Contracts* of Chitty, Comyn, Parsons, and Addison, and Browne on the *Statute of Frauds*. As to sale of real property consult Sugden on *Vendors and Purchasers;* Dart on do.; Fry on *Specific Performance;* Gerard on *Titles to Real Estate;* Curwen on *Abstracts of Title;* Cruise's *Digest*, Greenleaf's ed. For information on the rules of the Roman law consult the treatises of Pothier, Troplong, Ortolan, etc., etc., and the *Institutes of Justinian*, by Sandars.) T. W. DWIGHT.

Salmon Breeding and Fisheries. See FISH-CULTURE, FISHERIES, SALMON, and SALMONES, in CYCLOPÆDIA, and SALMONIDÆ.

Salmon'idæ [from the Lat. *salmo*, a "salmon"], a famous family of fishes, containing species among the most gamy and savory of the inhabitants of the water. The body is always elongated, and generally more or less fusiform; the scales cycloid and more or less small; the lateral line distinct, and nearly concurrent with the abdomen; the head conic in profile, more or less compressed from side to side, and covered by a naked skin; the cheeks unprotected, the suborbital bones being small or moderate; the eye moderate, and rather in the anterior than the posterior half of the head; the opercula unarmed and normally developed, the suboperculum being moderate, and the interopercula small; the mouth has an oblique lateral cleft extending under the eyes and more or less backward; the upper jaw is not protractile, and is constituted above by the intermaxillaries, and on the sides by the supramaxillaries; the teeth are in the typical forms (*Salmones*) well developed and conic, in others (*Coregoni*) very small or none, and one form (*Plecoglossus*) in part laminated; the branchial apertures are capacious and confluent below; the branchiostegal rays numerous; the true dorsal fin composed of articulated and mostly branched rays, and situated about the middle of the body; a second adipose dorsal is developed far behind; the anal is smaller than the dorsal, and situated below, about midway between the rayed and adipose dorsal fins; the caudal is generally more or less emarginated, or at least truncated, the margin not being convex; the pectoral fins are placed low down, and have a narrow base; ventral fins abdominal and under the dorsal. The skeleton is characteristic, the cranium being in good part cartilaginous, but overlaid by well-developed cartilage and membrane bones; the vertebræ are numerous. The viscera are noteworthy in the following articles: the stomach cæcal; pyloric appendages developed in great number, and closely applied together; the air-bladder is large and simple, and of course communicates with the intestinal canal; the ovaries discharge their eggs into the cavity of the abdomen, from which they are directly excluded. Such are the characters common to all the forms of the family as now limited. From the family are excluded the genera *Argentina*, *Osmerus*, *Mallotus*, etc., which appear to form a peculiar family, distinguished by the skeleton as well as modifications of the intestinal track: as thus limited, it includes the salmons, trouts, charrs, whitefishes, inconnus, and related species. The genera require to be elaborated, those generally adopted being in part heterogeneous and artificial. By Günther, *e. g.*, all the representatives of the family are combined under the genera *Salmo*, *Oncorhynchus*, *Brachymystax*, *Thymallus*, *Luciotrutta* (= *Stenodus*), and *Coregonus*. These naturally fall into three groups—(1) Salmoninæ, including *Salmo*, *Oncorhynchus*, and *Brachymystax;* (2) Thymallinæ, represented by *Thymallus;* and (3) Coregoninæ, of which *Coregonus* is the type. If *Plecoglossus* actually belongs to the family, it is the representative of another distinct sub-family, Plecoglossinæ. (See further SALMON, SALMONES, and FISH-CULTURE, in CYCLOPÆDIA.) THEODORE GILL.

Sambalpur', the most eastern district of the Central Provinces, British India, lies between 19° 10′ and 22° 15′ N. lat. and 82° 40′ and 85° 5′ E. lon. Its area is 4200 sq. m. The greater part of this country is an undulating plain, with rugged hills rising in every direction, the underlying rock being, as a rule, highly silicious and indurated; the soil is light and sandy. The principal river is the Mahanadi: the climate is very unhealthy: foreigners suffer terribly from fever. Iron ore of the best description is found in nearly every subdivision. The chief exports are rice, oil-seeds, stick-lac, silk, cotton, and iron; in ordinary years a very high profit is made on these exports. The imperial lines of road run from Raipur to Cattak: wooden bridges are thrown over the principal rivulets: a railway connecting Sambalpur with Nagpur, as well as Cattak, was sanctioned in 1875. The total population was in 1866, 812,348, of whom 497,774 were classed as agriculturists, 666,960 as Hindoos, and 142,758 as aborigines: these belong chiefly to the tribes of the Gonds, Kols, or Dhangars, and are a hard-working, honest, and light-hearted class. Among the Hindoos are excellent weavers and goldsmiths: the Mohammedans are chiefly merchants and government servants. According to tradition, the rajah of Sambalpur acquired his independency from the maharajah of Patna in 1460 A. D.; in 1732 occurred the first collision of these

wild chiefs with the spreading Mahratta power; in 1804 a British force restored the district to the rajah of Nagpur, who had conquered it in 1797, but had been superseded in 1817 by a descendant of the ancient line to the throne, and his successor, Narayan Singh, having died 1849 without male issue, the country was held to have lapsed to the British government, and is now administered by an English deputy commissioner with his assistants. Education has made wonderful progress; there are not less than 442 schools in the district; 13,091 boys and 1273 girls are receiving instruction. The chief town of the same name is situated on the northern bank of the Mahanadi, which is here nearly a mile broad. The native town with formerly narrow streets has of late been much improved; two large streets have been opened; of the 1500 houses most are tiled. The fort is N. W. of the town proper. P. 9450. E. SCHLAGINTWEIT.

San Francisco Mountain, the loftiest mountain in Arizona, in N. lat. 35° 10′, W. lon. (from Greenwich) 111° 45′. In 1853, Lieut. Whipple measured the altitude of its base by barometer, and that of its summit by angulation from the base. In 1871, Lieut. Wheeler carried a barometer to its summit. The former gives 12,124 feet as its altitude above the ocean; the latter, 12,561. The mountain stands on the Colorado Plateau, near its southern edge. Near it are the lesser cones of Bill Williams, Kendrick, and Sitgreaves, but they are not united with it. It stands quite alone, and, rising abruptly from the plain to a height of 5000 feet, is a conspicuous landmark from all directions. Its base is 10 miles across, and its form is irregularly conical. Its crest takes the form of a crescent, with the concavity turned to the E. Geologically, San Francisco is partly a mountain of eruption and partly a mountain of circumdenudation. Its upper part is composed of dark trachyte, which was extended before the plain had been degraded to its present level. The tough trachyte opposed a more stubborn resistance to the agents of erosion than did the sedimentary rocks of the plain, and not merely held its own while the latter were worn away, but protected and preserved that portion of the strata which it covered. As erosion proceeded, fragments of the trachyte fell down upon the sedimentary escarpment, and so nearly covered it that it can be detected at a few points only. The strata which are preserved under the trachyte are of Triassic age; the bed which now constitutes the surface of the plain is the upper member of the Carboniferous formation. So the mountain is an insular table of Triassic sandstone, standing on a Carboniferous floor, and capped by a cone of trachyte. Since the removal of the Triassic strata new fissures have opened in the plain, and basaltic lava has flowed out, spreading over the surface in broad black sheets and throwing up hundreds of low cones. From the summit of San Francisco one can look down into the throats of more than a hundred volcanoes. G. K. GILBERT.

San Gimigna'no, town of Italy, province of Siena, on the slope of Monte Cornocchio, about 24 miles S. W. of the city of Siena. This town is very old, though its documentary history begins only in the eighth century. Few towns in Italy preserve so much of their mediæval physiognomy, its numerous lofty and picturesque towers recalling the dark and stormy days when every palace in Florence and Siena was crowned by a similar structure. P. 8094.

San Gine'sio, town of Italy, province of Macerata, on a high, broad hill overlooked by the neighboring Apennines. Itself a very old town, the numerous remains of still greater antiquity found near it show that a yet older city once flourished here. It is now a place of considerable activity; the climate is very healthful, though subject to violent thunderstorms. P. 6000.

San Gior'gio Morge'to, town of Southern Italy, province of Reggio di Calabria, on a high Apennine hill, the foot of which is washed by the Vacale. The old castle is still standing, but the town is almost inaccessible for want of roads. P. 5258.

San Giovan'ni a Tedue'cio, town of Italy, province of Naples, one of the most attractive villages in the immediate neighborhood of the great city. It lies on the road between Portici and Castellamare di Stabia, contains some fine villas, and enjoys all the advantages of climate and position peculiar to that enchanting coast. P. 11,116.

San Giovan'ni in Fio're, town of Southern Italy, province of Cosenza. The most thickly populated part of the town is around the old castle, but it has no post-office nearer than Cosenza, 42 miles distant. P. 9500.

San Giovan'ni in Persice'to [anc. *Forum Marcelli*], town of Italy, province of Bologna, lying in a broad fertile plain producing rice, hemp, vines, etc. In the tenth century it was governed by its own municipal council, but in the thirteenth it passed under the rule of Bologna, whose fortunes it afterward shared. It is now a thriving town, with a somewhat scattered population of 15,295.

San Giovan'ni Roton'do, town of Italy, province of Foggia, pleasantly situated on the southern slope of Monte Calvo, but supplied with water only by a shallow and impure lake. Linen and hempen fabrics are manufactured here to some extent. P. 7745.

San Giusep'pe Ja'to, town of Sicily, province of Palermo, about 18 miles S. W. of the city of Palermo. It is a modern town, built in the last century and in part of fragments from the ancient *Jatas* or *Jetas*, a city of Greek origin which once occupied the hill above. Many interesting remains of the old city may still be seen. P. 5100.

San Laz'zaro, a small island of the Venetian lagoons, first mentioned in the twelfth century, when a hospital for lepers was established there. After the disappearance of this disease it was used for other hospital purposes, until the Venetian republic ceded it to Peter Mechitar and his Armenian followers who had fled before the Turks. The Armenian church and convent contain many objects of interest to the scholar and to the general traveller. Lord Byron spent some time here.

San Marcel'lo Pistoje'se, town of Italy, province of Florence, 18 miles N. of Pistoia, on the high-road to Modena, and more than 2000 feet above the level of the sea. The paper and other manufactories are of considerable importance, and the place is resorted to in summer as a healthful retreat from the heat of the lower towns.

San Mar'co in La'mis, town of Southern Italy, province of Foggia, at the western foot of Monte Calvo, about 13 miles N. E. of San Severo. The district is mountainous, but very rich in woods and pasturage, and the town itself is the centre of an active internal trade. P. 14,540.

San Minia'to, town of Italy, province of Florence, about 27 miles W. of the city of Florence, embracing several distinct fractions, the most important being San Miniato al Tedesco. This was once a fortress, and it took its name from a church erected here about the year 700. Guelphs and Ghibellines were alternately masters of San Miniato for several centuries, but the fortress and adjacent country formed a part of the commonwealth of Florence throughout the period of its greatest prosperity. This town was the cradle of the Bonaparte family. P. 16,187.

San Pier' d'Are'na, or **Sampierdarena,** town of Italy, province of Genoa, occupying a tongue of land about 2½ miles W. of the city of Genoa. Though it may in some respects be regarded as a suburb of Genoa, it has a completely distinct city organization. The churches contain some valuable works of art, and there are some noticeable public buildings as well as private palaces. It is a place of much commercial and manufacturing activity, and its rapid advance in this latter direction has given it the surname of the "Manchester of Italy. P. 17,000.

San Re'mo, town of Italy, province of Porto Maurizio, nearly 32 miles E. N. E. of Nice. It is picturesquely situated on a slope descending to the sea, with rich olives behind it, and surrounded by luxuriant lemon and orange orchards. The date-palm also flourishes here as an ornamental tree, but its fruit does not ripen. The old part of the town is characteristically Italian, with narrow, steep, and crooked streets, but the new quarter lies along the shore, and has altogether a modern aspect. San Remo is a favorite resort of invalids, for whom ample accommodations are provided, and is preferred by many to either Nice or Mentone, as being more sheltered than the former and less confined than the latter. P. 12,000.

Sanserit. See SANSKRIT.

San Secon'do Parme'se, town of Italy, province of Parma, on the high-road between Parma and Cremona. This town was for centuries the stronghold of the Rossi, a powerful family of Parma. P. 5246.

Sansepol'cro, town of Italy, province of Arezzo, in the upper valley of the Tiber, in a charming plain surrounded by mountains, about 23 miles from the city of Arezzo. It is a walled town with a castle, and the churches and other public buildings, very respectable as to architecture, are adorned with pictures by Perugino and other less distinguished but meritorious old artists. This town, named from an oratory erected here in the tenth century by two pilgrims from Palestine, was placed, by papal authority (1163), under the government of the monks of Camaldoli, who had erected a large monastery here. The inhabitants, however, soon rebelled against their spiritual lords, and the governing power was then exercised alternately by two rival families until the town was nearly destroyed by a terrible earthquake (1351), in which 2000 persons are said to have perished. It was soon after rebuilt, and subsequently shared largely in the

internal factions and external wars of the times. It was the episcopal seat of a diocese containing 136 parishes, and was renowned for its woollen and silk manufactories. It is still a place of lively traffic. P. 8068.

San Severi'no Mar'che, town of Italy, province of Macerata, at the foot and on the slope of a hill near the right bank of the Potenza. It is a pretty, well built town, and the new cathedral contains some admirable paintings, among which may be specially mentioned a *Virgin*, long supposed to be by Mantegna, but now known as one of the finest works of Pinturicchio. In the municipal palace, besides many curious portraits, there is an interesting collection of inscriptions and other ancient objects from the old Greco-Roman *Settempeda*, the site of which is in this immediate neighborhood. The churches and convents within the town and in the suburbs are very numerous, and contain valuable pictures. There are several remarkably fine villas on the hills near the town. San Severino was a place of some importance during the Middle Ages. Besides the traffic in agricultural products, the inhabitants are engaged to some extent in manufactures. P. 14,182.

San Seve'ro, town of Italy, province of Foggia, in the N. E. corner of the great plain of Apulia, overshadowed by Monte Gargano on one side and by Liburno on the other. It lies about 15 miles N. of the town of Foggia, with which it has railway communication. San Severo is surrounded by a half ruined wall, two only of the seven original gates being still standing. The general aspect of the town, however, is agreeable, and the inhabitants are, for the most part, in comfortable circumstances, the district being fertile in grain and fruit and not lacking in pasturage. This town, of mediæval origin, was wellnigh destroyed by an earthquake in 1627. It suffered severely from the same cause in 1828 and in 1851. P. 17,124.

Sanskrit Language and Literature. The word *Sanskrit* or *Sanscrit*, derived from *sam* (Gr. σύν), "together," and *krita*, "done," with an epenthetic *s*, and signifying "perfected" or "refined," was applied by Hindoo grammarians to the literary language of their race, and by a natural extension of meaning now designates also the same language in its earliest discoverable form, which, as is evident from the Vedas, must have been much simpler in its structure than the Sanskrit proper. It was formerly believed that the Sanskrit was not only the oldest of Indo-European tongues, but the parent of all the others; hence it was considered as identical with the primitive speech of the undivided Aryan stock on the N. W. slopes of the Hindoo-Koosh, while the land afterward known as India was still exclusively occupied by the dark-skinned races, now called Dravidians; but recent advances in ethnological and philological research have dispelled this error, and revealed the primitive Sanskrit as a sister-tongue of the ancient Aryan or Iranian, from which latter sprang the old Bactrian and old Persian languages, while the former gave rise not only to the polished Sanskrit, but to the Pali and the numerous Prakrit languages. (See LANGUAGE and INDIA, in CYCLOPÆDIA.) While it is doubtful whether the palm of antiquity should be awarded to the Sanskrit or to the "old Bactrian" of the Zend-Avesta, the abundance of the literature preserved in the former, and the enormous amount of critical apparatus supplied by the plodding industry of the grammarians, render Sanskrit the most important of languages for the comparative philologist. The period at which it ceased to be spoken as a vernacular cannot be ascertained; some would place it as early as the Christian era, while others contend for a comparatively modern date, or even assert that down to the present time there has always been a considerable number of Brahmans to whom Sanskrit has been imparted as the mother-tongue. However this may be, the knowledge of Sanskrit by Europeans dates only from the close of the eighteenth century, and its rapid spread through the universities of Europe is one of the distinctive features of the nineteenth century. The founder of the critical school of Sanskrit philology, Franz Bopp, survived until 1867, and the study of the text of the Vedas in Europe has been pursued for but little more than a generation.

The usual written character of the Sanskrit is the so-called *Deva-nagari* ("divine city") alphabet, which is of comparatively modern origin, certainly several centuries later than the Christian era. No trace of the history of writing in India can now be found, but from internal evidence the earliest alphabets are believed to have been of Shemitic origin. The Deva-nagari, however, is written from left to right, and extremely complete, expressing with perfect clearness nearly every syllabic combination of letters by single characters, a letter *a* being supposed to be inherent in every consonantal character when no other vowel-sign is subjoined, while the ancient alphabet was notably deficient in vowels and spirants. Notwithstanding the vast number of rules invented by Sanskrit grammarians, word-building and syntax are extremely simple, and in fact consist of nothing but a process of mere aggregation, in which the original words, roots, affixes, and terminations, may be discriminated with the greatest ease. This is an important fact in the practical applications of Sanskrit to purposes of comparative philology, which have in consequence been too frequently limited to the discovery of roots. There is a general agreement of a marked nature between the Sanskrit and the Greek inflectional systems, but the latter language marked a decided advance in the direction of artistic elegance and logical convenience by rejecting some of the too numerous Sanskrit declensions and more than doubling the conjugational forms, while the Sanskrit pursued an opposite tendency, the classical language having dropped, for the most part, the imperative, optative, and subjunctive moods, which may still be traced in the Vedic literature. The Sanskrit vocabulary is wonderfully and even vexatiously copious, abounding in epithets formed *ad libitum* from almost every root.

Literature.—The mass of treatises which have been preserved is enormous, but of very unequal value. Not one work in twenty has been, or deserves to be, printed, but until a more careful examination of Indian libraries has been made it is obviously impossible for European scholars to make very positive statements as to what may or may not be found in Sanskrit literature. One great fact, however, is sufficiently certain—the classical Sanskrit contains no historical works in the ordinary acceptation of the term. It would seem to be an inherent defect in the Hindoo mind to attach little importance to *facts* as such, and no one of the thousands of writers who have elaborated to the minutest detail their religious and metaphysical classifications has ever thought it worth while to write the history of his times. Hence, the whole literary as well as political chronology of India is involved in the utmost uncertainty, and the opinions of European scholars vary hundreds of years as to the date of almost every important literary work. The authorship of Sanskrit writings is involved in scarcely less uncertainty. They are all essentially anonymous, and though names of writers have been traditionally ascribed to them, it is rare that any work can be received with confidence as the genuine production of the celebrated sages to whom they are attributed. It is therefore impossible at present to trace the development of Sanskrit literature, or to characterize the style of Sanskrit authors, with any accuracy, as the more important works are hopelessly interpolated, so that the ideas and practices of successive ages are found mixed up in the same poem or treatise. The only classification possible is that of subjects, and the dates and authorship must be understood as approximations.

The chief religious, philosophical, and poetical books are treated in separate articles. (See MAHÂBHÂRATA, RÂMÂYANA, and HINDU PHILOSOPHY.) Upon the substructure of the Vedas and the two great epic poems a vast edifice of comment and mystical interpretation has been reared by the different sects and schools of philosophy under the names of Puranas, Tantras, and Upanishads. The Puranas (Sansk. *pura*, "past"—*i. e.* "ancient") are works which stand to the modern Hindoo religions in the same relation which the Vedas, upon which they are built, formerly bore to the primitive Brahmanical religion—a relation somewhat resembling that of the New to the Old Testament. Like the Vedas and the Mahâbhârata the eighteen Puranas are all ascribed to the mythical Vyasa (*i. e.* "the compiler or arranger"), who is at once the Indian Homer and Plato. They consist of dialogues upon almost every subject, but their chief purpose is to establish the supremacy and inculcate the ritual either of Vishnu or of Siva, the two gods who have replaced as objects of popular worship the pantheon of the Vedas. Eight of the eighteen Puranas may be classified as Vaishnava, six as Saiva; one, the *Markandeya*, is in part the textbook of the worshippers of Durga, the female power or *Sâkti* of Siva; one, the *Vamana*, "divides its homage between Siva and Vishnu with tolerable impartiality," and may therefore be presumed to be more ancient than the rest. Prof. Wilson places the authorship of the Puranas between the twelfth and seventeenth centuries. Only three of the Puranas have been edited in the Sanskrit text, the *Bhagavata*, *Markandeya*, and *Linga*, but the contents of all have been subjected to analysis; and the most important, the *Vishnu-Purana*, has been translated by Prof. Wilson (*Works*, vols. iii. and vi., 1864). Considerable extracts are also given in Muir's *Sanskrit Texts*. There are also eighteen *Upa-Puranas*, or "little Puranas," of the same general character, but shorter, more modern, and sectarian, and less authoritative, which are almost unknown to European scholars, as none of them have been printed. The Tantras are the sacred books of the Saktas, or worshippers of the female power of Siva, who constitute a numerous and important class of modern Hin-

doos. They are in the form of dialogues between Siva and his wife, who is variously called Durga, Uma, or Parvati, and consist chiefly of rituals and *mantras*, and prayers containing incantations of supreme efficacy. The *Upanishads*, or works containing the mystical doctrines of the nature of God and his relations to the earth and man, are a branch of the later Vedic literature, though some of them are confessedly of quite modern date, written for the purpose of reconciling philosophy with the sectarian worship of Vishnu and Siva. Some commentators have discovered striking resemblances between the doctrines of the *Kathaka Upanishad* and the Platonic philosophy. The celebrated "code of laws" of Manu or Menu, which has become so well known in Europe through the translations of Sir William Jones, is in reality a religious and ethical treatise, the Hindoos never having had any conception of law in the European sense of the term. The *Yajnavalkya* and *Parasara* are later "codes" of similar character, the latter being the one considered especially binding upon the present age.

In poetry the modern epics are mere variations upon the themes of the two great poems; it will be sufficient to name as the best the works attributed to Kalidasa—viz. the *Raghuvansa*, the *Kumara-Sambhava*, and the *Nalodaya*, the *Sisupalabadha* by Magha, and the *Raghava-Pandaviya* by Kaviraja. In lyric poetry the palm is again to be assigned to Kalidasa for his *Ritusanhara* and *Meghaduta*, of which the only rival in popularity is the *Gita-Govinda* by Jayadeva, devoted to the adventures of Krishna among the shepherdesses.

Dramatic literature is comparatively rare, and the structure of the plays extremely artificial, the hero and chief persons speaking Sanskrit, while the women and servants speak Prakrit. We here again meet with Kalidasa as author of the celebrated dramas *Abhijnana-Sakuntala*, "The Fatal Ring," *Vikramorvasi*, and *Malavika agnimitra*, of which the former, a really beautiful work of art, was translated by Sir William Jones in 1789. The earliest drama is supposed to be the *Mrich-hakati*, "The Toy Cart," attributed to King Sudraka, who reigned in the first century B. C.

The collections of fables known as *Panchatantra* and *Hitopadesa* are undoubtedly of extreme antiquity, since they became known to the Western World under various disguises many centuries since. (See PANCHATANTRA.) The large collection of tales known as the *Kathasaritsagara*, "the Ocean for the Rivers of Tales," by Somadeva of Kashmir, is the Sanskrit equivalent, and perhaps the prototype, of the *Arabian Nights' Entertainments*.

The immense grammatical literature of the Sanskrit language is chiefly based upon the labors of a single writer, Panini, who is usually assigned to the third or fourth century B. C., but in the opinion of some recent inquirers should rather be placed several centuries later. More than 4000 rules are laid down in his work, of which the phraseology is technical in the extreme. The commentaries of Sayana upon the Vedas are next in value to the works of Panini in this branch of literature.

Works upon astronomy, mathematics, music, medicine, architecture, and other of the exact sciences are quite numerous. In lexicography the foremost places belong to Yaska, author of the *Nirukta*, the oldest known glossary of Vedic words, and to Amarasinha, author of the *Amarakosha*, the earliest glossary of classical Sanskrit, believed to date from the third century A. D.

The only modern dictionary with any pretensions to completeness is the great work of Böhtlingk and Roth (St. Petersburg, 1855–75). The most useful manual lexicons are those of Monier Williams (London, 1872) and Benfey (London, 1866). Westergaard's *Radices Linguæ Sanscritæ* is also very useful to the student. The most complete grammars are those of Benfey (Leipsic, 1852) and Bopp (4th ed. 1868). Among the briefer grammatical manuals those of Monier Williams, Müller (1870), Oppert (1859), and Elihu Burritt (1876) deserve commendation. As reading-books for the beginner there are none better than the *Sakuntala* (1853) and *Nala* (1860), both edited by Monier Williams, which may be advantageously followed by the *Hitopadesa* (1864) and *Meghaduta* (1867), as edited by Johnson, and the *Bhagavad-Gita* (Hertford, 1855), by J. C. Thomson. Most of the above-named works may be read in poetical versions, but the most instructive translations from the Sanskrit are Muir's *Sanskrit Texts* (5 vols., 1858–70) and many treatises in the *Works* of Prof. H. H. Wilson (17 vols., London, 1862 *seq.*). PORTER C. BLISS.

San'ta Cateri'na Villarmo'sa, town of Sicily, province of Caltanissetta, near the right bank of the Salso, 12 miles N. of the town of Caltanissetta. It is a fortified place, and the adjacent country is fertile in the common products of the island. P. 6490.

San'ta Cro'ce sull' Ar'no, town of Italy, province of Florence, on the right bank of the Arno, 6 miles N. of San Miniato. Florence, Pisa, and Lucca were successively masters here from the twelfth to the sixteenth centuries, and several old monuments of this period still exist. P. 6197.

San'ta Eufe'mia d'Aspromon'te, town of Southern Italy, province of Reggio di Calabria, in a very fertile region, about 10 miles S. E. of Palma. P. 6252.

San'ta Fio'ra, town of Italy, province of Grosseto, picturesquely situated in the midst of vast masses of peperino, on the S. side of Mont' Amiata, very near the sources of the Fiora. It is surrounded by noble chestnut, beech, and fir forests, and is abundantly supplied with excellent water from the mountain-streams, which are also utilized for mechanical purposes. Santa Fiora was long a fief of the Aldobrandeschi, whose family castle, once strongly fortified, occupies the highest point of the town. Distance from Grosseto, 50 miles. P. 6304.

Sant' A'gata de'i Go'ti, town of Italy, province of Benevento, on a hill at the foot of Monte Taburno. It is a walled town, and its ancient castle, famous for many a mediæval siege, is still standing. Great antiquity is claimed for this town, and Etruscan vases, coins, etc., are often found here. P. 8014.

Sant' A'gata di Pu'glia, town of Southern Italy, province of Foggia, on a mountain about 10 miles from Bovino, in an olive and vine bearing district. P. 5268.

Sant' Agosti'no, town of Italy, province of Ferrara, on the right bank of the Reno, about 7 miles from Cento. It contains some noticeable buildings, and the *campanile* or bell-tower (sixteenth century) is remarkable for its height and for the architecture of the spire. P. 7544.

San'ta Luci'a del Me'la, town of Sicily, province of Messina, about 8 miles S. E. of Milazzo, contains several churches and large, well-built convents. The highest point of the town is occupied by an old castle with round and triangular towers and enclosed by lofty walls. P. 6284.

San'ta Margheri'ta di Beli'ce, town of Sicily, province of Girgenti, in a district abounding in good pasturage and in all the choice productions of the island, is situated about 15 miles N. W. of Sciacca, and manufactures cottons and leather. P. 7493.

San'ta Margheri'ta Ligu're, town of Italy, province of Genoa, beautifully situated on a small bay about 9 miles W. of Chiavari, is a well-built town, and the churches contain both paintings and statuary worthy of notice; among the former should be mentioned two remarkable pictures by Luke of Leyden in the church of San Lorenzo. There are some fine palaces in the neighborhood, and the heights are still crowned by ruins of the strong old castles that once protected the town. The inhabitants of Santa Margherita Ligure are very laborious; the women make large quantities of the lace known as Genoese, and the men, besides many other industries, are extensively engaged in coral fishing, no less than 80 small vessels from this port being constantly employed in this business. P. 7188.

San'ta Mari'a Ca'pua Vete're, town of Southern Italy, province of Caserta, in a very fertile district, about 5 miles from the town of Caserta. Santa Maria Capua Vetere occupies the site of the ancient *Capua*, and remains of old catacombs, of the amphitheatre, a triumphal arch, etc., still exist. The present town is well built, and the inhabitants are industrious, prosperous, and better educated than is usual in Southern Italy. P. 17,896.

San'ta Mari'a in Mon'te, town of Italy, province of Florence, on a mountain-spur descending to the Arno. It is a walled town, with castle, etc., and dates back to the eighth century. P. 5780.

Sant' Anasta'sia, town of Italy, province of Naples, at the foot of Somma, about 5 miles N. E. of the city of Naples, in a region of extreme fertility, but greatly exposed to danger from the eruptions of Vesuvius. P. 6616.

Sant' An'gelo de'i Lombar'di, town of Southern Italy, province of Avellino, on a hill about twenty miles from the town of Avellino. This town, the seat of a bishop as early as the close of the eleventh century, was almost entirely destroyed by an earthquake in 1666. P. 6654.

Sant' An'gelo di Bro'lo, town of Sicily, province of Messina, about 10 miles W. of Patti, stands near the sea in a fertile district, and the churches and convents possess some works of art worthy of notice. P. 5306.

Sant' An'gelo Lodigia'no, town of Italy, province of Milan, at the junction of the Lambro with the Canal Vettabbia, on the high-road between Lodi and Pavia. It is a well-built, rich, and thriving place, with city municipal privileges. P. 8500.

San'ta Nin'fa, town of Sicily, province of Trapani, in a very fertile valley about 8 miles from the sea. P. 6685.

Sant' Anti'mo, town of Italy, province of Naples, about 5 miles from the city of Naples. P. 8651.

Sant' Arcan'gelo di Roma'gna, town of Italy, province of Forlì, on the right bank of the Luso, about 7 miles from Rimini. The antiquity of this town is proved by the remains of ancient structures and by the vases, bronzes, and coins found in and near it. The most striking architectural object in the town is a kind of triumphal arch dedicated to Clement XIV. (Ganganelli), who was born here. P. 7938.

Sant' Eli'a Fiumera'pido, town of Southern Italy, province of Caserta, about 4 miles from Cassino. P. 5288.

Sant' Elpi'dio à Ma're, town of Italy, province of Piceno, on a hill overlooking the Adriatic, from which it is about 3½ miles distant. It is a walled town, with respectable buildings, both public and private. The inhabitants are industrious, and carry on a modest traffic by means of their small harbor. This town occupies the site of the ancient *Cluana*, and interesting Roman and mediæval remains are found here. P. 9177.

Sant' Era'mo in Col'le (St. Erasmus), town of Southern Italy, province of Bari delle Puglie, in a healthy and fruitful district, about 11 miles from Altamura. P. 9305.

San'thia, town of Italy, province of Novara, about 12½ miles W. of Vercelli. It was anciently the chief town of the Ictimuli, a Lybian race, according to Pliny and Strabo. Charlemagne here received (801) the ambassadors of Haroun-al-Raschid. This town is now made unhealthy in summer by the neighboring rice-fields. P. 5207.

San'to Stefa'no Quisqui'na, town of Sicily, province of Girgenti, in a very fertile district about 4 miles from Bivona. The name *Quisquina* is derived from a celebrated sanctuary here dedicated to Santa Rosalia, who is said to have dwelt many years in a neighboring grotto. P. 5593.

Sauvi'to al Tagliamen'to, town of Italy, province of Udine, on the right bank of the Tagliamento, about 15 miles from Udine. There is considerable commercial and manufacturing activity here. P. 8578.

San Vi'to de'i Norman'ni, town of Southern Italy, province of Lecce, about 12 miles from Brindisi, in the midst of a most fertile plain and in the neighborhood of a very fine forest. P. 7257.

Sar'no, town of Southern Italy, province of Salerno, about 15 miles N. of the city of Salerno. It is situated on the western slope of the spur of the Apennines which divides the valley of the Volturno from that of the Sarno, is surrounded by old crenated walls, and the castle of its mediæval dukes is still standing. The manufactories here are numerous and flourishing, silk, cotton, linen, and hempen fabrics being exported. Besides the more common products of Southern Italy, cotton is grown extensively in this vicinity. Sarno is believed to have been a Pelasgian settlement, but its proper history begins in the tenth century. P. 15,382.

Saron'no, town of Italy, province of Milan, near the torrent Lura, on the post-road from Milan to Varese. It is a well-built town, containing churches, convents, and other public buildings, unusually rich in objects of artistic interest. The Madonna dei Miracoli, for example (begun 1498), besides a fine exterior, possesses admirable frescoes by Luini, Gaudenzio Ferrari, Cesare da Sesto, Procaccini, etc. Sarcophagi and other remains of Roman and ante-Roman times are found in and near this town. P. 6546.

Sarza'na, town of Italy, province of Genoa, about 12 miles E. of La Spezia and 4 miles from the sea, is a walled town, with bastions and a citadel (1268) at the N. E. angle of the town. The cathedral (begun 1200) contains noticeable works of art, as does also the church of San Francesco outside the walls. Candles, leather, cottons, straw hats, etc., are manufactured in this town on a considerable scale. For many centuries Sarzana was subject to Pisa, and shared its fortunes. P. 9533.

Sas'sari, town of Sardinia, capital of the province to which it gives its name, in the N. W. portion of the island, about 12 miles from the sea-shore. The commerce of Sassari is almost entirely carried on by the Genoese. The principal exports are oil, grain, and cheese. P. within the old walls, 22,000; including suburbs, 32,674.

Sassoferra'to, town of Italy, province of Ancona, on a high hill at the foot of which flows the Sentino. The town is divided into the Castello and the Borgo, the former occupying the crest of the hill, the latter extending to its foot. The Castello contains the best buildings, and in the church of Santa Chiara and also in several private dwellings may be seen some of the best works of Salvi, better known as Sassoferrato. This town occupies the site of the ancient city of *Sentinum*, destroyed by the Lombards in 774, and many antique objects—marble columns, mosaics, bronze tablets, inscriptions, etc.—have been found here. The chief industry of Sassoferrato is the manufacture of nails. P. 7693.

Sassuo'lo, town of Italy, province of Modena, near the left bank of the Secchia, about 10 miles S. W. of the city of Modena. Portions of the strong fortifications which made it a place of importance during the mediæval period still exist. It is now a town of considerable manufacturing activity and is otherwise thriving. P. 6245.

Sat'lej, originally **Sutadru** (the "hundred-channelled"), was also called **Gara** by the Hindoos, and **Langchen-Khabab** ("descended from the mouth of an elephant") by the Thibetans, is the name of the eastern of the five rivers which traverse the province Panjab of the British Indian empire. It issues from the Mansarour Lake in Western Thibet at an elevation of 15,200 feet, traverses in a western direction the sterile mountain-valley along the northern slope of the Himalaya, bursts through these mountains, and flows in a south-western direction through Bisser, and is 98 feet broad where it enters the plain, which it traverses first in a western, then in a south-western, direction, until it joins the Indus below Sitapur. It is navigable for steamers from its mouth to Adamwatan; at Phillar the Debli-Lahor Railway crosses it on a bridge. E. Schlagintweit.

Satpu'ra ("hundred towns"), a name originally the appellation of that portion of the range which divides the Narbada and Tapti valleys, is now generally applied to the great range or table-land, which, commencing E. of the famous Amarkantak plateau, runs nearly up to the western coast. Accepting Amarkantak as the eastern boundary, the Satpuras have a range from E. to W. of about 600 miles, and in their greatest depth exceed 100 miles from N. to S. The shape of the range is almost triangular; from Amarkantak, 3328 feet above the level of the sea, an outer ridge runs S. W. to a point in the Bhandara district. The average height at the crest of the chain is but little under 2000 feet above the sea; the highest peak, Dhupgarh, in Hoshungabad, rises as high as 4454 feet. Nearly the whole range consists of trap; toward the W. a series of craggy peaks is met with. The Amraoti-Nagpur branch of the Bombay-Agra Railway runs at the southern foot of the range; its continuation from Nagpur to Orissa, touching Satpura, was sanctioned 1875. E. Schlagintweit.

Saun'ders (Frederick), b. in London in 1807; established himself in the publishing business in New York in 1836, but, the enterprise not succeeding, he subsequently became for some time an assistant editor of the New York *Evening Post*. In 1859 he received the appointment of assistant librarian of the Astor Library, which office he continued to hold until the beginning of 1876, when he was made chief librarian or acting superintendent. He published *Memories of the Great Metropolis* (1852), *Salad for the Solitary* (1854), *Salad for the Social* (1856), *Pearls of Thought* and *Mosaics* (1858), *Festival of Song* (1865), *About Woman, Love, and Marriage* (1868), *Evenings with the Sacred Poets* (1871), and a revised and illustrated edition of *Salad for the Solitary and the Social* (8vo, 1872).

Sau'ry Pike, or **Skipper** (*Scomberesox saurus*), a European marine fish of the family Scomberesocidæ, represented on our Atlantic coast by *S. storeri*, one of the so-called bill-fishes. These fishes go in great shoals, and are very active, leaping far above the surface of the water. They are highly esteemed for the table.

Seafa'ti, or **Seafatti,** town of Southern Italy, province of Salerno, about 5 miles from the city of Salerno, on the banks of the Sarno, near the sea. Besides the usual products of Southern Italy, cotton is grown to some extent in this neighborhood, which, however, is on the whole neither very fertile nor very healthful. P. 10,462.

Scandia'no, town of Italy, province of Reggio nell' Emilia, is pleasantly situated at the foot of a hill about 8 miles S. E. of Reggio, and is a place of much industry and traffic. The wine of Scandiano has an excellent reputation. For many centuries this town was a possession of the house of Este, and in the old castle, still standing, Petrarch is said to have been magnificently entertained. Scandiano was the birthplace of Bojardo, the author of *Orlando Innamorato*, who also established a printing-press here, the editions issued from which are of great rarity. P. 7742.

Scar'borough (John), D. D., b. in the State of New York about 1826; was educated at Trinity College, Hartford, Conn.; graduated at the General Theological Seminary of the P. E. Church in New York; was settled as a minister first at Poughkeepsie, N. Y., and subsequently at Trinity church, Pittsburg, and was elected bishop of the diocese of New Jersey Nov. 12, 1874.

Scelidosau'ridæ [Gr. σκελίς, -ίδος, "leg," and σαῦρος, a "lizard"], a family of large extinct reptiles, belonging to the order Dinosauria or Pachypoda, established by Prof. Huxley. As defined by Huxley it includes species in which the integument was (at least usually) provided with a dermal armature in the form of bony scales or spines; the teeth of both jaws had sharp-edged triangular crowns with serrated margins, the serrations being oblique to or parallel with the long axis of the teeth; the rami of the lower jaw were slender, and tapered to their symphysis; the femur at its proximal end had a subglobular articular head, connected with a neck which was set nearly at right angles to the axis of the shaft, while its direction was nearly parallel with the flat surface on which the condyles rested; and the ilium had its anterior prolongation more slender than the posterior. To this family have been referred by Huxley the genera *Thecodontosaurus*, *Hylæosaurus*, *Polacanthus* (?), and *Acanthopolis*. These forms were inhabitants of Europe during the Triassic period. (See Huxley, *On the Classification of the Dinosauria*, in the *Quarterly Journal of the Geological Society of London*, vol. xxvi. pp. 32–50, 1870.) THEODORE GILL.

Seabury Mission. See BISHOP SEABURY MISSION.

Sel'la (QUINTINO), b. at Biella, Italy, July 7, 1827, of a family then and still largely interested in manufactures; educated at the University of Turin; received a special training at the School of Mines at Paris; successively filled the professorships of applied geometry and of mathematics at Turin, and was long employed in the general direction of the mines of Northern Italy; was elected to the national parliament in 1861, and was minister of finance in 1862, 1864–65, and 1869–73. His *Lezioni di Cristallografia* (Torino, 1867) and his numerous memoirs on that and other branches of science are widely known, and his paper *Sulle forme cristalline di alcuni sali di Platino a del Boro adamantino* created almost universal attention among mineralogists. He is a member of many scientific and literary bodies, and is president of the Accademia dei Lincei.

Sel'lon (PRISCILLA LYDIA), b. in England in 1821, daughter of a captain in the royal navy; was for many years engaged at Plymouth and Devonport in providing for the educational and spiritual destitution of the lower classes in those cities by the establishment of industrial infant and ragged schools under the auspices of the late bishop of Exeter, and eventually founded for that purpose, at Devonport in 1845, the semi-conventual order of "Protestant Sisters of Mercy," modelled upon the Roman Catholic orders for a similar purpose, of which similar "sisterhoods" were soon founded in London and other large cities of Great Britain. Some of the members were sent to the hospitals of the Crimea in 1854, and a body of "Missionary Sisters," organized by Miss Sellon, went to the islands of the Pacific in 1864 under the patronage of the Church of England Missionary Society.

Semitic Languages. This group of tongues was by Jerome called "Oriental," a designation which is no longer sufficiently distinctive, and might with as much propriety be applied to the languages of India or China as to those of Syria or Arabia. The name "Syro-Arabian" has also been proposed, which is formed after the analogy of Indo-European by combining the extreme limits of the territory which these languages have occupied. The most prevalent name is "Semitic," which is justified by the fact that the principal nations belonging to this family were descended from the patriarch Shem. (See Gen. x.)

The most important and best-known languages of this family are the Aramean (including Chaldee and Syriac), Hebrew, Arabic, and Ethiopic. Of these, the Arabic is the most, while the Aramean is the least, copious, flexible, and soft. The Hebrew, which lies geographically between them, occupies an intermediate position also in respect to these qualities. The Samaritan is a corrupt form of Aramean. The Phœnician language, or that of Tyre and its colonies, is shown by its scanty remains, mostly inscriptions, to be Semitic; and the cuneiform inscriptions have established the same thing with regard to the Assyrian. Some scholars have contended that the Coptic belonged to this family, but without sufficient reason. Its chief modern representative is the Arabic, to which a few unimportant local dialects may be added: *e. g.* the modern Syriac, the Amharic (descended from the Ethiopic), and the Maltese (a corrupt Arabic).

The proper home of the Semitic tongues is the territory bounded by the Tigris on the E., the Mediterranean Sea on the W., Mount Taurus on the N., the Red Sea and Arabian Gulf on the S., and embracing Syria, Mesopotamia, Palestine, and Arabia. They have occupied this region from the dawn of history, and they have rarely, and only to a limited extent, passed beyond it, chiefly as carried by Phœnician trade and by Mohammedan conquest.

The Semitic, like the Indo-European family, belongs to the inflective as distinguished from the agglutinative and isolating languages. The prime distinction between these two great families of cultivated tongues is that in the Indo-European the formation and flexion of words is conducted by the external addition of significant syllables, but in Semitic by typical forms, and for the most part internal changes. Thus, from the English root "love" come such derivatives as *lover*, *loving*, *lovable*, *beloved*, *lovely*, *loveliness*, *unloveliness*, in which each of the various prefixes or suffixes was in its origin separate and independent, with a force and meaning of its own, but has in usage sunk to a mere formative or modifying adjunct. In Hebrew, on the other hand, from the root *gdl* came such words as *gâdal*, "to be great;" *giddâl*, "to cause to grow;" *higdîl*, "to make great;" *gâdêl*, "growing great;" *gâdôl*, "great;" *gildêl*, "too great;" *gôdel*, "greatness;" *gdullâ*, "magnificence;" *gâdîl*, "tassel" (twisted together and so enlarged); *migdâl*, "tower" (something great). Here, except in the last example (where the prefixed *m* is of pronominal origin), there are no significant appendages, but merely forms following an established model to which a special signification has been attached. The clearest illustration of this is perhaps to be found in the verbs, which are modified by a series of symbolic changes known as species or conjugations. Thus, in Arabic the simple idea of the verb in its active form is expressed by employing the consonants of the root in their single power, and giving to each the simplest of the short vowels, *a*; thus, *katala*. This *light* form, as it has been technically called, may be loaded in various ways, each of which expresses the inclining or determining of the thought in some particular direction. A consonant may be doubled, thus giving new energy to its pronunciation and symbolically adding energy to the idea conveyed, or some special force may be imparted by lengthening or prefixing a vowel, and thus protracting the utterance of the word; its idea being intensified in some particular direction by its being thus dwelt upon or extended in one or other of its parts. Thus, *kattala* is intensive; *kâtala*, relative; *aktala*, causative; *iktalla* or *iktâlla* (the *i* is purely euphonic) denotes color more or less intense. Middle—*i. e.* reflexive or reciprocal—forms are produced by prefixing (or inserting) the consonants *n* or *t* to the active forms: thus, *inkatala*, *iktatala*, *takattala*, *takâtala*, *istaktala* (with euphonic *s*). Passives are formed by substituting the obscurer vowels *u* and *i* for the simple open *a*; thus, *kutila*, *kuttila*, etc. All these several forms express definite modifications of the thought, not by combining separate significant elements, but by symbolically attaching a given phase of thought to words moulded after a particular pattern.

The compounding of words, which enters so largely into the constitution of Indo-European tongues, is entirely unknown to the Semitic, the only semblance of it or approach to it being in the inseparable particles, the fragmentary pronouns, and the construct state of nouns. Particles of but one consonant (the article, conjunction, or prepositions) are attached in writing and pronunciation to the following word. So pronouns, whether the subject or object of verbs, or dependent upon other parts of speech, are reduced to fragmentary forms, which are attached to the words to which they belong. Thus, the Hebrew *ûmêartsô* ("and from his land") is written as one word, though it embraces a conjunction, preposition, noun, and pronoun: but this is a mere aggregate, in which each element retains its separate force and value unchanged, not a compound, in which the several constituents combine in the expression of one idea.

When one noun is modified in meaning by another, Indo-European tongues attach a case-ending to the latter, suggestive of this relation; Semitic tongues, for the most part, adopt a method the reverse of this—viz. the construct state, which is a change in the modified noun, and that not by an added ending, but an interior abbreviation, the first word being, as it were, hurried over to reach the second, which completes the sense; thus, Heb. *bayith*, "house," but *bêthêl*, "house of God," *domus dei*. Expressions of this sort, even when employed as proper names, are, however, strictly speaking, phrases rather than compound words.

Several remarkable consequences flow from this fundamental peculiarity of Semitic tongues—viz. their adoption of the internal and typical method of word-formation and inflection as opposed to that of compounding them with added significant elements. One is the superior stability and prominence of the consonants as compared with the vowels. The former constitute the permanent framework of words to which the essential idea is attached, while the intervening or accompanying vowels are subjected to numerous changes in producing the various typical forms suggestive of the various shades and modifications of the thought. In Indo-European tongues the ultimate roots consist of a syllable—*i. e.* either a vowel alone, or a vowel with one or more consonants, the vowel being as essential and im-

mutable as the consonants. The Semitic root, on the other hand, is purely consonantal; no vowel enters into it whatever. The root is wholly abstract and unpronounceable; the insertion or addition of vowels converts it from a root into a word of some particular form and determinate signification. This higher rank of the consonants and subordinate function of the vowels are reflected in the Semitic alphabets, in which consonants are denoted by distinct letters or characters, while the vowels are either not written at all, or expressed by points or minor appendages to the letters.

A further consequence is, that Semitic roots as a rule are triliteral. In order that the introduction of given vowels may produce forms of a fixed type to represent different classes of words, it is necessary that the roots should themselves be formed upon one unvarying model. Biliteral roots would not admit of sufficient variation; three is the lowest number of letters consistent with the variety of forms required by the necessity of the case.

A still further consequence is the poverty of the Semitic tongues in inflections as compared with the Indo-European. The number of inflections possible where these are formed by welding external significant additions to the root is practically unlimited. But where these are discarded the resources at command must be restricted within narrow bounds. The same limitation tends to restrict the range of mutual divergence in the members of the Semitic family. Instead of branching out into numerous divisions and subdivisions as the Indo-European family, the number of its dialects is small, and their differences are more like such as obtain between members of the same branch of the Indo-European—between English and German, for example, or French and Italian—than between distinct branches, as the Iranian and Italic, or Teutonic and Celtic. It likewise conspires with the immobility of the Orientals and their fixed habits and modes of life to preserve the languages from change, so that in their comparative freedom from the attrition and decay of words incident to Occidental tongues Renan calls them "languages of steel."

The first main peculiarity which affects the structure of these tongues has now been sufficiently illustrated and traced to its consequences. A second peculiarity affects the style of thought; they are more pictorial and less reflective than the Indo-European. Thus, the Semitic languages have uniformly but two genders. The distinction of sex existing in living beings is carried by them throughout inanimate nature, as well as into all abstract terms and words expressive of mental conceptions. Again, while many words in Occidental tongues are figurative in their origin, the metaphor is lost sight of as they are ordinarily used, and is only brought to light by philological analysis. But in Semitic words the original metaphor abides in the consciousness of those who use the language as palpable as when it was first employed. Thus, anger is variously denominated in Hebrew by words that denote excited *breathing*, *heat*, *burning*, *boiling*, *breaking* asunder with violence, and *roaring*. Discouragement or despair is a *melting* of the heart, the reins, or the knees. The essence of anything is its *bone*, etc., etc.

Connected with this is a want of that precision or exactness of expression which the Indo-European labors to attain. The pictorial and imaginative Semite barely suggests the thought in outline or in substance, which he leaves to the intelligence or fancy of his hearer to fill up and complete. Thus, he requires but two tenses, deeming it sufficient to refer all action to the past or to the future; the Indo-European not only distinguishes from both these the vanishing present, but makes distinctions in the regions of the past and the future themselves by the perfect, imperfect, and pluperfect, or by the simple future and future perfect, and still further notes the mode of action as indicative, subjunctive, potential, optative; of all which the Semite makes no account, or leaves it for the most part to be inferred from the connection. The Semite, again, never employs long and complicated periods. He utters his sentences in succession, but without concatenation or exhibiting their mutual relations of dependence. Whether the clauses be cumulative or adversative or inferential, they are simply joined by the copulative *and*, the precise nature of the connection being left to the determination of the hearer or reader.

This quality of the Semitic tongues rendered it eminently fitting that one of them should be selected to record the revelation of the Old Testament, which was one of types and figures, while an Indo-European tongue was made the vehicle of the New Testament, in which truth was set forth in completed form, with precision of language and in its logical relations. It was likewise fit that the stationary Semite should receive that divine Word which was to be held from generation to generation in its native seats, but that what was to be propagated over the world should be committed to the restless and enterprising Indo-European.

It has already been stated that the Semitic alphabet is purely consonantal. It contains some consonants peculiar to itself, and which other races find great difficulty in pronouncing, particularly among the gutturals, which are remarkable for their number and variety. The written characters of all Semitic tongues (except the Assyrian cuneiform) are traceable to one common source, the Phoenician, from which the Indo-European alphabets are likewise descended; and except in the case of the Ethiopic they are traced and read from right to left.

The question whether a pre-grammatical relationship can be scientifically demonstrated between the Semitic and Indo-European families of tongues has been vehemently disputed, and can scarcely be said to have reached a definitive conclusion yet. It is sufficient, perhaps, to say upon this point, that their common origin is not disproved by the divergence existing between them, great as this is acknowledged to be. (See HEBREW LANGUAGE.) W. H. GILES.

Seni'se, town of Southern Italy, province of Potenza, at the foot of a hill on the right bank of the Serrapotamo. P. 5050.

Sepi'no [anc. *Sapinum*], an old Samnite city of Southern Italy, province of Campobasso. Interesting remains of the ancient town still exist. (See Keppel, *Excursion in the Abruzzi*, vol. ii. p. 92.) P. 5300.

Sere'gno, town of Italy, province of Milan, nearly on the railway between the city of Milan and Como. It is as old as the seventh century, and has been the theatre of some curious incidents in modern history. In 1796 the women of Seregno rose against the conscription, prostrated the liberty tree, and headed an insurrection so tumultuous that Bonaparte was with difficulty induced to rescind an order for the bombardment of the town. In 1848 the Austrians dealt severely with it for its turbulent patriotism. P. 6800.

Seri'no, town of Southern Italy, province of Avellino, on a hill on the W. slope of Monte Fermolo, near the right bank of the Sabato. The ruins of the ancient *Sabatia*, mentioned by Livy, may be seen near this place. P. 6306.

Sermi'de, town of Italy, province of Mantua, on the right bank of the Po, on the railway between Mantua and Verona. It is a place of more than usual industry. P. 6655.

Ser'pents [Lat. *serpens*; Gr. ἕρπειν, to "creep"], a group of the class of reptiles, distinguished by naturalists as an order under the scientific name Ophidia (Gr. ὄφις, a "serpent"). They are recognized by their very elongated and flexuous body and the absence of true external limbs; the body regularly graduates into the tail, and there is no abrupt distinction between the two; the back and sides are covered with imbricated scales, generally imbricated, rarely granular, while the lower surface is generally covered in front of the anus with a row of very broad plates, and behind the anus with usually two, sometimes one, row; sometimes, however, the scales extend upon the abdomen as well as on the sides and back; the head is covered with plates, which in the typical forms are developed as follows from before backward: (1) one rostral, (2) two prefrontals, (3) two postfrontals, (4) a vertical in the middle and upon each side thereof, and over the eye a superciliary; and (5) two occipitals; the lips above and below are bordered respectively by the upper and lower labials, and the chin by peculiar oblique plates; in others the scales encroach upon the head, and are little differentiated from those on the back and sides. The principal characteristics of the order, in contrast with those of others, especially as given by Prof. Huxley, are as follows: The skull has the floor of the cranium nearly flat, and the vertical height of its cavity diminishes gradually in front, so that it remains spacious between the eyes in the frontal regions generally; the periotic region is not produced into parotic processes; the walls of the cranial cavity are well ossified in its anterior as well as posterior half, and the bones which gird it are firmly united; the premaxillaries are generally rudimentary, and represented by a single small bone, which is connected with the maxillaries only by fibrous tissue; the palatine bones never unite directly with the vomer or with the base of the skull, but are usually connected with the maxillaries by transverse bones, and by the pterygoids with the movable quadrate bones; thus the connection of the palato-maxillary apparatus with the rest of the skull is more or less lax, and in the typical species exceedingly so; in certain worm-like forms, however, this is not the case; the lower jaw has its rami connected at their symphysis, generally by ligamentous and extremely elastic fibres; the result of the mechanism exemplified in the typical serpents is, that the mouth-pieces are extremely dilatable, and hence prey of much greater diameter than that of the serpent in its ordinary condition can be ingested. The teeth are acute, and directed more or less backward, and are generally developed simply upon the maxillary, palatine, and dental

bones; sometimes on other bones as well; *e. g.* the premaxillary and pterygoid; sometimes (as in Uropeltidæ) they are wanting in the palatines, and in at least one genus (*Rhachiodon*) the inferior spines of eight or nine of the anterior vertebræ are developed by tooth-like processes. In the typical species they are in a long series on each of the bones designated; in the specialized poisonous species, however, only poison-fangs are developed on the maxillaries, but the rows on the palatines and dentaries exist as in the typical species; in an intermediate type, but containing very poisonous species, there are also rows of teeth behind the poison-fangs. The vertebræ and ribs are very numerous, and every vertebra from the head to the end of the tail has its ribs: they all have ball-and-socket articulations, the anterior extremity of each vertebra being developed into a ball, which articulates with a corresponding cup in the posterior face of the antecedent vertebra; they are provided with processes connected with each other, and limiting the motion of the animal to lateral undulations; the ribs are articulated with the vertebræ by ball-and-socket joints. True limbs, as already remarked, are wanting, and the anterior are not present in all forms, but the posterior are in some types represented by rudiments which are occasionally exserted and appear as hooks. The alimentary canal is differentiated into an œsophagus, a stomach, a small intestine, and a large intestine: the small intestine has its folds united by fibrous tissue and enclosed by a common sheath of peritoneum. A cloaca passes all the contents of the viscera. The lungs are unequal in size, and in the typical forms the disparity is very great, the left one usually being the smaller of the two; to such an extreme is this disparity sometimes carried (especially in the venomous species) that only one of the lungs is developed: the form of the lungs is that of an elongated sac, in which the walls are produced into numerous septa "which render the cavity highly cellular near the bronchus, while at the opposite end they become smooth and but little vascular; in this latter region the lung may receive its blood from the systemic, and not from the pulmonary, circulation." The bronchus opens directly into the lung. The heart is divided into two auricles and a single very imperfectly-separated ventricle.

Although serpents are more or less familiar to every one, their movements are often misconstrued. They progress by sinuous flexures from side to side, and are incapable of the vertical undulating movements which are sometimes accredited to them in pictorial illustrations. Though destitute of members, the typical species can progress with great rapidity upon surfaces that are rough; and this progression is greatly facilitated by the transverse plates with which the abdomen is covered. Many serpents are also capable of ascending trees, and almost or even quite vertical surfaces; but they are quite unable to progress on polished or glass-like surfaces, and are there utterly helpless. Their habitats are various: some live in marshy regions, some in rocky, some on sandy desert plains, others among the trees, and still others burrow in the earth; again, some affect fresh waters, while a few are even modified as sea-serpents and for swimming in the ocean. Among the most noteworthy perhaps are species of rattlesnakes, found in the deserts of the south-western portion of the U. S., the sea-serpents, or Hydridæ of India, and the worm-snakes or scolecophidians. The sea-serpents in question are not to be confounded with the mythical sea-serpents, for the Hydridæ are comparatively small species, whose tail is strongly compressed and adapted for swimming, and which have small poison-fangs. The Scolecophidea, in part at least, burrow in the earth, and thus by their habits, as well as form, justify the term of worm-like snakes.

Most serpents are oviparous, and lay eggs whose shell is generally more or less soft and yielding, but which have, at the same time, a greater or less amount of lime; and sometimes this is developed in sufficient quantity to give a considerable rigidity to the shell: other serpents are ovoviviparous. The distinction, however, between these two modes of generation is very trifling, and species not distantly related, and at least belonging to nearly-allied genera, sometimes contrast in this respect. So slight, indeed, is the value that even there may be individual exceptions to the mode prevalent in a species; so that, for example, a normally ovoviviparous species may exclude its eggs before the birth of the young. Nevertheless, as a rule it may be said that the innocuous species are oviparous, and the venomous ovoviviparous, but the exceptions are numerous. The eggs are generally excluded in a chain, being connected by a viscous substance. In most cases the mother, after laying her eggs, leaves them to be hatched by the sun or decaying vegetable matter, but some species coil themselves around the eggs and thereby hatch them. Many species go with their young for some time after birth, and protect them from enemies. It is now quite well ascertained that some species open their mouth at the approach of danger, and receive therein their young, which are allowed to depart therefrom unharmed.

The principal subdivisions of the order are based upon modifications of the cranium and the dentition. The generally-admitted groups are (1) Solenoglypha, (2) Proteroglypha, (3) Asinea, (4) Tortricina, and (5) Scolecophidia; these are enumerated in an order inverse to their evolution, the first containing the most specialized forms of the order, and the last the most generalized types. The Solenoglypha, Proteroglypha, and Asinea best express the general idea of a serpent; while the Tortricina and Scolecophidia are rather worm-like in their appearance, and approach, most of the ophidians, to the lizard type. The Solenoglypha are those serpents which are provided with great poison-fangs on each side of the upper jaw, and include the Crotalidæ (rattlesnakes, etc.), Viperidæ (vipers), Causidæ, and Atractaspididæ. The Proteroglypha are also poisonous serpents which have less modified maxillary bones, although the poison-fangs are well developed, and embrace the families Najidæ, Elapidæ, and Hydrophidæ. The Asinea include the great bulk of non-venomous serpents, and are divisible into quite a large number of families, of which are recognized by Cope the Rhabdosomidæ, Colubridæ, Homalopsidæ, Achrochordidæ, Lichanuridæ, Boidæ, Pythonidæ, and Xenopeltidæ. The Tortricina are worm-like snakes, which have teeth developed on the ecto-pterygoid and maxillary bones, and are represented by a few species, forming the families Uropeltidæ and Tortricidæ. The Scolecophidia are worm-like snakes, destitute of teeth on the maxillary and ecto-pterygoid bones, and its few species have been combined under the families Stenostomidæ and Typhlopidæ.

The order is represented by about 1000 living species. The geographical distribution of its members is to a large extent determined by thermometrical conditions. The representatives of the order as a whole affect hot regions, and are averse to cold. They are absent altogether in the extreme northern and southern countries, and sparingly developed and hibernating during cold weather in the temperate regions, but almost equally abundant in the tropical regions of the several quarters of the globe. In the North American or "Nearctic" realm are found, according to Cope, 132 species of the order; of these, 19 belong to the family Crotalidæ (including the rattlesnakes and copperheads), 3 to the Elapidæ (the so-called coral snakes), 103 to the Colubridæ (almost all of the common snakes), 2 to the Boidæ, 3 to the Lichanuridæ, and 2 to the Stenostomidæ. The number of species increases toward the S., as does also the proportion of the venomous to the harmless species. In the Northern States only three species of poisonous snakes (the scale-headed and plate-headed rattlesnakes and the copperhead) occur, and the greatest number in any one region within the U. S. are found in Arizona and New Mexico. The poisonous species are confined to the families Crotalidæ and Elapidæ, and number only 22 species, or one-sixth of the total of the ophidian fauna of the country. (See POISON OF SERPENTS, THANATOPHIDIA, in CYCLOPÆDIA, and the names of different families, as well as other groups and species.) THEODORE GILL.

Serran'idæ [from the Lat. name, *Serranus*, of a Mediterranean form of the family], a family of fishes of the order Teleocephali and sub-order Acanthopteri, containing numerous species found in the tropical and, to some extent, temperate seas of the globe. The body is more or less compressed; the scales ctenoid, imbricated, and generally of moderate or small size; the lateral line entire and nearly concurrent with the back; the head compressed, and more or less pointed forward; the cheeks unarmed: the opercular bones generally armed, the preopercular being serrated and the operculum spinigerous; the mouth with a lateral cleft; the upper jaw slightly protractile; teeth conic, and generally dense and in numerous rows on the jaws as well as palate; branchial apertures large and confluent below; branchiostegal rays generally seven, rarely six, on each side; dorsal fin composed of a longer spinous and shorter soft portion; anal like the soft portion of the dorsal, and with, generally, three spines; caudal distinct; pectorals well developed, with branched rays; ventrals thoracic, each with a spine and five branched rays. The stomach is cæcal, and pyloric appendages are developed, generally in moderate, but sometimes in very large, numbers. The skeleton has typically the vertebræ developed in normal number—*i. e.* dorsal 10 and abdominal 14. The exact limits of this family are not yet determined, it being uncertain to what extent it conflicts with the families Pristipomatidæ, Sparidæ, etc.; but the typical genera are *Serranus* and its subdivisions and allies, *Paralabrax*, *Epinephelus*, *Trisotropis*, *Plectropoma*, *Hypoplectrus*, *Centropristis*, *Anthias*, and numerous others. In the Atlantic coast waters of the U. S. are to be found twelve species, belonging to

the genera *Epinephelus*, *Triaotrapis*, *Promicrops*, *Centropristis*, *Trilobarus*, *Diplectrum*, *Dules*, *Hyporthodus*, and *Promicropterus*, and in the waters of the Pacific slopes four species, representing the genera *Paralabrax* and *Stereolepis*. The variation in size among the species of the family is great, some being only a few inches long, while others exceed seven or eight feet. Among the gigantic forms are the *Promicrops guaza*, or jew-fish of the Southern States and Cuba, of which a skeleton and cast of a specimen of 700 pounds weight is in the Smithsonian Museum, and the analogous *Stereolepis gigas*, or jew-fish of California, which appears to attain an equally large size. Almost all the species are esteemed as food. They are carnivorous, and feed on smaller fishes with avidity.

THEODORE GILL.

Sew'ard (AUGUSTUS H.), son of William H., b. in Auburn, N. Y., about 1825; graduated at the U. S. Military Academy in 1847, and entered the 8th Infantry as brevet second lieutenant; was engaged in the war with Mexico 1847–48; in active service in Texas and the Indian Territory 1848–51, and on Coast Survey duty 1851–59; promoted to be captain 5th Infantry in the latter year, and accompanied the Utah expedition 1859–60, serving subsequently in the Navajo expedition in New Mexico; was appointed paymaster in the army Mar. 27, 1861, and was brevetted lieutenant-colonel and colonel for faithful and meritorious services during the war. D. at Montrose, N. Y., Sept. 11, 1876.

Seward (FREDERICK W.), LL.D., b. at Auburn, N. Y., July 8, 1830, son of Wm. H.; educated at the academies of Albany and Auburn; graduated at Union College in 1849; studied law, and was admitted to the bar at Rochester in 1851, and to the U. S. Supreme Court in 1854; was associate editor of the Albany *Evening Journal* up to 1861; assistant secretary of state of the U. S. 1861–69; member of the assembly in 1874; edited *Autobiography of William Henry Seward, 1801–84*, with *Memoir* (1877); and is again assistant secretary of state of the U. S.

Sha'ler (ALEXANDER), b. in Haddam, Conn., Mar. 19, 1827; for many years prominently identified with the New York State militia, which he entered as a private in 1845, and in 1867 became major-general 1st division N. G. S. N. Y.; was major of the 7th New York on the outbreak of war in 1861, but in June was appointed lieutenant-colonel 65th New York Vols.; became colonel July, 1862; served with the Army of the Potomac in its many engagements; in command of a brigade, 6th corps, from Mar.–Nov., 1863; commissioned brigadier-general of volunteers May 20, 1863; commanded military prison at Johnson's Island, O., during winter of 1863–64. Returning to the field at the opening of the campaign in 1864, he was taken prisoner May 6, and held three months in Charleston; subsequently to his exchange he served in the South-west until mustered out. Brevet major-general for gallant and meritorious conduct. As president of the Metropolitan Fire Department 1867–70, and a commissioner of that department 1870–73, he contributed largely to the present efficient condition of that body. Is president of the National Rifle Association, also of an automatic telegraph company.

Shar'key (WILLIAM LEWIS), b. in Tennessee in the beginning of this century, but removed with his parents to the Territory of Mississippi in 1804; graduated at Greenville College, Tenn.; studied law in Natchez, under Turner and Metcalf; was admitted to the bar in 1822; began to practise at Warrenton; moved in 1825 to Vicksburg; was elected a member of the State legislature in 1827, and chief-justice of the high court of errors and appeals in 1832, to which position he was re-elected four times in succession; settled in 1850 at Jackson; was appointed provisional governor of Mississippi in 1865, and elected U. S. Senator in 1866; removed to Washington, and d. there Apr. 29, 1873. ALEXANDER H. STEPHENS.

Sheep [Lat. *Ovis*], a genus—or, according to some authors, a group of genera—of mammals belonging to the family Bovidæ, group Pecora or Ruminantia, and sub-order Artiodactyli, of the order Ungulata. The form is familiar in connection with the common sheep, which, in its ordinary variety, tolerably well exemplifies all species, save that the trunk is more massive and the legs more slender, and consequently the aspect less graceful, than in the wild species; the head is rather broad; the forehead flat or concave; the nose is naked; the chin is not bearded, either in the males or females; the horns arise behind the orbit, are more or less spirally curved and the apices directed sidewise, and are somewhat trihedrally compressed and longitudinally angulated on the adorbital sides, and have the surface transversely rugose; though developed generally in both sexes, they are not infrequently wanting in the females; the incisors are nearly equal in size, and sloping; the molars destitute of supplemental lobes; the hoof mostly triangular, and shallow behind; the tail is diversiform, but generally quite short, though sometimes well developed; the skull, according to Turner, is characterized by a flat basiocipital, which is more or less expanded anteriorly by the extension of the anterior pair of tubercles, the posterior ones being small; the auditory bullæ are small; a more or less marked round suborbital depression exists, but there is no fissure; the masseteric ridge ascends high before the orbit. The species are quite numerous, and the latest systematic writer on the group, Dr. W. Peters, enumerates twenty-one. These have been combined by that author under the genus *Ovis*, but by a few (*e. g.* J. E. Gray) they have been separated into as many as four genera. The geographical range of the genus is moderately extensive, and covers several of the islands of the Mediterranean (Corsica, Sardinia, and Crete), the greater portion of the temperate parts of the highlands of Asia and the Rocky Mountains of North America; while, as is of course well known, in a domestic state its distribution is almost coequal with that of man. Of the wild species, two at most (*Ovis montana* and *O. californica*)—and perhaps only one—are inhabitants of America, the others being mostly Asiatic. By Dr. Peters the species have been grouped under two sub-genera—*Ovis* and *Musimon*. (I.) *Ovis* is characterized by having each horn form a complete whorl of a spiral, the right curving to the left, and the left to the right, and the direction of the points is always forward, and, in general, also outward. To this belong the following species: (1) *O. montana*, inhabiting the Rocky Mountains northward; (2) *O. californica*, the Rocky Mountains southward; (3) *O. nivicola*, Kamtschatka; (4) *O. borealis*, the mountains of the highlands of Pjassina and Chatanga in Northern Siberia; (5) *O. Hodgsoni*, the Himalayas and Thibet; (6) *O. Blythi*, also Thibet; (7) *O. argali*, Eastern Mongolia and around Lake Baikal; (8) *O. collinus*, the lower steppes to the northward of Lake Balchat; (9) *O. Karelini*, the Tjantjanish mountain-system; (10) *O. Polii*, the sources of the Kaschgar-Darya and Amu-Darya; (11) *O. Heinsii*, Western Tjantjan; (12) *O. nigrimontana*, Karatau, N. W. of the preceding. (II.) *Musimon* is distinguished by the horns forming an incomplete whorl of a spiral, of which the right turns toward the right, and the left toward the left; the points are directed inward. To this belong the species (13) *O. nahoor*, Himalaya, about the sources of the Ganges; (14) *O. burrhel*, Himalaya; (15) *O. orientalis*, Northern Persia; (16) *O. anatolica*, Asia Minor, etc.; (17) *O. cypria*, Cyprus and Candia; (18) *O. cycloceros*, the North-western Himalayas in Punjaub; (19) *O. vignei*, Little Thibet, etc.; (20) *O. musimon*, Sardinia and Corsica; and (21) *O. arkal*, the eastern side of the Caspian Sea.

The domestic sheep is generally supposed to be derived from the musimon of Corsica or the argali of Asia. Whatever may be its origin, however, it has deviated considerably from the wild stock, and, like most of the long domesticated animals, has broken into a great number of varieties, some of which are very marked and distinct. Among the most eccentric of these varieties are the fat-rumped sheep of some parts of Asia, and especially of Tartary, distinguished by an excessive development of fat upon the buttocks and its long, pendulous ears; the Fezzan sheep of Africa, noteworthy for its arched forehead, pendulous ears, long legs, and the mane on the neck and shoulders; both of these species thus contrast greatly with the wild types, and even the generic diagnosis must be widened to admit them in the genus. The fine breeds prevalent among the modern civilized nations are to a great extent due to the intermixture of the celebrated stock of merino sheep, which is supposed to have originated in Spain, or which at least has been imported from Spain into other countries to improve their breeds. The merino sheep is celebrated for the fineness of its wool, which is also developed on the forehead and cheeks, and is very long, fine, soft, and curly. The care which has been devoted to sheep-culture in various countries, such as the U. S., England, etc., has resulted in the development of breeds which are even superior to the original merino. While many are raised for the fleece, others are cultivated chiefly for food, and in some countries mutton is the principal meat diet. In the U. S., in 1870, the principal sheep-raising State was Ohio (which produced 4,928,635); California, the next, yielded 2,768,187; and New York, the third, raised 2,181,578; the other States furnished each less than 2,000,000, and those producing between 2,000,000 and 1,000,000 in a descending order were Minnesota, Pennsylvania, Indiana, Illinois, and Wisconsin. A report of the department of agriculture in Jan., 1874, gives the number then in the U. S. as 34,038,200, valued at about $89,000,000.

THEODORE GILL.

Shep'hard (E. M.), U. S. N., b. Sept. 16, 1843, in New York; graduated at the Naval Academy in 1861; became a lieutenant in 1864, a lieutenant-commander in 1866; served on board the steamer Mississippi in several hard fights on the Western waters, and with the naval battery at the siege of Port Hudson, and highly commended in official despatches. FOXHALL A. PARKER.

Ship-Canals. By "ship-canal" is meant a canal intended for the passage of *ships* proper: hence, therefore, canals to connect sea with *sea*, and thus by a "short cut" to obviate a long ocean navigation. As the fitting localities are rare, such canals in the full sense of the phrase cannot be numerous. Such canals are usually laid across an isthmus or peninsula. The Suez Canal is an apt instance: so also are the *projected* canals across the Central American isthmus and our own isthmus of Florida. The Gotha Canal of Sweden, the Caledonian of Scotland, are instances of a minor class of ship-canals. In another sense, those proposed to connect routes of *natural navigation* (rivers or lakes), by allowing the passage of the vessels, whatever they may be, used in such navigation. To this class belong many of the works described in the CYCLOPÆDIA under separate heads—*i. e.* The ILLINOIS AND MICHIGAN CANAL, the ST. MARY'S RIVER CANAL, and also the *Louisville and Portland*, the *Delaware and Chesapeake Canal*, and others mentioned under the head of NAVIGATION, INLAND, where the subject of this class of canals is treated in relation to the U. S. To the same class would belong the projected Niagara Falls Canal, for which a survey and plans were made by the late Capt. W. G. Williams, Top. Engrs. U. S. A. (see *Ex. Doc. No.* 214$\frac{2}{1}\frac{4}{4}$ and 463$\frac{2}{2}\frac{5}{5}$ H. R.), and the Bay Verte Canal. (See CANALS OF CANADA.)

The Gotha Canal of Sweden (constructed 1794–1800) joins the Cattegat with inland navigation and with the Baltic. Its cuttings at one point, around the Trosbeetta Falls, are 72 feet in depth through solid rock. The Languedoc, or *Canal du Midi*, of France, though constructed (1666–70) to save a distance in transportation of 2000 miles *viâ* the Straits of Gibraltar, by connecting Toulouse on the Garonne with Agde, or the created port of Cette, on the Mediterranean, a distance of but 148 English miles, cannot be called a ship-canal, since its depth was but 6½ feet and width 65 feet. Twenty-six locks on the Atlantic side and seventy-four on the Mediterranean surmounted a summit-level of 117 feet above the sea.

The CALEDONIAN CANAL (which see), constructed by the British government for military purposes and for the transportation of Baltic timber, though a monument to Telford's engineering skill, requiring twenty years for its construction and an expenditure of £1,000,000, has nevertheless scarcely paid expenses of maintenance. The locks do not admit ships of more than 160 feet in length. The three canals just mentioned, though they scarcely claim to rank with true ship-canals, since they admit but an inferior class of sea-going vessels, or (as the Languedoc and Gotha) exclude such vessels, are yet interesting as among the earliest of the great works intended to connect sea with sea.

(For a description of existing ship-canals proper see NORTH HOLLAND CANAL, NORTH SEA CANAL, SUEZ CANAL.)

The importance of a navigable connection between the Atlantic and Pacific oceans through the American isthmus calls for a condensed view of the chief plans proposed at different dates, and of the natural obstacles baffling them all up to the present time. No commercial, geographical, or speculative problem has had a history more marked. From the era of the Spanish conquest of America the search for the secret of the supposed natural strait was carried on along the whole coast-line of the two continents; and when this ceased, the possibility of the construction of an artificial route began to be discussed. During the last fifty years, governments, companies, and individuals have devoted much time and money to the search for a practical route for a ship-canal. Tehuantepec, Nicaragua, Chiriqui, the Isthmus of Panama (or Darien), and the Atrato River, have all figured in connection with this question, and a full statement of the various surveys and projects made prior to 1866 will be found in the report of the superintendent of the U. S. Naval Observatory (Admiral C. H. Davis), made in compliance with a resolution of the Senate (*Ex. Doc.* 62$\frac{3}{1}\frac{9}{9}$).

The successful accomplishment of the Suez Canal construction in 1868 called public attention again to the corresponding project for the American isthmus; and the U. S. government, through its navy department, undertook a fresh exploration of the various routes of alleged practicability, the more important results of which will be here stated. (For a description of the American isthmus, their common *locale*, reference is made to "Central America" in article AMERICA.)

Commencing with Tehuantepec (see also the article TEHUANTEPEC), Capt. R. W. Shufeldt, U. S. N., who surveyed this route (see *Reports of Explorations and Survey, etc., Ex. Doc. No.* 64$\frac{2}{2}$, *Senate*), affirms the practicability of, and recommends, a ship-canal of top breadth of 122 feet, bottom breadth 60 feet, and depth of 22 feet. "These dimensions were assumed as a basis, because a canal of that width and depth would be amply sufficient to accommodate at least nine-tenths of the commerce of the world, and certainly wide and deep enough for our own domestic trade; and I question," he says, "if a surface-canal with as many locks as will be required for this one will not present so many difficulties in the transit of very large ships as to fail to fulfil its object." The terminal harbors are, on the Atlantic or Gulf extremity, the mouth of the Coatzacoalcos River, "one of the best harbors in the Gulf of Mexico," having 14 feet of water on its bar (through which a deep channel can be made), and the natural harbor of Salina Cruz, on the Pacific (a mere indentation in the coast-line), where "a magnificent port may be made with comparatively small outlay of money." Other engineers have recommended the Ventosa Bay, and others the "Lagoons," avoiding the difficult passage of the Tehuantepec River and of the chain of hills which surround the harbor of Salina Cruz. This route would be eminently a *national* one to the U. S., both from its proximity and from its being, as it were, a prolongation of our *coasting* navigation from the Atlantic and Gulf shores, and from the inland navigation of the Mississippi River to our Pacific shores. It would, too, be as a *national* work one more easily defensible in war than others.

The Nicaragua Route follows the most deeply-marked depression of the American isthmus, and has the natural advantage of the great lake of the same name as a canal-feeder, and would perhaps be more directly in the world's highway. A route for a ship-canal was surveyed by O. W. Childs, C. E., in 1850, whose report will be found in the *Journal of the Franklin Institute*, June, 1870, *seq.* The government survey has been recently executed by Commander E. P. Lull, U. S. N. The canal, as it results from his survey (*Ex. Doc.* 57$\frac{3}{1}\frac{3}{3}$, *Senate*), commencing at Greytown, follows the San Juan River to the mouth of the tributary San Carlos, 41.9 miles; thence a slackwater navigation of the river by the construction of four dams, the highest of which at Castello raises the lake to 107 feet above tide, or 4 feet above its mean high-water level, to Lake Nicaragua; thence lake navigation to the Rio del Medio, 56 miles; thence to the Pacific at Brito, a canal of 16⅓ miles in length fed from the lake. For 7½ miles there is an average cutting of 54 feet, with a maximum of 134 feet. The absence of natural harbors is the most serious objection to this route, the once commodious and excellent harbor of Greytown having been converted by the extension and emergence of its bar into a mere lagoon. The restoration of this harbor, and the construction of an artificial one at Brito, are therefore necessary features of the canal project. The estimate for the whole work, as made by Commander Lull, is $66,000,000, nearly.

Across the Isthmus of Panama occurs, next to Nicaragua, the greatest depression yet found on the isthmus, the summit-level of the railroad being but 287 feet.

The route from Porto Bello or Chagres to Old or New Panama has been the established line of communication since the year 1653, nearly coeval with the first settlement in America. A survey was made in 1843 by the French engineer M. Garella (*ingénieur en chef des mines*), of which an account is given in the document referred to, and of which the report was printed in the *Journal of the Franklin Institute*, also in the French *Journal des Ponts et Chaussées*, 1844.

Mr. G. M. Totten, chief engineer of the Panama R. R., subsequently made an estimate for a canal to cost from $60,000,000 to $115,000,000, according to the summit-level adopted. The survey was renewed by our government by Commander E. P. Lull, U. S. N., resulting in the location of a practicable line for an interoceanic ship-canal 26 feet deep from the Bay of Aspinwall on the Caribbean Sea to Panama on the Pacific. The total length of the line is 41.7 statute miles. Twelve lift-locks on each side will be required, and one tide-lock at Panama, or twenty-five in all. The lift of the locks will be 10.3 feet each; that of the tide-lock, 10 feet. It is proposed to cross the river Chagres by means of a viaduct 1800 feet in length. The water-supply is to be drawn from the river Chagres, and to be conveyed to the canal by a feeder 10.22 miles in length. The Chagres was found by careful gauging to discharge at an unusually low stage 55,900,800 cubic feet per day—a quantity considerably in excess of the maximum possible demand of the canal. Estimated cost, $94,911,360.

In the section of the isthmus known as Darien the U. S. government surveys and reconnaissances made by the navy department (see *Report of Explorations and Surveys, etc.*, by Commander T. O. Selfridge, published in 1874

by the navy department) embrace the following alleged favorable crossings:

I. From the Gulf of San Blas to the Bay of Panama *viâ* the Chepo River. There being no water supply for a summit-level, this route, 27 miles in length, with an excellent harbor at San Blas, could only be utilized as a *sea-level* canal by a tunnel 10 miles in length.

II. From Caledonia Bay to the junction of the Sucubti and Chuennaqua rivers (flowing to the Pacific), thence to the junction of the Lara with the Savanna River, which it follows to the Bay of San Miguel. "Its noble harbors, and the assertions of Dr. Cullen, but partially contradicted by the meagre reports of Gisborne and Strain, required that this route should be surveyed—a route celebrated in history as the path by which Balboa in 1513 crossed and beheld for the first time the mighty Pacific; the road of the buccaneers in their raids upon the Spanish settlements of the W. coast; the spot where perished the ill-fated Scottish expedition of Patterson; the wilderness which witnessed the heroic and disastrous sufferings of Lieut. Strain and his party." The route is found impracticable for the same reasons that apply to the San Blas. A tunnel of 7 miles would be required. A variation of this route by the Morti River is found equally inadmissible. At 3½ miles from the beach (Caledonia Bay) an elevation of 250 feet is attained, with but insignificant mountain-streams to supply water.

III. Another route with the same Pacific terminus (Gulf of San Miguel), ascending the Atrato River and its tributary, the Caricara, thence connecting with the sources of the Tuyra River, which through the Boca Chica (or Darien harbor) discharges into the gulf first named, promised eligibility (see *Putnam's Magazine*, Mar., 1869). This route is pronounced impracticable for nearly the same reasons as have applied to the two just mentioned. Lowest elevation, 410 feet.

IV. Through the valley of the Atrato many explorations have been made to various points of the Pacific coast. An alleged ancient "Raspadura Canal" (so called), connecting its head-waters with those of the San Juan River, which enters the Pacific near the Bay of Choco, finds place in the authoritative *Atlas Universel* of Brué (see ZUYDER-ZEE) and in a chart of Malte Brun (*Annales des Voyages*, 1811). Its existence is now disproved, though Indians may have taken canoes across. A public-spirited citizen of New York, F. M. Kelley, Esq., fitted out several different expeditions successively under Messrs. J. C. Trautwine, Lane, Porter, and Kennish, in 1852, 1853, 1854, the last of which selected the Truando, the heads of which (about 100 miles from the mouth of the Atrato) are but 10 miles from Humboldt Bay of the Pacific. The U. S. government was thereupon induced to institute a survey of this route by an expedition under Lieut. (now Bvt. Brig.-Gen.) N. Michler, U. S. Engineers, and Lieut. (the late Commander) T. A. Craven, U. S. navy (*Ex. Doc.* 93/6, *Senate*). The lowest point of the divide is about 900 feet, and two tunnels, one of 12,250, another of 850 feet, are required; summit-level, about 100 feet above tide. The results of the two surveys under Com. Selfridge (1871–73) was the choice of the Napipi tributary, which 40 feet above the sea-level enters the Atrato about 150 miles from its mouth, through which length the latter affords ship navigation of 26 feet depth. The canal, 28 miles long, follows the Napipi and Doguado rivers, penetrates the dividing ridge, here 660 feet high, by a tunnel 3 miles long, and reaches the Pacific at the Bay of Chiri-Chiri, 10 miles S. of Cupica Bay. The summit-level, 125 feet above tide, is fed by the Napipi River. The harbors are the mouth of the Uraba delta-arm of the Atrato, to be improved by "artificial banks" (jetties), and the open Bay of Chiri-Chiri on the Pacific, where "two short breakwaters are necessary." This was resurveyed in 1875 by Lieut. F. Collins, according to whose report (*Rep. Secy. of Navy*, 1875) the length of tunnel necessary to carry the canal under the dividing ridge, which attains a height of 778 feet, was found to be 3.5 miles. The total length of the canal by this route, as determined by Lieut. Collins, is 32.2 miles, and his estimates of the probable cost of the construction of a suitable canal, with all the works necessary for its preservation and successful operation, amount to $98,000,000.

All the different projects, and the various surveys upon which they were based, have been submitted by order of the President to a commission consisting of Gen. A. A. Humphreys, chief of engineers U. S. army, Prof. Benj. Peirce (succeeded by Capt. Carlisle Patterson), chief of the Coast Survey, and Commodore D. Ammen, chief of the bureau of navigation, U. S. navy. As stated by them, the route known as the Nicaraguan, beginning at or near Greytown on the Atlantic side, and ending N. of the Rio del Brito on the Pacific, offers fewer difficulties from engineering, commercial, and economical points of view than any one of the other routes shown to be practicable by survey sufficiently in detail to enable a judgment to be formed of their relative merits; that the cost will be at least $100,000,000, and the time ten years; and that an inter-oceanic canal across this continent should be under the protection of all the nations interested.

Another class of ship-canals comprises the works, few in number, intended to provide access for sea-going vessels to a port the connection of which with the sea is obstructed by shoals, or to connect a naturally-accessible port with an interior ship navigation. Such, in an inferior sense, was the ancient canal of Alexandria, connecting that port with the Canopean delta arm of the Nile; the two "maritime canals" of the emperor Claudius at the mouth of the Tiber; and the FOSSA MARIANA (which see) at the mouth of the Rhone. In reality, both the North Holland and the North Sea (or Amsterdam) Canal of Holland belong to the category; so also the Canal *St. Louis*, connecting the Rhone with the Gulf of Foz (a name derived from the *Fossa* Mariana), which, after an ineffectual attempt to make a deep channel through the "bar" of a natural mouth by closing other outlets (delta-arms), has been recently (1864–73) made by the French government.* To this class belong also the much-discussed Fort St. Philip Ship-Canal, intended to connect the Mississippi River with Breton Bay of the Gulf of Mexico (see *Ex. Doc.* 113 3/8, *H. R.*, and 114 3/8, *H. R.*; also the article JETTIES), and the canal projected to connect the port of St. Petersburg with the Gulf of Finland. (See Van Nostrand's *Engineering Magazine*, Feb., 1876.) As bearing upon the general question of ship-canals, reference is made to the *Memoir on the Possibility of a Ship-Canal between the North Sea and the Mediterranean* (*Revue maritime et coloniale*, July, Aug., 1870). J. G. BARNARD.

Shoe'buryness, a promontory on the northern shore (Essex co., England) of the estuary of the Thames, directly opposite Sheerness. The termination *ness* is from Anglo-Saxon *näss* or *naze* (identical with the Fr. *nez*), signifying *nose*, common to *promontories* on that part of the English coast, and which is probably transformed into "news" in our James River promontory "Newport News." Shoeburyness has acquired celebrity in recent years as the locality of experimental firing at armored targets and for trial of the new guns. Here were subjected to test the iron constructions used in fortifications (see IRON-PLATING FOR FORTIFICATIONS, in CYCLOPEDIA), models of sides of iron-clads (see SHIPS, IRON-CLADS), as well as trials of the new monster guns themselves. (See ARTILLERY and ORDNANCE.) The sandy and little-frequented shores and the open range seaward determined its selection. The place has become a permanent post, with a small garrison of artillerymen; but with the residences of the officers in charge and of the numerous artificers, and with the experimental constructions and relics of old ones, is one of great interest, especially so on days of firing; and it may be said to have brought there, in its numerous gatherings, all the renowned military and naval men of the age. J. G. BARNARD.

Shreve (HENRY MILLER), son of Col. Israel Shreve of the American army, b. in Burlington co., N. J., Oct. 21, 1785; was reared in Western Pennsylvania, and became interested in the navigation of the Western rivers when quite young. In 1810 he brought the first cargo of lead, buying it of the Indians, from Galena River to New Orleans, and opened a business which had been previously monopolized by the British. In 1814 he took command of the fourth steamboat, of which he was part owner, built in the West, and a few days before the battle of New Orleans, at the request of Gen. Jackson, carried supplies to Fort St. Philip, passing the British batteries, and protecting his vessel from their fire by cotton-bales. In May, 1815, he ascended the Mississippi to Louisville in the Enterprise, the first steam vessel that had ever performed that voyage, all previous attempts having signally failed. Convinced of the defects of the engines of Fulton and French, he commenced the construction of the Washington, of 400 tons burden, upon an entirely new plan. It was a "two-decker," and resembled a dismasted frigate, the cabin being between the decks. Previously, the boiler had always been placed in the hold of the vessel, and under Fulton's patent upright and stationary cylinders used—under French's, the vibrating cylinder. Capt. Shreve placed his

* There being but 2 mètres *navigable* depth in the Rhone, and no hope of ever obtaining more than 4 up to Arles, while the canal has 5 mètres navigable depth (*actual* depth 6*m.*), the creation not merely of a sea-entrance "port" (formed by two jetties), but of a *port on the Rhone* capable of receiving vessels coming from sea by the canal, was necessary. This is a basin of 400 × 300 mètres. The canal, 2 miles (3230*m.*) long, has a single lock (the lift into the Rhone even at flood heights being slight) of 22.7*m.* width by 160*m.* length of chamber; depth on sills, 7.50 mètres.

cylinder in a horizontal position, and gave the vibration to the connecting-rod or "pitman." He used a double high-pressure engine, with cranks at right angles and the boilers on the main deck. Mr. David Prentice had previously employed the cam-wheel for working the valves to the cylinder: to this Capt. Shreve added his great invention of the cam cut-off, saving three-fifths of the fuel. The result was a steam vessel unlike any other then known, machinery far lighter than Fulton's, and using half the fuel. On Mar. 3, 1817, heavily laden both in descending and ascending, and crowded with passengers, the Washington made her first trip. The return trip from New Orleans was made in twenty-five days, and Capt. Shreve's prediction that it could be made in ten days was received with incredulity. In 1806 there were 6 keel-boats and 2 barges only owned on the Ohio River. In 1819, so rapid was the increase after Capt. Shreve's success, 25 steamboats, aggregate tonnage of 6050, were owned by the citizens of the Ohio Valley, and 26 others, tonnage of 6720, were nearly ready to be launched. Fulton, associating himself with Robert R. Livingston of New York, with a view of monopolizing the trade of the Western States and Territories, obtained in 1811 an act of incorporation from Orleans Territory granting to them the exclusive right "to navigate all vessels propelled by fire and steam in the rivers of said Territory." The enterprise of Capt. Shreve soon excited the hostility of the corporation; his boats were seized in New Orleans, and he was arrested. A protracted lawsuit followed, which was finally decided in his favor. After building other boats and making other improvements, he finished the George Washington in 1824 upon a new model, that which is in use at the present day, and with side-wheels, each worked by a separate engine. In 1829 he completed his snag-boat, the Heliopolis, for removing snags and sawyers from the Ohio River. This was done after the failure of the government in attempting to remove these obstructions, and against many remonstrances. This boat had twin hulls about 11 feet apart, firmly connected together "abaft midships," with a wedge-shaped "snag-beam" at the bows and on the water-line: its success was complete. Capt. Shreve was then placed in charge of the removal of the Red River raft: the result is thus stated in official reports to Congress: "The great raft of the Red River, consisting of an accumulation of trees, logs, and driftwood of every description, firmly imbedded in its channel for more than 160 miles, was removed, and the navigation of that river opened, inclusive of the raft, a distance of nearly 1200 miles. In 1829, Capt. Shreve invented a steam marine battering-ram for harbor defence at the request of Gen. Jackson. He was made superintendent of Western river improvements in 1826, and continued in that position until 1841. D. in St. Louis Mar. 6, 1854. S. H. SHREVE.

Shreve (SAMUEL HENRY), A. M., LL.B., b. at Trenton, N. J., Aug. 2, 1829; graduated at Princeton 1848, at Harvard University 1850; studied civil engineering; was chief engineer of several railroads; published in 1873 a treatise on the *Strength of Bridges and Roofs*, and became in 1875 engineer of the New York Rapid Transit Commission and consulting engineer of New York Elevated R. R. and of the Gilbert Elevated Railway. At present he is preparing a work on *Arch and Suspension Trusses*.

Sicard' (MONTGOMERY), U. S. N., b. Sept. 30, 1836, in New York; graduated at the Naval Academy in 1855; became a lieutenant in 1861, a commander in 1870: served on board the Oneida at the battle of New Orleans and the passage of the Vicksburg batteries in 1862, and led the men of the Seneca in the naval assault on Fort Fisher, Jan. 15, 1865; highly commended by Commander S. P. Lee, and recommended for promotion by Rear-Admiral Porter.
FOXHALL A. PARKER.

Sight, Defects of. Defects of sight are due either to (1) errors of refraction, (2) opacities of the refractive media, (3) lesions of the optic nerve, retina, or choroid, or (4) continued exclusion of the eye from visual purposes.

(1) In the lesser degrees of deviation from the normal condition of refraction (emmetropia) the vision can generally be raised to the normal standard by the use of suitable glasses, but in very high degrees of ametropia the sight can rarely be raised to over one-half or two-thirds the normal. In high degrees of myopia and myopic astigmatism there is usually an affection of the choroid (staphyloma posticum), which increases the area of Mariotte's "blind spot," and, when extensive, encroaches upon the region of the macula and interferes very seriously with the acuity of the sight. In high degrees of hypermetropia and of hypermetropic and mixed astigmatism all objects are seen under large circles of dispersion, and hence with great indistinctness. The eyes are thus, under the influence of prolonged bad vision, so affected that they do not, even when an existing refractive error has been corrected, at once exhibit the expected sharpness of vision. In young subjects this defect often passes away quickly under exercise of the organs with the correcting lens. It is difficult, and often impossible, to correct with glasses those defects of vision arising from irregular astigmatism.

(2) Serious defects of sight may arise from opacities of the cornea so slight that they can only be perceived by the aid of the ophthalmoscope or of a powerful convex lens. In the other extreme the cornea may be entirely opaque, thus reducing the vision to bare perception of light. Where the pupil is covered with opaque cornea, and another part of the cornea is transparent, vision is often in a great measure restored by making an artificial pupil immediately behind the clear portion of the cornea. The deformity produced by opacity of the cornea is sometimes removed by tattooing the white spot with India-ink.

Next we have opacities of the crystalline lens and its capsule. An infrequent form of opacity of the anterior capsule is the unabsorbed remains of the pupillary membrane of fœtal life. This usually consists of one or more filaments of opaque tissue stretched from the pupillary border of the iris to a point of attachment near the centre of the anterior capsule. Opacities of the lens constitute what is known as cataract. This, like nearly all other affections of the eye causing defects of sight, may be either congenital or acquired. It may be the result of a blow upon the eye, or of diabetes, or of the general breaking down of the system, and consequent malnutrition of the lens, due to old age. Whatever may be its cause, it can in no case be removed except by surgical operation.

Opacities of the vitreous may be due to hæmorrhage from the retinal or choroidal vessels, and the consequent mingling of blood with the vitreous humor, or to inflammatory or degenerative changes in the humor itself. A curious form of vitreous opacity is produced by the formation of numerous crystals of cholesterine in that fluid, presenting a brilliant ophthalmoscopic picture, like a shower of sparkling meteors.

(3) Inflammation or atrophy of the optic nerve, or of either of the coats forming the back wall of the eye, separation of the retina from the choroid, tumors of the optic nerve and retina, hæmorrhages into the substance of the retina, all produce grave defects of vision, and can be diagnosticated only by means of the ophthalmoscope.

(4) In cases of squint of one eye, either convergent or divergent, the image of the object formed upon the retina of the deviating eye is almost always involuntarily suppressed. Thus the eye is excluded from vision, and gradually loses the power of performing its function, as would be the case with any other unused organ. When such an eye has been restored by operation to parallelism with its fellow, the visual power not unfrequently increases to a marked degree. In alternating squint, where the individual sees first with one eye and then with the other, the sight remains good in both eyes. Hence in these cases there is not the same urgent necessity for an early operation. In cases where one eye is emmetropic and the other very hypermetropic, more or less impairment of vision of the latter usually occurs. This, if it has not gone too far, may often be remedied by daily and regular exercise of the amblyopic eye with a glass correcting the refraction, the perfect eye being temporarily excluded. Cases occasionally come under observation where it is impossible to detect any cause for the defect, which may range from a slight impairment of vision to total blindness. Ophthalmologists not very infrequently meet with cases in which defective vision of one eye had existed for many years before it was accidentally discovered. (See also VISION.)
DAVID WEBSTER. REVISED BY CORNELIUS R. AGNEW.

Sigs'bee (C. D.), U. S. N., b. July 16, 1845, in New York; graduated at the Naval Academy in 1863; became a lieutenant-commander in 1868; served on board the Monongahela at the battle of Mobile Bay, Aug. 5, 1864, and in both the Fort Fisher fights. He was commended for "gallantry." FOXHALL A. PARKER.

Silk-Printing, a process not differing essentially from that of calico-printing (see CALICO-PRINTING in CYCLOPÆDIA), is not largely practised on silk goods, as in all the higher classes of silks the desired effect is produced with much greater beauty by Jacquard weaving. The thin summer silks and mixed goods, such as India silks, foulards, pongees, the so-called Japanese silks, and the thinner millinery goods, handkerchiefs, neck-ties, etc., etc., are generally printed, though of late the guipure lace scarfs and ties woven by the Jacquard process have taken the place of printed goods. The methods employed in silk-printing are those of topical printing and steam color-printing. L. P. BROCKETT.

Silk'worm, The, is the larva or caterpillar of *Bombyx mori*, which feeds upon the mulberry, and was originally derived from the northern or mountainous provinces of

China, though the wild worm has not been rediscovered. The moth, one of the types of the lepidopterous family Bombycidæ, is white, with falcate fore wings, while the hinder pair do not reach to the tip of the abdomen, and the antennæ are well pectinated. The eggs are about .05 of an inch in their longest diameter, and flattened ovate. When hatched, the caterpillar is of the usual form of the bombycid larvæ when hatched, and is hairy, with a large head. When fully fed it is naked, not very thick-bodied, cylindrical, with a tubercle on the second thoracic ring and a long horn on the tail. It is three and a half inches long, and of an ashy or cream color. In almost every batch of worms raised in India, observes Capt. Hutton, there will be seen, after the first moult has occurred, some dark-colored worms, which at the first glance appear to be a distinct species, but they are actually types of the original species. The silkworm is an annual, though some allied species yield two or three broods in the warmer parts of India. It moults four times, but occasionally only three times. There being four moults, there are five ages of the caterpillar. The eggs are about the size of mustard-seeds, and the larvæ of the first age are one or two lines long, and of a dark color. In five days begins the second stage. In the third stage the worm is naked, whitish, and lives six days before attaining the fourth. The fifth stage is the longest, lasting nine days; and at this time the worm is very voracious. It then ceases to eat, walks about, and in about thirty-six days after the worm hatches it begins to make its cocoon, which is spun from the large silk-glands opening in the under lip (labium). The silk-glands may be taken out, stretched on a board, and dried to form "gut" for fishing-lines. (See ENTOMOLOGY for illustration.)

The cocoon is spun of a continuous thread about 1000 yards long, and is finished in about four days. The cocoon is white or whitish-yellow, and is over an inch long and nearly half as broad; 360 cocoons weigh a pound and a half. Within the cocoon the insect remains in the pupa state from fifteen to seventeen days. When about to break through, the moth moistens the anterior end of the cocoon with a liquid thrown out from the head, so that the threads are moistened and separated, and the moth is able to extricate itself. In an hour or two after exclusion the sexes unite, and the female lays from 300 to 700 eggs within the space of three days. A few females have been observed to lay unfertilized eggs which have produced caterpillars. This very rarely happens, however, for M. Jourdain found that out of about 58,000 eggs laid by unimpregnated silk-moths many passed through their early embryonic stages, showing that they were capable of self-development; but only twenty-nine out of the whole number produced caterpillars. (*Darwin.*)

Our account of the rearing of the silkworm, as carried on in France, is from Figuier's *Insect World*, compiled by him from the works or articles of MM. Robinet, Guérin-Méneville, Eugène Robert, Le Clerc, and Dandolo. The work-room should be well ventilated and warmed, with racks containing frames from 1 to 1¾ yards in breadth, with a border to prevent the worms from falling, and lined with paper on the bottom. The eggs laid before the end of winter are hung up in woollen cloths in a cool, dry place exposed to the N. As soon as the buds of the mulberry tree begin to unfold the eggs are spread out on sheets of paper in very thin layers, placed for three or four days on a table in a room having a southern aspect, but out of the direct rays of the sun. The temperature of the room is gradually raised until of 25° C., and maintained till all the eggs are hatched. The larvæ are fed six to eight times a day on chopped leaves. The worms are removed to new food by nets placed upon the old food, the worms ascending through the meshes to the fresh leaves placed above. When fully fed the worms ascend into sprigs of heather placed at intervals on the tables. Here they spin their cocoons, some of which are white, producing the best silk, while most of them are yellow. Before the cocoons are sold to the silk-spinners the chrysalis is killed by steaming in wicker baskets. The process of spinning is thus described by Figuier: "The woman who is spinning stands before a sort of loom which is called *tour*. Under her hand is a copper containing water, which she heats to the required degree by opening the tap of a tube, which brings a current of steam. She plunges the cocoons into the hot water, and moves them about in it, to soften the gummy substance which sticks the silken threads of the cocoon together. Then she beats them, with a light hand, with a small birch broom. The threads of the cocoons get caught in the extremities of the twigs of which the little broom is made, and the work-woman seizes with her fingers the bundle of threads, and shakes them about till she perceives that they are all single and in a fit state to be joined together. Let us suppose now that she wishes to make up a *brin*, or staple, by uniting together the ends of five cocoons. She chooses five ends in the mass, makes of these a bundle, and introduces it into the hole of the *filière*. She makes two staples (*brins* at once—one on her right, the other on her left hand. She then brings them together; she crosses them, rolls them and twists them, the one on the other, several times; after which she separates them from above and keeps them well apart, making each of them pass into a hook at a distance, from which they are going to twist round into a hank, separately, on a wheel. The two threads thus twisted are drawn close together, compressed, and become one, getting round by rolling on each other, and being kept in continual motion, drawn out as they are by the rapid motion of the wheel."

Of the diseases which affect the silkworm, muscardine was until lately the most prevalent, the losses in France being estimated at one-sixth of the profits. When affected, the worm changes to a duller white, its movements are slower, it becomes soft, and soon dies. Seven or eight days after death it turns hard and reddish, and in a day after the whole body becomes floury. The disease was found by Bassi, an Italian, to be due to the attacks of a fungus, *Botrytis bassiana*. But still more destructive is the new disease, called *pebrine*, in allusion to the dark spots peppering (whence the term *poivrine*, *pebrine*) the skin of the worm. This disease was probably unknown before 1842. Quatrefages believes that the disease is not a new one, but was confounded with muscardine; he compares it with the Asiatic cholera, and states that it is an hereditary epidemic, and that it may become accidentally contagious and infectious. It originates from the presence of exceedingly minute corpuscles, probably a parasitic fungus, which multiply by self-division and infest the tissues and viscera of the larva, pupa, and adult, as well as the scales of the latter. The disease first showed itself in France, and spread eastward until it reached China, and, in 1865, Japan. It was also a few years ago introduced into the native silk-worm establishment of Mr. Trouvelot at East Medford, Mass., and carried off from $5000 to $10,000 of worms of *Telea polyphemus*, the American silkworm, which he then had under domestication. In France also it attacked native caterpillars. Pebrine, then, differs from muscardine in being hereditary. Another formidable disease is called *flacherie*, where the worms become enfeebled by the fermentation of the food in the stomach, resulting in the development of vibrios or fermentation-fungi. This disease is also hereditary, but, like muscardine, more or less accidental, and not an epizoötic, as pebrine is, and does not affect the eggs.

Alarmed by the fearful ravages of pebrine, silk-raisers, particularly M. Guérin-Méneville, turned their attention to the importation of other silkworms. Of these the Tussch and Arrinda moths are the most manageable and promising. The Tussch moth (*Antheræa paphia* or *mylitta*, with its Chinese variety *peryi*, and Japanese form *A. yama-mai*) has a closed cocoon, spun from an unbroken thread. It is semi-domesticated in India, and the silk is an article of commerce. It spins a hard, most durable silk of a dark-brownish color. While the Tussch moth proper of India cannot be reared in Europe, the yama-mai variety does well in the climate of France in the open air.

The ATLANTHUS SILKWORM (which see) can be reared in Europe and the U. S., and is double-brooded. Though the cocoon is open at one end, the thread with care can be unwound; in one case an unbroken thread 800 yards long was unreeled. The silk, however, like that of the Tussch moth, is coarse, ill-colored, and cannot be placed in competition with the most inferior mulberry silk. (*Murray.*)

A similar article is furnished by the American silkworm (*Telea polyphemus*). The thread is coarser than that of the *Bombyx mori*, but has a rich gloss, and can be used very extensively in commerce. The thread of which the closed cocoon is spun is unbroken, and can be readily unwound. Its larva feeds on the oak, and is thick, fleshy, striped obliquely with white on the sides, with angulated segments, on which are tubercles giving rise to a few short hairs. The pupa is very thick, and the cocoon is regularly oval-cylindrical. Mr. L. Trouvelot gives an account in the *American Naturalist* (vol. i.) of this silkworm. So successful was he in raising it that in a single season "not less than a million could be seen feeding in the open air upon bushes covered with a net." The moths leave the cocoons late in May, appearing until the middle of June. They then lay their eggs, generally singly, on the under side of the leaves. In ten or twelve days the caterpillars hatch. The worm moults five times, the first four moults occurring at intervals of ten days, while about twenty days elapse between the fourth and fifth moults. It spins its cocoons late in September, and in six or eight days after beginning its cocoon assumes the pupa state, and in this condition passes the winter.

Mr. Trouvelot's experiments were brought to a sudden termination by an unfortunate attack of the epizoötic disease pebrine, which was imported in some Japanese silk-

worm eggs carried by way of France. When the larvæ hatched, the disease was diagnosed, and the worms were at once destroyed, but the infection remained about the house, and though the native worms had not hatched out, yet "a few days after the third moultings the worms began to manifest symptoms of the deadly disease, and two or three days after, of a million, I had but a single one left, and this one even died in the pupa state. The following year I thought I could begin anew, but I found that the epidemic had spread further, as I had feared, and the third year the wild individuals were as robust as usual, but the disease, or at least the seeds of it, was infesting my buildings, and as soon as the healthy wild *polyphemus* would approach them they became sick and died." (Riley's *Fourth Rep. Ins. Missouri.*) Mr. Trouvelot gave the writer substantially the same account, and added that any further attempts at raising the native silkworm would have to be carried on in some other town, at least twenty miles away from Medford. It is possible that the liberal use of a disinfectant like carbolic acid would arrest the spread of pebrine. The culture of the Chinese silkworm in this country, especially with the aid of Chinese skilled labor in unreeling the silk, can be made a profitable business. (See SILK AND SILK MANUFACTURE, etc.) A. S. PACKARD, JR.

Silver-Mines must have been worked from a very early age, as silver is mentioned in the Old Testament among the riches of Abraham, and, according to the same authority, was employed in great masses by Solomon in the ornamentation of the temple and his palace. It was obtained from Nubia and Ethiopia and from the countries of Eastern Asia and Southern Europe. From the very dawn of the historic age in Europe we know that silver-mines were worked in Attica and Epirus by the Greeks, and in Spain by the Phœnicians and Carthaginians. The latter mines were especially famous, and Pliny tells us that Hannibal opened a mine at the present Guadalcanal, at the foot of the Sierra Morena, which yielded 300 pounds of silver daily. The mines of Schemnitz, Hungary, were worked in the tenth century, and they still yield from 30,000 to 40,000 marks of silver annually. Those of Joachimsthal, Bohemia, are as old, but they have now lost much of their productiveness, yielding only about 8000 marks of silver a year. In 1873 the total production of silver by the Austro-Hungarian empire amounted to $1,600,000. The silver production of the German empire is larger, amounting in 1873 to $3,000,000; the principal mines are found in the Hartz and the Erzgeberge, especially in the vicinity of Freiberg, where no less than twenty-four mines producing silver ore are in operation. They were discovered in 1196. In 1623 the Kongsberg mines in Norway were opened, and they have been worked continuously since that time, with a short interruption from 1805 to 1815, yielding, in the period from 1624 to 1864, 1,817,710 pounds troy of silver. During the Middle Ages the Spanish mines, so celebrated in antiquity, fell entirely into decay, and even the Guadalcanal mine was abandoned in the seventeenth century and filled with water. After 1825, however, the silver-mining industry was once more taken up in Spain, and two new and rich mines were discovered—that of the Sierra Almagrera in 1839, and that of Hiendelaencina in 1843. The total production of silver by Spain in 1865 was estimated by J. Arthur Phillips at 110,000 pounds troy. By the discovery of America, and the conquest of Mexico and Peru by the Spaniards, the silver production received an enormous increase. Humboldt estimates that, for the period from 1492 to 1803, Mexico and Peru produced silver to the value of $4,152,000,000, while the production by Europe during the same period hardly amounted to $200,000,000. For the period from 1804 to 1848, Danson estimates the production of silver in Mexico and Peru at $1,244,380,947, and in Europe and Asiatic Russia at $325,000,000. The most celebrated silver-mines in Mexico are those of Catorce, Guanajuato, Sombrerete, Valencia, and Zacatecas, situated in the central group of the Cordilleras. Most of them were discovered and opened in the sixteenth and seventeenth centuries, and about 3000 distinct mines were in operation when Humboldt visited the country. One of the richest of these mining districts is that of Guanajuato. In 1873 it employed 8979 miners and laborers, and 1815 tons of ore were raised each week, a ton of ore yielding on an average 34 ounces troy of silver. The famous mines of Potosí, Bolivia, were discovered in 1545, and have yielded from that time, and up to our days, about $1,300,000,000. Other rich South American silver-mines are those of Gualanca, Pasco, Lucanas, etc., in Peru; of Lipes, Poreo, etc., in Bolivia; of Copiapó in Chili, etc. The total production of silver in South America during the period from 1848 to 1868 was estimated by W. P. Blake at $200,000,000, and during the period from 1868 to 1875 at $56,000,000. Silver production received a new impetus from the discovery in 1859 of the COMSTOCK LODE (which see). The total production of silver in the U. S. since 1859 is estimated as follows by R. W. Raymond:

1859	$100,000	1867	$13,500,000
1860	150,000	1868	12,000,000
1861	2,000,000	1869	13,000,000
1862	4,500,000	1870	16,000,000
1863	8,500,000	1871	22,000,000
1864	11,000,000	1872	25,750,000
1865	11,250,000	1873	36,500,000
1866	10,000,000	1874	38,200,000

(See, for further details, the articles on SILVER, in CYCLOPÆDIA, COMSTOCK LODE, etc.)

Sim'mons (GEORGE C.), b. at Portland, Me., Apr. 17, 1840, where educated; removed to Boston in 1859; served during the civil war in the 35th Massachusetts Vols. 1862–64; clerk of U. S. board of engineers for fortifications since 1868, and has contributed largely to this CYCLOPÆDIA articles on American and foreign military biography and other subjects.

Simmons (Sir J. LINTORN A.), K. C. B., b. about 1816: entered the corps of royal engineers as second lieutenant Dec. 14, 1837; was engaged for three years on the Maine frontier during the disputed territory controversy; served in Turkey in 1853; joined Omar Pasha in 1854; present during the siege of the fortress of Silistria, having been escort to the new governor: in the Danube campaign the lines of Slobodzie and Georgevo were laid out and constructed by him—an operation of which he had entire charge; was present during the occupation of Wallachia; during the Crimean war was present at the battle of Eupatoria, which place he fortified; was in front of Sebastopol from Apr., 1855, until after its fall; served subsequently in Mingrelia, and in command of the division which forced the passage of the Ingur, turned the enemy's position, and captured his works and guns, the success of the day being accorded him by Omar Pasha; was British commissioner to the Ottoman army throughout the war; also commissioner for laying out the Turco-Russian boundary in Asia. In 1868 he was appointed major-general, and lieutenant-general in 1872; colonel commandant since 1872, and governor of the Royal Military Academy at Woolwich 1870–75; inspector-general of fortifications and works since 1875.

Simmons (WILLIAM HENRY), b. in London June 11, 1811, pupil of Messrs. Finden, and while such obtained the Society of Arts' silver medal in 1833 for an engraving finished from his own design. His works, very numerous, comprise engravings of the principal works of Millais, Holman Hunt, Salomon, Faed, Frith, and others, among which are *The Proscribed Royalist, The Verdict and Acquittal, The Poor the Poor Man's Friend, The Last of the Clan, The Marriage of the Prince and Princess of Wales, Christ and his Disciples, A Wee Bit Fractious*, etc.

Simpson Centenary College, Indianola, Ia., founded in 1867, has the full classical course of four years, and a scientific course, differing from the classical chiefly by the substitution of the modern languages for the ancient. The law department was organized at Des Moines, the capital of the State, in 1875, and opened with 38 students. The institution has also a commercial department and a musical, and classes in telegraphy and phonography. No distinction is made in any degree or work on account of sex. The last meeting of the board of trustees ordered the establishment of a medical department at the capital, and preliminary steps have all been taken. The school was opened in 1877. The present attendance is 297. The president is Rev. Alexander Burns, D. D.

Skin Diseases. The human skin is subject to the same morbid processes to which other organs of the body are. The diseases appear as primary or secondary eruptions, the former being immediate products of the morbid processes, the latter produced by further development or changes of the primary eruptions. Primary forms are—(1) The *macule* or *spot*, a change of the normal color of the skin without elevation, not uniformly distributed over the surface, arising from hyperæmia, hæmorrhage, or inflammation, sometimes from anomalies of the distribution of the coloring granules of the skin, the pigmentum. More or less uniform changes of the color of the surface are termed *discolorations*. (2) The *papule* or *pimple*, a projection above the surface, varying in size between a millet-seed and a lentil, produced by diseases of the cutaneous glands, inflammation, and new growths of the papillary layer. (3) The *tubercle*, a solid projection of the size of a lentil up to that of a hazel-nut. (4) The *wheal* is slightly raised above the surface, and greatly exceeds the thickness in horizontal extension, varying in size from that of a finger-nail to that of the palm of the hand. (5) The *tumor* forms a solid projection of the size of a walnut to that of a man's fist. (6) *Vesicles* are elevations of the epithelial layer of the skin produced by a transparent or milky fluid, corresponding in size to that of papules, and as such never being of a long duration;

while (7) *blebs* surpass the size of vesicles up to that of a goose's egg, and (8) *pustules* always contain pus, and therefore form superficial abscesses of the skin. Vesicles, blebs, and pustules almost always are surrounded by inflammatory areas.

Secondary forms of eruptions are—(1) The *excoriation*, a flat abrasion of the epithelial layer of the skin, arising from destruction and rupture of primary eruptions, very often through scratching with the finger-nails. They always heal without the formation of a scar. (2) The *ulcer* presents a loss of substance penetrating into the derma, which heals slowly and with formation of a cicatrix. (3) *Fissures* are elongated cracks in the skin on parts liable to much stretching. (4) *Scales* are produced by detached epidermis. (5) *Crusts* result from drying of an exuded fluid or of extravasated blood. If the scales or crusts or the sebaceous secretion be placed one over the other in strata, they are termed (6) *lamellated crusts*. (7) *Scars* or *cicatrices* are connective-tissue formations, which replace deeper losses of substance of the derma.

The causes of diseases of the skin are either rooted in the whole organism, or they are local ones, by which the skin is primarily or chiefly attacked: hence the division into *symptomatic* and *idiopathic* affections of the skin. There exist eruptions on the general covering which are intimately connected with and caused by diseases of the whole organism, such as in variola, scarlet fever, measles, syphilis. Certain rashes occur in typhoid fever, in purulent infection of the blood, so-called pyæmia, in scrofulosis, scorbutus, etc. Moreover, diseases of internal organs may involve the skin, especially affections of the intestinal tract, of the liver and spleen, of the internal genital organs, of the urinary apparatus, of the nerve-centres. There are, lastly, normal processes—the dentition, menstruation, pregnancy—which lead to various kinds of cutaneous affections. Hereditary transmission is of a doubtless influence in causing skin diseases (syphilis, psoriasis, leprosy, etc.); furthermore, the age, the business, the mode of life, and climate. But the most potent agencies for producing affections of the skin are those external to the body, attacking the skin directly. Besides general injurious influences—heat and cold, dryness and moisture, different arts and trades—merely local diseases are caused by the operation of caustic substances, neglect of cleanliness or exaggerated washing and rubbing with strong kinds of soap, long-continued pressure upon certain parts, and parasitic organisms which penetrate the skin. The scratching of the patient himself who suffers from itching is an important cause for producing mechanically lesions of the skin. Thus, parasites give rise to such affections by irritating the skin directly or by exciting the sensibility of the cutaneous nerves by producing the sensation of itching. Besides the vegetable parasites, living within the skin, *Trichophyton*, *Microsporon*, *Achorion*, and *Oidium*, there exist animals which dwell within the tissues of the skin—the itch-insect (*Acarus scabiei*), the pimple-mite (*A. folliculorum*), the sand-flea (*Pulex penetrans*), the Guinea-worm, the harvest-bug—or merely seek their food upon the skin's surface, such as the different kinds of lice, the flea, the bed-bug, the mosquitoes, and gnats.

With regard to these causing agencies of skin diseases the treatment will either be a universal or a merely local one. If we succeed in removing the cause of the disease, perfect cure is possible, especially of affections produced by local injurious agencies, parasites, external irritations, and the like. Skin diseases rooting in the general constitution need a general treatment, either surgical or internal. There exist many skin diseases which can be radically cured, while other ones can be removed temporarily only, without the view of radical cure; and still other ones are incurable. Many diseases run their course without any treatment, or their course cannot be modified by the physician; in these diseases, therefore, the indifferent treatment is attended with the best results. The treatment of certain skin diseases varies, however, greatly, depending upon the views about their causation; thus, very often internal remedies are given unnecessarily where mere local treatment is sufficient to cure a skin disease.

In considering the different varieties of affections of the skin, we propose to follow in all essential points the classification adopted by the Vienna school, the champion of which is Hebra. His experience, together with an unprejudiced mind, led him to doctrines more in accordance with clinical observation than those of other dermatologists of either the past or the present time. The changes of the skin, by too great an afflux of blood (hyperæmia) or lack of blood (anæmia), as such do not produce diseases of their own, being always of a transient character or rooted in diseases of the whole organism. We therefore omit their consideration.

1. *Diseases due to Perverted States of the Secretions of the Cutaneous Glands.*—The sweat-glands of the skin (see HISTOLOGY) produce a fluid, the perspiration, which contains 99.3–99.5 per cent. of water, the residue consisting of solid matters, among which are chloride of sodium, phosphate of lime, hydrochlorate of ammonia, and traces of iron and of fatty matters. Even in the normal state each individual diffuses around him a special odor. There are persons with a peculiar rancid odor of their perspiration, a disease called *bromidrosis*, either universal or local—for instance, lasting in the armpits, on the feet—in spite of the most scrupulous cleanliness. This disease is always dependent on too copious perspiration (*hyperhidrosis*), and curable by repeated treatment with dinchylon ointment. The secretion of a colored perspiration is termed *chromidrosis*. The sebaceous glands, which secrete a fatty mass, may produce the sebum in excessive quantity, there being no impediment to its secretion—the so-called *seborrhœa*. The disease is very common on the scalp (dandruff), and always leads to loss of the hair. It yields readily to certain preparations of tar, and a new growth of hair can very often be obtained. If, on the contrary, the excretion of the sebaceous mass be interfered with, the result is its accumulation within the glands or their ducts, the so-called "flesh-worms"—*comedones*. In the mass of a flesh-worm there is often found an insect, the *Acarus folliculorum*. The flesh-worms, again, are the most common causes of pimples, as they act upon their neighborhood like foreign bodies. Hardened flesh-worms are termed *milium*. Sometimes the sebaceous glands become very much enlarged, giving rise to appearance of tumors, *atheroma*, which if pedunculated are termed *molluscum*, but are not contagious at all. Too scanty production of sebaceous matter leads to brittleness and desquamation of the epidermis—*pityriasis simplex* and *xerosis*.

2. *Diseases due to Inflammation.*—Inflammatory affections of the skin either terminate within a short period of time, with a definite duration, these being called *acute*, or the development and involution of the eruption take place less quickly, the inflammation being of a longer duration from repeated relapses—*chronic inflammatory processes*. The acute inflammations, again, are either caused by contagion, and themselves generate an infectious matter, or they do not owe their origin to contagion nor develop it during their course. *The acute contagious inflammations*, so-called *exanthemata*, are due to diseases which attack the whole organism, are attended with febrile symptoms, present certain definite appearances on the surface of the body, and run a course the duration of which can be computed beforehand. In these diseases—*measles*, *scarlet fever*, and *small-pox*—the sympathy of the entire organism is manifested by symptoms of various kinds, both while the rash is present and also after its disappearance. They therefore cannot be regarded as mere skin diseases. *The acute, non-contagious inflammations* have a definite typical course, as their symptoms succeed one another in regular order. If the inflammation be manifested mainly by redness, with a slight exudation of the fluid part of the blood, fugitive rashes are produced, which when spread over large parts of the surface and do not produce the sensation of itching, are termed *erythema*, but when presenting isolated red spots are termed *roseola*. Extended and isolated superficial inflammations, accompanied with stinging or itching sensation, receive the name of *urticaria*, the latter being always characterized by the development of wheals. Diseases of this kind often are produced by disturbances of the stomach or by local irritations of the skin—for instance, by certain coloring-matters of cloths, stockings, etc.—and accompanied by fever. They usually disappear after a short period of time without special treatment, but are very liable to recurrences. To the group of acute, non-contagious inflammations belong all diseases produced mechanically or by poisons, by too high or too low a temperature; furthermore, the *erysipelas* and *furuncles*. The difference in the anatomical characters depends on the extent, the penetration into the depth, and the termination of the inflammation. Lastly, there exist acute inflammations with accumulation of fluid beneath the epidermis, leading to the formation of vesicles and blebs, with short duration and no liability to return. In this group we enumerate the *herpes* (hives) and *miliaria*. The *herpes zoster* (shingles) is the most important of the forms of herpes, it being more extensive and the number of groups of vesicles much larger than in common forms of hives. The seat of shingles always corresponds to the distribution of certain cutaneous nerves; they almost always are confined to one-half of the body, and always accompanied with intense pains. Shingles attack the individual, in most instances, only once in the life; unfortunately, very little can be done for the relief of the pains. *The chronic inflammations* are characterized by a tendency to repeated relapses and the protracted course which they run. One group of these diseases is formed by eruptions which manifest themselves by a superficial redness and

slight swelling, affecting principally the papillæ of the derma, and are attended with an excessive production of epidermis, but only with trifling sensations of itching, tension, or pain. Such are *psoriasis, lichen*, and *pityriasis rubra*. *Psoriasis* is a very common disease, characterized by white, rough, uneven epidermical patches on a dark-red ground, dispersed all over the body, mainly on the elbow and knee joints. The patches are not liable to any further change, such as suppuration and ulceration; they leave no scars, though they are sometimes followed by persistent pigmentation. Sensations of pricking or itching are complained of only when the patches first come out; afterward there are no subjective symptoms. The disease occurs almost only on otherwise healthy and strong individuals. It is, however, harmless, but very liable to recur after it has been removed by local caustic and tar applications, together with internal administration of arsenic, carbolic acid, etc.

A second group of inflammatory skin affections is characterized by intense itching, and besides the primary form of eruption they irresistibly provoke scratching in consequence of the itching: this, again, gives rise to those further changes in the skin which are known under the name of excoriations. To this group belongs a very common disease termed *eczema*, and a rare disease termed *prurigo*. The *eczema* (moist tetter or salt rheum) is a skin disease of usually chronic course, characterized either by the formation of aggregated papules and vesicles, or by more or less deeply-red patches covered with thin scales, or in other cases by a moist surface; while in any of these forms there may be developed in addition partly yellow and gummy, partly green or brown, crusts. The different stages of one and the same malady are, therefore—papular, vesicular, squamous, weeping, and crustous eczema. The disease rarely turns into a dangerous one, but is very troublesome on account of great itching and the consequences of scratching. It is curable in every stage—by indifferent remedies when acute; by ointments, especially the diachylon and zinc ointment, when weeping; by tar preparations when scaly; and caustics when chronic and having led to hardening, so-called hypertrophy of the skin. Internal remedies almost always are useless.

A third group of chronic inflammatory skin diseases embraces those pimply and pustular affections which arise from inflammation of the hair-sacs and sebaceous glands. They are recognized as forms of *acne*, and distinguished into *dispersed acne, sycosis*, and *acne rosacea*. The dispersed acne on the face, the chest, and the back—one of the most disfiguring diseases—is always produced by accumulation of sebaceous masses in the glands (flesh-worms), and is entirely curable by repeated emptying of the glands and irritating agencies, without internal treatment. Analogous are the cause and the treatment of acne rosacea, which produces the most common forms of red nose. Even this disease is, if not neglected too much, entirely curable. The healing of *sycosis* (barber's itch) can be obtained by application of diachylon ointment, repeated shaving and pulling of the hairs, in the sheaths and follicles of which the inflammation is mainly situated.

To the fourth group of chronic inflammations belong the eruptions in shape of blebs, termed *pemphigus*, an incurable disease. Chronic inflammations of the skin of very variable but characteristic forms are produced by a general disease, *syphilis*; here the skin is merely symptomatically attacked, besides different other organs. With traumatic lesions of the skin, as well as with its inflammatory diseases, very often *hæmorrhage*, escape of blood from the vessels into the tissues, is combined. Hæmorrhage is furthermore a symptom of universal disease in *scorbutus*, in *purpura rheumatica*, and *morbus maculosus*.

3. *Diseases due to Hypertrophy.*—Too copious production of any tissue of the skin may be a consequence of a chronic inflammatory process, or it may occur without the symptoms of irritation as a consequence of anomalous congenital productivity. The *corn* and the *tyloma*, for instance, are products of a long-continued local irritation of the skin, but we know of instances in which tyloma, the hardening and hypertrophy of the skin of the palms and the soles, must be considered as a congenital disease. The *elephantiasis arabum*, an immense hypertrophy of all constituting tissues of the skin, is doubtlessly due to chronic inflammation of the lymphatics; while *ichthyosis*, the exuberant growth of epidermis, is due to the congenital hypertrophy of the papillæ. *Warts* and *papillary growths* of the skin may be produced by either kind—local irritation as well as anomalous function of papillæ. *Horns* of the skin, hypertrophy of the nails and the hairs—*polytrichia*—always are dependent on congenital anomalies in the formation of the tissues of the skin. The pigment-granules of the rete mucosum are very often hypertrophied, leading to formation of brown spots, *ephelides* (freckles), *chloasma* (liver-spots), while long-continued irritation of the skin leads to universal dark discoloration—*melasma*.

4. *Diseases due to Atrophy* are based on the same principles as the too copious formation of certain parts of the skin—hypertrophy. Inflammation often produces first hypertrophy, afterward ulceration, loss of substance, and atrophy. *Leprosy, lupus*, and *sclerodermia* are instances of such combined diseases. In leprosy tumors first appear, which subsequently shrink or ulcerate, or the shrinkage is the immediate symptom of the disease—*morphea*; here the decreased sensibility of the attacked parts is one of the main symptoms. All these diseases lead to secondary ulceration, loss of parts of the skin, even parts of the body. The treatment is only in *lupus* successful, but even here not invariably. Hypertrophy of the pigmentum is not rarely combined with its partial atrophy in *vitiligo, leukopathia*, etc. Merely to atrophy are due the senile changes of the skin, the white color of the hairs, the early falling out of the hairs without visible cause, the localized atrophy of hairs in *alopecia areata*. A plain atrophy is also the *xerodermia*. But very little can be done with regard to the cure of these diseases.

5. *Diseases due to New Growths.*—New growths or tumors either belong to the connective-tissue formations of the skin, the derma, or they are products of an anomalous epithelial growth. Tumors of the former kind may be benign or innocent—viz. painless, not ulcerating, not recurring after extirpation, and not infecting the organism, such as *fibroma*, a variety of which is the formation of scars without preceding lesion, the so-called *cheloid*; furthermore, *papilloma*, growth of the papillary layer, embracing most of the *warts* and *nævi*; lastly, *angioma*, erectile tumors produced by copious new formation of blood-vessels. Or the connective-tissue tumors are malignant—viz. painful, ulcerating, producing new growths around the first-formed tumor, and easily recurring after extirpation, even leading to secondary formations of identical tumors in the lungs, the liver, etc., such as *sarcoma*, one variety of which, the *pigmented* or *melanotic sarcoma*, forms the most malignant kind of tumors of the organism. Cancer is considered to be essentially an epithelial formation, which always is malignant. In all tumors the radical extirpation is the only reliable means of curing the disease, very often of saving the life of the patient.

6. *Diseases due to Anomalies of Innervation—Neuroses.*—Many of the already-named diseases of the skin can be looked upon as being disturbances of the nerves in the first instance (*urticaria, herpes zoster, leprosy, atrophy of pigment*). Besides, we know disturbances in the property of sensation of the skin, lowered sensibility—*anæsthesia*—and excited sensibility—*hyperæsthesia*. To the latter kind belongs the itching of old persons, *pruritus senilis*, which malady often is treated successfully by internal administration of carbolic acid.

7. *Diseases due to Parasites*—The *scabies* is produced by the presence of the itch-insect within the epidermis. It begins with development of small vesicles, mostly on the skin of the hands, especially that between the fingers, these places being the most exposed to invasion of the insect. The eruption is accompanied with severe itching, which compels the patient to scratch. By simply scratching a certain length of time, all symptoms of *eczema* arise, even boils and furuncles. The disease is readily curable by local application of preparations of sulphur. Analogous is the action of the flea, the bed-bug, the louse. By vegetable parasites are produced slightly-scaling and itching brown spots, *pityriasis versicolor*; furthermore, *herpes tonsurans* (ring-worm), a very common disease, appearing first in the shape of small vesicles or ring-like red eruptions, which, when situated on the parts provided with hairs, lead to baldness; lastly, *favus*, a disease kindred to ring-worm. If we succeed in killing the parasites locally, a perfect cure can be obtained in a short period of time; but on the scalp and the beard, where the parasites advance deeply into the root-sheaths of the hairs, these diseases usually are very obstinate. C. HEITZMANN.

Slavery, the condition in which one person is the property of another, is found in the earlier stages of the history of almost every nation known. It originated, no doubt, from war, which then was not so much a settlement by force of some disputed question as a struggle for existence, in which the vanquished, naturally enough, became the property of the victor who spared his life. Among the ancient Assyrians, insolvent debtors, as well as captives taken in war, were reduced to slavery, and the slavery was perpetual. The Hebrew system was one of great mildness. Native Hebrews might either sell themselves on account of poverty, or be sold in punishment of theft; but only for six years at most, and not even for that length of time if the jubilee year came sooner. Foreign slaves appear not to have shared in the jubilee release, but their personal

rights were carefully guarded. The smiting out of a servant's eye, or tooth even, brought freedom to the servant. A master who killed his servant, man or maid, was to be "punished" (Ex. xxi. 20)—the law does not say how, but probably, as in Egypt, with death. With the Greeks and Romans slavery formed the very basis of the political constitution, and Plato, although he recognized it as being opposed to the true idea of human nature, declared it, nevertheless, necessary for the maintenance of the state. In all the Greek states the slaves outnumbered the freemen, and in some—as, for instance, in Sparta—they were treated very harshly (see HELOTS), while in others—as, for instance, in Athens—the institution assumed a much milder character, and attempts were made to give the slave some rights and a certain dignity. In Rome the slave had originally no rights at all. For the smallest misdemeanor he could be legally punished with death—crucifixion—and he was never admitted as a witness without being put to the torture. Subsequently, the rich Romans fed the murænas for their tables by throwing their old slaves into the ponds, and hosts of young slaves were annually educated to fight and kill each other in the arena. The institution was not only cruel, however; it also by degrees assumed almost incredible dimensions. Many a rich Roman possessed from 10,000 to 20,000 slaves—a large number in his luxurious house in the city, the rest on the immense sheep-walks, vineyards, olive-plantations, etc., from which he derived his income. Slave revolts occurred in 140 and 104 B. C. in Sicily, and in 73 B. C. under SPARTACUS (which see), and led to the introduction of some milder measures. But it was not until the time of the emperors that any great change took place in the condition of the slaves. Augustus granted every ill-treated slave a hearing before the magistrates when he sought refuge at his statue. Antoninus deprived the master of his right over the lives of his slaves. Manumissions became very frequent for political reasons; and finally, the institution vanished before the spirit of Christianity, or assumed another character. (See SERF.)

The Koran forbids the Moslems to keep their co-religionists as slaves, and neither Mohammed nor his next successors subjected their conquered enemies to slavery. They kept negro slaves, however, imported from Africa, but they treated them very mildly. It was the contact between the Mohammedans and the Christians during the Crusades which gave a new impulse to slavery. The Christian knights made slaves of their Mohammedan captives; the Mohammedan warriors took redress, and from the tenth to the fourteenth century there grew up a considerable slave-trade, of which Rome was the centre. Here the Spaniards brought their Moorish prisoners into the market, and here, under the very eyes of the popes, the Venetian merchants sold Christian men and women into Mohammedan slavery. Slavery still exists in most Mohammedan countries, but in a very mild form, and as a political rather than as a social institution, it being possible for the slave not only to acquire liberty, but even to attain the highest social position. Among the Berbers, however, along the northern coast of Africa, slavery and the slave-trade developed, as early as the fifteenth century, into a terrible calamity. Merchants, sailors, casual passengers, and others, crossing the Mediterranean, were kidnapped by the Berbers, and if not ransomed sold into slavery. Charles V. fought against this evil with some momentary success, but it was not fully suppressed until 1830 by the French conquest of Algeria. Another and still more powerful impulse the institution and the trade received after the discovery of America. The invention of hunting negroes in the interior of Africa to use them as slaves in the colonies is due to the Portuguese, but for its application to the New World and its establishment as a regular and legal business the world is indebted to the Spanish priest, Las Casas. In 1517, Charles V. gave the marquis de la Bresa a monopoly for eight years of importing negro slaves to the American colonies; but soon a very extensive and profitable trade sprang up, in which the English procured their share by the Peace of Utrecht (1713), where Spain was compelled to allow them to import 144,000 slaves to her American colonies. But the history of this part of the subject is fully treated under the heads ABOLITION OF SLAVERY, ANTI-SLAVERY, AMENDMENT, CONSTITUTION, REPUBLICAN PARTY, and UNITED STATES (*History*), in CYCLOPÆDIA.

Sloane (JAMES RENWICK WILSON), D. D., b. at Topsham, Orange co., Vt., May 29, 1823; graduated at Jefferson College in 1847; studied theology at the Reformed Presbyterian seminary of North-western Ohio, where he graduated in 1853, and in 1854 became pastor of the Reformed Presbyterian church in Rushsylvania, O., and in 1855–56 of the Third Reformed Presbyterian church in New York City. In 1868 he was elected professor of theology in the Reformed Presbyterian theological seminary at Allegheny City, Pa., a position which he still holds. He has published a number of sermons and some literary addresses.

Smalley (DAVID A.), b. at Middleton, Addison co., Vt., Apr. 6, 1809; studied law, and entered the Franklin county bar in 1831; was made a State senator in 1842; admitted to the bar of the U. S. Supreme Court in 1844; appointed collector of customs for Vermont in 1853, and U. S. district judge of Vermont in 1857, from which position he retired on full pay, by act of Congress, in 1875. D. Mar. 10, 1877.

Smith (BENJAMIN BOSWORTH), b. at Bristol, R. I., June 13, 1791; studied theology at Brown University; was ordained deacon in 1817, and priest in 1818, and was consecrated bishop of the Protestant Episcopal diocese of Kentucky Oct. 31, 1832, at New York. He edited the *Episcopal Register of Vermont* in 1827, and the *Episcopal Recorder*, Philadelphia, from 1829.

Smith (E. P.), b. at South Britain, Conn., in June, 1827; was educated at Dartmouth and Yale colleges, and graduated from the theological seminary of New Haven; was settled for several years as a minister of the Congregational church at Pepperell, Mass.; became one of the most active members of the U. S. Christian Commission during the war, and published in 1869 a large volume, *Incidents of the Christian Commission*; was appointed, after the war, general field-agent for the American Missionary Association in the Southern States, and in 1873 U. S. commissioner of Indian affairs, but retired from this position in 1875, and went next spring to visit the African mission-field for the American Missionary Association; arrived at the mouth of the Gambia Apr. 27, but died at Aura in July, 1876.

Smith (HAMILTON LANPHERE), A. M., LL.D., b. at New London, Conn., Nov. 5, 1819; graduated at Yale College in 1839; was appointed professor of natural philosophy and astronomy at Kenyon College in 1851, and at Hobart University in 1869, and has published *Natural Philosophy* (1847–50), *World* (1848), *Sundry Papers on Microscopy, Diatomaceæ, etc.*, in *Silliman's Journal*, etc.

Smith (JOHN COTTON), D. D., b. at Andover, Mass., Aug. 4, 1826; graduated at Bowdoin College in 1847, and studied theology in the divinity school of the diocese of Ohio; was ordained in 1849, and immediately became rector of St. John's church, Bangor, Me.; in 1852 became assistant minister on the Greene foundation of Trinity church, Boston, whence in 1860 he was called as rector of Ascension church, New York City. He has written essays on evolution and a personal Creator, and on the modern schools of thought, collected in his *Miscellanies, Old and New* (New York, 1875). JAMES APPLETON MORGAN.

Spen'cer (SARAH ANDREWS), b. at Lavonia, N. Y., in 1837; graduated from high and normal schools in St. Louis, Mo.; was a teacher from the age of sixteen to her marriage in 1864 with Henry C. Spencer, when she removed to Washington, D. C., where she conducts a school for the business training of women. In 1871–72 she defeated attempts to license the "social evil" in Washington; in 1873 she secured a bill from the District of Columbia legislature for the reform of outcast girls, and has a girls' reform school bill now (1876) pending in Congress. Apr. 14, 1871, Mrs. Spencer and 72 other ladies of Washington were refused their right to register and vote. Mrs. Spencer brought suit in the supreme court of the District, and Judge Cartter's decision that "women are citizens, but have not the right to vote without local legislation," was reaffirmed by the U. S. Supreme Court in 1874. Mrs. Spencer represented the National Woman Suffrage Association at the Republican Presidential convention at Cincinnati in 1876, and addressed both the convention and the committee on resolutions and platform. Mrs. Spencer engrossed and signed the Woman's Declaration of Rights, and was one of the committee of five who presented it to Vice-President Ferry at the Centennial celebration in Independence Square, Philadelphia, July 4, 1876. SUSAN B. ANTHONY.

Sponges [Gr. σπογγιά]. Until quite recently these animals have held a doubtful position, but the observations of Grant and Lieberkuhn, Carter, Clark, Haeckel, have placed them unquestionably in the animal kingdom. They are structurally remarkably uniform, though differing greatly in external aspect. They (Fig. 1) consist internally of a mass or layer of sarcode or mesoderm containing a greater or less number of true cells, and have an ectoderm and endoderm of cellular issue. The majority of the forms are supported by a skeleton of interwoven threads or spicules, or both, of various forms. The exterior is perforated by innumerable pores leading into channels in the interior, which enlarge and join with groups of neighboring channels, forming large branches. These in turn form junctions with other branches, and finally all of them unite into one or several

large trunks, which open outwards like minute craters on the external surface. These are lined with another membrane, differing from anything else of its kind in the ani-

Fig. 1.

Tethya gravata, Hyatt (N. S.).

mal kingdom. It is composed of minute cells furnished on the free side with a long whip or flagellum surrounded by a collar. Their interiors contain a nucleus and digestive vacuoles, and they in all respects resemble the independent animals known as Flagellate Infusoria. They take in and digest food in the same manner, and eject excrements in great profusion from the area enclosed by the membranous collar, as shown by Carter and Clark. In the silicious sponges these flagellate cells are surrounded by a distinct bag-like membrane, and the whole is called an ampullaceous sac. The eggs and spermatozoa, as shown by Schultze, are derived from modified cells of the mesoderm, whereas the skeleton is either built up partly from the external membrane and partly from the sarcode by exogenous growth, or by the transformation of the loose cells of the sarcode into spiculæ, as shown first by Lieberkuhn. The function of the smaller external pores is to admit the water, which is thus strained and deprived of its coarser floating material. It is then carried along the canals by the motion of the cilia, and conveys its load of minute food to the ampullaceous sacs and zoöidal cells. The hydraulic pressure occasioned by the inward flow of the innumerable minute streams forces it through the larger trunks and out at the craters or ostioles with great rapidity. The excrements of the zoöidal cells and other fæcal matters are thus cast out of the ostioles at such a distance from the body that they are not affected by the inward currents through the pores, and are carried away by the water. This peculiar structure induced Carter and Clark to consider them compound animals, and the latter associated them directly with the Flagellate Infusoria. The observations of Haeckel, however, substantiated and corrected by those of Metschnikoff, Carter, and especially Schultze and Barrois, show that this view is not consistent with the history of their development. They have true eggs, derived from the mesodermic layer. These undergo segmentation, and a single layer of cells is formed around the exterior. Those on one hemisphere of the larva of the Calci-spongiæ speedily acquire the collars and flagelli and elongated forms of the mature zoöidal cells, but those of the other hemisphere remain simple. The next stage is a gastrula made by the invagination of the simple-celled membrane (Fig. 1). Subsequently, the opening of the bag-like stomach becomes filled again by an extension or evolution of the same cells, according to Barrois, and the larva penetrates through the endoderm into the channels, and from thence into the water. The larvæ of Silicioidea and Carneo-spongiæ differ from these in not having a gastrula stage. The endoderm either occupies one pole at first, as in the Calci-spongiæ, or fills the interior with a granular mass. This last or solid form is the more common one, and is also distinguished by the fact that the endoderm is visible at one end of the larva in what might be called the basal area, a circular space, which is usually surrounded by a thickened rim or tumid collar, the basal collar. The area is in the Silicioidea marked with bright spots, the bases of a primitive bunch of spicules, and in the Carneo-spongiæ these spicules are absent. This space is the homologue of the mouth of the gastrula of the Calci-spongiæ, and like that, also, is the true base of the larva and the end by which it usually attaches itself. The ampullaceous sacs are developed from the endoderm, and the canals are subsequently hollowed out of the mesoderm. Holes or perforations, the pores, are formed, connecting the interior with the surrounding waters, a large ostiole or cloacal aperture breaks through at the top, and the simplest sponge form is complete. Huxley and Lieberkuhn ascertained that the sponges are hermaphroditic, developing both eggs and spermatozoa in the same individual. Besides this means of propagation, they also possess another class of reproductive bodies known as gemmules, which are usually protected by a leathery or horny case, in most cases strengthened by spines or spicules of various shapes. These contain a cellular mass, whose development has been followed by Lieberkuhn in Spongilla. The earlier stages of the development of the gemmule are not well understood, but the result is the same as in the development of an egg, the first form of the sponge being a body with a ramifying cavity and ostiole, permeated on the sides by pores leading into a system of canals and ampullaceous sacs.

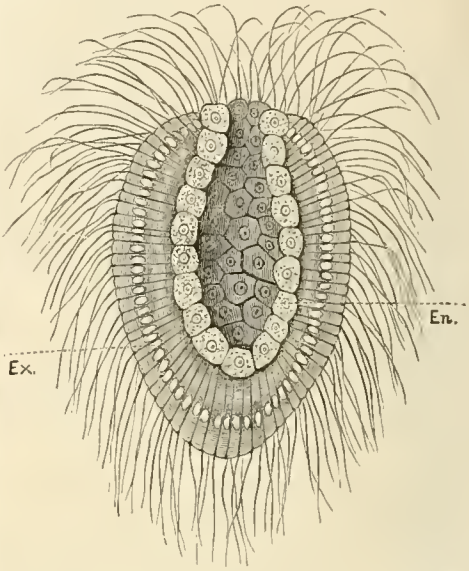
Fig. 2.

Ostioles of *Cliona sulphurea*, Verr., projected through the epidermis of the shell of a mussel.

Fig. 3.

Aspect of a section through Fig. 2.

Fig. 4.



Gastrula of *Luculmis echinus*, Haeckel: *En*, endoderm; *Ex*, ectoderm. (From *American Naturalist.*)

The structural evidence, therefore, leads to the following anomalous conclusion: that the sponge, though developed like other individual animals from a single egg or bud, eventually acquires a membrane, either partially or wholly lining the interior, which is partly composed of cells functionally and structurally homologous with Flagellate Infusoria. It is therefore in its simplest adult form homologically a single animal with the internal structure and functions of a colonial organization. This transformation is so complete that the distinguishing characteristic of the group, the water-system with its innumerable pores and oscules, and all the modifications of the form and skeleton, are directly subordinate to the function of supplying the zoöidal cells with floating food of suitable size and the efficient exportation of the excrements. Haeckel and some other authorities consider the water-system of the sponges as homologous with the gastro-vascular system of the Cœlenterata. The true stomach of the Cœlenterata, however, is formed either by a division of the contents of the planula, or by the invagination of the external membrane. The gastrula stage, therefore, arises in a different way in the two groups, but even if similarly formed, I cannot see that this agreement would necessarily associate the sponges with the Hydrozoa and corals, when the young differ so essentially in all the succeeding stages. Huxley was the first to recognize the importance of the characteristics of the sponges, but was completely misled by the too hasty adoption of Haeckel's gastræa theory and his low estimate of the value of taxonomy, which makes his own attempts in that direction, though very original and often very valuable, more remarkable for the strong light they throw on some single

structural character than for their comprehensiveness. The Poriferata or Porifera were called by him, in his classification of the animal kingdom founded on embryological data, the Metazoa Polystomata, and considered the equivalent in this respect of the remaining sub-kingdoms or branches, the radiates, articulates, and vertebrates, which were united under the name of Metazoa Monostomata. Though the sponges, like all animals except the Protozoa, as shown by Haeckel, have eggs which undergo segmentation, and they may therefore be called Metazoa, they cannot be said to be monostomatous, since, as above described, the homologue of the mouth is the basal area, and this does not persist in the adult colony, but serves as the base of attachment. MacAllister, in his *Animal Morphology*, subsequently corrected this mistake, and gave the true value of the characteristics of the Poriferata, considering them a distinct sub-kingdom of animals. The conclusion recorded in this article was reached independently of either of these authors, MacAllister's book not having been seen until after the manuscript was sent to the publisher, and it may therefore be considered more reliable than if it stood alone. From the Protozoa the sponges are still more remote, since their nearest allies, the Flagellate Infusoria, propagate either by direct fission or by the encystment of one individual alone, or by the fusion of two individuals into one, and the subsequent encystment and division of this one into many others, as shown by Dallinger and Drysdale. Viewed in every light, therefore, the sponges appear distinct from all other animals, and we must consider them as a branch or sub-kingdom. The older classifications were founded upon the peculiarities of the external form, and are now useless. The modern classifications, though based on an extended knowledge of the skeletons, are also necessarily very imperfect, owing to the slight and fragmentary nature of our existing information with regard to the fossil forms. The following is a modification of various other classifications, especially those of Schmidt, Carter, and Haeckel, but is based on original observations and adopted by the author in his *Memoirs on the Porifera (Poriferata) of North America*, now in course of publication by the Boston Society of Natural History:

BRANCH OR SUB-KINGDOM—PORIFERATA.

CLASS CALCI-SPONGIÆ.

Animal supported by a skeleton of calcareous material, disposed in lines or columns at right angles to the walls.

ORDER OLYNTHOIDEA.

Skeleton spicular. Spicules calcareous and of three kinds; single axis or needle-shaped, and three or four rayed. These last are arranged usually in one or two rows, so that the rays of the bases interlace and are the principal supports of the walls.

SUB-ORDER ASCONES.

Described by Haeckel as having thin walls, with pores which are not permanent, but may close, and open again anywhere through the wall. The skeleton spicules are in one row, except in Ascyssa.

SUB-ORDER LEUCONES.

Described by Haeckel as having irregular, branching, permanent canals and thick walls. The skeleton spicules are in two rows in most species.

SUB-ORDER SYCONES.

Described by Haeckel as having regular, tubular, permanent, radiatory canals and thick walls. The skeleton spicules are in two rows in most of the species.

ORDER COLUMNOIDEA.

This is instituted for the reception of those fossil forms which like Receptaculites and Stromatopora have columnar instead of spicular supports between the walls of the body, the walls themselves being in the fossils largely calcareous, and partly composed of the expanded bases of the columns. Receptaculites, though its affinity with sponges has been very clearly shown by Billings, may be still considered doubtful, but there can be no question of the affinities of Stromatopora since the figures published by James Hall in the *Reports of the State Museum of New York* and the analysis of the structure of the genus by Nicholson in the *Annals and Magazine of Natural History*.

CLASS CARNEO-SPONGIÆ.

The central layer or mesoderm is exceedingly thick. The skeleton may be either of keratode or silicious, and may consist of fibres or spicules, or a combination of both. These are distributed with reference to the greater or less irregularity of the form in a more or less radiatory manner, but this plan is subordinate to the necessity of producing a strong supporting framework for the canals and form by the interlacement of fibres and skeletal spicules. Some species have no skeleton, but they lead by slight gradations into true keratose and silicious sponges.

ORDER HALISARCOIDEA.

No skeleton. Animal gelatinous. Only one genus, *Halisarca*, has as yet been described, which can be properly referred to this group.

ORDER KERATOIDEA.

Skeleton consisting of horny fibre, either wholly or partly formed by the external layer, and therefore frequently containing foreign materials.

SUB-ORDER GUMMINIÆ.

Skeleton consists of very fine keratose threads, according to Schmidt. Animal very tough and leathery. The external layer thick and cortical. Only one genus, *Gumminia*, can be referred to this order.

SUB-ORDER DARWINELLINÆ.

Has the primary fibres similar to those of the Aplysinæ, but with a solid core and horny flesh spicules.

SUB-ORDER SPONGINÆ.

Fibre solid, rounded, not generally thickened by exogenous growth.

SUB-ORDER APLYSINÆ.

Fibres hollow, thickened by exogenous growth, generally flattened.

ORDER KERATO-SILICIOIDEA.

Skeleton composed of solid keratose fibre and silicious spiculæ.

SUB-ORDER CHONDRILLINÆ.

This is established in order to include the singular genus *Chondrilla*, Schmidt excluding the genus *Columnitis* and *Chondrilla phyllodes*, Schm., which are true Siliciæ. The skeleton consists of very fine keratose fibre and scattered star-like silicious spiculæ.

SUB-ORDER RHAPHIDONEMATA.

Fibres with a core of silicious, simple spiculæ. Equivalent to the order thus described by Carter.

SUB-ORDER ECHINONEMATA.

Fibres with a core of silicious spicules, and a secondary system of spicules projecting from the fibres. Equivalent to Carter's order of the same name.

ORDER SILICIOIDEA.

Skeleton composed of silicious spicules, either separate or arranged in bundles.

SUB-ORDER CHONDROSINÆ.

This division includes the *Chondrosia* of Nardo, which has been described by Schmidt as permeated by hard granules and distinct silicious spicules. It is likely, also, that the two species, *Chondrilla phyllodes* and *Columnitis squamata*, Schmidt, both belong to this sub-order, since they have the silicious star-like spicules and also a system of true skeletal spicules.

SUB-ORDER HOLORAPHIDOTA.

The fibres are composed of silicious spicules of the single-axis system in great abundance, intertwined and bound together by sarcode (*Carter*).

SUB-ORDER ASCORINÆ.

This group, according to Schmidt, contains the Lithistidæ, Leodinidæ, and Ascorinidæ. They have anchor-shaped spicules or spiculæ, belonging to the pyramidal type.

SUB-ORDER HEXACTINELLÆ.

Skeleton spicules with six rays.

The Poriferata are probably universal in distribution, but none have been described from the extreme arctic or antarctic zones, and but few species of one genus, *Spongilla*, inhabit the fresh waters. They are almost invariably attached or anchored to the bottom and to stationary or floating objects, and are only found in pure waters. None seem to be truly parasitic—that is, capable of living upon the juices or in the interior of other animals—though several are externally parasitic, and several are borers in shells or limestone. None are used as food either by animals or by man, though frequently serving as the abode of larval and adult forms, especially of the worms and Zoanthidæ.

The Calci-spongiæ are generally small in size, and attracted but little attention until Haeckel published his great work on the *Kalkschwämme*. They are inconspicuous in color, and generally fusiform, or if branching the branches are of the usual fusiform shape, with the single opening at the apex (Fig. 6). There are many exceptions to this rule in the shape of solid branching and irregular forms, but these do not come under general observation. They are all

marine, and, so far as known, generally distributed, but are only found in the shallower waters.

The order Keratoidea is the best known of the Carneospongiæ through their common representatives, the commercial sponges. The marketable kinds are all of one genus, that from which all the sponges derive their common name, *Spongia*. There are six species only, with numerous varieties, which are offered for sale. Three of the species are from the Mediterranean and the Red Sea, and three from the Bahamas and Florida. Other species of this genus have a very general distribution, but they are all confined to the equatorial and south temperate zones, within an area on either side of the equator which is limited by the isotherm or average temperature for January of 50° F. The *Spongia graminea*, Hyatt, and *Spongia cerebriformis*, Duch. et Mich., are occasionally used in Florida and Bermuda, but not exported. The marketable sponges owe their excellence to the closeness, fineness, and resiliency of the interwoven fibre of the skeleton. The Mediterranean appears to be particularly favorable to the production of specimens with skeletons possessing these desirable qualities in the greatest perfection. Those from the Red Sea are next in rank, while those of our own shores, though corresponding species to species with these and the Mediterranean forms, are coarser and less durable. Thus, *Spongia equina*, Schm., the horse or bath sponge of the Mediterranean, is finer than the *Spongia gossypina*, Duch. et Mich., the Wool-sponge of Florida and Nassau, though it otherwise resembles it closely. The *Spongia zimocca*, Schm.—Zimocca sponge—represents in the Mediterranean waters the much coarser *Spongia corlosia* and *Spongia dura*, Hyatt, the Yellow-sponge and Hard-head, on the American side. The *Spongia adriatica*, Schm., the Turkey-cup sponge and Levant toilette sponge of the Mediterranean, answers to the finest of our own sponges, the *Spongia tubulifera*, Duch. et Mich., the Glove-sponge. It is probable that the Mediterranean and Red Sea were both colonized from the Caribbean Sea, and, strictly speaking, the six marketable species ought to be classed as three species, with six principal varieties, differing from each other according to their habitat. This conclusion is borne out by the facts that the Caribbean Sea contains more species of this genus than any other locality, that no marketable sponges are found in the Indian or Pacific Ocean, and that the differences in quality cited above are occasioned in these and other sponges with fibrous skeletons by any change from shallower to deeper water, or from waters loaded with sediment to clearer waters. In each and all of these cases a finer texture is the result, and this correlates directly with the fact that even in the Mediterranean the marketable kinds are found in waters which are probably very rarely reduced even during the month of January to 55°, and perhaps for the best qualities not below 60°. They are confined to the coast between Trieste and Ceuta on the African side of the Straits of Gibraltar, none being found in the Black Sea, on the coasts of Italy, France, or Spain, or the islands of Corsica, Sardinia, the Balearic Islands, or even Sicily.

When living, the commercial sponges have the general aspect and consistency of a piece of beef's liver, but the color is darker. They are gathered by means of hooks on long poles, or directly by the hands of divers, or, as in case of some of the coarser kinds, dragged up roughly by dredges. When secured they are exposed to the air for a limited time, either in the boats or on shore, and then thrown in heaps into the water again in pens or tanks built for the purpose. Decay takes place with great rapidity, and they are soon fished up again and the animal matter squeezed and washed out, leaving the cleaned skeleton ready for the market. In this condition, after being sorted, they are sold to the dealers, who have them trimmed, re-sorted, and put up in bales or on strings ready for exportation. There are many modifications of these processes in different places, but in a general way these are the essential steps through which the sponge passes before it is considered suitable for domestic purposes. Bleaching-powders or acids are sometimes used to lighten the color, but these, unless very delicately handled, injure the durability of the fibres. The genus *Spongia* does not usually appear in water deeper than 30 fathoms, but other members of the order may occur at a depth of even 75 fathoms. The Keratoidea are all marine, and are found on stony ground or coral-reefs; muddy and sandy bottoms are not favorable to their growth.

Fig. 5.

Aspect of a specimen of *Spongia corlosia* (yellow sponge) when dried, before the animal matter is washed out. Near the top of the figure the outer membrane, ectoderm, is unbroken except by the pores and the large ostioles, but below it is much torn.

The Kerato-Silicioidea resemble the Keratoidea closely in appearance, but possess less consistency and are the most difficult to preserve, the mesoderm being, even in the strongest alcohol, liable to wash out of the skeleton. The fibres are harsh and stiff, and the forms generally bush-like. The distribution is general, so far as known, and they are found on clean hard bottoms or in situations exposed to the full sweep of the strongest currents. They are all marine, and vary from the most brilliant colors to the dullest whitish-brown. They are found principally in the shallow water near the shore, but probably occur at all moderate depths on the proper kind of bottom.

The order Silicioidea has the greatest range in all respects. The forms differ, from those like *Vioa* and *Cliona*, which may be of any shape, to those like the *Euplectella* or Venus's flower-basket, which excel all others in the beauty and regularity of their spun-glass skeletons. They are found on all kinds of bottom, in all climates, and at all depths, in both salt and fresh water, and contain the only species known to occur in situations periodically exposed to the air, such as the *Spongillæ* in the tanks of India and one marine species, not yet described, from the coast of California. They are best known by the mud-dwelling forms belonging to the sub-order Hexactinellæ, or spun-glass sponges, so called on account of the aspect of the long fibres, which spring out in all directions from the base of the mass, and serve to anchor them in the mud. These are almost exclusively found in the deeper waters and on muddy bottoms. Some of the forms of the sub-order Holoraphidota are also remarkable for their habit of growing in the bottom itself, between and around the particles of sand, but no ampullaceous sacs have yet been described in these forms, so that their true nature is still doubtful. Perhaps the most remarkable are the boring sponges, which dissolve the interior of shells, destroying vast numbers of oysters, mussels, and scallops. One of these, *Cliona sulphurea*, Verrill, does not confine itself alone to the shell in which it generally starts, but spreads out on all sides, killing the animal, surrounding and dissolving the entire shell, and continuing to grow, taking in sand and stones in great quantities, until some of the masses reach the diameter of a foot or more. No other species of the Poriferata is known to have such varied habits, since it is sometimes also found attached to rocks, with a perfectly clean interior. One species also, *Suberites compacta*, Verrill, inhabits shifting sands on exposed coasts, where it must lie loose upon or partly buried in the surface. This, however, is no exception to the rule that all sponges are normally attached, since one specimen found on stony bottom was fastened at one end to a stone, and the skeleton was modified, as usual, to form the base.

Fig. 6.

Sycandra ciliata, Haeckel. (From *American Naturalist*.)

A. Hyatt.

Squier (Miles Powell), D. D., b. in Cornwall, Vt., May 4, 1792; graduated at Middlebury College 1811, and at Andover Theological Seminary 1814; ordained first pastor of the First Presbyterian church of Buffalo, N. Y., May 3, 1816, where he continued eight years; in 1824, for one year, financial agent of Auburn Theological Seminary; from 1825 to 1833 Western agent of the American Home Missionary Society; founded Geneva Lyceum in 1831; elected professor of intellectual and moral philosophy in Beloit College in 1849; retained that connection till he d. at Geneva, N. Y., June 22, 1866. Dr. Squier was a frequent contributor to religious papers and reviews, and was author of the following works—viz. *The Problem Solved* (1855), *Reason and the Bible* (1860), *The Being of God and Moral Government* (1867).

A. L. Chapin.

Staff and Staff Schools [Fr. *état major*; Ger. *Stab*; It. *stato maggiore*; Span. *estado mayor*], the body of officers and their assistants whose special function is the direction of the mass which constitutes the force of an army. Its constitution varies in different armies. In the French army the *état major général* (the general staff) comprises the marshals of France, the generals of division, the gen-

erals of brigade. The service of the staff comprises—(1) the officers of the staff, as follows: 40 colonels, 40 lieutenant-colonels, 120 chiefs of squadron, 200 captains; (2) officers of the records: 24 captains (*archivisten*); total, 400 officers. The special staff of the artillery comprises 37 colonels, 37 lieutenant-colonels, 98 chiefs of squadron, 112 first and second captains—total, 284 officers—and 514 guards, 160 arms-keepers, 170 artificers, 260 battery-keepers.

The duty of the artillery staff is to assure to the several armies the service of the staff of the artillery of the armies and of the army corps, and the general direction of the different services of the artillery arm. The staff of a regiment of artillery comprises the following: (1) officers: 1 colonel, 1 lieutenant-colonel, 4 chiefs of squadron, 1 major, 1 surgeon first class, 3 first and second captains—viz., 1 instructor of equitation, 1 adjutant-major, 1 treasurer—the clothing officer, 1 lieutenant or sub-lieutenant as assistant treasurer, 1 assistant surgeon, 1 first veterinary, 1 second veterinary, 1 assistant veterinary; total, 16 officers. (2) Enlisted men: viz. non-commissioned staff (*petit état major*), 3 adjutants (of whom one has charge of barracks), 1 chief artificer, 1 sergeant, chief machinist, and guard of the park, 1 sergeant-bugler, 1 corporal-bugler; total, 7 non-commissioned officers; 1 adjutant in charge of arms and harness, 1 chief armorer, 1 chief sergeant, 1 fencing-master (an adjutant or a sergeant), 8 sergeants—viz. 1 baggage-master, 1 librarian, in charge of the school apparatus, 1 hospital steward, 1 veterinary-hospital steward, 1 in charge of remounts, 1 first secretary to the treasurer, 1 storekeeper and first secretary to the clothing officer, 1 master saddler; 1 quartermaster, 6 corporals—viz. first secretary to the adjutant in charge of arms, first armorer, first tailor, first shoemaker, first saddler, second secretary to the treasurer; cannoniers, 1 for the veterinary hospital, 2 armorers, 2 tailors, 2 shoemakers, 2 secretaries of the colonel and of the major, second secretary to the clothing officer, 3 secretaries to the treasurer, 1 *enfant de troupe;* total, 16 officers, 37 non-commissioned officers and men, 1 *enfant de troupe*, making, as the staff of each regiment of artillery on the peace footing, 16 officers and 38 men.

Special staff of the engineers comprises—(1) 33 colonels, 33 lieutenant-colonels, 124 chiefs of battalions, 148 first captains, 148 second captains; total, 486 officers. (2) Assistant engineers: 20 principal assistants first class, 100 principal assistants second class, 100 assistants first class, 150 assistants second class, 200 assistants third class. (3) 6 workmen. (4) 292 artificers of various classes; total, 486 officers, 868 men—1354 in all.

The staff of a regiment of engineers comprises 16 officers, 79 men, and 1 *enfant de troupe*. That of a regiment of infantry of the line comprises 19 officers and 93 men, and 1 *enfant de troupe;* and in the regiments of other arms the staff is not very different.

In this organization, which is that adopted by the law of Mar. 13, 1875, after the French state had in a measure recovered from the shock of the destruction of the old French army in 1870–71, it is seen that the staff includes all ranks from the "marshal" of France to the artificer and enlisted man. It is a complete organization, whose business it is to think for and provide for, and to direct and use, the mass.

In the service of the U. S. the annual army registers from 1815 to 1827 contained a section devoted to the general staff, which included (1) the general officers of the army; (2) the adjutant-general's department; (3) the inspector-general's department; (4) the topographical department; (5) the ordnance department; (6) the quartermaster's department; (7) the judge advocates; (8) the hospital department; (9) the chaplains; (10) the Military Academy; (11) the purchasing department; (12) the pay department. Now, the word staff does not appear as a heading to any branch of the army in our army registers, except in the index, where the staff departments are named as (1) the adjutant-general's, (2) the inspector-general's, (3) the medical, (4) the ordnance, (5) the pay, (6) the quartermaster's, and (7) the subsistence departments.

All European states since the great success of the Prussian armies in their contests with Denmark, with Austria, and with France, in the campaigns of 1864, 1866, 1870–71, are remodelling their armies and their staffs, and have made the Prussian staff-system in some degree their exemplar. A sketch of this system will perhaps be most interesting to the military student. The Prussians recognize the fact that forms are not the essentials. The Prussian system of staff has been subjected to constant and great changes. The value of a staff lies in the practice, the instruction, the activity, the zeal, the patriotism, and the capacity of its components. The perfection of the present Prussian staff is due, doubtless, to the ability and personal devotion of its chief, since 1857, Gen. Field-Marshal Count von Moltke.

We find in the army of the elector of Brandenburg, before the erection of the Prussian monarchy, the seeds of a staff organization. Lieut.-Col. Gerard von Bellicum was in 1655 the first quartermaster-general of the army of Brandenburg. He soon had assigned to him as an assistant Col. Jacob Holtzen. The quartermaster-general was only one member of the staff, to which at that time belonged all the generals and high military officers. In 1657 we find a Feld-zeugmeister as general-in-chief; a commissary-general ranking as lieutenant-general, who united the functions of chief of staff and intendant general; a "general wachtmeister," ranking as major-general, assistant to the commissary general, charged with the regulation of the order of march, the encampment, and the order of battle; 2 general aides-de-camp; 1 auditor-general; 2 quartermaster-generals, for the engineer service, the establishment of trenches and of camps, and in time of peace for the administration of castles and fortresses; 1 master-general of subsistence (general proviant-meister); 1 staff quartermaster, charged with the lodging of the troops; 1 field treasurer; 1 field preacher; 1 field apothecary; 1 field surgeon; 1 wagonmaster-general; 1 provost-marshal-general, who had 1 provost and 2 executioners with him. Between 1670 and 1673 we find as assistants to the quartermaster-general 2 lieutenant quartermaster-generals, 2 engineers, and 1 captain of guides. There was an intimate relation between the staff and the engineers for more than a century, which lasted till 1806, and even in that year Lieut.-Gen. von Geusau was chief of engineers, chief of staff, and quartermaster-general.

Frederick the Great had few officers of the staff of the quartermaster-general. This great captain was not only his own chief of general staff, but he often assumed the functions of a staff officer of an inferior grade. He wrote or dictated the plans of operations, formations, and instructions. His orders of battle were given aloud. If he wanted assistance, he had at his command his aides-de-camp, some officers of engineers, and mounted jägers. The staff of the quartermaster-general then had already more than a nominal existence. In the summer of 1757, Frederick wrote out "instructions of the king for his quartermaster-generals," which consist principally of information on the construction of fortresses, the establishment, attack, and defence of entrenched camps. In 1758 he dictated another instruction for his field engineers, whom he used for surveys of ground, reconnoissances of the camp and positions of the enemy, and for the discovery and establishment of routes for his columns. During the Seven Years' war he revived the offices of captain of guides and brigade-major. The first commanded the field or column jägers, who in absence of maps guided the columns of troops on the march. The latter received the countersign and parole, placed the guards, and kept the daily rolls and prepared the reports. But all these officers retained the uniforms of their corps. In 1764, Frederick increased the staff of the quartermaster-general, which in the army list for 1767 consists of 1 quartermaster-general, 1 quartermaster, and 15 lieutenant quartermasters. These last he required to do at stated times a course of duty in the regiments of the guard for practical acquaintance with military duty. In 1785 the general staff included all officers without troops. The staff of the quartermaster-general then contained only 10 officers. In 1791 the staff corps consisted of 19 officers; in 1796, of 15, with 15 engineer geographers added; and in 1796 the trigonometric survey of Prussia was committed to the staff of the quartermaster-general.

In 1800, Gen. von Le Coq of this staff drew up instructions for staff service under the following heads: (1) selection of camps; (2) reconnoissance of routes of march; (3) guiding of columns; (4) establishment of the troops in camp; (5) reconnoissance of military positions; (6) foragers and their support; (7) reconnoissance of the enemy's positions; (8) duties of aides-de-camp with the general in battle; (9) guiding of columns or detachments in battle; (10) execution of engineer duties in sieges, in absence of regular engineers; (11) field fortification in the same circumstances; (12) intelligence and "spy" service; (13) keeping of the journal.

After the destruction of the Prussian army by Napoleon in the campaign of 1806, Col. von Schornhorst in 1808 became lieutenant quartermaster-general of the Prussian army, with rank of major-general. His staff consisted of 2 quartermasters, 6 lieutenant quartermasters, 10 assistants, and 15 officers attached—34 in all. After 1815 the organization of the staff, which had rendered distinguished and important services during the closing campaigns against Napoleon, was seriously studied. A part of its officers, placed under a special chief as the *great general staff*, was assembled at Berlin, while its other officers, doing staff duty in the general and divisional commands, were in direct contact with the troops. The general staff was under the minister of war till 1821, when the king named Lieut.-

Gen. von Mueffling chief of the general staff, which then acquired an independent position, taking its orders directly from the chief of the state and commander-in-chief of the army—a position it still retains. To this independence of all subordinate authority the Prussian staff attributes its ability to render the services in its late campaigns which have placed it as first among the military organizations. Lieut.-Gen. von Mueffling was succeeded in 1829 by Lieut.-Gen. von Krauseneck, who was followed in 1848 by Lieut.-Gen. von Reyer, on whose death, in 1857, Gen. Field-marshal Count von Moltke became chief of the general staff. The part played by this general staff in changing the map of Europe in our day makes its history one of great interest.

There is a great advantage in giving to the person who has digested and prepared the work the general plan of operations and the measures to carry it out—the actual direction of its execution. A modern European army is transformed in a few days from a number of independent bodies of scholars, of officers and men under training, education, and preparation for war, into a compact, well-organized manœuvring and fighting army, of which the army corps, hitherto independent and scattered over the whole country, are the members, the whole directed by a brain whose thinking and reasoning power is represented by the general staff, while its *will* is the monarch and his trusted councillors, ministers, and officers. Were the preparation and issue of the innumerable orders and instructions necessary at the moment of mobilization to complete the several army corps, to carry their numbers up to the full war complement, to assemble the individuals at the corps dépôt, and to transport the corps to the place of rendezvous on the frontier, to be committed to new hands, to officers selected and designated at the outbreak of hostilities, much valuable time would be lost. In the opening of the campaign of 1870 it was a question of days, of hours, whether the war should break out on the soil of Germany or of France. Germany, through her independent and trained great general staff, was the better prepared, and made her concentration first. She crossed the boundary, and France fought a defensive campaign ending at Paris. In 1824, several years of peace having intervened, economic considerations led to the suppression of that part of the general staff which was attached to the divisions, and the general staff was reduced to 1 lieutenant-general as chief, 13 colonels—9 of them chiefs of staff of the army corps—3 chiefs of staff for the three great theatres of war into which Prussia was divided, 1 chief of the general staff of the inspection of artillery, 13 field officers, 10 captains, and 9 lieutenants. The campaign of 1866 showed the necessity of having ready at the moment of mobilization of the army a great general staff, capable of being doubled, and of leaving behind it when the army took the field a sufficient number of trained staff officers to make sure of the means and measures of military transportation, and of continuing to supply the wants which in course of a campaign occur in the army of operations. In 1867 a royal order established the staff on the following footing: *Higher list:* 1 chief of general staff of the army; 3 chiefs of division at the great general staff; 12 chiefs of staff of the army corps; 1 chief of staff of the inspector-general of artillery; 7 field officers of the great general staff; 12 field officers on the division staffs; 15 captains of the great general staff; 12 captains with the higher army commands; total, 88 officers. *Scientific list:* 4 chiefs of division; 5 field officers; 12 captains; total, 21 officers at the office of the great general staff. Total, 109 officers, of which 46 belong to the great general staff.

At the breaking out of the war of 1870 the German army contained 200 staff officers, which number was considerably increased in the course of the campaign. In 1875 the general staff consisted of 190 officers—147 Prussian, 23 Bavarian, 10 Saxon, 10 Würtembergers. Of the 147 Prussian staff officers, 72 are attached to the staff of the troops, 74 to the great general staff. The work of the great general staff is distributed to separate divisions. The chief of the general staff directs the whole. In his office, under direction of his aide-de-camp, questions relating to the personnel of the staff, to its organization and administration, are considered. The work of collecting military information, domestic and foreign, the use of railroads, the pursuit of military science, preparation of maps, etc., are distributed to various sections, grouped according to their work or to the countries to whose study they are devoted. The staff is divided into three sections, whose duty is to study attentively all military events, domestic and foreign; to keep themselves acquainted with the changes affecting the organization, recruiting, arming, and equipment of armies; to study the military geography of different countries, the establishment or demolition of fortresses, the development of the network of roads, railroads, canals, etc. The first section devotes itself to Sweden, Norway, Russia, Turkey, and Austria; the second to Germany, Denmark, Italy, and Switzerland; the third to France, England, Belgium, Holland, Spain, Portugal, and America. Each is directed by a chief. Some staff officers, and some officers ordered on staff duty and charged with the special study of military questions in different countries, are under the orders of each chief.

The fourth section is that of railroads. It is directed by a chief, to whom are attached officers, some of whom belong to the scientific corps of the staff. This section is charged with all that relates to military transportation. It should know the connections of the railroads at home and abroad, the equipment and rolling stock; and it elaborates the great schemes for army transportation by railroad. Considering the great number of officers needed to manage the movement of a great army by railroad, as many officers as possible are from time to time attached to this section in order to their instruction in these duties.

In the scientific corps of the staff are the officers who have charge of the section of military history, who have charge of the archives and of the library. In this scientific corps belong also the section of geography and statistics and the preparation of military maps of foreign countries. The general service of charts belongs, under a chief of the trigonometric survey, to another part of the great general staff. Under him are three sections—(1) the trigonometric, (2) the topographical, (3) the cartographical sections. In the first section are 7 staff officers and 26 experts, trigonometers. In the topographic section are 6 staff and civil officers, 15 officers on special duty, and 79 topographers. The cartographic section has charge of all the completed charts and engraved plates. It prints and draws all charts for the staff. It has a chief and 2 staff officers, 16 cartographers, and 21 other persons, experts in various branches of its service.

The present scheme of organization of the German army requires at the outbreak of war 220 staff officers—on a peace footing, 190. But, judging from the experience of 1870–71, not less than 253 would be called into active service should a great war break out.

This sketch will give an idea of the organization which carried the Prussian army to the gates of Vienna and of Paris, and which enabled the German armies to capture the whole of the regular army of France. Its success was not, however, a mere question of organization. It depended upon severe selection and training under the eye of one whose whole thoughts were devoted to preparing a body of officers competent to advise whoever might be in command of troops in such a way that their advice would be taken as the best. These officers are selected from the ablest graduates of the military schools after a certain term of service in the line. They serve on the staff in greater number than can possibly become permanent staff officers. They return to the line and serve a term with their regiments, not knowing whether they will ever be recalled to the staff. As vacancies occur in the permanent staff, at the discretion of Gen. von Moltke they are filled by selection from those officers who have while under his eye given proof of greatest capacity and devotion. Such men's advice carries weight, and is followed, and to the "staff" the Germans attribute a great share of the glory of their arms.

Russian Staff.—It is not limited by any formal rule; it embraces—(1) the chiefs of staff of military districts and officers doing staff duty with troops and commands. (2) Military agents abroad; professors and assistant professors of the three military academies, the staff, the artillery, and the engineer schools; the chiefs of the schools of war and of the "Jünkers." (3) The aides-de-camp of the emperor and of the members of the imperial family, and of the officers attached to their persons. (4) The officers on staff duty at the war ministry; those attached to other ministries or to the schools of war and of the Jünkers, provided they have served three years in the staff. (5) The highest officers of the military hierarchy, such as the commanders of troops in the military districts, commanders of divisions, chiefs of the principal divisions of the war department, directors of military gymnasia, and finally certain officers of high rank who by order of the emperor are placed on the rolls of the staff.

On the staff in 1874 were 18 generals, 52 lieutenant-generals, 71 major-generals, 196 colonels, 55 lieutenant-colonels, 51 captains, 12 second captains.

Austro-Hungarian Staff.—On a peace footing this comprises 348 officers.

Italian Staff (*corpo di stato maggiore*) comprises (1) The general in command of the corps (chief of general staff, and the officers placed under his command), with the military bureau and the bureau of accountability. (2) The staff of the troops. On a peace footing, 2 generals, 9 colonels, 34 lieutenant-colonels and majors, 75 captains, 20 first lieutenants; total, 140 officers. Also, 60 captains on staff duty. Of the whole, 85 officers belong to the great

general staff and 115 to the staff of the troops; 90 other officers are temporarily added to the staff. They are generally officers who have served in the staff or have distinguished themselves at the military schools. They are officers liable to be called into the staff in case of preparation for war.

English Staff.—The English differs from all other European armies in its method of recruiting and in its division into corps and bodies of troops. It can scarcely be said that there is any English military staff as a separate and distinct corps of officers. The English military staff is composed of the higher commanders of troops, and of the officers who are attached personally to them in time of peace or war when they are invested with commands.

The English war department is dual, embracing a set of political and of military officers—an outgrowth of the English constitution, jealous of the military power, and always maintaining, as a cardinal principle of the liberty of the citizen, the subordination of the military to the civil power. The war office and the Horse Guards, long distinct, were united into one department by act of Parliament in 1870. The general commanding-in-chief was thus brought into the war office, which is under the secretary of state for war. In the war office are three branches: (1) The military department, at the head of which is the field-marshal *commanding* in chief (not the *commander-in-chief*). (2) Until Nov., 1875, the control department, the department of administration, placed under the surveyor-general of ordnance. (3) The financial department, under the financial secretary; 2 under-secretaries of state are placed immediately under the secretary of state for war: first, the parliamentary secretary; second, the permanent under-secretary. The first retires at a change of ministry, and assists his chief in Parliament; the second does not sit in Parliament; he has the real direction of business, and does not go out with the ministry. The surveyor-general of ordnance and the financial secretary are members of Parliament, and fall with the ministry.

There are four bureaux: (1) the central division; (2) the division of the engineers; (3) division of artillery; (4) division of finance.

The system is complicated, and in Nov., 1875, the control department, which had been in existence for only six years, was abolished, and a new distribution of duties ordered by royal warrant. While the pay sub-department was retained, a commissariat and transport department and an ordnance-store department were created by this warrant. The details of the new service have not yet reached us. Provision is made for commissary-generals, deputy commissary-generals, assistant commissary-generals, commissaries, deputy, and assistant and sub-assistant commissaries. A commissary-general with an army in the field has a special rank, otherwise he ranks as a major-general. A deputy commissary-general ranks as colonel; assistant commissary-general as lieutenant-colonel; commissary as major; deputy commissary as captain; assistant commissary as lieutenant; sub-assistant commissary as sub-lieutenant.

For all the work which in the Prussian system is done by the great general staff there are available in the English army but 7 staff officers and 4 officers attached to the intelligence branch, created in 1873 by law, and placed under the orders of the quartermaster-general attached to the Horse Guards. This bureau receives the despatches and memoirs of the military officers attached to all foreign English legations to observe and study the military condition, force, and science of foreign nations.

The three divisions of the English general staff are the departments of the quartermaster-general, of the adjutant-general, and of the military secretary. In the annual army list the commanders of colonial military districts appear in the staff, which may be divided thus: (1) Generals commanding districts, divisions, etc. (2) Staffs attached to the various commands: 1, Adjutant-general's department; 2, quartermaster-general's department. (3) Personal staff: 1, military secretaries; 2, aides-de-camp.

The officers of the staff are taken exclusively from the regular army, and should have spent two years at the staff college or passed the final examination for graduation at that college. A condition of eligibility to examination for admission to the staff college is five years' service in the army. Every officer who presents himself for the graduating examination at Sandhurst Staff College must have had seven years' service.

Department of the Adjutant-General.—I. In time of peace there are only 4 adjutants-general—1 at the Horse Guards and 3 in India. A fifth is appointed when an army takes the field. The adjutant-general at the Horse Guards is always a general officer belonging to the staff of the sovereign. In the Indies an adjutant-general is a colonel, and in an army in the field he is a colonel or a general. II. A deputy adjutant-general assists and replaces his chief, and is at the head of his department whenever there is no adjutant-general; he is always a field officer, generally a colonel. III. An assistant adjutant-general is a field officer, and is often the head of his department; every division has one. IV. A deputy assistant adjutant general is of the lowest rank in this department. He should be a captain, but his duties are often performed in India by lieutenants. In time of war one is attached to each division. V. The brigade-major is the brigade adjutant, always a captain. VI. Subalterns fill the position of place majors or adjutants of garrisons at posts.

Department of the Quartermaster-General.—This department has charge of transports by sea and land, preparation of orders of march, barracks and cantonments, camp equipage, all information in relation to geography and topography, the preparation and distribution of plans and dispositions for attack and defence. I. A quartermaster-general exists only at the Horse Guards (he is on the staff of the sovereign) and at the Indian presidencies, and in case of mobilization of a grand army. At the Horse Guards and with an army in the field the quartermaster-general is always a general; in India, a colonel or lieutenant-colonel. II. A deputy quartermaster-general is always a field officer, generally colonel or lieutenant-colonel. III. An assistant quartermaster-general is attached in peace to certain districts, and in war to every division; excepting in India he is always a field officer. IV. A deputy assistant quartermaster-general is often in peace the only officer of the quartermaster's department in a district. In time of war one is attached to each division. In time of peace only captains are eligible to the office. In time of war lieutenants are occasionally assigned to this duty. The duties of the adjutant-general's and of the quartermaster-general's departments are often performed by the same officer.

Military Secretaries.—Military secretaries are attached only to the higher commands. Their duties are confidential. When attached to civil governors they are military advisers, and then, as in India, their positions are of great importance. I. There are 9 military secretaries—viz. with the officer commanding-in-chief, with the viceroy or governor-general of India, with the governors of Madras and Bombay, with the commanders-in-chief in the three presidencies in India, with the governor-generals of Canada and of the Cape of Good Hope. II. Besides these 9 military secretaries, assistant military secretaries are attached to less important commands; 7 of them appear in the military budget. III. The aides-de-camp granted to governors and to generals are captains, attached to these officers personally.

The staff of the general-in-chief in England consists of 1 military secretary, 1 assistant military secretary, 4 aides-de-camp, 1 adjutant-general, 1 deputy adjutant-general, 2 assistant adjutant-generals, 1 deputy assistant adjutant-general, 1 quartermaster-general, 1 deputy assistant quartermaster-general. To this staff are added for the artillery and engineers, of which the general-in-chief is inspector, 2 deputy adjutant-generals, 1 assistant adjutant-general, 2 deputy assistant adjutant-generals.

STAFF SCHOOLS are so connected with other military schools that a general sketch of the whole scheme of military schools is necessary in order to an understanding of the system. The following, in addition to those described under the head MILITARY ACADEMIES (see in CYCLOPÆDIA), are mentioned here.

Austria.—In 1868 a general reorganization of the Austrian military schools was decreed on the following basis: A. For the education of youth—(1) the Military Orphan Asylum; (2) the Military Technical School; (3) the Military College; (4) the Military Academy. B. Schools attached to regiments and divisions for soldiers, non-commissioned officers, and cadets or aspirants for commissions—(1) regimental or troop schools; (2) regimental officers aspirant schools; (3) division officers aspirant schools. C. For education of officers, to qualify them for promotion to higher grades—(1) the higher artillery course; (2) the higher engineer course; (3) the War School (staff college); (4) the course of instruction in military frontier administration; (5) the Central Cavalry School; (6) the Medical and Surgical Academy (Josephinum); (7) the Military Veterinary Institute; (8) the School of Intendance (administration).

Bavaria has four establishments for military education: (1) the Cadet Corps; (2) the War School; (3) the Artillery and Engineer School; (4) the War Academy.

Russia.—The Nicholas Academy is the principal staff school. It has a corps of military professors of high rank, embracing one general as director, one lieutenant-general, 4 major-generals, and 7 colonels as professors, besides other officers. The staff is recruited, though not entirely, from the officers who have distinguished themselves at this

academy. There are two courses—one of two and a half years, one of four years. Fifty officers are admitted annually. In September the examinations are held, and the students are divided according to their result into three classes. Those of the first class are recommended for immediate employment: those of the third class are considered as not sufficiently instructed. Thirty officers may be annually sent into the staff for service and further study and practice. The most capable among these are selected for staff service; the others re-enter the regiments. None are admitted to this academy until they have served four years as officers, and have passed the required examinations for admission. M. C. MEIGS.

Stars. To the number of stars mentioned in the article under this title in its regular place in the CYCLOPÆDIA as having suddenly made their appearance in the heavens, is to be added a new one discovered by Schmidt of Athens Nov. 24, 1876, in A. R. 21*h*. 36*m*. 50*s*.; decl. 42° 16.9′ N. Its spectrum has been described by Cornu of Paris as interrupted and exhibiting bright lines. From the 3d magnitude, to which it belonged when discovered, it passed to the 5th on the 30th of November, and to the 7th on the 15th of December. If the observations of Mr. Cornu are correct, this spectrum belongs to the category of the variable in the Crown and R Geminorum, showing the direct lines G and F of hydrogen, with others undetermined.

To the catalogue marked "*Table C*" in the article STARS should have been appended the following note:

"This catalogue was published originally by Schjellerup of Copenhagen in the *Astr. Nach.*, No. 1591, July 18, 1866; and was afterward reproduced, with additions and corrections, in No. 1613 of the same journal, Oct. 13, 1866. It is founded on that of Lalande, *Con. des Temps*, year III. of the Republic, on that of Zach, *Corresp. Astr.*, vol. vii., and on that of Sir John Herschel, *Cape Observ.* It has been more recently inserted by Chambers in his *Descriptive Astronomy*.

"We have added to it some new stars of our own more recent discovery, with others discovered by Birmingham of Tuam, and have inserted in notes brief descriptions of the spectra determined by our observations, and of those later described by D'Arrest in the *Astr. Nach.*, Nos. 2009, 2016, 2032, 2044. The positions of all of these stars have been reduced to 1870, which is that of the last catalogue of Chambers. Some of these have been verified in the heavens. On a comparison, it appears that some stars referred by us to the second type are classed by D'Arrest as of the third: in part because of a real variability, and in part because of the difference of instruments.

"The present catalogue is a supplement to those of the first and second types heretofore given. There can be no doubt that many spectra are variable; and hence, to the variability of stars in *magnitude* must now be added variability of *spectrum*. This undertaking of ours will be continued, and what we give here is presented only as a prodromus of a more extended labor. P. A. SECCHI."

Stars which are variable in color are necessarily variable in spectra. A remarkable example of periodical variation of this kind has been recently found by Klein of Cologne in α Ursæ Majoris, which varies between yellow and fire-red, the period being about five weeks. F. A. P. BARNARD.

Starva'tion [Ang.-Sax. *steorfan*, to "die" or "perish"], or **Inanition,** the condition of tissue-waste, exhausted vitality, and death resulting from prolonged privation of food. A slower starvation ensues when food is scanty and impure, or is persistently deficient in one or more of the several constituents essential to the mixed diet of man. Animals have been fed experimentally on single classes of food—one upon albuminoid matter, another partaking of only farinaceous substances, a third only of the hydrocarbons or fats. Such exclusive diet, of whichever kind, proved disastrous; emaciation, enfeeblement, and death by starvation ensued. The phenomena of starvation, complete and partial, have often been studied and recorded by the shipwrecked, by persons immured in mines, soldiers deprived of supplies, arctic explorers, as also the insane and others practising voluntary starvation. Prolonged abstinence necessitates bodily waste; hence, the reported cases of prolonged subsistence without food, usually women apparently in a state of trance or catalepsy, are not to be accredited; carefully investigated, they invariably prove to be artful deceptions by hysterical or demented persons. Rigid exclusion of food and drink causes death, as an average, in from five to eight days. Water, freely supplied, with exclusion of solid food, may prolong life two or three weeks, exceptionally longer. Water constitutes over half the weight and bulk of the body; it is the solvent for all nutritive matter entering the body, and all azotized products which are to be excreted. Even solid food, so called, is in part water. If desiccated food alone be supplied, with no drink, death will result in a few days. Starvation at the outset produces urgent hunger; this may gradually lessen, be replaced by faintness, loss of appetite, and even loathing. The strength fails, the body wastes, the mind becomes enfeebled: in some cases there is listlessness and stupor, in others marked nervous excitement and delirium—phenomena excited by non-excreted effete matter accumulated in the blood. The starving person is liable to intercurrent disease, and the community suffering privation is often visited by epidemics of contagious and infectious diseases, which assume an unusually malignant and fatal type, consequent upon the nervous depression and vitiated blood of the persons attacked. Starving persons, when rescued, should not be supplied too suddenly or freely with food; the enervated digestive apparatus can retain and assimilate but small quantities at a time, an excess exciting irritation and dangerous and fatal diarrhœa. Certain diseased conditions may cause starvation; such are stricture and cancer of the œsophagus and upper orifice of the stomach, gastric ulcer, atrophy of the peptic and intestinal glands, and tubercle of the intestine.

E. DARWIN HUDSON, JR. REVISED BY WILLARD PARKER.

State. The word *state* brought with it from its Latin parentage no necessarily political meaning. The Romans said *status nostræ civitatis* ("the state or condition of our civic community"); but never, so far as I have noticed, does *status* itself mean what our *state* means—that is, a self-governing community, organized under permanent law which has for its aim justice and the security of all. It is, however, at present, the best term for denoting communities on their political side, whatever their form of government be. The term *nation* implies common origin and language, and so Cicero spoke of the *Greek nation*, although the Greeks never formed a state, nor even a confederation, embracing all who spoke the Greek tongue. And on the other hand, the kingdom of the Netherlands, such as it was before the disruption in 1830, consisted of inhabitants speaking three languages, Dutch, Flemish, and French, with various earlier institutions and political connections. This was in no sense a nation, but was a state. So Austria at present is not a nation, but is a state, where three nationalities at least—a German, a Hungarian, and a Slavonic, to say nothing of Italian and Wallachian subjects—are bound together under the same political institutions. And the British *nation*, which is in use, while we never hear of the British state, is objectionable, because the nationality of Ireland is certainly different from that of those of the other parts of the kingdom.

The political senses which the word *state* and others from the same source put on were more than one. Thus, the *estates* of the later feudal kingdoms were the three or four groups holding the property and represented in the assemblies called the assemblies of the estates. These were the clergy, nobles, burghers, and, in a few countries, the peasants. In the Dutch republic much later each province held a meeting of its estates, and the general meeting of the provinces was called the states general, where all were represented. The abstract sense of an organized body politic also came into the word. When the American colonies called themselves free and independent States, this sense was adopted, and this sense remained in the term *United States*, which was attached to the new federal republic for want of a better. The reasoning from this term, and from *sovereignty*, as to what the rights of the States and of the Union are under the Constitution, instead of discovering from their attributions and powers what they are, has been a source of much confusion and error. Political science, however, is not responsible for this confusion. It knows of independent and of dependent states, of states formed out of states, and of simple states, of states under the most varied and dissimilar forms. From the word *state*, then, we can argue nothing positively of the attributes of that which is so called. The most that can be said is that a state entirely independent and self-governing in order to carry out the ends of its existence ought to have such and such powers. (See also SOVEREIGNTY, in CYCLOPÆDIA.) T. D. WOOLSEY.

Steel, Chemical Nature and Relations of. No questions now mooted before the scientific and practical world can surpass in interest those which relate to the nature of steel and its relations to elementary iron. In the article on STEEL, in CYCLOPÆDIA, Mr. Alex. L. Holley, a distinguished engineer, has presented a large mass of facts of practical bearing, embracing nearly all that is known regarding the elementary chemical composition of the various products that are now designated by the name of steel, but there still remain some facts and considerations that are more or less significant, or at least pregnant, in connection with the great question above referred to: What is the chemical nature of steel? Moreover, when such a question is under examination it is always of value to set

forth distinctly what we do not yet know, to stimulate the discovery of such yet unknown facts as may help us in the problem.

Though it is at present evidently impossible to satisfy all, by any *definition*, as to what modifications of iron are or are not entitled to be denominated steel, yet no one disputes that there is a certain range of chemi-physical characters, defining in a salient manner one modification of this metal, known by that name from time immemorial, and used for making tools, blades, and springs. The chief characters of this modification (or mixture?) may be stated as follows:

Composition.—Mr. Holley has sufficiently set this forth under STEEL. (See also IRON AS A METAL, by JOHN B. PEARSE, in CYCLOPÆDIA.)

Fusibility.—This character depends on the presence of foreign elements, mainly carbon, and is unquestionably due to the formation, at least at high temperatures, of some definite chemical compound or compounds, *as yet uncertain*, of iron and carbon. Here, then, is one essential point wherein our knowledge is as yet insufficient to enable us to meet the problem. Until we know and understand with precision the definite compounds of iron with carbon, we cannot expect fully to understand steel. The most reliable fact in this direction has recently been announced by Boussingault, who has made it at least probable that the *highest* carburet of iron is Fe_5C, corresponding to 4.11 per cent. of carbon. This, however, is but an initial step in the investigation, which chiefly remains yet to be made. Even of this compound Boussingault has omitted to give us what is doubtless its most significant character, its *density*. Nor did he investigate the nature of the carbon contained in this compound, Fe_5C. The degree of fusibility of steel varies widely with the proportion of carbon. An authoritative work states it at "probably about 1800° C.," equal to 3272° F.

Malleability, or rather susceptibility of being forged and welded, like soft malleable iron, at high heats.—Steel containing above 1.25 per cent. of carbon is generally found to be still malleable, but difficult to weld; at 1.5 per cent. of carbon the weldability has disappeared, though it may still be forged with some difficulty. Above this latter proportion of carbon it will usually be rated as cast iron.

Temper.—This most important character is definable as the capability of assuming a great degree of hardness, combined with strength and elasticity (resilience), on being rapidly cooled from incandescence. The same steel, on slow cooling, will be found soft, inelastic, and susceptible of bending without breaking. The usual idea, or rather form of words, applied to this familiar but remarkable phenomenon is that a different "molecular structure" is produced; which explains nothing. To a chemist the known behavior, under similar treatment, of iron somewhat more highly carburetted, with other analogous known cases, strongly suggests the hypothesis that the tempered steel has a different chemical constitution from soft steel. More distinctly, this hypothesis is that both when incandescent and when tempered the carbon present is all in chemical combination with the iron, forming a homogeneous molecular mixture of definite carburets of iron, but that during slow cooling more or less dissociation occurs into free carbon and soft, less-carburetted compounds. A mode of testing this hypothesis, or at least of throwing light on the general problem, would be found in the minute chemical investigation of the comparative condition and character of the carbon separated by solvents from the same steel when softened and when hardened. A number of investigations, though as yet a very inadequate number, has been made of the changes of *density* during tempering. (See under *Density*, below.) Tempered steel is said to be *whiter*, and when polished more lustrous, than the same steel when soft. The hypothesis that the hardness, whiteness, highly crystalline texture, and other qualities of tempered steel are simply attributable to an intimate admixture, with lower carburets, of the highest *spiegeleisen*, or Boussingault's Fe_5C, appears quite plausible enough to demand tentative investigation from chemists.

Magnetic Persistency.—This is a remarkable characteristic of hardened steel, in which, however it participates with cast iron. The remarkable recent discovery of Jamin, that soft iron, in filings, acquires *by compression* the same power of retaining magnetism possessed by tempered steel, will of course be hereafter found to throw light upon the nature of steel, but its bearing at present is unintelligible.

Density of Steel.—The study of the changes of density of steel with change of composition and other conditions is only beginning to receive some attention of late years from practical men, although in the laboratory as yet but a minor regard is paid to this character, with reference not only to steel, but also to iron generally; many skilful investigators often omitting to record the densities of important samples and varieties of metal. In the case of ordinary steels the records of density-figures are lamentably meagre. More is known of the densities of what are sometimes called "special" than of common steels. The following compilation of figures is therefore given here as in a measure new, and to furnish a starting-point for investigation of this part of the subject:

Densities of Varieties of Steel.

Wootz, by Pearson	7.181
" " fused	7.2
" " forged	7.647
Soft steels, *minimum*, by Karsten	7.6224
Wootz, by Henry	7.727
Col. Wade's *minimum* for cast steels	7.729
Soft blister steel, by Rinman, *minimum*	7.751
Soft steels, *maximum*, by Karsten	7.8131
Wootz, by Rammelsberg	7.822
Bessemer steels, mean of 7, by Buchner	7.837
Chrome steels, mean of 12, by Bauer (said to contain *no carbon*)	7.839
Wade's *maximum* of cast steels	7.862
Bessemer steels, mean of 10, by Koppmayer (0.55 of carbon)	7.863
Bessemer ingot, by Beland	7.866
" " "	7.8851
" steel, *maximum* of 6, by Buchner (0.11 of carbon)	7.8718
" " " 10, by Koppmayer (0.14 of carbon)	7.922
Soft cast steel, by Elsner	7.93
Soft blister steel of Rinman, *maximum*	7.991
Remelted cast steel, of Elsner	8.0923
Rolled Bessemer rails, by Beland, mean	7.9828
" " " densest part	8.408(?)

To the above may be added some records of the changes of density during tempering. Réaumur and Rinman stated that an expansion of volume occurs during tempering, of $\frac{1}{48}$th part: but this was doubted by Karsten. It has since appeared that steel sometimes becomes heavier and sometimes lighter when tempered, though generally lighter. The following figures have been collected for this work:

	Before tempering.	After tempering.
Fused wootz, Pearson	7.2	7.166
Steel tempered 30 times successively, by Caron	7.817	7.743
Cement or blister steel, *minimum*, Rinman	7.751	7.553
" " " *maximum*, "	7.991	7.778
Styrian steel	7.782	7.822
Cast steel, Elsner	7.9288	7.6578
" remelted	8.0923	7.7647
Common steel, Pearson	7.79	7.67
Hammered steel, A. Riche	7.839	7.735
" " "	7.846	7.749
" " "	7.839	7.738
" " "	7.841	7.843
" " "	7.839	7.845
" " "	7.841	7.843

HENRY WURTZ.

Steril'ity, an incapacity for procreation, whether in the male or female. A knowledge of the causes of sterility implies a knowledge of the laws of conception. Generation is effected in both the animal and vegetable kingdoms by the conjoint action of male and female germs. In animals the male and female are twain. In the vegetable kingdom this is sometimes so, but usually the male and female elements are found in juxtaposition in the same organism. In man and other animals the semen of the male must be brought into direct contact with the ovum of the female to ensure fecundation; but if the semen should be wanting in any of its essential constituents, conception cannot occur, and the male is said to be sterile. If the male, by cause of old age or other influences, is incapable of performing the part allotted by the laws of nature, he is said to be impotent, and therefore sterile. But the male may be able to perform in the most complete manner the sexual act, and yet be incapable of procreation, because the semen may not possess zoösperms, without which fructification is impossible. This deficiency may be natural or acquired. A man may be born with but one testis (monorchid), and then as a rule it does not secrete zoösperms (those strange microscopic animalcules, full of a vigorous instinctive activity, destined to be nourished and developed into the future man, in which we are compelled to recognize the

FIG. 1.

Spermatozoa: *a*, human; *b*, of rat; *c*, of *Menobranchus*.

commencement of the mysterious incarnation of soul in matter). Or he may have two, but they may be so imperfectly developed as to remain always in the cavity of the abdomen, as in the fœtus, and then the seminal fluid is deficient in the all-important property necessary for fecundation. This condition is also often acquired, and is then most generally the consequence of youthful indiscretion. Whatever produces an inflammation of the testes (orchitis) in the male may bring about such a change in the secretory apparatus of these organs as to destroy the vitalizing power of the semen. A fall or a blow on these glands may do this. But the most common cause is inflammation communicated to them by continuity of surface from the urethra, neck of the bladder, and vesiculæ seminales, sequels of urethritis (gonorrhœa). Not unfrequently this happens as a consequence of parotitis (mumps), where from cold or other cause the inflammation is suddenly translated from the parotid (salivary) gland to the testes. Any man who has suffered from orchitis from any of these causes may suspect himself of incapacity for procreation, notwithstanding the normal strength of his animal propensities. He is not of necessity sterile, but he may well feel anxious about it till it is proven otherwise.

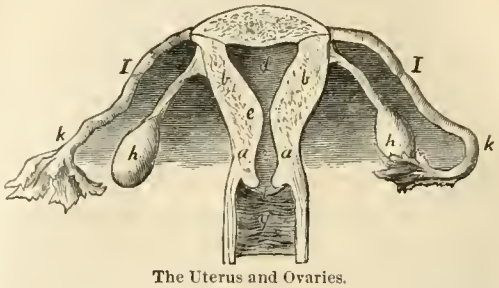
To determine the source of unfruitfulness in any given case it is necessary to inquire into the condition of both male and female: (1) Is the male competent to perform the sexual act? (2) Is the female competent for the married relation? (3) Does the seminal fluid possess zoösperms? (4) Do these pass into the canal of the neck of the uterus? (5) Is the mucous secretion of this canal fit for the viability of the zoösperm? The first point is ascertained by a question, the second by examination; the other three can only be determined by the microscope. A drop or two of semen taken from the vagina or the neck of the uterus soon after coition and placed under the microscope will show the presence of zoösperms in great abundance if the secretion is normal and suitable for fecundation. But if these are wanting, then fructification is impossible. This condition is found oftener in men than is generally supposed. It is sometimes curable, often incurable. A man may be sterile or incapable of procreation at one time, and by appropriate treatment under favorable circumstances he may possibly regain the lost power. But the removal of this incapacity in the male is not generally so successful as the removal of the obstructive causes in the female.

If we find that the male is capable of performing the sexual act even feebly, and if we find the seminal fluid in a normal state or full of living zoösperms, we may take it as proven that the fault does not lie with the male; and we then proceed to inquire into the aptitude of the female for conception.

We have said that to ensure conception the zoösperm of the male must be brought in direct contact with the ovum of the female. We must then determine what obstacles intervene to prevent this important junction. To fully comprehend these points, some idea of the physiology of conception, based on a knowledge of the anatomical relations of the female generative organs, is necessary. These organs are external and internal. The latter only will here engage our attention. They are the vagina, uterus, ovaries, and Fallopian tubes. The vagina is the canal leading from the external organs to the neck of the uterus. The uterus is the organ for the reception and maturation of the ovum till the full term of parturition. The ovaries are the source of the ova, without which there can be no conception. The Fallopian tubes serve to conduct the ova from the ovaries to the cavity of the uterus. Conception can only occur during menstrual life. As soon as the female menstruates she is capable of conception. It has often taken place at the early age of ten years. It is possible as long as menstruation continues, even irregularly. It has often occurred at the age of fifty-two, and even at fifty-five. It is said to have occurred as late as the sixtieth year, but these cases are not based on sufficiently well-authenticated facts.

Fig. 2 shows a longitudinal bilateral section of the uterus and vagina, with the ovaries and Fallopian tubes on the sides. The uterus is a hollow muscular body, pear-shaped, slightly flattened antero-posteriorly, nearly three inches long, an inch and three-quarters in its broadest transverse diameter, and an inch and a quarter in its antero-posterior diameter. It is nominally divided into two portions—the cervix or neck *a a*, and the body *b b*. The cavity of the uterus *c d* is called the utero-cervical canal, and is about two inches and a half long. The upper portion *d* is the true cavity of the uterus, from which the menses flow. It is about an inch and a quarter long, and perhaps an inch wide at the top, where the Fallopian tubes enter. The lower portion *c* is called the cervical canal, is somewhat elliptical in shape, about an inch and a quarter long, and one-third of an inch in its broadest diameter. The narrowest portion *e*, where the cervical canal *c* becomes continuous with the cavity of the uterus *d*, is called the os internum. The outer orifice of this canal *f* is the os tincæ. The vagina *g* is the membranous canal leading from the ex-

Fig. 2.



The Uterus and Ovaries.

ternal organs to the neck of the uterus; *h h* the ovaries, one on each side, floating in the cavity of the abdomen, with a membranous attachment to the body of the uterus; I I the Fallopian tubes leading from their fimbriated extremities *k k* up to points near the top of the uterus on each side, where they enter the cavity *d* of this organ.

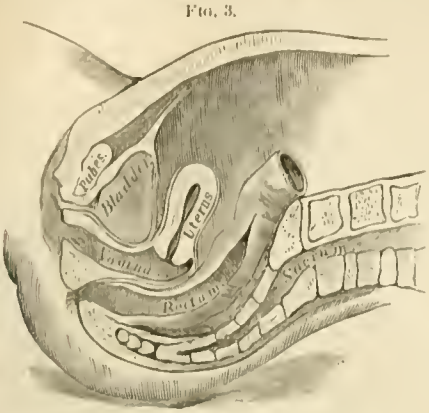
Thus understanding the anatomical relations of these several parts of the female generative apparatus, we can more easily comprehend the physiology or laws of conception, and by consequence the causes operating to produce the sterile condition. Menstruation may be taken as a sign of the fitness of the female for conception. Near the period of each menstruation a vesicle (or two or three in case of twins or triplets) in the ovary *h* swells, bursts, and discharges an ovum, which is grasped by the fimbriated extremity *k* of the Fallopian tube I, and is slowly carried along the canal of said tube into the cavity of the uterus *d*, where, if it meets with the vitalizing zoösperm of the male, it becomes a living organism, attaching itself to some portion of the walls of the womb, where it grows and develops till at the fulness of time a child is born. But if, when the ovum reaches the cavity of the uterus, it does not encounter the male zoösperm, then it passes off as effete material with the secretions that belong to the uterine cavity. The duration of the passage of the ovum along the Fallopian tube, which is only large enough to admit a bristle, varies from two to six days. Conception usually occurs within the ten days following menstruation, but it may occur at any time between the menstrual periods. The zoösperm, entering the cavity of the uterus and not meeting the ovum, sometimes finds its way along the Fallopian tube, and occasionally encounters the ovum on the surface of the ovary or in the fimbriated extremities of the Fallopian tube, where, if the ovum becomes vitalized, it attaches itself to the neighboring parts and begins to grow, and we then have what is termed extra-uterine pregnancy, which endangers the life of the woman. If this occurs in the canal of the Fallopian tube, we have tubal pregnancy, which is equally dangerous. Fortunately, these cases are not of frequent occurrence.

With this knowledge of the laws of conception we can better understand the operation of causes that interfere with them, thus producing the sterile condition. Whatever obstructs the passage of the ovum from the ovary to the cavity of the uterus, and whatever obstructs the passage of the zoösperm to the same, are causes of sterility. Some of these are incurable, while many are amenable to treatment. If menstruation is normal, we take it for granted that ovulation is normal—that the ovum is at the regular time discharged from the ovary and starts on its way to the cavity of the womb. But some previous pelvic inflammation may have obstructed the Fallopian tubes or bound down their fimbriated extremities, so as to prevent them from fulfilling their functions in conducting the ovum to the cavity of the uterus. This state of things we can hardly hope to diagnose with accuracy or to treat with any degree of certainty. Our efforts at diagnosis and treatment must therefore be directed mainly to the state of the uterus itself, or to such conditions of it as are capable of preventing the passage of the zoösperm to the cavity of the uterus.

Fig. 3 represents a vertical antero-posterior section of the pelvis (lower part of the body), with the female generative organs contained therein. The uterus is here shown in its normal position, in the middle of the pelvis, standing at about right angles with the axis of the vagina, the os tincæ pointing toward the extreme end of the sacrum (end of the spine), while the top of the organ points toward the umbilicus. Any marked and permanent deviation of the uterus from a normal position, whether anteriorly, posteriorly, laterally, or by descent, may, and does at times, interfere with conception. When the body of the uterus falls far forward, on the bladder, toward the pubes (or cross-

bone in front), it may so displace the os tincæ or produce such a degree of congestion in the whole organ as to prevent the zoösperm from reaching the cavity of the uterus.

Fig. 3.



The Female Generative Organs.

It is then important to remedy this malposition, with its consequences, before we can ensure the desired result. When the body of the uterus falls far back under the hollow of the sacrum, pressing upon and obstructing the rectum, it must be restored to its normal position and kept there. Fortunately, this can be done in a great majority of cases, and with considerable facility and certainty. Lateral malpositions and descent may require the same attention and the same nicety of rectification. But a more frequent cause of the sterile condition is found in the neck and cavity of the uterus. The cavity of the uterus may contain a tumor or polypus, which must be removed, or it may be in a state of inflammation (endometritis), which must be cured. Again, the mouth of the uterus (os tincæ) may be so small that the semen cannot enter it. Then it must be enlarged by surgical means, either by forcible dilatation with bougies, etc., or by incision, which is easy enough in the hands of the skilled practitioner. Abnormal curvature of the neck of the womb is a frequent cause of sterility. It is sometimes, indeed often, curved almost or quite to an angle instead of being comparatively straight, as shown in the diagram. And when this is not complicated with the presence of a fibroid tumor or other adventitious growth, it may be remedied, and is often easily and promptly cured, by surgical means.

But perhaps the most frequent of all the well-recognized causes of sterility is an abnormal condition of the secretions found in the utero-cervical canal. The mucus of the cervical canal examined from the third to the tenth day after the end of menstruation should be translucent, clear as the white of a new-laid egg, without any opaque or milky-looking spots. But even when it presents to the naked eye all the characteristics of a normal secretion, it may not be so. The microscope can alone determine this point, and for this purpose it is necessary to remove a drop or two of mucus from the cervical canal with a suitable instrument a few hours after sexual intercourse, and then place it under the microscope. If we find living zoösperms in abundance twenty-four hours or more after coition, we can safely pronounce the case one capable of conception. But if we find the zoösperms all dead or in a dying state, then we know that there is some abnormal condition of the utero-cervical canal which gives rise to the abnormal secretion. A healthy secretion is the result of a healthy state of the secretory organ; a diseased secretion is evidence of a deranged state of the apparatus producing it. We must here, then, continue to investigate, and to treat the diseased condition of the utero-cervical canal till its mucous secretion is restored to a normal state, which will be proven only when we find that it is favorable to the viability of the zoösperms. This deranged state of secretion in the utero-cervical canal is often found where the general health is perfect. While it seems to be local, requiring mostly local remedies, constitutional treatment is not to be overlooked. We now see that the causes of sterility, in most cases, can by the light of science be accurately determined, and that many cases may be entirely remedied. A few years ago we knew comparatively nothing on this subject, but now it is no longer a question wrapt in doubt and darkness, for almost every case is capable of explanation, even when incurable. (See also REPRODUCTION.) J. MARION SIMS.

Ste'venson (ALAN), son of Robert, b. at Edinburgh, Scotland, 1807: educated at the University of Edinburgh; subsequently studied natural philosophy under Sir John Leslie, and for the profession of a civil engineer in the office of his father, with whom he entered into partnership. In 1843 he succeeded his father as engineer to the commissioners of northern lighthouses, to which his subsequent practice was confined. Among many other important improvements in lighthouse apparatus, he introduced the dioptric system in 1836. Of the many lighthouses designed and constructed by him, the "Skerryvore" was his chief work (see LIGHTHOUSE CONSTRUCTION), an *Account* of which he published; also a *Treatise on Lighthouse Illumination;* contributed articles "Harbors," "Lighthouses," etc., to the *Encyclopædia Britannica*, and various scientific articles to *Edinburgh Philosophical Journal*, etc. The emperor of Russia and the kings of Prussia and Holland bestowed medals upon him in recognition of his services as a lighthouse engineer. Fellow of the Royal Society of Edinburgh, member of the British Institution of Civil Engineers, etc. D. at Portobello, near Edinburgh, Dec. 23, 1865.

Stock'ton (JOHN P.), son of Commodore Robert F. Stockton, b. at Princeton, N. J., Aug. 2, 1826: graduated at Princeton College 1843; was licensed to practise law 1846; was a commissioner to revise the laws of New Jersey, and subsequently reporter to the court of chancery; published 3 vols. of equity reports (Trenton, 1856–60); was minister resident at Rome 1858–61; was chosen U. S. Senator as a Democrat in 1865 for the term ending in 1871, but was unseated for alleged informality in the election after holding the position more than a year, and was subsequently Senator 1869–75, after which he returned to the practice of his profession, and took an active part in the Presidential campaign of 1876.

Stoichiom'etry [from Gr. στοιχεῖον, "element," and μέτρον, "measure"], "that department of chemistry which considers the numerical relations of atoms. All calculations, therefore, which can be made from the atomic weights and volumes are stoichiometrical calculations." (Barker's *Chemistry.*) *Illustrations:* (1) Silver is weighed as silver chloride (AgCl); to deduce the weight of silver from 1.312 grammes AgCl, the following equation is used:

Molecular weight.		Atomic weight.		Absolute weight.		Absolute weight.
AgCl	:	Ag		AgCl	:	Ag
108 + 35.5	:	108	=	1.312	:	
143.5	:	108	=	1.312	:	0.987 Ag

This expresses the fact that as 143.5 AgCl contain 108 Ag, then 1.312 grammes AgCl contain 0.987 gramme Ag. (2) For determining the strength of an alkali a standard acid is used in measured solution, the process being called titration. 1 molecule of nitric acid (HNO_3) is diluted to 1000 cubic centimètres. The molecular weight of HNO_3 being 63, each c. c. contains 0.063 of the acid. One molecule of sodic hydrate NaOH is 40. To test a sample of sodic hydrate, weigh out 4 grammes, for example: dissolve in water; add litmus, and run in from a graduated burette the standard nitric acid till the alkali is exactly neutralized. If the sodic hydrate is pure, 100 per cent. in strength, it will require $\frac{40}{63}$ $\frac{1}{10}$ of a molecule of nitric acid, or 100 c. c. of the standard acid. If it is only 80 per cent. sodic hydrate, it will require 80 c. c. Thus, using 4 grammes of the commercial article, the number of c. c. standard acid required will indicate at once the percentage of sodic hydrate. (See Josiah P. Cooke's *Chemical Problems and Reactions;* Karl Stammer, *Sammlung von chemischen Rechenaufgaben;* Albert Frickhinger, *Katechismus der Stoechiometrie;* G. F. Barker, *Textbook of Chemistry;* and the article CHEMISTRY.) C. F. CHANDLER.

Stomiat'idæ [from *Stomias*—στόμα, "mouth"—the typical genus], a family of fishes of the order Teleocephali and sub-order Isospondyli, distinguished by the enormous gape (whence the name), combined with other characters. The species are all elongated and of a club-shaped form, tapering from before backward; the skin is naked, or covered with very thin and readily-deciduous scales; the lateral line is indistinct; the head is oblong, with the snout short and rounded; eyes large and anterior; opercular apparatus imperfectly developed and very oblique; mouth with a very deep lateral cleft; upper jaw with its margin formed by the supramaxillary as well as intermaxillary bones; teeth on the jaws acute, and often barbed; palate sometimes toothed, sometimes unarmed; branchial apertures very deep and continuous below; branchiostegal rays numerous (12–17); dorsal fins variable, according to subfamily; anal fin very far behind and small; caudal distinct; pectoral fins low down on the scapular arch, and narrow; ventral fins inserted far backward. The stomach is cæcal, and pyloric appendages are wanting (at least in *Stomias*). The ovaries have oviducts, and consequently the eggs are discharged directly through them into the water. The air-bladder appears to be absent. The family is composed of a few species, which are of rather small size (all being considerably less than a foot in length), and inhabitants of the open sea and deep water. At present only eight species are known, all of which have been obtained from the At-

lantic Ocean and the Mediterranean Sea, and many doubtless remain to be discovered. The forms differ much as to the dorsal fins, the Stomiatinæ having a single dorsal, which is directly opposite the anal, and the Astronesthinæ having two dorsal fins, the first of which is rayed and opposite the interspace between the ventral and anal fins, while the second is adipose and opposite the anal. The first has three genera (*Stomias*, *Echiostoma*, and *Malacosteus*), and the second one (*Astronesthes*). THEODORE GILL.

Stone'-borer, a name applied to certain species of bivalve or conchiferous mollusks belonging to several distinct families (Pholadidæ, Gastrochænidæ, Saxicavidæ, Veneridæ, Petricolidæ, and Mytilidæ) which have the faculty of perforating stone. Most of them belong to the order Dimyiaria, and have the mantle behind prolonged into siphons, but otherwise they differ considerably. Only the differences in the shells can, however, be here noticed.

The Pholadidæ have a shell which gapes more or less in front as well as behind, to accommodate the large animal, and is generally divided externally into two regions (an anterior and posterior), characterized by differences of sculpture: the hinge-margins are usually reflected, and there are generally, also, one or two dorsal or umbonal valves. The cartilage is small and internal; the ligament external. The anterior surface of the shell is provided with a rasp-like armature. Species in greater or less number are found on almost every coast.

The Rocellariæ (family Gastrochænidæ) have a shell which also gapes at the two extremities, and which is irregular and inequivalve. The surface is rugose. The ligament is external and small, the hinge edentulous. The living species are confined to the Eastern seas.

The Saxicavæ (family Saxicavidæ) also possess a shell which gapes somewhat at the anterior and posterior extremities, but the valves are not differentiated into distinct regions of sculpture, but simply concentrically striated and folded and rugose. The cartilage is external and well developed. The species are very generally distributed.

The Rupellariæ (family Veneridæ) have shells which gape backward, but not forward, and which are concentrically plicated and striated on their outer surfaces; the ligament is external; the hinge armed in one valve with two, and in the other with three, small diverging teeth. The species are quite widely distributed.

The Petricolidæ have shells which gape posteriorly, and which are covered with a hard, thin, and often muricated epidermis; the ligament is external and short; the teeth in the hinge generally two, but often in part rudimentary or atrophied. Species are very generally diffused in the different seas.

The Lithodomi or Lithophagi (family Mytilidæ) have shells which are of a finger-like form (hence a typical species is called *Lithodomus dactylus*), and have closely-fitting valves, whose surfaces are generally provided with a fine reticulated or file-like sculpture; the ligament is marginal and chiefly internal, the hinge toothless. The species are common in most tropical and subtropical seas. These belong to the order Heteromyiaria.

Such are the several types of stone-borers. It will be seen that they have scarcely any one character in common, and it is possible that their excavations into rocks may be effected in different ways. It is, however, tolerably certain that most, at least, effect their labors by mechanical means and by grinding away the rock with the anterior portion of their shells. This is frequently muricated or file-like. M. Cailliaud, a French naturalist, who long ago investigated the subject, experimented with the shells of Pholadidæ, and by rotation of the valves excavated a burrow such as the living animals might. (See also Robertson, *Rep. Brit. Assoc. Adv. Sc.*, 1872.) An Italian naturalist, Signor C. Caramagna, has also (1870) made confirmatory observations on the Lithodomi. He observed the *Lithodomus lithophagus* make its appearance at regular intervals at the entrance of its cavity, and then let itself drop with an audible noise to the bottom. "In the fore part of many specimens there can be traced spots which have been injured, and have been repaired by the animal; which tends also to prove the mechanical action of the burrowing. In a mole built only seven years ago specimens of a length of 13 millimètres and 11 in circumference have been found." (*Bull. Mal. Ital.*, iii. pp. 46–19, quoted in *Zool. Rec.* for 1870, p. 177.) Some of the species (Pholadidæ and Rocellariæ) form tubes or linings to their burrows, in which they live (and hence were combined by Lamarck under the name Tubicola), while others live in the simple burrows excavated. The species are liable to do great damage by excavation into piers, etc., and gradually breaking them down, although there appear to be no marked instances on record. The columns of the temple of Serapis at Puteoli (Pozzuoli) are frequently alluded to as having been perforated by "stone-borers," and their burrows indicate the former position of the columns in the water. Some species may be found in brackish or almost fresh water; *Martesia fluminalis*, *e. g.*, is a species of Pholadidæ which is found in creeks of the delta of the Irrawaddi River in India, and bores in the soft argillaceous sandstone of the banks. (See Blanford, *Journ. As. Soc.*, n. s., ii. p. 67, 1867.)

Besides the mollusks thus enumerated, species of worms and echinoids also excavate stone, and to that extent are also "stone-borers." THEODORE GILL.

Stone'man (GEORGE), b. at Busti, N. Y., Aug. 8, 1822; graduated at the U. S. Military Academy in 1846, and entered the 1st Dragoons, which he joined at Fort Leavenworth, from whence he conducted a supply-train to Santa Fé, New Mexico, where he became acting quartermaster of the Mormon battalion, which he accompanied to California in 1847, remaining actively engaged on the Pacific coast until 1855, in March of which year he became a captain in 2d Cavalry, and served mainly, until 1861, in Texas, and was in command at Fort Brown when ordered to surrender by order of Gen. Twiggs in February, but refused to do so, and evacuating the fort reached New York in a steamer chartered for the purpose; promoted major 1st Cavalry May, 1861, and served on the staff of Gen. McClellan in W. Virginia until Aug. 13, when appointed brigadier-general of volunteers and chief of cavalry of the Army of the Potomac, which branch he organized and commanded during the Virginia Peninsular campaign of 1862; succeeded to command of Kearny's (1st) division, 3d corps, on the death of the latter, and of the 3d corps, Nov. 15, 1862; promoted major-general of volunteers Nov. 29, 1862, and led his corps at the battle of Fredericksburg; commanded cavalry raid to Richmond Apr.–May, 1863; chief of cavalry bureau July, 1863–Jan., 1864; in command of 23d corps Jan.–Apr., 1864; of cavalry corps department of Ohio Apr.–July, 1864, participating in the Atlanta campaign May–July, 1864; conducted a raid for the capture of Macon and Andersonville and liberation of prisoners, but was compelled himself to surrender July 31, and held prisoner until Oct. 27; in temporary command of department of Ohio Nov., 1864; conducted raid to S. W. Virginia Dec., 1864; in command of various districts and departments until mustered out of volunteer service Sept. 1, 1866. Became colonel 21st Infantry July 28, 1866; brevetted colonel, brigadier and major general for gallant conduct; retired from active service Aug. 16, 1871.

Stough'ton (EDWIN W.), LL.D., b. at Springfield, Windsor co., Vt., May 1, 1818; came to New York in 1837; became in 1839 a contributor to *Hunt's Merchants' Magazine*, and was admitted to practise in the Federal courts and in the superior court of New York in 1840, and in the supreme court in 1841; commenced immediately practising in the city of New York, and acquired soon a large and very important practice. Some of his most remarkable successes have been achieved in the trial of extremely difficult and intricate patent cases. He was counsel and advocate on the Republican side before the Electoral Commission, after which Hayes and Wheeler were declared elected. Appointed U. S. minister to Russia 1877 and resigned in 1879.

Stra'chey (RICHARD), served in the Sutlej campaign 1845–46, on the staff of Sir Henry Smith at battles of Alsival and Sobraon; appointed to the Bengal engineers in 1836, and promoted to major-general 1871; was nominated a member of the council of the governor-general of India in 1868; acted as assistant secretary in the public works department 1869, and appointed member of the council of the secretary of state for India in 1875.

Strong (JAMES WOODWARD), D. D., b. Sept. 29, 1833, at Brownington, Orleans co., Vt.; graduated at Beloit College, Wis., in 1858, and at Union Theological Seminary, New York, in 1862; was ordained Sept. 28, 1862, and commenced his ministry at Brodhead, Wis. After two years he went to Faribault, Minn., where in Jan., 1866, he was installed pastor of the Plymouth Congregational church; in 1870 became the first president of Carleton College (then called Northfield College), at Northfield, Minn.; subsequently the duties of professor of mental and moral philosophy were also assigned to him.

Submarine Blasting. For a general description of the preparations for and mode of submarine blasting see HELL-GATE and BLASTING, in CYCLOPÆDIA.

Sunday-School Union. See AMERICAN SUNDAY-SCHOOL UNION.

Sur'gery. The term "surgery," or "chirurgery," as it was formerly written (χείρ, the "hand," and ἔργον, "work"), at once suggests the province to which this branch of the healing art was once restricted, and the source from which our earliest information regarding it is derived. For, while the investigations of Oriental scholars indicate traces of a knowledge and practice of this art in yet earlier

civilizations, our first definite traditions regarding it, and first collected body of doctrine, come from the Greeks. They looked on surgery as that branch of the healing art that administered to injuries or diseases by the hand alone, the employment of instruments, or the use of topical remedies. It has been maintained that therapeutics must be coeval with mankind, and those who accept the theory of evolution, and have studied the manners of existing savage tribes, and observed the habits of highly-organized inferior animals, will not hesitate to assign a yet more remote origin to the healing art. It is altogether probable, also, that in antiquity of origin surgery must take precedence of medicine, since attempts to assuage the pain or to remove the inconveniences of wounds or injuries resulting from external violence would be likely to be made before internal diseases were in any degree understood or supposed to be within the control of human means. Baron Percy has remarked that, while the internal diseases of mankind were still ascribed to the anger of the gods, and the smoke of expiatory sacrifices ascended from altars, surgeons had already become renowned by bold and salutary operations; and is inclined to attribute the origin of this art to the first occasion when some one, pierced by a foreign body, invoked the aid of a skilful comrade for its removal; remarking that in ancient times it was sufficient to extract adroitly darts or arrows, and to place on the wounded part some soothing balm, in order to be reckoned a benefactor of humanity entitled to divine honors (Homer, *Iliad*, lib. xi.). Percy is even inclined to admit with Sextus Empiricus (πρὸς τοὺς μαθηματικοὺς ἀντιῤῥητικοι, lib. i. cap. 2) that the word ἰατρὸς, or *medicus*, denotes the primitive function of the medicine-man, and that it is derived from ἰός, signifying *sagitta*—an opinion from which modern Sanskrit scholars would probably dissent. Students of the recently-revived Sanskrit literature, and those who have sought to decipher the inscriptions of Egyptian and Assyrian ruins, find some grounds for the belief that surgery was more advanced among those ancient peoples than is commonly supposed, pictures and *bassi-rilievi* having been found displaying surgical instruments and operations not unlike many in use in modern times. We can be sure, at least, that the custom of embalming the dead, which implies some anatomical and surgical knowledge, was prevalent in very early times, and that among the Jews the operation of circumcision was practised by divine command through many ages. The Asiatics and Egyptians were the preceptors of the Greeks; and Dujardin in his erudite *History of Surgery* has carefully traced the channels through which information was transmitted to a more gifted and brilliant nation. He would accept Plutarch's account, that Agenor, a Phœnician king, practised surgery with distinction, dressing the wounded arm of a son of Priam, and devising the scarf or sling now almost indispensable in many injuries of the upper extremity. Chiron, the Thessalian centaur, is more generally accredited the father of surgery in the fabulous ages of Grecian history. He was celebrated for his knowledge of plants and skill in applying soothing herbs to wounds and bruises. His reputation is eclipsed by that of Æsculapius, a son of Apollo, by some reckoned the pupil of Chiron, by others his contemporary and superior, believed to have been deified fifty years before the Trojan war, although skeptics have called his very existence in question. That his temples in Epidaurus, Cnidos, Cos, and Pergamus became the repositories of surgical knowledge is a respected tradition, and that he was esteemed the most venerable authority in surgery we are assured by the testimony of Celsus. In the dim light of fable we discern that Jason, Theseus, and Hercules practised surgery, and that Epione, the wife of Æsculapius, as well as Medea, proved that women thus early not only shared with men the perils of war, but aided in repairing its ravages. A Thracian king, Orpheus, had such knowledge of the virtue of plants that he cured a woman bitten by a snake, whence arose the fable that he had rescued her from hell. The Greeks, prodigal in apotheosis, made many demigods partly because of their achievements in the healing art. Two sons of Æsculapius are not inconspicuous among the heroes of the *Iliad*. Homer always names Podalirius the first, but it appears that Machaon was the elder and most celebrated, and that his precedence is sacrificed to the exigencies of the poet's verse. Menelaus, wounded by an arrow from Pandarus, and Philoctetes, struck by a poisoned javelin, are cured by the skilful Machaon; and Pausanias records that the Messenians, over whom he reigned, raised a temple in his honor. Podalirius, his brother, though much praised for his surgical skill in the Trojan war, has no important cures circumstantially ascribed to him, except that of the daughter of Damœtus, king of Caria, whom he bled from both arms when she was stunned by a fall, and, on her survival, married her, receiving the province of the Chersonese as a dowry. Hence the origin of phlebotomy is attributed to this surgeon, although Pliny (*Hist. Nat.*, l. viii. cap. [illegible]) refers this remedial means to the lower animals. The surgical attainments of these sons of Æsculapius seem not to have extended further than the extraction of darts, the suppression of hæmorrhage by pressure or styptics, and the application of lenitive salves. When the warriors at the Trojan siege sustained fractures of the bones, Homer tells us that recourse was had, as when pestilence arose, to invocations to the gods. Thus we find surgery developed amid the contentions of men, and practised by those who were themselves warriors. As Lucretius tells us (lib. v. 1282), men fought first with their teeth and nails, and with clubs and stones afterward:

> "Arma antiqua manus, ungues, dentesque fuerunt,
> Et lapides, et item sylvarum fragmina ramei;"

and then swords and lances were employed, and arrows and javelins, and then the more effective projectiles devised in the progress of the art of methodically and gloriously destroying life.

Surgery may boast of a noble origin, since the earliest accounts we have of its practice refer it to one of the most generous sentiments of humanity, that sympathetic benevolence which inspires pity for the suffering and an anxious desire to alleviate their pain.

For six centuries after the Trojan war we have little information of any advances in surgery. In common with other branches of knowledge, it was passing through that theological stage in which the intervention of supernatural powers is recognized rather than the scope of human possibilities. The infancy of the art in every nation is the same; the priests of India, the magi of Egypt, the jugglers of China and Japan and of the savage tribes of the two hemispheres, combine, with their manual interference, mysterious practices on which their cures are supposed mainly to depend. It was thus with the Asclepiadæ, or reputed descendants of Æsculapius. They supplemented their ignorance by appeals to the gods, founding temples, delivering oracles, receiving gifts, and doing nothing for the progress of their art. Kurt Sprengel has minutely described this stationary period in the history of medicine and surgery, and Dr. John Watson, in a discourse before the New York Academy of Medicine in 1855 on the *Medical Profession in Ancient Times*, reviewed it with equal conciseness and erudition. In the course of this long monopoly of the Asclepiadæ schools for the instruction in such surgical information as the professors possessed or were willing to impart were established about the temples, and the schools at Rhodes, Cnidos, and Cos became distinguished. Real achievements in surgery appear to have been known during this period, such as cutting for the stone and operating for cataract, although these advances were discredited by the priests, as suitable only for specialists of the baser sort. Empirical improvements were all that were possible, since there was an almost complete ignorance of anatomy, save notions of the human skeleton derived from practice in fractures and luxations, and vague ideas of the relations of the viscera from examination of the lower animals or through instructions from the Egyptians, enlightened by their practice of embalming. It was not until Pythagoras brought the light of philosophy to bear upon the practice of the healing art that the way was paved toward raising its dignity in the direction of positive knowledge. The school that he founded at Crotona not only produced surgeons of distinction (among others, Damocedes, who, made captive by the Persians, treated Darius with a dislocated ankle and his queen Atossa with a cancer of the breast), but also inspired the schools of Cnidos and Cos with the philosophic spirit, so that, a century later, there appeared in the latter that splendid genius, Hippocrates. Born in the 80th Olympiad, about 460 years before the Christian era, a contemporary of Socrates, this great man did much to free medicine from the absurdities with which superstition and ignorance had surrounded it, and through a long and honored life gave a noble example of persevering industry, of philosophical research, and of lofty moral worth. His attention was more turned to medicine than to surgery, yet in the latter branch his practice was bold and decisive. It was with him a maxim that when medicine failed recourse should be had to the knife or to fire, and he used courageously the cautery and knife. He commended some operations that are even now hardly approved as ordinary surgical resources, such as tapping the chest for empyema, nephrotomy for calculus lodged in the kidney, and trepanning the skull for headache. He was familiar with cataplasms and venesection and cupping; with operations on ranula, nasal polypi, and ganglia; with the treatment of piles and fistules by ligature; with tapping in dropsies, advising even paracentesis in hydrocephalus; with all the surgical procedures known in his day except the operations for lithotomy and cataract, which seem to have been con-

fined to specialists. He gave rules, for the most part rude and cruel, for the reduction and treatment of dislocations and fractures, and anticipated a multitude of the practices that have been vaunted by the moderns. He had the privilege of the friendship of Democritus, that happy sage, and on his death was commemorated by a statue of gold voted him by the inhabitants of Argos, and by almost universal tributes and honors. For many generations after Hippocrates surgery made little progress. The religious prejudices that forbade the dissection of the human body precluded the acquirement of any definite knowledge of anatomy, and there was a barren interval of several centuries. Of the more immediate successors of Hippocrates, Diocles of Carystus was one of the most prominent in surgery. He devised sundry bandages, especially for wounds of the head, and improved the *beluleon*, an instrument for extracting arrow-heads and darts, invented during the Peloponnesian war. Praxagoras of Cos is reported to have been a very bold surgeon, incising the fauces freely in cases of cynanche, and laying open the abdomen for the removal of intestinal obstructions. The labors of Aristotle had probably some influence in promoting the healing art; but we look in vain for any practical important advance until, on the dismemberment of the great empire of Macedonia, the chief centre of learning was transferred to Alexandria, and the Egyptian school took its rise (B. C. 300). Herophilus of Chalcedon and Erasistratus were the most conspicuous leaders of the Egyptian school. The former was a pupil of Praxagoras. He was the first to direct attention to the radial pulse as an index of the varying conditions of health and disease. According to Fallopius, he held as an anatomist among the ancients the same place as Vesalius among the moderns. Marx of Göttingen in 1840 published an elaborate analysis of his labors. That he dissected human bodies is expressly asserted by Galen. That he even dissected living criminals has been generally credited, the Carthaginian father Tertullian, with evident exaggeration, declaring that he made not less than 600 such examinations. Dr. Marx is satisfied that he discriminated nerves of motion from those of sensation; that he described the occipital depression now known as the "torcular Herophili" as the point at which the sinuses of the dura mater converge; distinguished the cerebrum from the cerebellum; and named the *calamus scriptorius* of the medulla oblongata, and the *duodenum*, and also carefully dissected the tunics of the eye and originated the term *retina*; and came near anticipating Aselli in the discovery of the lacteals, recognizing their relation with the mesenteric glands. Yet he fell into palpable mistakes, confounding the tendons and ligaments with nerves, and possibly the trachea with the aorta. Erasistratus, a native of Chios, who had studied philosophy under Theophrastus, is also greatly distinguished as an anatomist, but his erroneous interpretation of the function of the arteries, overthrown by Galen, retarded the discovery of the circulation, reserved for the illustrious Harvey. Erasistratus is reported to have been a very bold surgeon, not hesitating to excise portions of the liver and of the spleen. The invention of a metallic catheter is ascribed to him. He decried drugs, and insisted on the utility of diet, bathing, regimen, gymnastic exercises, and other hygienic resources as therapeutic measures. Xenophon of Cos, a pupil of Erasistratus, is said to have been among the first to restrain hæmorrhage from the limbs by tightly encircling the member with a ligature. Mantius, another pupil, devised many complicated surgical dressings. Philoxenus wrote extensively on surgery, and Andreas invented machines for reducing luxations. All of the surgeons of the Alexandrian school seem to have had a predilection for complex dressings and apparatus. Among them the practice of lithotomy, as in the times of Hippocrates, seems to have been relegated to specialists. One of them, Ammonius, surnamed *Lithotomus*, invented an instrument for crushing vesical concretions too large to be extracted through the ordinary incision—what would now be called a lithoclast—and hence is erroneously accredited with anticipating Civiale in the invention of the lithotrite, an instrument for crushing stone without a cutting operation. As Dr. John Watson well remarked in his anniversary discourse, already cited, the brightest era in science at Alexandria was the earliest. The leaders felt the impulse of Aristotle's teachings in natural history, and of those of Euclid and his great associates in scientific investigation at the Museum under the protection of the Ptolemies. Their successors seem to have been incapable of appreciating and following the road that was opened to them. Philinus and Serapion, and the surgeon from Bithynia who assumed the name of Asclepiades, and is sometimes reckoned the founder of surgery in Rome, and Themison, added nothing to the stock of knowledge, abandoning dissections, wasting time over futile discussions on the materia medica, or in vain speculations that they essayed to dignify by calling themselves Dogmatists, Rationalists, Methodists, and Eclectics.

From the time when the empire of the world was transferred to Rome until the reign of Augustus there appeared no surgical practitioner or writer of note until Aulus Cornelius Celsus. Tryphon, Euelpistus, Themison, Archagathus, and Meges—the latter graciously noted by Celsus as "the most learned of them all"—are among the few whose names have left a trace in history. Asclepiades by insinuating manners acquired the favor of the patricians, and even the friendship of Cicero, his influence leading the great orator to proclaim the dignity of the healing art, and to make the oft-quoted declaration, that "nothing brought men nearer to the gods than by giving health to their fellow-creatures." Asclepiades originated the famous surgical aphorism, "Officium esse medici, ut tuto, ut celeriter, ut jucunde curet." Yet he appears to have been but a clever charlatan, adding nothing to the real knowledge of his profession. But little scientific advancement in surgery could be looked for among the slaves, freedmen, and Greek adventurers into whose hands the practice of the art fell in those days. Yet we owe to this period a compendium of surgical knowledge which is by far the most valuable contribution to the subject that has come down to us from ancient times. Of the numerous writings of Celsus, the eight books *De Re Medica* are alone preserved. The last four books treat exclusively of surgery. With equal sagacity, erudition, and impartiality the author sums up all of value that was known on this subject to the Greeks in the great school of Alexandria and among his immediate predecessors and contemporaries in Rome. He advises the amputation of limbs affected by gangrene, pronouncing the operation very dangerous, as subjects frequently died in the course of it, either from bleeding or shock, but declaring that it was the only means of saving life, and giving excellent precepts for the performance of the operation. The method of lithotomy he describes is still regarded as of value, especially in children. He gives rules for the removal of cataract by depression, for forming an artificial pupil, and for the recognition and reduction of several varieties of hernia. The diagnosis and treatment of fractures and luxations he treats of judiciously and in detail. He is thought to have been the first to point out ruptures of the intracranial blood-vessels unattended by fracture. In the twenty-sixth chapter of his fifth book occurs the remarkable passage in which he advises that the bleeding from a wounded vessel, if it cannot be otherwise restrained, shall be controlled by two ligatures, placed one above and the other below the bleeding point. He recommended the ligature also in varices and hæmorrhoids. But it would be an endless labor to particularize. Not only the value of his subject-matter, but the purity and elegance of his style, have made the works of Celsus classical and immortal. Not many authors have said so much in a few words. A contemporary of Virgil, Ovid, and of Horace, who is supposed to refer to him (*Ep. I.*, iii. 15), his literary art is as conspicuous as his erudition and sound judgment. No Latin writer has been more fortunate in his editors. Rhodius, Almeloveen, Casaubon, Morgagni, Daremberg, and Targa—the latter devoting his life to this object—are among his illustrious commentators. Morwitz (*Geschichte der Medicin*, Leipsic, 1849) enumerates over sixty Latin editions of his work, and there are annotated translations of it in the principal modern languages. Aretæus of Cappadocia practised in Rome in the latter part of the first century. The earliest use of blisters by means of cantharides is ascribed to him. Dr. John Watson (*op. cit.*) regards him as "one of the most original and elegant writers of antiquity." He treated chiefly of medical topics, but his surgical was in keeping with his medical ability. His instructions on catheterism and on lithotomy are interesting; he opened hepatic abscesses and used the trephine for the cure of epilepsy. Heliodorus, the medical adviser of Trajan, was the author of some good observations on injuries of the head. Rufus of Ephesus is said to have been the first to tie successfully an artery for an aneurism at the bend of the elbow caused by venesection. He left a treatise on diseases of the bladder. Archigenes wrote on surgery, but his writings have been lost. No great surgical writer appeared from the time of Celsus to that of Galen, toward the close of the second century. He was a surgeon at Pergamus (A. D. 165), and afterward practised his profession at Rome. Dazzled by the prevalent taste for philosophical systems and speculations, he gradually neglected surgery, yet his commentaries on various surgical subjects are of value, and he indirectly aided surgical science by making a step toward the knowledge of the circulation of the blood, as Flourens has well shown in his history of that great discovery. According to Kühn, he prepared not less than 300 separate papers, several on surgical topics. His essay on bandaging shows that he was well acquainted with even the minor details of the art

as then practised. While he had a great contempt for theological superstitions, and individually exercised great freedom in intellectual inquiry, it must be admitted that he founded a school imbued with such reverence for professional authority that it hindered rather than advanced the progress of surgical knowledge.

After Galen, in the third century came Antyllus, who was a bold and successful surgeon. He recommended extraction for hard cataract, but cautiously, advising the operation only when the cataract was small. He also suggested arteriotomy in place of venesection in some cases, arguing that there was not risk of excessive bleeding, since the hæmorrhage might be controlled by cutting the vessel completely across. In this slight outline of the historical development of surgery we might pass without notice several centuries of the Byzantine era, which was most unfavorable to the advance of the sciences—surgery in particular making little progress, or indeed occasionally retrograding. We owe to this period, however, an encyclopædic performance by Oribasius (326–403 A. D.), a pupil of Zeno and friend of the emperor Julian, at whose request he compiled, in seventy-two books, all that he considered of value in the medical and surgical literature then extant. Seventeen of these books, with some fragments, have come down to us, and have lately (1851) been edited in magnificent style by Daremberg under the auspices of the French minister of public instruction. Oribasius was a judicious and honest compiler, prefixing to each chapter the names of the authors from whom it was abridged or textually copied. His observations on operations on the urinary organs and on fractures and luxations are of value. He alludes to the partial or bent fracture of the long bones of children (willow fracture)—an observation for which the erudite Malgaigne accredits Lanfranc, a surgeon of the thirteenth century. The next surgical writer commonly thought worthy of mention, after a lapse of nearly two centuries, is Aëtius (550 A. D.). One of the earliest and best historians of the art of healing, Dr. Freind, says that "in his chirurgical pieces there are many things worth taking notice of." He was a compiler for the most part, and a compiler who made no acknowledgment of what he copied; but Freind insists that he sometimes speaks from his own experience, as in his chapter on castration, in which he tells much that is neither in Celsus nor in Galen. He was the first Greek medical man of prominence to embrace Christianity, and the bias of his religious ideas is clearly indicated in his writings. If a foreign body is arrested in the gullet, and the surgeon has vainly exhausted every means of extracting it, he must turn the patient on the side, and, exhorting him to attention, say, "Come forth, as Lazarus from the sepulchre, or Jonas from the whale's belly!" In bites of bees and wasps a disk of iron, "engraved with the venerable image of the cross of Christ," will, according to Aëtius, "avert any inflammation." Costly Aldine and other editions of his sixteen books have been printed by Cornarius, Montanus, and others, but they have now little interest save as illustrating the influence of Christianity on the progress of medicine and surgery. After the decadence of the sciences in the second century, when magic, astrology, thaumaturgy, and theurgy conspired to bring about a blind dogmatism that paralyzed the pursuit of knowledge, very few surgeons freed themselves from the dense ignorance that surrounded them. Alexander of Tralles (570 A. D.), however, though not uncontaminated by the vices of his time, appears to have been an independent thinker, and at the close of a long and useful career wrote from his own experience with such sound judgment that the work in twelve books he has bequeathed to us is a valuable relic. Paulus Ægineta, who was a professor at Alexandria about the time (640 A. D.) of its final subjugation by the Saracens, had the good fortune to write a compendium of the healing art which is more circumstantial than any that has reached us, even that of Celsus. The excellent translation by Adams, published by the Sydenham Society, has made the work familiar to English-speaking surgeons. The sixth book is esteemed the best body of surgical knowledge prior to the revival of letters; and the reputation Paulus still enjoys is based on this treatise. Although in his preface he says that "it is not because the ancient writers had omitted anything relative to the art that I have composed this work, but in order to give a compendious course of instruction," he wrote from his own experience as well as that of his predecessors. In lithotomy he advised, after exploring by the rectum, an incision to the left of the raphe, or the modern lateral operation, instead of the median incision of Celsus. He discriminated aneurism by anastomosis, and performed ablation of the mamma, laryngotomy, and herniotomy in strangulation. He first treats of fractures of the patella. He was pre-eminent as an accoucheur, and is reputed to have devised the procedure of embryotomy. He was indeed surnamed *Obstetricus*. Though he was not devoid of the slavish prejudices of his day, we have reason to be grateful to him for transmitting much valuable information. He was the last of the Alexandrian school of any note. Freind and Le Clerc can discover no other Greek or Roman surgeon of mark until the beginning of the twelfth century, when Actuarius is mentioned as practising with distinction at Constantinople, where he compiled several surgical treatises that contain no vestige of original research. With the decline of the vast communities that composed the Roman empire and its relapse into barbarism, the best of the surgeons "were content to reverence what they had neither the skill to equal nor the temerity to set aside."

In the seventh century, contemporaneously with the vast achievements and conquests of the followers of Mohammed, learning was gradually communicated to the Arabians, and for the next five centuries we must look for anything noteworthy in surgery in this direction. At the medical schools early founded by the munificent caliphs the works of the great Greek authors were translated and studied, and some teachers of prominence appeared, as Mesue and Serapion; but these were pure physicians, and no writer distinguished in surgery arose until Rhazes (852–932 A. D.), who practised and taught at Bagdad at the close of the ninth and beginning of the tenth century. He was the first to describe spina bifida. He cauterized the bites of rabid animals. He gave a better account of hernia than his predecessors. He seems to have had little confidence in ophthalmic surgery, for when he was old he had cataract, but could not be induced to submit to an operation. Numerous editions of his writings have been printed at Venice, Bâle, and Paris. Hally Abbas lived at the end of the tenth century, and was a voluminous writer. He was surnamed "the Magician," because of the extent of his attainments. His work on surgery, which is preserved, presents scarcely anything new. In tapping for ascites he preferred to puncture in the linea alba, and he used caustics for the cure of hydrocele. Avicenna (980–1037 A. D.), educated in the schools of Bagdad, acquired an extraordinary distinction, but his *Canon* is esteemed by the best critics a servile compilation: and, as Bostock says, he seems to have regarded a familiarity with Aristotle and Galen as the ultimate aim of a physician or philosopher. The most important to surgery among the Arabian celebrities is Albucasis (1110 A. D.). The edition of his *Chirurgia* by Channing of Oxford is still consulted, and contains the most complete view we have of the knowledge of surgery that then existed. He seems to have abused the actual cautery, and enthusiastically extols the surgical virtues of fire. He employed the cautery to suppress hæmorrhage, and styptics likewise, but also complete division of the vessel, and even the ligature. He was the first, apparently, to remark the occlusion of a divided artery by a coagulum. He practised enterorrhaphy, and invented a probang for dislodging foreign bodies from the gullet, and an instrument for operating in lachrymal fistula. These and various other instruments he figures in his writings. He disapproves, fond of operating as he was, of interference with cancerous tumors, saying that he never cured, or saw cured, a single instance of the disease. After Albucasis arose two notabilities of the Saracenic school, who were natives of Spain, yet wrote in the Arabic language. Avenzohar (1162 A. D.), a Jew, practised at Seville in Andalusia, and his compendium entitled *Thaisnyr*, though mainly a compilation, contains some original matter. He describes abscess of the mediastinum, and a case of suppuration of the kidney with discharge of fourteen pints of pus. He treats judiciously of fracture involving the hip-joint, and of wounds of the blood-vessels. Freind, Sprengel, and others regard him as an improver of his art, yet he spoke of lithotomy and kindred operations as "filthy and abominable, and unfit for any man of character to perform," and can hardly be admitted as one of the promoters of surgery. His pupil, Averroës (1198 A. D.), a native of Cordova, achieved a great reputation. Dante mentions him in canto iv. of the first part of the *Divine Comedy*. He was an obsequious follower and copious commentator of Galen. His principal work, the *Universal*, passed through many editions in Hebrew and Latin, and was republished at Venice in the seventeenth century. Yet it contains not a single permanent addition to knowledge, and may be considered the last of the dregs of the Arabs. It is reported in the *Deutsche Zeitschrift für Chirurgie* for 1873 (B. ii. p. 263) that a manuscript of 336 quarto pages, by an unknown author, was discovered in 1863 in the library of the University of Madrid, which gives an extended view of the Arabic treatment of wounds, including shot wounds by missiles of iron and stone. In a prize-essay by Dr. Don Antonio, entitled *Memoria sobre el Origen y Vicissitudes de la Terapeutica que han usado los Cirujanos españoles en las Heridas de Arma de Fuego* (Madrid, 1863), it is claimed that the nature and treatment of shot wounds are judi-

ciously discussed in this parchment, and that it dates from the closing part of the fourteenth century, or shortly after the introduction of gunpowder in warfare. Should the date and authenticity of this manuscript be established, it would be the earliest treatise on shot injuries extant. Neither Arnold of Villanova nor Guy of Chauliac mentions these injuries, and priority in adverting to them has, until lately, been ascribed to the German surgeon Heinrich von Pfolsprundt (1460 A. D.), whose manuscript, *Buch der Bündth-Ertzney*, was printed in 1868 by Haeser and Middeldorpf. The contempt with which the Saracenic school has been regarded in Christendom seems not altogether undeserved. The works of its most eminent teachers are characterized by a horror of the effusion of blood and of human dissections, and a passion for endless multiplication of instruments and appliances and for the mechanical parts of surgery, and a want of any enlightened spirit of improvement. They appear to have calculated the efficacy of surgery by the richness of its arsenal, but every mechanic knows that the skilful workman is not often changing his tools. In polypharmacy they excelled the professors of materia medica and nostrum-vendors of the present day. They seemed anxious to inspire terror rather than confidence, and the employment of boiling pitch for the suppression of bleeding is due to them. They have been praised for transmitting the works of the Greek masters, but there is reason to believe that even Averroës knew their classics only through translations, and, making them poorer by additions, conveyed to posterity only enormous compilations. It may be said, however, that by the systematic division of the medical art into physic, surgery, and pharmacy they made a certain progress; and the best of them, Albucasis, rendered service by figuring in his text the surgical instruments known in his day. The intellectual darkness that surrounded the neighboring nations accounts for the credit ascribed to the feeble illumination of the Saracens. For several centuries we find among the successors of the Greeks and Romans no name in surgery to arrest our attention by association with improvements either in theory or practice. The only attempts worthy of notice are in connection with the schools established at Salerno and Monte Casino, which maintained their prestige until the thirteenth century, when they were eclipsed by the rising reputation of the schools of Bologna and Paris (Freind, p. 355–357; Eloy, art. "Salerne;" Lauth, p. 291; Ackerman, cap. xxxi.). The origin of the school of Salerno is not well ascertained, though it was probably founded by Charlemagne in 802. It had already some renown in the eleventh century, and was a resort for crusaders of all nations passing between Europe and Palestine. It is chiefly remembered by a poem in rhyming Latin verse on the "Preservation of the Health" (*Regimen Sanitatis*), addressed to Robert of Normandy, a son of William the Conqueror. It attained the dignity of a university, and initiated the scholarly titles "magister" and "doctor." When Constantinus Africanus, a Benedictine monk from Carthage, arrived here (1087), expelled from Babylon as a sorcerer, he found preferment at court, but caring more for repose than social distinction, he retired to Monte Casino and occupied himself with translating the Greek and Arabian medical writings. Most of the Italian surgeons of the thirteenth century whose names have left any trace in the history of the art appear to have derived their knowledge from one or the other of these schools. The first of these in date is Rogerius of Parma (*circa* 1206). His *Chirurgia Magna* was long a textbook in Italy. It is but a servile compilation from the Arabs. He practised enterorrhaphy, even in cases of complete division of the intestine, attempting to unite the divided surfaces by direct apposition over a cylinder of elder-wood. His disciple, Roland Capelluti, professed surgery at Bologna (1264), and composed a voluminous commentary on the work of his preceptor—whom he far surpasses in erudition—citing the Greek classics as well as the works of the Arabians. In a case of hernia of the lung he excised the protruding part, and the patient survived. Another disciple of Rogerius was Jamerius, who is described by Guy of Chauliac as a brutal and eccentric surgeon, but is placed by Peter of Argelata among celebrated operators of his time. Great obscurity envelops the history, and even the names, of the Four Masters, to whom are ascribed some important improvements in surgery, especially a method of suture of wounded intestines which still holds a place in the art. According to Devaux, they were four monks living at Paris in the time of Lanfrancus (at the close of the thirteenth century), devoting themselves to good works. According to others, they were four teachers of surgery, who professed in four languages—Magister Salernus in Latin, M. Pontus in Greek, M. Abdallah in Arabic, and Rabbi Elimus in Hebrew. Weber and others believe that Rogerius, Jamerius, Theodoric, and William of Salicet are the four teachers referred to under the designation of the Four Masters. The little evidence extant gives most plausibility to the first of these conjectures. Manuscript copies of their voluminous work on surgery existed in the seventeenth century at Avignon and at Paris, and some fragments are said to be still preserved in the Bodleian Library at Oxford; but the work was never printed, and the opinions of these skilful masters are known to us only through citations in the works of their contemporaries. Hugo of Lucca (d. 1252) is regarded as the founder of the Bolognese school. He is said to have been an experienced practitioner, rather than a man of erudition. He reduced a luxation at the hip of a year's standing in a man of twenty-five. He used alcoholic lotions largely as topical applications to wounds. After Hugo came Brunus of Longobucco, a professor at Padua (1262). He composed a *Chirurgia Magna*. He approved of dry dressings to wounds. He was familiar with the translations of the Greek and Arabian authors then known in Italy. His works are printed in the Venetian collection of 1499. Theodoric of Cervia, a pupil—and, according to Tiraboschi, a son—of Hugo of Lucca, expounded the views of his predecessors. He was confessor to Pope Innocent IV., and afterward (1266) bishop of Cervia, but he resided in Bologna, and amassed great wealth by the practice of surgery. His *Chirurgia*, in four books, describes the practice of Hugo, but he quotes much from Brunus. A folio edition was printed at Bergamo in 1498. Theodoric is accredited with having substituted soft and simple bandages and splints in fractures for the cruel appliances in vogue in his day. He used dry applications or desiccating lotions in dressing wounds. According to Guy of Chauliac, the Italian surgeons of this period may be classified in two schools. One, with Rogerius, Rolandus, Jamerius, and the Four Masters as its exponents, treated all wounds and ulcers by emollient fomentations and cataplasms; the other, in which Hugo, Brunus, and Theodoric were conspicuous, employed dry dressings or desiccating lotions. William of Salicet (born at Piacenza in 1210) practised in armies, and at Cremona, Pavia, and Verona, and finally went to Bologna and lectured on surgery; and there (June 8, 1275) completed his work on surgery. It is much more complete than the writings of his contemporaries and immediate predecessors. Writing at the close of a long life, he speaks from his own experience. He is the first Italian surgeon who treats at any length of the surgical affections of women. Nicholas of Fernham, after teaching surgery at Bologna, returned to England in 1241 as bishop of Durham, but wrote nothing. Gilbertus Anglicanus (1290) appears to be the first English writer on surgery. There is a Venetian edition (of 1510) of his poor compilations. In 1271, Pitard founded the college of St. Côme at Paris, which was the origin of the academy of surgery that became so famous in later years. Pitard was a man of eminence in his day, and his observations on wounds of the head and on poisoned wounds are still remembered. The thirteenth century is conspicuous as the era in which most of the great European universities were founded—Padua in 1221, Salamanca in 1222, Naples in 1224, Vienna in 1237, Oxford in 1249, Cambridge in 1257, Upsala in 1277, Lisbon and Coimbra in 1290, and Bologna in 1295. Surgical writings were preserved at these seats of learning, but the professors wore the philosophical robe and were enslaved in a blind devotion to the systems of Galen or of the Arabs, and even men of intellect could not free themselves from the prevalent mental servitude. Manuscripts were very rare and very costly, and were for the most part in the hands of the clergy. In the middle of the thirteenth century they were forbidden by an edict of the Council of Tours from causing the effusion of blood for the purpose of healing bodily ailments, although bloodshed for the suppression of heresy was not interdicted. Thus, the practice of surgery fell into the hands of the uneducated laity, and reached a deplorable abasement. Lanfrancus, a Milanese and a pupil of William of Salicet, is generally regarded as the creator of surgery in France. Implicated in the contests of the Guelphs and Ghibellines, he fled to Paris in 1295, and there practised with high reputation, and composed his *Chirurgiæ* (*parva et magna*)—works still consulted. He was the first to speak of the healing of wounds by "first intention." Malgaigne, in his charming introductory chapter to the works of Paré, speaks with enthusiasm of the services rendered the profession by Lanfrancus. At this time flourished Master Jehan Ypermann (1295–1350), lately styled the father of Flemish surgery, whose manuscript treatise on the art was discovered and published as late as 1854 by the medical society of Ghent. During the fourteenth century surgical science was dead in Italy. Rienzi states that Bartolomeo de Varignana dissected human bodies in 1290. Mondini de Lucci also publicly dissected at Bologna the cadavers of two women, braving the prejudices of his time, and published an anatomical work illustrated

by wood-engravings (1325). His efforts to revive anatomical studies were followed by Nicolo Bertrucci. But civil disorders ruined the Italian universities, and thirty years later Petrarch lamented the utter decay of their ancient splendor, and Boccaccio, visiting the library of Monte Casino, found the doors and windows overrun by herbs and vines and the books buried in dust. A few of the more ambitious students went to pursue their studies in France. Early in the fourteenth century John of Gaddesden, after studying at Montpellier, practised surgery with success at Oxford, and composed his *Rosa Anglica*. John of Ardern flourished in Newark about 1350, and later removed to London. He compiled voluminously, but a treatise on *fistula in ano*, published in 1588 by John Reed, is the only one of his writings that was printed. Contemporaneously with the removal of the papal see to Avignon the neighboring school of Montpellier acquired a reputation that cast all its rivals in the shade. Guy of Chauliac practised in Avignon in the middle of the fourteenth century with renown. He is accounted "one of the revivers of the languishing art," and his numerous works on surgery are still consulted. In them we find the first mention of the Cæsarian operation and the only account of the writings of some authors whose works are lost. He operated on the king of Bohemia for cataract without success, but the heroic blind old man nevertheless led a charge against the English at the battle of Cressy, ordering his horse to be fastened to those of two of his noblemen. Guy is esteemed a bolder surgeon than Lanfrancus. Ackerman declares that his *Grande Chirurgie* embraces all of value written on surgery up to its epoch. Pre-eminence in surgical knowledge seems to have passed from Salernum to Bologna, and thence to Montpellier. The latter school, fostered by the neighboring papal court at Avignon, was enriched by manuscripts from both Spain and Italy. Guy possessed the works of not less than eighteen Arabian authors, and had the good fortune to obtain the sixth book of Paulus Ægineta, then unknown in the West. He made good use of his materials. He made no discoveries of much moment. The special forms of the knives and cauteries he invented are forgotten, and his treatment of indolent ulcers by binding on them a leaden plate is perhaps the only innovation of his that is remembered; but he was thoroughly familiar with the surgical information accessible in his day. His definition of the essentials of a good surgeon is classic. He should be "lettered, expert, ingenious, and fertile in resources—bold when sure, but wary in doubtful and dangerous circumstances. He should avoid all doubtful or discreditable practices, and should be gracious to his patients, kindly to his colleagues, wise in his prognosis. He should be chaste, sober, compassionate, merciful; not covetous or extortionate, regulating his remuneration according to the service rendered, the ability of his patient, the result of the case, and his own dignity." These words indicate the character of the man, and worthily re-echo the precepts of Hippocrates and of Celsus. Guy of Chauliac in preparing his writings enjoyed one great facility denied his predecessors. Prior to his time, parchment or silk or papyrus had been used for manuscripts, but early in the fourteenth century began the manufacture of paper from rags. The exact date of that invention and the name of the inventor are unknown, but Tiraboschi states that at the middle of the century paper was fabricated at Padua, and afterward at Treviso, by a certain Pax de Fabiano, whom he styles *primus inventor* (t. v. lib. i. cap. 4). Guy makes no mention of gunshot wounds, although artillery was used in the defence of fortified places early in the fourteenth century, and field guns were employed at the battle of Cressy (1346). The frightful injuries inflicted by these new weapons would naturally attract the attention of all observers interested in surgery. In the latter part of the fourteenth century the school of Montpellier rapidly declined. Both Italy and France were desolated by contending factions; the library of Guy was scattered. Balescon of Taranta, a Portuguese professor who succeeded to the chair of surgery, laments the loss of the works of Paulus, Rufus, etc. Balescon (or Valescus, as his name is sometimes Latinized) is said to have first advised the employment of mercurial ointment for the removal of lice and other parasitic vermin. In the fifteenth century the discovery of the art of printing (c. 1450) rendered the accumulated stores of knowledge more accessible, and surgery shared in the impulse given to the sciences. On the capture of Constantinople by Mohammed II. (1453), Christians fleeing from the city brought to Western Europe many manuscripts of the Greek writers, which were printed and slowly disseminated. A copy of Celsus was discovered in 1443 at Milan; three manuscripts of Paulus were found about the same time, together with some Greek versions of Hippocrates and Galen. Nicolo Falcucci (d. 1412), or Nicholas of Florence, a contemporary of Balescon, compiled voluminously on surgery, borrowing from the same sources as Guy of Chauliac, but with less discrimination. Peter of Argelata (1493) professed surgery at Bologna, where a statue was erected in his honor in the amphitheatre of the university. He dissected and embalmed the body of Pope Alexander VI. His work, still occasionally referred to, is creditable only when considered in relation with the abased condition of surgery in Italy in his day. Leonardo Bertapaglia (1429) is said to have practised human dissections, and to have brought a certain lustre upon the chair of surgery at Padua. He wrote on ulcers and wounds, and enumerates twenty-two kinds of punctured wounds by darts and arrows. He seems to have first described the tenaculum. Among other Italian surgeons who in some measure aided in the progress of surgery may be mentioned Guainerius, professor at Pavia, who wrote on diseases of the joints; his successor, Matthew of Gradi, and Bartolomeo Montagnana (1444), professor at Padua, who wrote on hernia, and first distinguished that variety of ventral hernia that protrudes through the linea alba. Arculanus also (1427) taught with credit at Verona and Ferrara, and devised several kinds of trusses and an instrument for extracting foreign bodies from the ear. He ligated the spermatic vein in varicocele, and wrote judiciously of ectropion. Marcellus Cumanus was a surgeon in the Venetian army in 1495 at the invasion of Charles VIII., and treated harquebuse wounds with boiling oil, regarding them as poisonous. Antonio Benivieni, a Florentine nobleman (1460), is probably the first writer treating systematically of morbid anatomy. He dissected two cases of coxalgia, an affection which J. L. Petit is sometimes supposed to have first described. Sprengel has hardly done him justice. Nicholas Colnet and Thomas Morstede were the chief surgeons attending Henry V. in his invasion of France (1415). Heinrich von Pfolsprundt, after participating in the great war in Poland in 1451, wrote his *Buch der Bündth-Ertzney*, containing an early observation on shot wounds. He describes a rhinoplastic operation, anticipating Taglicozzi by a century. From 1467 to 1500 a large number of medical and surgical works were printed at Venice, and a few at Rome, Paris, Strasbourg, London, Oxford, and in Spain and Portugal, and made available for general circulation. Hieronymus Brunswig (b. 1430) published a treatise on the *Handwerckung der Wundartzney*, which was translated into English, and was one of the earliest works relating to medicine, if not the earliest, *printed* in that language. In 1480, Colot, a French surgeon in favor with Louis XI. of France, performed lithotomy successfully on a condemned criminal; and this operation, previously abandoned to itinerant quacks, became a part of the legitimate practice of surgery. With the revival of letters and of the natural sciences in the sixteenth century a new era dawned on surgery. Observation and experimental investigation gradually reassumed their proper places, students slowly perceiving that they could not equal their predecessors by a servile following in their footsteps. Investigation of anatomy in the true spirit was undertaken by Vesalius (1513–61). Senac compares his great work with the discovery of the New World. Fallopius (1532–62) and Eustachius (1520–79) worthily succeeded this founder of modern anatomy. Fabricius of Acquapendente (1537–1619), a pupil of Fallopius, was the teacher of William Harvey (1578–1675) the immortal discoverer of the circulation of the blood. Gasparo Aselli (1581–1626) followed with the discovery of the lymphatic vessels. The way was thus paved for advances in surgery, which, illuminated by science, became a worthy pursuit for men of talent and education. Preceded by John de Vigo (1520), who still believed shot wounds poisonous, and by the Swiss surgeons Hans von Gersdorf (1520) and Felix Würtz (1576), who have left original observations of value, the latter being reputed the first surgeon who ventured to amputate in the thigh, appears Ambrose Paré, the founder of the modern French school, and reckoned the ablest of early army surgeons. He made authority yield to observation or sought to reconcile them. If not the inventor, he was the restorer of the art of securing arteries by ligature after amputation—an advance which alone sufficed to secure for him immortality. Though originally a barber-surgeon, he became the counsellor of four kings of France, and acquired such esteem that "his mere presence in a besieged town was enough to reanimate the garrison. 'We are saved,' exclaimed the defenders, 'for Paré is with us.'" Dr. O. W. Holmes terms him "the great king-honored, man-loving, God-serving chirurgeon." Brantôme tells us that on the horrible night of the St. Bartholomew massacre his reputation saved his life. The weak and cruel Charles IX. concealed him in a closet in his apartments, remarking that, although he was a Protestant, "it was unreasonable that one who could save a whole city should be thus massacred." This great man subjected the works of his predecessors to sharp criticism, and rejected the farrago of problematical remedies with which they had encumbered the

art. He had great reliance on the restorative powers of nature. "*Je le pansay et Dieu le guarit*" is the significant expression from his writings inscribed on the bronze statue by David (d'Angers) in the courtyard of the School of Medicine at Paris. His first work, on harquebuse wounds, was of 1545; other surgical writings appeared in 1551. His complete works were collected and published by his pupil, Guillemeau, in 1582, and have passed through many editions in many languages. (For further details of the life of this illustrious surgeon the reader must turn to the biography by the erudite Malgaigne, prefixed to the latest edition (Paris, 1840) of the works of the master.) Pigrai of Cremona succeeded Paré in his high dignities, and received great praise from his contemporaries. Morwitz accredits him with instituting ambulance-wagons, an advance in medico-military administration usually ascribed to Larrey in the present century. He gave a poor Latin synopsis of his master's writings. Guillemeau, besides editing Paré, distinguished himself in operative midwifery. In Italy at this period appeared several treatises on shot wounds. Maggius wrote *De Vulnerum Bombardorum et Sclopetorum Curatione* at Bologna in 1552. Ferrius published the next year a work on shot wounds at Lyons; and Rota, a professor at Bologna, followed on the same subject in 1555. These writings are printed in the Gesner collection (Tiguri, 1555). The authors shared the prevalent notions regarding the poisonous nature of gunpowder and actual "ustion" produced by the ball. The work of Leonardo Botal on the cure of shot wounds (Lyons, 1560) is, after the writings of Paré, the most valued of the treatises on shot wounds of this period. Carcanus of Milan (1573) and Berengarius of Carpi (1550) published original but little-known treatises on injuries of the head. Marianus Sanctus of Barletta, near Naples (1550), suggested improvements in lithotomy, and Tagliacozzi published in 1597 at Venice his treatise on plastic operations. The English surgeons of this period are not conspicuous. Thomas Gale, who served in 1544 with the army of Henry VIII. at Montreuil, published (1563) the *Institution of a Chirurgeon* and a treatise on gunshot wounds, which had the merit of denying the poisonous nature of such injuries. J. Hall (1561) also treated of shot wounds. John Woodall, who served in France in 1589, and was afterward surgeon-general of the East India Company's forces, published a *Military and Domestic Surgery*. W. Clowes, a naval surgeon, wrote (1591) a *Proved Practice in Burnings by Gunpowder*. Peter Lowe, who served in France and Flanders, printed (1597) an *Army Surgery* that went through several editions. The work of Duchesne (*alias* Quercetanus) on shot wounds (1576) was translated into English. In Germany, J. Schenckius, professor at Freiburg (1531–98), compiled a voluminous work of rare surgical cases, which remains a mine of interesting information.

In the seventeenth century the impulse given to the sciences by the diffusion of learning led to further improvements. Cæsar Magatus, professor at Ferrara, simplified the treatment of wounds. His work (*De Rara Medecatione Vulnerum*, Venice, 1616) is still consulted with advantage. Fabricius Hildanus of Berne (1560–1634), by some styled the father of German surgery, was a man of great acquirements, but clung to old prejudices and amputated with red-hot knives. Gottfried Purmann of Breslau (1685) was an acute observer, who has recorded most interesting cases, especially in military surgery. Peter Marchetti of Padua (1589–1656) was also an industrious collector of interesting observations. Scultetus of Ulm (1595–1645) compiled a surgical armamentarium more complex than those of the Arabs. Richard Wiseman, surgeon to Charles II., has often been styled the true father of English surgery, but his *Severall Chirurgical Treatises* (1676) really contain no positive addition to the knowledge of the time. John Brown, another chirurgeon in ordinary to Charles II., a naval surgeon, published a *Discourse on Wounds, general and particular*, and a *Treatise of Gunshot Wounds*, at London in 1678—a work deduced from his practice in the navy in the Dutch war of 1665, in which he was severely wounded. Holland, restored to liberty in this century, furnished several good surgeons who promoted their art. J. J. Rau of Leyden was probably the most successful lithotomist on record. Palfyn (1649–1730) was distinguished for devising a new plan for intestinal sutures. The famous Ruysch of Amsterdam aided surgery by his anatomical discoveries. Roonhuysen (1663), by his operations for wry neck, may be regarded as the inventor of tenotomy. Van Meekeren and Barbette (1672) contributed important reports of cases, and Stalpart Van der Wiel (1688) collected a series of rare surgical cases which is a standard work of surgical reference. Solingen (1677) rivalled Scultetus in descriptions of complicated apparatus. Peter Verduin of Amsterdam proposed (1693) an important modification in the flap method of amputating the leg. In France the tourniquet was first used in amputations by Morel at the siege of Besançon (1674). The first printed reference to this instrument is in the rare *Currus Triumphalis à Terebintho* of James Young (or Yonge) of Plymouth, printed at London in 1679. Lowdham of Exeter and his friend Young dispute with Verduin priority in suggesting the flap method of amputation. Dionis (1690) figures Morel's tourniquet in his *Course on Operative Surgery*. Verduc of Paris (1685) wrote instructively on fractures and luxations. Frère Jaques improved the manual procedure of lithotomy. Belloste (1696) deserves credit for denouncing the abuse of tents and complicated dressings then in vogue; and Saviard for recording reports of interesting surgical cases. Earlier in the century Cabrol and Covillard of Montpellier had added many curious observations to surgical literature. Yet surgery was in a languishing condition in France, as exemplified by the oft-cited illustration that Louis XIV. could not find any one to treat rationally his anal fistule. Voltaire in his attempt to depict mental progress in what he calls the "most enlightened age ever known," and to enumerate those who promoted science, literature, and art, does not mention a single surgeon.

In the eighteenth century we find great advances in surgery, and the French surgeons in the front rank. J. L. Petit (1674–1768) occupies a proud prominence among the early educated writers on the art. His treatise on diseases of the bones is classic; his work on general surgery is still consulted with profit. He devised the screw tourniquet, esteemed for a century an essential appliance in amputations. Le Dran (1685–1773), with less genius, was an original and excellent author. His copious writings abound in practical wisdom. P. J. Desault (1744–95) is one of the great names in surgery. He was the first who taught, systematically, surgical anatomy. His improvements in the treatment of fractures are illustrated in the every-day practice of the present time. He substituted straight amputating knives for the formidable sickle-shaped weapon previously employed. He improved the procedure for ligating arteries, and proposed the plan for the cure of aneurisms by distal ligature that bears the name of "Brasdor's method." Dominic Anel of Toulouse (1678–1725) secured a permanent niche in the annals of surgery by first proposing the proximal ligature of the main trunk in aneurism. The majority of French surgical writers claim that he thus anticipated the discovery of Hunter. Most English writers, with some tinge of special pleading, maintain that the application of the ligature at a *distance* from the tumor, on a sound part of the vessel, is the distinctive feature of this improvement. The institution of the Royal Academy of Surgery at Paris (1731) had great influence on the advancement of surgery not only in France, but throughout the world. Its *Mémoires*, composed of contributions from the most eminent men, constitute a rich mine of information, which has been diligently worked by modern compilers, for the most part with scanty acknowledgment. The presidents, La Peyonie, La Martinière, and Maréchal, furnish judicious dissertations. The secretaries, Louis, Morand, and Hevin, contribute exhaustive discussions on a great variety of topics. Hevin may be regarded as the leading authority on wounds of the abdomen. Daviel, the oculist, Belloq, well known by his canula, Le Cat, the lithotomist, and Moreau, the founder of the practice of excision or resection of joints, are conspicuous among the specialists. Garengeot, Bagieu, Faudacq, Dufouart, and Quesnay were military surgeons whose writings may still be referred to with advantage. Sabatier, Chopart, and Hoin yet enjoy the highest reputation as authorities in operative surgery. Bordenave, Saucerotte, Boucher, and Andouillé are still quoted on gunshot wounds. The list of contributors includes many honored names in surgery besides these, as Brasdor, Tenon, Grima, Petit (the younger), Desormeaux, the obstetrician, La Faye, and Pipelet. Besides these academicians were many French writers who hold an honorable place in surgical literature. The works of Ravaton (1750), Pouteau (d. 1775), Hautesierk (1766), on military surgery are estimable, and Baron Percy, whose invaluable manual for the army surgeon was published in 1792, may be esteemed the foremost military surgeon between Paré and Larrey. De la Motte (1655–1735) compiled a systematic treatise on general surgery which is still an important work of reference. The name of Xavier Bichat (1771–1802) grandly closes this era in French surgery. The illustrious founder of general anatomy, the great genius who accomplished so much in his short space of life, commenced his career as a surgeon, and his earlier works are annotated editions of the teachings of his great preceptor, Desault.

In England surgery attained great eminence in this century. William Cheselden (1668–1752), Samuel Sharpe (1700–65), Percival Pott (1713–88), W. Bromfield (1712–92), Benjamin Bell (1749–1806), and the brilliant John

Bell (1763–1820), all secured a permanent place in the literature of surgery, while the illustrious John Hunter (1728–93), a philosopher as well as an anatomist and surgeon, is justly ranked with the greatest minds that have graced the profession. Munro (1697–1767) is indissolubly associated with the birth and fame of the Edinburgh school. C. White of Manchester (1770) rivalled the achievements of the Moreaus in France in excising the larger joints. Atkins (1734), a naval surgeon, Ranby (1711), surgeon to George II. at Dettingen, and Neale (1784) wrote on shot wounds, but their works are of little value. The latter attended the British troops that failed to subjugate the American colonies.

In Italy, Scarpa (1747–1832) by his researches on hernia and aneurism attained a high reputation. Bertrandi of Turin and Troja were progressive surgeons; and Morgagni (1682–1771), by his magnificent labors in pathological anatomy, lent great aid to surgery as well as medicine. In Spain the name of Gimbernat is eminent; Morraba y Roca (1725), Velasco (1793), and Villaverde (1788), Canivel (1789), and Queralto (1796), are mentioned as writers and prominent practitioners, but their works are little known outside of their own country. H. Callisen (1740–1821) is the most prominent surgeon of Denmark of the last century. His *Systema Chirurgiæ Hodiernæ* is often quoted.

Prof. Billroth laments that the names of the German surgeons of this century are insignificant. They brought what knowledge they had from Paris, and added little that was original. Heister (1683–1758), however, wrote a system of surgery that was translated into many languages and still enjoys a certain repute. Bilguer (1720–96), an illiterate military surgeon who sought to abolish amputations, made a noise only on account of his official position. Schmucker (1712–86) and Theden (1714–97) were good practical military surgeons. Mursinna (1741–1823) and Richter (1742–1812) are valued by students for their important collections of cases. Siebold (1736–1807) wrote respectably on surgical subjects. The encyclopædic Albert Haller (1708–77) was professor of surgery at Göttingen, and with Meckel (d. 1774), Wrisberg, and the excellent Sömmering (1755–1830) (whose anatomical labors must have indirectly advanced surgery) should shield the German school from any very disparaging comments.

"It is about the middle of this century," says the author of the excellent review of "Surgery" in the *Encyclopædia Britannica* (8th ed., 1859, vol. xx. p. 819)—a paper to which we have been much indebted in the preparation of this article—"It is about the middle of the eighteenth century that our attention is first attracted to our Transatlantic brethren. In 1763 lectures on anatomy and surgery were delivered in Philadelphia by Dr. Shippen, and in 1791 the medical school of that city was completely established under Benjamin Rush, the Hippocrates of Columbia—a school which has since lent invaluable aid to the progress of both medicine and surgery." Prof. Gross in his Centennial review of surgery (*American Journal of Medical Science*, 1876, vol. lxxi., p. 433) adds the names of John Warren (1753–1815), professor of surgery at Harvard, and of James Tilton (1745–1822), a surgeon of the Revolutionary war, and afterward (1813) surgeon-general of the army.

At the threshold of this century French surgeons are still in the foreground. Jean Dominique Larrey (1776–1842), the friend of Napoleon I. (who pronounced him the most upright man he had ever known), was an almost undisputed authority in military surgery in his time. He was an indefatigable writer, and his memoirs are still read with the greatest interest. Boyer (1757–1833) prepared a systematic treatise on surgery that was long a standard textbook. Delpech (1776–1832) taught surgery at Montpellier with nearly equal reputation. Dupuytren (1777–1835) may be regarded almost as the founder of a school. Many of the great French surgeons of the middle of the century were his pupils—the encyclopædic Velpeau (1795–1867), the erudite Malgaigne (1806–65), the audacious Jobert (1799–1868), Vidal (1803–56), the excellent systematic writer, and Nélaton (1807–73), and that solid surgeon, Goyrand of Aix; Roux (1780–1854) was Dupuytren's contemporary and rival. It would be endless to enumerate the eminent surgeons of the time. Lisfranc (1788–1847) acquired an unrivalled distinction in operative surgery. Cloquet (1790–1855) was renowned as a clinical teacher. Civiale (1794–1867) originated, and Leroy (1798–1861) improved, lithotrity. Bonnet of Lyons (1809–58) was among the first to treat in a scientific manner of diseases of the joints. In our own time we lament Follin (1823–67), one of the most solid of modern French surgeons. In Germany the advance of surgery, if not as brilliant, was relatively as decided. Kern of Vienna (1760–1829), Rust of Berlin (1775–1840), Von Walther of Munich (1782–1842), Graefe of Berlin (1787–1840), C. J. M. Langenbeck of Göttingen (1776–1850), Dieffenbach of Berlin (1795–1847), C. von Textor of Wurtzburg (1782–1860), all aided the progress of surgery by their writings, and several of them made important improvements in the art. At the commencement of the century the Vienna school in ophthalmology was pre-eminent. G. J. Beer (1762–1821) was perhaps its most distinguished representative. The great illustrator of military surgery in Germany, the illustrious Louis Stromeyer (1804–76), the worthy successor of Paré and Larrey, has just passed away after fifty years of brilliant professional service. He was one of the founders of modern conservative surgery in cases of injury. In Belgium, Seutin devised the method of treating fractures by starch bandages, which has led the way to the plaster treatment of the present time. In Italy, Assalini (1765–1840) and Porta acquired distinction. In Great Britain a succession of surgeons of the first merit rivalled their French contemporaries. The London school points with pride to Cline (1750–1827); to Abernethy (1764–1831), the original thinker and daring innovator; to Sir Astley Cooper (1768–1841), who became such an unimpeachable authority; to Wardrop, Earle, Stanley, Travers, Hodgson, Lawrence, and Aston Key; to Sir Charles Bell, admirable alike in physiological investigations, in surgery, in literature and art; to the ophthalmic surgeons Tyrrell, Saunders, and Dalrymple; and to the illustrious Sir Benjamin Brodie (1783–1862), at once philosopher and surgeon. In England, Colles, Carmichael, Jacob, and Bellingham are known by original researches, and Cusack and Crampton earned high reputations. Scotland may boast of Liston, the almost incomparable operator; of Miller, the sound systematic writer; of Syme, one of the most progressive and successful of modern surgeons; and of Sir J. Y. Simpson, the obstetrician, who introduced chloroform as an anæsthetic. The annals of English surgery in this century are further advanced by two names that will always be remembered in the front rank of military surgeons—John Hennen (1770–1829) and G. J. Guthrie (1785–1856). Worthy contemporaries of Larrey, their works will ever be read with reverence by students of army surgery. Hennen died of yellow fever at Gibraltar in the prime of life. Guthrie lived quite into our time, to encourage and guide the army surgeons in England's last great European war. There are many men now living who maintain the honor of British surgery at as high a standard as their predecessors. Prof. Billroth has justly remarked that in the scientific as well as the practical part of surgery England is now more advanced than any other country, and that from the time of Hunter to the present English surgery has had about it something noble.

In the U. S. in this century "great advances have been made in practical surgery" (*Billroth*). A pupil of John Hunter, Philip Syng Physick (1778–1837), is often styled the father of American surgery. He left no works to record his vast experience, but his views have been to some extent recorded by his nephew, J. S. Dorsey (1783–1818), the author of the first systematic treatise on surgery published in this country. Physick's ingenious practice in ununited fractures merits particular attention. His claims to priority in internal urethrotomy have hardly received sufficient appreciation. John Collins Warren of Boston (1778–1856) wrote a treatise on tumors, and was the first to perform (Oct. 16, 1846) an operation of importance on a patient anæsthetized by sulphuric ether. Valentine Mott (1785–1865) acquired an immense fame by his daring operations on the arteries. According to Prof. Gross, "no surgeon, living or dead, ever tied so many vessels, or so successfully, for the cure of aneurism, the relief of injury, or the arrest of morbid growths." Benjamin Winslow Dudley (1785–1870) of Kentucky had marvellous success as a lithotomist, and was noted for his dexterity in bandaging. Ephraim McDowell (1771–1830) of Kentucky first performed ovariotomy (1809). William Gibson (1788–1868) of Philadelphia was the first to tie the common iliac artery and to successfully repeat the Cæsarian operation on the same subject. Nathan Smith (1762–1829) of New Haven was a bold surgeon of indomitable industry and great versatility. T. D. Mütter (1810–59) was noted for his skill in the treatment of deformities. He bequeathed a valuable surgical museum to the Philadelphia College, with a liberal endowment fund. George Hayward of Boston (1791–1863), George W. Norris (1808–75) of Philadelphia, and J. Mason Warren (1811–67) of Boston were able hospital surgeons, whose contributions to the literature of the art are of permanent value.

As the middle of the century is approached the boundaries of nationality seem to vanish from the domain of surgery. With marvellously increased facilities of intercommunication, all advances in the art are speedily known

throughout the civilized world. At no former period, assuredly, has there been greater scientific activity. One result of the emulative ardor with which surgery has been latterly cultivated is the prevalent tendency to pursue special branches of the art. This practice is not devoid of the danger of narrowing the views of the practitioner and debasing him to the grade of a clever artisan, but undoubtedly it has already promoted most valuable advances in surgery. Ophthalmology, invoking the aid of physical science, has been revolutionized, and in many other directions some light has been thrown upon branches of surgery until lately enveloped in the deepest obscurity. The discoveries and improvements in surgery in the nineteenth century are not inferior to those of any preceding age. The practical use of anæsthetics, introduced in the shape of ether-inhalation by Morton in 1846, and by the use of chloroform by Simpson in 1847, constitutes an epoch-making advance in the art. The introduction of ovariotomy (1809) by MacDowell, of lithotrity (1822) by Civiale, are improvements of the first order. The extensions of reparative surgery to the relief of cleft palate, vesico-vaginal fistulæ, and of a great variety of deformities, have been of great value. The employment of metallic sutures and ligatures (Levert, 1829), of immovable apparatus in the treatment of fractures (Seutin, 1842), and of manipulation in the reduction of luxations (W. W. Reid, 1855), are most important innovations. The bloodless method of Esmarch (1873) and the antiseptic method of Lister (1869) are of far-reaching application. The great advances made in the treatment of diseases of the joints, of blood-vessels and nerves, of the eye, ear, larynx, urethra, and rectum, and of outgrowths and tumors, are most creditable. It would be profitable to review these in detail, but many of the subjects are discussed in other parts of this work, and the limits assigned to this article have already been attained, if not exceeded. Enough has been said to illustrate the progress of this beneficent art, and to encourage the hope that now, for ever freed from the fetters of the schools and entrusted to enlightened and original workers, it may steadily advance toward that absolute perfection that is probably unattainable. GEORGE A. OTIS.

Sylves'ter (JAMES JOSEPH), M. A., F. R. S., b. in London Sept. 3, 1814; educated at the University of Cambridge; was for a short time a professor in the University of Virginia, then professor of natural philosophy in University College, London; became a member of the Royal Society in 1839; professor of mathematics in the Royal Military Academy at Woolwich 1855, and professor of mathematics at Johns Hopkins University, Baltimore, Md., 1876, and is author of a large number of scientific memoirs, 112 of which, published prior to 1863, are recorded in the Royal Society's *Index of Scientific Papers*. Among the most important of these is a paper of great value, both from a mathematical and historical point of view, on Newton's rule for discovering the number of real and imaginary roots of an equation; also his researches on the *Reversion of Series and the Partitions of Numbers*, and his papers on the *Analytical Development of Fresnel's Optical Theory of Crystals* and on *The Rotation of a Rigid Body*, and his discoveries on the *Involution of Six Lines in Space*, culminating in the result that if these six lines represent forces in equilibrium, they must lie on a ruled cubic surface, are of high value. He has invented an instrument, the plagiograph or modified pantagraph, which, in addition to altering the magnitude, possesses the property of rotating the image of a figure through any desired angle; and another, the geometrical fan, which has been applied to the construction of a cheap astronomical spectroscope. Prof. Sylvester's most distinguished work has, however, been done in the modern algebra. A very large portion of the theory of determinants is due exclusively to him, and the great modern theory of invariants owes its origin and early development almost wholly to his efforts and those of Prof. Cayley. THOMAS CRAIG.

Sylvicolidæ and Sylviidæ. See WARBLERS.

T.

Tal'bot (JOHN), rector of Fretherne, Gloucestershire, England, 1701; chaplain on the ship Centurion, which brought to America, in June, 1702, the first missionaries of the Society for the Propagation of the Gospel in Foreign Parts; was himself appointed a missionary of this society Sept. 18, 1702; founder and first rector of St. Mary's church, Burlington, N. J., Mar. 25, 1703; for twenty years a leader of the Church of England in the northern colonies of America; consecrated bishop in 1722 by nonjurors in England. D. in Burlington, N. J., Nov. 29, 1727. His *Life* and *Letters* are given in the *History of the Church in Burlington, N. J.* GEORGE M. HILLS.

Tammany Ring. See TWEED (WILLIAM MARCY), in CYCLOPÆDIA.

Tar'box (INCREASE N.), D. D., b. at East Windsor, Conn., Feb. 11, 1815; graduated at Yale College 1839; pastor of the Congregational church at Framingham, Mass., 1844–51; since 1851 secretary of the American Education Society at Boston; author of *Winnie and Walter Stories* (4 vols., juvenile, 1860), *Nineveh, or Buried City* (1858), *Missionary Patriots* (1864), *Uncle George Stories* (4 vols., juvenile, 1865), *The Curse* (1863), *Tyre and Alexandria* (1865), *Life of Major-General Israel Putnam* (1876).

Têche, Bayou. What is now termed Bayou Têche was once the lower portion of the ancient channel of Red River (which then discharged its waters directly into the sea, and formed high and fertile alluvial banks, or a *delta*, sloping regularly seaward), extending from the present Bayou Courteaubleu, E. of Opelousas, La., around and to the W. and S. of what is now the Grand Lake basin—then probably an inland bay into which the Mississippi River discharged—to the Gulf of Mexico, but now, too, the lower Atchafalaya River, S. of Grand Lake. The lower half of the Têche is a currentless (except for brief periods after heavy rainstorms or during the flood-period of the Mississippi River) tide-water channel, and is only navigable for small steamboats to St. Martinsville, about 100 miles above the railroad terminus at Morgan City on the lower Atchafalaya. Above St. Martinsville the Têche is only navigable for flat or keel boats during the flood-season or for brief periods after heavy rains, but it has been proposed to elevate its surface by means of locks and dams, and so convert it into a canal. The ancient channel of Red River, of which the Têche formed a part, comprised what are now known as the Courteaubleu, Bœuf, Robert, Rapides, and Jean de Jean or Cotile, but there is now no connection between Red River, at or above the falls (at Alexandria), and the Bœuf, which itself is not navigable. Pattersonville, Centreville, Franklin, New Iberia, and St. Martinsville are prominent towns on the Têche. The Têche, below the head of navigation, comprises one of the richest sugar-regions of Louisiana, and its lands generally, especially on the right bank, are above the reach of overflow, and do not require leveeing. G. W. R. BAYLEY.

Teeth [Ang.-Sax. *tôdh*; Lat. *dens, dentis*; Gr. ὀδούς, ὀδόντος], certain hard bodies situated in the mouth or at the commencement of the alimentary canal. This definition, comprehensive and vague as it may appear, is as exact as the nature of the case permits. Under this definition are included not only the teeth of mammals and other vertebrates, but the hard bodies that stud the surface of the odontophore or lingual ribbon of mollusks, etc. Homologically speaking, however, there is no similarity between the homonymous parts in the representatives of the different branches; inasmuch, too, as the term belongs specially to the vertebrates, the appendages in the representatives of that branch will alone be considered here. These are sufficiently variable in development, as well as form and position, and their characteristics in the several classes may be briefly examined in the order of their development.

The leptocardians or pharyngobranchiates are entirely destitute of teeth.

The marsipobranchiates have teeth developed on the tongue, and more or less from the surface of the oral disk; in the myxinoids a single tooth is present on the roof of the mouth; but in the petromyzonts numerous teeth exist in oblique rows on the disk.

The selachians or elasmobranchiates exhibit a very considerable diversity in their dentition, of which the chief types have been briefly adverted to in the article ELASMOBRANCHIATES.

The fishes are, more than any other class, distinguished by the diversity in development and position of the teeth, as well as form and mode of attachment.

As to position, they may be entirely absent from at least the mouth proper, or they may be present on almost all the bones—*i. e.* the intermaxillaries, the supramaxillaries, the vomer, the palatines, the pterygoids, the ento-pterygoids, and the tongue, as well as the pharyngeal bones, the branchial arches, and the commencement of the œso-

phagus. There may be also a considerable diversity in dentition within the limits of the same natural family, although, as a rule, the differences are inconsiderable: as examples among American fishes the cyprinoids and centrarchoids may be mentioned. All of the cyprinoids are totally devoid of teeth in the mouth, although they have them well developed on the pharyngeal bones. The centrarchoids offer considerable diversity: in *Pomotis* and *Lepomis* teeth are present only on the jaws and vomer, but in *Ambloplites* and *Chænobryttus* they exist not only on the jaws and vomer, but also on the palatine and pterygoid bones. A still more noticeable case of diversity is afforded by the family of clupeoids, including the herrings, shad, etc.: in *Alosa* (the shad) the mouth is almost edentulous, while in *Clupeoides* teeth are developed on the intermaxillaries and supramaxillaries (as crenulations), as well as on the dentaries, vomer, palatines, pterygoids, and tongue: between these there is almost every gradation. These variations in the clupeoids are generally to such an extent unaccompanied by other modifications of structure that their systematic value is very slight. Nevertheless, in most cases there is a quite close concordance between the development of the teeth and other characters, so that, on the whole, the nature of the dentition may be tolerably well predicated from the associated characters. The most common combination, too, at least among the specialized acanthopterygian fishes, is expressed in the aggregation of teeth on the intermaxillaries, dentaries, vomer, and palatines. The Percidæ, Serranidæ, and Scombridæ (but not all their species) are examples of this class. Closely-related types, however, have the teeth confined to the intermaxillaries and dentaries; such are, *e. g.*, the typical Pristipomatidæ and Sparidæ. In one family (Stromateidæ) teeth are developed on plates at the entrance of the œsophagus.

In form there is great variety. The most common is an elongated conic, but more or less curved, contour, or some slight modification thereof. The most noteworthy examples of other types are the following: Extremely elongated, slender, and almost hair-like teeth are found in the chætodontids; incisors like those of mammals, superficially at least, are developed in the Sargi (sheepshead, etc.); molar-like teeth are present in the jaws of many Sparidæ and on the palate in Anarrhicadidæ; barbed or arrow-like teeth are exemplified in the Trichiuridæ and related forms; compressed, lancet-like teeth exist in the jaws of *Pomatomus* or *Temnodon* (the blue-fish); slender, spoon-like teeth are to be seen on the lips of the loricariids; squamiform, imbricated teeth cover the jaws in the Scaridæ; and broad, incisorial teeth are confluent with the jaws in the diodontids and tetrodontids.

In their combinations and mode of attachment there is almost equal variety. In most fishes they are very numerous, and aggregated in many rows on the jaws as well as palate; in many they are uniserial; often they are differentiated into two or more kinds—*e. g.* the foremost tooth or the hindmost ones, and sometimes (as in different labrids) both, may be developed as canines, while the others are small; often, too, the teeth of the anterior row are much larger than the others; again, in the sparids *e. g.*, the teeth of the front of the jaws are conic or incisorial, and those of the sides molar. In fishes generally the teeth are immovably implanted in sockets in the jaws, but readily detached therefrom; in some, however (*e. g.* in *Salarias*, *Euchalarodus*, certain Serranidæ, etc.), they are more or less movable, while in loricariids they seem to be loosely attached to the lips; in the scarids they are imbricated on the jaws; and in the diodontids and tetrodontids they are inseparable from the jaws.

In respect to development, according to Tomes, the following are the facts: "In all cases the whole series of changes take place beneath an unbroken surface, and often at some little depth; in this respect, however, differences are met with upon different bones in the mouth of the same fish, so that this would appear to be influenced by accidents of reflection. From the deepest layer of the oral epithelium, which is very thick in many fishes, there dips downward a blunt-ended process, descending into the loose connective tissue beneath. When it approaches the surface of the bone a dentine pulp is developed in the subjacent connective tissue, which it eventually covers over like a cap or bell-jar. The epithelial process, making its way downward, is recognizable before the dentine papilla can be distinguished; its end becomes transformed into an enamel-organ, but no very definite capsule is formed around the dental germ."

In the amphibians there is much less diversity than in the fishes, or even the selachians. In form they are mostly slender, conic, and pointed. In position they exhibit much greater diversities: in the Gradientia (salamanders and other tailed species) they are present on the jaws and palate under various combinations. (See GRADIENTIA, in CYCLOPÆDIA.) In the Salientia they are less constantly present; in many (*e. g.* the frogs) they are suppressed in the lower jaw, and present only in the upper; in numerous others (*e. g.* the toads) they are absent from the upper as well as the lower jaw; in the frogs teeth are developed in the vomer, but in the toads are entirely wanting on the palate as on the jaws. The other modifications of dentition must be sought for under special articles.

In the reptiles the varieties of dentition are quite numerous, but less so than in the fishes. The principal modifications are adverted to in the articles on the different orders, and to them reference must be made. It need only be added here that, according to Tomes, but contrary to the older authors, "the teeth, as far as known, consist of dentine, to which is very generally superadded an investment of enamel, partial or complete, but that cementum is only present in a few instances," the only forms having teeth covered with cementum being "those which have them implanted in more or less complete sockets or in a groove," as the crocodilians and ichthyosaurians.

The birds of the present epoch are entirely destitute of true teeth, and the mandibles have generally more or less trenchant, unarmed linear edges, but sometimes they are armed with processes of bone simulating teeth, but in no other respect entitled to that name. In former epochs, however, there existed types actually provided with true teeth, having all the structural characteristics of those organs, and fitting in sockets in the jaws: these have been combined by Marsh under the general term Odontornithes (*i. e.* toothed birds).

In the mammals teeth are confined to the jaws—*i. e.* the intermaxillary, supramaxillary, and dentary bones—and are almost always developed, although in a few forms, representing several orders, they are entirely wanting. It may at the same time be recalled that while true teeth are confined to the jaws, there are certain asperities on the tongue (*i. e.* in the Felidæ, monotremes, and some other mammals) which are almost as much entitled to be called teeth as are analogous processes in other animals: these, nevertheless, differ entirely in histological characters from teeth; and in this respect are quite dissimilar from the teeth on the tongues of fishes, which are essentially similar to those of the jaws and other parts of the mouth. In the existing monotremes of the family Ornithorhynchidæ molar tooth-like appendages are developed in the jaws on each side, and have been designated as teeth; but, although functionally they are such, they must not be confounded with the molar teeth of other mammals: with them they are not at all homologous, but rather are epidermal appendages like whalebone, etc. In the marsupials and placental mammals the teeth are homologous with each other, and developed in the same manner. The fully-developed teeth are composed essentially of three elements—(1) the dentine, (2) the enamel, and (3) the cement. (1) The dentine is the chief component of the teeth, and is exemplified under several conditions. "In most mammals (according to Owen) the body of the tooth consists of a gelatinous animal basis and calcareous earth, combined and arranged according to the plan which characterizes the tissue called 'unvascular dentine.' The compartments of the basal substance, [by Owen] called 'calcigerous' or 'dental cells,' and which contain the hardening salts in their densest state, are subcircular or subhexagonal. The calcigerous and nutrient tubes, varying from $\frac{1}{10000}$th to $\frac{1}{20000}$th of an inch in diameter, and placed with intervals equal to from two to six of their own diameters, proceed at first with strong, and then with gentle, curves from the pulp-cavity to the outer surface of the dentine, their general direction being always more or less at right angles to that surface: those tubes which proceed from the apex, and from the basal third part of the pulp-cavity, are the straightest. They are nearly parallel to one another, both in their general course and curvatures; but, as the outer surface of the tooth exceeds the inner one in extent, the tubes slightly diverge in their course and divide, decreasing in diameter to their peripheral extremities, and rapidly so near their termination, where they become irregularly flexuous and often interlaced. The dichotomizing calcigerous tubes send off from their sides much more minute branches, which quickly divide and subdivide in the interspaces of the trunks, and penetrate the dentinal cells. In the unvascular dentine of all mammalian teeth the tubes present the 'primary curvatures' and 'secondary gyrations' described in the introduction. These curvatures are strongest and least regular in the dentine of the elephant's grinders. In that of the tusks of the elephant and mastodon the form, extent, and parallelism of the secondary curvatures of the dentinal tubes cause the peculiar appearance of the decussation of curved lines, like the ornamental work called 'engine turning,' upon the surface of transverse or oblique

sections or fractures of the tusk, which is characteristic of true 'ivory.'" Several other modifications are noticeable.

In a few mammals, *e. g.*, in the incisors of some rodents, and in the molars of the Brata, of the sub-order Tardigrada, more or less of the dentine is modified by the persistence of certain tracts of the pulp-cavity, forming vascular or medullary canals. "In certain other Bruta of the sub-order Fodientia (family Orycteropodidæ) the dentine of the long and slender prismatic denticles which are aggregated to form the compound tooth is unvascular, and is characterized chiefly by the frequent division and wide angles at which the branches of the bifurcating calcigerous tubes diverge, before resolving themselves into their minute wavy terminations." (2) The enamel is generally more or less developed around the dentine on the crown of the tooth, and is excessively hard and composed of extremely minute fibres standing outward over the dentine. The enamel is developed around the teeth of most mammals, but to a varying extent, and is wanting chiefly in most of the representatives of the order Bruta. (3) The cement is quite like bone in appearance and composition, and enters to a varying extent into the composition of the tooth. It is, however, generally most developed around the roots, and least so on the crowns; but in some forms there is a large deposit around the crowns also.

The teeth of mammals are always inserted in sockets in the jaws, surrounded by gums. They are severally divided into two portions—the exposed portion or crown, and the inserted portion, known as the fangs or roots. The difference is generally well defined, but in some forms, especially in certain rodents (Arvicolinæ), etc., there is no abrupt distinction between the inserted and exserted portions, and true roots are not developed.

The characteristic features in the development of mammals, according to Charles S. Tomes (*Phil. Trans. Royal Soc. London*, clxv. pt. 1, 1875, p. 285) are as follows: "i. There is never, at any stage, an open groove from the bottom of which papillæ rise up. ii. That the first recognizable change in the vicinity of a forming tooth-germ is a dipping down of a process of the oral epithelium, looking, in section transverse to the jaw, like a deep simple tubular gland, which descends into the submucous tissue, and ultimately forms the enamel-organ. iii. That subsequently to the descent of the so-called enamel-germ the changes in the subjacent tissue resulting in the formation of the dentine-papilla take place opposite to its end, and not at the surface. iv. That the permanent tooth-germs first appear as offshoots from the epithelial process concerned in the formation of the deciduous tooth-germ (*Kölliker*), the first permanent molar being derived from a primary dipping down (like a deciduous tooth), the second deriving its enamel-germ from the epithelial neck of the first, and the third from that of the second (*Legros* and *Magitot*)."

The teeth of mammals not increasing in size, as do the other parts of the body, a provision must exist for the accommodation of their size and development to that of the animal. This is effected in part by (1) the late development of some of the teeth, which do not appear until the animal has attained a large size; and, in part, as well, (2) by the replacement of some of the teeth developed about the time of birth by subsequent ones of larger size. Those animals which have only one set of teeth—the non-deciduous—are said to be monophyodont (μόνος, "one," φύειν, to "put forth," and ὀδούς, "tooth"); those which have two sets of teeth, an early (deciduous) and a later (non-deciduous) set, are called in contrast diphyodont (δίς, "two," φύειν, to "put forth," ὀδούς, "tooth"); these characters, however, are not co-ordinated with others, and mammals, therefore, cannot be contrasted, as has been attempted, into natural sections distinguished by such characteristics. In the marsupials only four teeth (one in each jaw on each side) are succeeded by larger teeth. These are, therefore, imperfectly diphyodont. The teeth of the second set are developed from diverticula of the sacs in which originated those of the first set. In the brutes or edentates the teeth, so far as known, in most of the sections are monophyodont, only one set being developed, but in the armadillos they are diphyodont, a set of milk teeth existing for a longer or shorter time after birth, and being finally succeeded, sometimes not until near maturity, by a second permanent set. Among the Carnivores, in the Fissipedes, or terrestrial species, the diphyodont type is well exemplified, the milk teeth being of a more or less large size, and retained for quite a long period, until finally replaced by the permanent set; but in the Pinnipedes, or swimming Carnivores, the milk teeth are extremely rudimentary, and replaced before birth by those of the permanent series. In the cetaceans but one set of teeth has been found, and it is probable, from the phases of development in allied types, that this represents the permanent or second set of the typical mammals, the first set being probably suppressed. In the rodents the great incisor teeth are permanent, and have no deciduous predecessors. In the case of those forms which have only three molars or less, as in the Muridæ, etc., these all belong to the permanent set, being true molars, and consequently the animals in question are strictly monophyodont. In those forms, however, where the number of molars exceeds three, the teeth in front of them are pre-molars, or teeth which have had deciduous predecessors.

The rows of teeth in almost all species exhibit interruptions of varying extent. These interruptions most frequently exist between the incisors and canines of the upper jaw for the reception of the canines of the lower, and in the lower jaw between the canines and molars for the reception of the canines of the upper jaw. The interruptions are designated as diastemas or diastemata, and result from the increased size of the canines in the respective jaws, and the necessity for space in the opposite jaw to receive them. When the canines are reduced in size, there is often a corresponding reduction in the extent of the diastemas; and in man, where the teeth are all nearly on the same level, the series in both jaws are perfectly uninterrupted; and in this respect man is distinguished from all the other living mammals, although approached by certain of the lemuroid species. The character is, however, not exclusive, and in certain extinct forms belonging to the ruminant family of Anoplotheriidæ there are also uninterrupted series of teeth in the two jaws. The diastemas, however, are by no means always co-ordinated with the development of the canine teeth, but very frequently result from the elongation of the jaws and the reduction of the anterior molar teeth, as in most of the ungulates and in all the rodents, in which latter the canines are never developed.

As to structure and functional development, the teeth throughout the series of mammals are differentiated on the whole into three groups: (1) Those in the front of the jaws have compressed cutting crowns, and have therefore been denominated *incisors* (*incidere*, to "cut"). In the lower forms there may be as many as ten (5 + 5) in the upper jaw, but in the higher forms the normal number is six (3 + 3), and this is never exceeded, although frequently the number is less, some being suppressed. The incisors are recognizable always by their position: in the upper jaw they, and they alone, are implanted in the intermaxillary or premaxillary bone, and in the under jaw those corresponding in position, or opposite the upper ones, are incisors. (2) On the sides behind the incisors are the *canines*, which are exemplified especially in the dog, whence the name (*caninus*, pertaining to the "dog"); these have generally more or less elongated, compressed, conic, but recurved crowns, but they vary much in this respect. Whatever may be the form, however, their character is determined by their position. Those teeth which are inserted in the supramaxillary bone in front, and immediately behind the suture between that bone and the intermaxillary in the upper jaw, are canines; and the teeth in the lower jaw which fit just in front of these are homonymous. They never exceed four in number—that is, one on each jaw on each side. (3) The molars are all the other teeth behind the canines, whatever may be their shape. Those of the set which are developed at birth, and not long thereafter shed, are designated deciduous or milk teeth, and the ones which succeed them are the premolars; these are always toward the front; the molars behind, which are permanent and have no deciduous predecessors, are known as true molar teeth. The number of the teeth in the lower types of mammals is so variable that a typical number can scarcely be said to exist. In the higher or educabilian series, however, a typical number exists, and in all the forms of that great group or superorder it is generally easy to locate the teeth which correspond to those of the primitive series, however much they may be developed or modified, and however few may ultimately remain. The number in question is 44. These are divided as follows: I. (incisors) $\frac{3}{3}$, C. (canines) $\frac{1}{1}$, P. M. (premolars) $\frac{4}{4}$, M. (molars) $\frac{3}{3} \times 2 = 44$. This formula is best exemplified among recent mammals in the common hog, but in the species of the early Tertiary period it was a very common, if not the predominant, one for the representatives of the educabilian series. But it is now very uncommon, and in almost all of the recent forms more or less of the teeth are suppressed; not distantly-related types, however, may differ in this respect: thus, in the Canidæ (dogs, etc.) nearly or quite the archetypical number may be developed, but in the Felidæ (cats, etc.) the number may be reduced to as low as 30, or even 26, the missing ones being the anterior of the premolars and the posterior of the true molars.

Such are, in short, some of the principal characteristics

of the dentition in the various classes of vertebrates. The imperatively forced limits of this article forbid a detailed notice of the modifications in the several orders and families, but this has in part been already given in special articles on these groups. Inasmuch as the views respecting the development of the teeth promulgated by the most expert recent investigators differ much from those of the older odontologists, the latest results of one of the most approved students of the subject are given in his own carefully-selected words: "1. It is desirable to entirely abandon the terms 'papillary,' 'follicular,' and 'eruptive' stage, inasmuch as these are hypothetical and arbitrary, and correspond to no serial conditions verified by observation. 2. In all animals the tooth germ consists primarily of two structures, and two only—the dentine-germ and the enamel germ. The simplest tooth-germ never comprises anything more. When a capsule is developed, it is derived partly from a secondary upgrowth of the tissue at the base of the dentine germ, partly from an accidental condensation of the surrounding connective tissue. 3. The existence of an enamel-organ is quite universal, and is in no way dependent upon the presence or absence of enamel upon the completed tooth, although the degree to which it is developed has distinct relation to the thickness of the future enamel. 4. So far as researches go, a stellate reticulum, constituting a large bulk of the enamel-organ, is a structure confined to the Mammalia. (It is absent in the armadillo, and, I should infer from Mr. Turner's description, in the narwhal.) 5. As laid down by Prof. Huxley and Prof. Kölliker, the dentine-papilla is beyond all question a dermal structure, the enamel-organ an epithelial or epidermic structure. As I believe it can be shown that the enamel is formed by an actual conversion of the cells of the enamel-organ, this makes the dentine dermal and the enamel epidermic structures. 6. In Teleostei the new enamel germs are formed directly from the oral epithelium, and are new formations arising quite independently of any portion of the tooth-germs of the teeth which have preceded them. In mammals and reptiles, and in some, at all events, of the Batrachia, new tooth-germs are derived from portions of their predecessors. 7. In all animals examined the phenomena are very uniform: a process dips in from the oral epithelium, often to a great depth; the end of the process becomes transformed into an enamel-organ coincidently with the formation of a dentine-papilla beneath it. The differences lie rather in such minor details as the extent to which a capsule is developed; and no such generalization as that the teeth of fish in their development represent only an earlier stage of the development of the teeth of Mammalia can be drawn." (Tomes, *Phil. Trans. Royal Soc. London*, vol. clxvi. pp. 265–266, 1876.) THEODORE GILL.

Teeth, Chemistry of. The teeth of different animal races present considerable variations in composition and in the relative proportions and arrangement of the different structural materials that make up the tooth—the enamel, the dentine, and the cement. Human teeth, of course, present the most direct interest. For the enamel of the teeth of young children Hoppe-Seyler found as follows:

Tricalcium phosphate	75.23
Calcium carbonate	7.18
Calcium chloride	.23
Trimagnesium phosphate	1.72
Ferric phosphate	.63
Soluble saline matter	.35
Soluble organic matter	1.23
Insoluble organic matter	14.36
	100.93

From an extensive research of Von Bibra upon the composition of teeth of different animals the following figures, relating to human teeth, are selected:

	Enamel of male molar.	Enamel of female molar.	Dentine of male molar.	Dentine of female molar.
Tricalcium phosphate and calcium fluoride	89.82	81.63	66.72	67.51
Calcium carbonate	4.37	8.88	3.36	7.97
Trimagnesium phosphate	1.34	2.55	1.08	2.49
Soluble salts	.88	.97	.83	1.00
Fat	.20	trace.	.40	.58
Total organic matter	3.59	5.97	28.01	21.00
Total inorganic matter	96.41	94.03	71.99	79.00

Von Bibra does not appear to have made any determinations, in these important analyses, of the actual proportions of fluoride of calcium in human teeth. He gives, however, a number of analyses of *fossil* teeth, in which he has separated the calcium fluoride and phosphate. In a molar of a mammoth he found the phosphate to vary from 62.83 to 68.43 per cent., and the fluoride from 4.15 to 3.72. In parts of this tooth the organic matter was 15.6 per cent., which is much less than in recent teeth, and the calcium carbonate was 15 per cent., so that it may have been somewhat altered. HENRY WURTZ.

Teeth, Human. Referring to the article TEETH for information respecting those characters of the teeth of man as to development and morphology which are common to him with other mammals and other vertebrates, the present article will be restricted to a notice of the peculiarities of the dentition of the human subject. These will be considered under two stages: (1) the milk or deciduous, and (2) the permanent set.

(1) The deciduous set is composed of 20 teeth—viz. I. $\frac{2}{2}$, C. $\frac{1}{1}$, D. M. $\frac{2}{2}$ = 2; *i. e.* in the upper and lower jaws, each, incisors 2, canines 1, deciduous molars 2, on each side. These correspond with the median and second incisors (I. $\frac{1^\circ 2^\circ}{1^\circ 2^\circ}$), the canines (C. $\frac{1}{1}$), and the last two of the three molars (D. M. $\frac{2^\circ 3^\circ}{2^\circ 3^\circ}$) of the dentition of the complete typical educabilian deciduous number. In the order of development they are cut at the following periods: at the age of seven months, the median incisors (I. $\frac{1}{1}$); at seven to ten months, the lateral incisors (I. $\frac{2^\circ}{2^\circ}$); at twelve to fourteen months, the anterior molars (D. M. $\frac{2^\circ}{2^\circ}$); at fourteen to twenty months, the canines (C. $\frac{1}{1}$); and at eighteen to thirty-six months, the posterior molars (D. M. $\frac{3^\circ}{3^\circ}$). The crowns exhibit successively the following modifications: the incisors have an incisorial edge; the canines are subconical; the molars of the upper jaw have, the first, three cusps, and the second, four cusps; and those of the lower jaw, the first, four cusps, and the second, five cusps. The roots are developed as follows: The incisor and canine teeth have each single fangs, the molars of the upper jaw have three widely-divergent roots, and those of the lower jaw each two divergent roots.

(2) The permanent series is constituted, when complete, of 32 teeth—viz. I. $\frac{4}{4}$, C. $\frac{1}{1}$, P. M. $\frac{2}{2}$, and M. $\frac{3}{3}$ = 2; *i. e.* in the upper and lower jaws, each, incisors 2, canines 1, premolars 2, and true molars 3, on each side. These correspond with the first and second incisors (I. $\frac{1^\circ 2^\circ}{1^\circ 2^\circ}$), the canines (C. $\frac{1}{1}$), the third and fourth premolars (P. M. $\frac{3^\circ 4^\circ}{3^\circ 4^\circ}$), and the several molars (M. $\frac{1^\circ 2^\circ 3^\circ}{1^\circ 2^\circ 3^\circ}$) of the typical educabilian number: the suppressed teeth of the series are thus seen to be I. $\frac{3^\circ}{3^\circ}$ and P. M. $\frac{1^\circ 2^\circ}{1^\circ 2^\circ}$. These teeth are erupted severally at the following periods: at the age of six and a half years, the first true molars (M. $\frac{1^\circ}{1^\circ}$); at seven years, the median incisors (I. $\frac{1^\circ}{1^\circ}$); at eight years, the two lateral incisors (I. $\frac{2^\circ}{2^\circ}$); at nine years, the first premolars (P. M. $\frac{3^\circ}{3^\circ}$); at ten years, the second premolars (P. M. $\frac{4^\circ}{4^\circ}$); at eleven to twelve years, the canines (C. $\frac{1}{1}$); at twelve to thirteen years, the second true molars (M. $\frac{2^\circ}{2^\circ}$); and finally, at seventeen to twenty-one years (whence they are called the "wisdom" teeth), the third true molars (M. $\frac{3^\circ}{3^\circ}$). The crowns are characterized as follows: the incisors present an incisorial edge; the canines are subconical; the premolars have each two cusps (whence called bicuspid), an external and an internal; the molars of the upper jaw have each four cusps, two external and two internal; and the third five cusps, two external and three internal; the corresponding teeth in the lower jaw have, the first, three external and two internal cusps; the second, four cusps, indicated by a very distinct crucial groove; and the third, five cusps, two external and three internal. A characteristic feature is that the posterior external and the anterior internal cusps of the molars of the upper jaw are connected by an oblique ridge. The roots exhibit the following characters: the incisor and canine teeth have single undivided fangs, the incisor smaller, and the canine larger ones; the premolars, or bicuspids, have each fangs single, but more or less grooved on their sides; of the molars, the first and second of the upper jaw have each three fangs, two external and one internal, and the third is also incompletely three-fanged, but with the fangs more or less coalesced or undifferentiated; in lower jaw all the molars have each two fangs, an anterior and a posterior, but slightly divergent.

The teeth of the permanent as well as temporary series form an oblong semi-oval or parabolic series, with the crowns nearly uniformly prominent, and uninterrupted by any breaks or diastemata in either the upper or lower jaw. The incisors and canines are comparatively small; next are the premolars, and considerably largest of all are the molars. The dentition in both stages exhibits a general agreement with the teeth of the anthropoid Primates or Quadrumana, and diverges as follows:

In the number and development of the teeth (*i. e.* P. M. $\frac{2}{2}$, M. $\frac{3}{3}$) man agrees with all of the Old-World apes and monkeys (Simiidæ and Cercopithecidæ), and differs from the New-World forms (Cebidæ and Mididæ), which are characterized by a reversed number of premolars and molars (*i. e.* P. M. $\frac{3}{3}$, M. $\frac{2}{2}$).

In the structure of the molars of the upper jaw, especially in that the front inner and the hind outer cusps are connected by an oblique ridge running between them, man agrees with the great apes, or Simiiæ (*Anthropopithecus*, *Gorilla*, and *Simia*), and differs from the long-armed apes, or gibbons (Hylobatinæ), in which the molars of the upper jaw are not so connected.

In the reduced size of the anterior teeth, and especially of the canines, and, concomitantly, the shortening of the jaws, as well as in the absence of diastemata, man is *sui generis*, and contrasts with all the other anthropoid Primates.

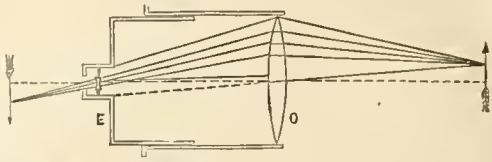
The diseases of the teeth and their cure are partially treated of under the head of DENTISTRY. THEO. GILL.

Telephone. See TELEGRAPH, Sec. IV., Subd. E, in CYCLOPÆDIA.

Tel'escope [from τῆλε, "afar," and σκοπεῖν, to "see"], an optical instrument for viewing distant objects. Its early history is involved in obscurity. It is asserted that Democritus could not have announced that the Milky Way is composed of small stars unless he had seen them with a telescope. But it is hardly credible that he or any of the Greek and Latin writers could have referred to this instrument, though some of their sentences have seemed to allude to its use. Roger Bacon, in his *Opus Majus*, in referring to the refraction of light through lenses, says: "Thus also the sun, moon, and stars may be made to descend hither in appearance, and to be visible over the heads of our enemies, and many things of the like sort which persons unacquainted with such things would refuse to believe." Leonard Digges, in a preface to an edition of Euclid published in 1570, seems to imply the existence of telescopes in England at that date. Two Italian philosophers, Battista Porta in 1561, and Antonio de Dominis in 1611, both published works relating to the combination of lenses so that objects might seem enlarged thereby. Other names might be mentioned, but since the question is still involved in controversy, the reader is referred to Grant's *History of Physical Astronomy* for a statement of the various claims. Many astronomers concede the invention to Hans Lippersheim of Holland, who used a convex object-lens in 1608. To Galileo belongs the fame of the first brilliant discoveries with an instrument so modest that at this distance it excites our surprise that he should have seen so much. After many years of patient labor the utmost power he could attain to was about thirty-three diameters. His first discoveries were in 1610. All of his telescopes were of the opera-glass pattern, and he reached the limit of power with that construction without achromatic lenses. It was not until the middle of the seventeenth century that telescopes composed of two convex lenses came to be generally used in astronomical observations, though Kepler in 1611 pointed out their advantages. The skilled philosopher Huyghens, to increase the magnifying power of his telescopes without encountering the aberrations of unachromatic lenses of short foci, made object-glasses of so great as 210 feet focal length. These telescopes were mounted without a tube, and could only be used with extreme difficulty; and even then the images formed by such object-glasses were unsatisfactory. Since it seemed that the refracting telescope had reached its highest development, the attention of philosophers was early directed to the construction of reflecting telescopes, the invention of which is involved in some obscurity. In 1663, James Gregory proposed that the light from a distant object be brought to a focus by a parabolic reflector. But the first person who actually constructed such an instrument was NEWTON (see in CYCLOPÆDIA). In 1672, Cassegrain, a Frenchman, brought forth still a third form of reflecting telescope. The reflector from this date began to supplant the refracting telescope, and maintained its lead until Dollond, about 1753, pointed out the error which Newton had made in regard to the refraction of light through different media. By combining together two or more lenses of crown and flint glass he produced the modern achromatic telescope, an instrument which from that day to this has steadily increased in size with the perfecting of the manufacture of optical flint glass—*i. e.* flint glass which is homogeneous throughout. (For the history of reflectors see SPECULUM.) For the tracing of the history of the competition between refractors and reflectors to the present date, a volume would be required.

Theory.—(For elementary explanation of refraction, lenses, and achromatism see MICROSCOPE and LENS.)—As in the microscope, so in the refracting telescope, the image of an object is first formed by a lens or system of lenses, and then in the common form of telescope this image is examined by means of a microscope. In the first telescopes made, however, and in the opera-glass of to-day, the rays of light from the object-glass are brought into the eye before they come to a focus, by means of a concave lens placed as in Fig. 1, where the distance OE equals the difference of

FIG. 1.



the focal lengths of the two lenses. The object seen will be erect, and in using it the eye should be placed exactly centrally behind the eye-lens, and the eye-lens should be limited by diaphragm to the size of the pupil of the eye. The magnifying powers usually range between three and eight diameters, and the best modern makers of opera-glasses construct them with both object and eye glass achromatic. The astronomical telescope, which must possess a much higher magnifying power and large field of view, is constructed differently, and in this case the object-glass forms the image, which is then examined by eye-pieces, which may be of many different forms.

The Object-Glass.—From a mathematical consideration of the subject it is found that an object-glass can be rendered achromatic (see ACHROMATISM and MICROSCOPE) for any two or more colors of the spectrum by combining together two or more simple lenses of known refractive indices and of certain focal lengths. From the extreme difficulty of centring more than two such lenses, it is the custom to combine two of the most prominent colors of the spectrum at the focus of the object-glass by means of a convex crown lens and a concave flint lens. The correction for the two colors selected depends upon the focal lengths of these two lenses. The formation of a sharp image at the focus of the object-glass depends upon the curves of the four surfaces of glass, supposing the glass to be perfectly homogeneous, though practically the theoretical curves are slightly altered by the skilled optician to compensate for defects in the glass itself. The determination of the radii of these curves has occupied the attention of geometers from the time of Newton, and the theory is so well understood at present that the manufacture of object-glasses with the minimum of distortion and color is limited by the difficulties in the manufacture of the materials used. Figs. 2, 3, 4, 5, with the accompanying data, indicate the most approved modern forms; they are taken from a paper published by Prof. G. P. Bond (*Proc. Amer. Acad.*, vol. vi. p. 169). Figs. 2 and 3 show the forms of object-glass best adapted for correcting chromatic aberration.

FIG. 2.

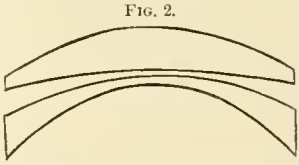


FIG. 3.

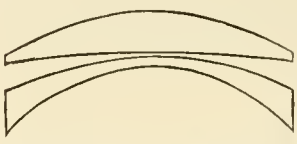


FIG. 4.

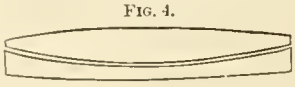
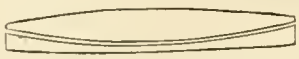


FIG. 5.



Gauss's Curves.

						Feet.
1st.	Surface of the crown lens,				convex, radius	= + 2.535
2d.	"	"	"	"	concave "	= − 7.521
1st.	"	"	flint	"	convex "	= + 3.123
2d.	"	"	"	"	concave "	= − 2.081
					Compound focus	= 21.00

Herschel's Curves, I.

$$\frac{r}{l} = 7.4922.$$

						Feet.
1st.	Surface of the crown lens,				convex, radius	= + 2.803
2d.	"	"	"	"	concave "	= − 9.525
1st.	"	"	flint	"	convex "	= + 3.482
2d.	"	"	"	"	concave "	= − 2.361
					Compound focus	= 21.00

Where r denotes the radius of the first surface of the lens, and l denotes the compound focal length.

Herschel's Curves, II.

$$\frac{r}{l} = 1.3964.$$

					Feet
1st.	Surface of the crown lens,	convex,	radius	=	+ 15.038
2d.	" " "	convex	"	=	+ 5.397
1st.	" " flint	" concave	"	=	— 5.507
2d.	" " "	" convex	"	=	+ 22.135
		Compound focus		=	21.00

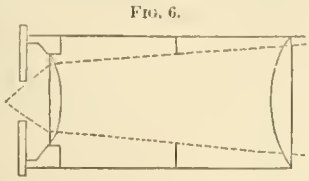
Fraunhofer's Curves.

					Feet.
1st.	Surface of the crown lens,	convex,	radius	=	+ 11.157
2d.	" " "	"	"	=	+ 5.635
1st.	" " flint	" concave	"	=	— 5.775
2d.	" " "	" convex	"	=	+ 25.945
		Compound focus		=	21.00

It is worthy of remark that since the forms given above all have the two lenses in contact, the indistinctness and the curvature of the image cannot be diminished. The distinguished opticians Alvan Clark and Sons have separated the two lenses in some of their latest instruments, and find the definition improved thereby. Many attempts have been made to avoid the necessity of large flint-glass disks by interposing a small concave lens of high refractive index between the eye-piece and the crown lens. Bisulphide of carbon seems to have been the favorite with experimenters.

The Eye-Piece.—If a perfect image could be formed by an object-glass, a single lens used to magnify it would both color and distort it. Accordingly, except in the very highest powers of a few telescopes, opticians have not used single lenses, but a combination of two or more. For a description of the Huyghenian or negative, which is the most common, eye-piece, see MICROSCOPE. This form, as modified by Sir George Airy, gives the best views of celestial objects, but cannot be used in the great part of astronomical work, since the image is formed between the lenses, and from theoretical considerations a micrometer could not be placed at that point. In a positive eye-piece the lenses are placed as shown in Fig. 6. This form is commonly used in all cases where measurements are required. Sometimes its place is taken by a single achromatic lens or an achromatic doublet. Steinheil, Kellner, and Clark have made such achromatic eye-pieces.

FIG. 6.



The preceding eye-pieces show the object inverted, an item of little consequence with celestial objects. For terrestrial viewing an eye-piece of four lenses is commonly employed, which furnishes an erect image. For the construction of the three common eye-pieces the astronomer-royal, Sir George B. Airy, has furnished the following practical rules for making: "For a negative eye-piece: (1) For distinctness, let the first lens be a meniscus lens of focal length 3, the radii of its surfaces as 11 : 4, and its convexity toward the object-glass. Let the second lens be a double-convex lens of focal length 1, the radii of its surfaces as 1 : 6, and its more convex side toward the first. Let the distance of the lenses be 2. (2) If plano-convex lenses be used, there is a considerable loss of distinctness, and no diminution of distortion. (3) The field-bar should be at the distance 1 from the eye-glass. (4) Any other proportion of the focal lengths of the lenses may be adopted; the distance between the lenses must, in all cases, be half the sum of their focal lengths. The forms of the lenses, without great error, may be the same as those just given. (5) If a bright object appears yellow, or a dark one blue, at the edge farthest from the centre of the field, the lenses must be brought a little nearer together.

"For a positive eye-piece: (1) Let the two lenses be plano-convex of focal length 3, placed at the distance 2, with the convex side of each turned toward the other. (2) This distance is somewhat less than that adopted by some of the most eminent opticians. I prefer it, because there is a smaller chance of seeing the dust, etc., on the field-glass, which, when the lenses are nearer, happens frequently, especially if the observer be near-sighted. (3) The distance of the field-bar from the first lens must be $\frac{3}{2}$.

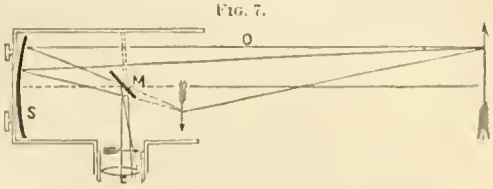
"For a four-glass eye-piece: (1) For distinctness, let the first and last lenses be double-convex lenses of focal length 3, the radii of the surfaces being as 1 : 6, and the more convex side of each turned to the other. Let the field-glass be plano-convex, of focal length 4, its plane side toward the eye, and the remaining glass a meniscus of focal length 4, the radii of its surfaces as 25 : 11, and its convexity toward the field-glass. Let the distance of the centre of the second lens from that of the first be 4, the distance of the field-glass from the second lens 6, and that of the eye-glass from the field-glass 5.13. (2) The distortion in this eye piece is very small. (3) The first diaphragm should be at the distance 3 from the first lens; the last diaphragm, or field-bar, at the distance 3 from the eye-glass. (4) Any other focal lengths and distances may be adopted if the following conditions be attended to: Let p be the focal length of the lens next the object-glass; q that of the next lens; r that of the field-glass; and s that of the eye-glass. Let a be the distance between the two first (or the length of the second pipe); c the distance between the field glass and the eye-glass (or length of the first pipe); b the distance between the two middle glasses (or the distance between the two pipes). Then p, q, r, s, a, and c may be taken at pleasure, and then b must be

$$= \frac{q\,[2(a+c)-(p+s)]-(q+r)[3ac+ps-2(cp+as)]}{3\,[c(p+q)+a(r+s)]-4ac-2(p+q)(r+s)}.$$

The forms of the lenses may be determined, without sensible error, by the rules given above. (5) If a bright object appears yellow, or a dark one blue, at the edge farthest from the centre of the field, the two pipes must be pushed a little nearer together."

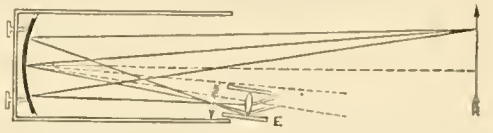
A little remains to be said in regard to the theory of reflecting telescopes. (See SPECULUM.) The four forms in which it has been constructed are shown in Figs. 7, 8, 9,

FIG. 7.



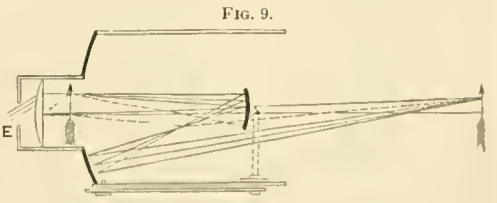
and 10, in which Fig. 7 is the form commonly adopted, the Newtonian, where the light enters through the aperture O and is brought to a focus at the eye at E, by reflection from the speculum S and the plane reflector M. In the Herschelian reflector, indicated in Fig. 8, the light is received directly from the reflector by the eye at E, and

FIG. 8.



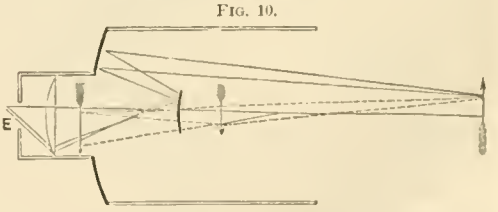
the observer has his back to the object. In the third form, shown in Fig. 9, the light is brought to a focus at

FIG. 9.



E by a concave mirror (the Gregorian telescope). In the fourth form, Fig. 10, a convex mirror answers the same purpose (the Cassegrainian telescope).

FIG. 10.



Construction.—The mechanical means for grinding lenses in themselves are simple enough. The disk of rough glass is made to revolve rapidly on a spindle, and its first shape is given by grinding with water and sand, using an iron tool which has the approximate curvature. Next, it is removed to another iron tool, where it is brought still further into shape by grinding the lower surface against the iron tool, which has a spherical surface, pressed against it by means of the hand alone. Five or six grades of emery-powder with water are used before this stage is finished. The iron tool is then covered with a coat of pitch, over which is sprinkled rouge; the polishing is then completed, still using the hand as a motor-power. After each surface of the lens has been polished in this manner—which re-

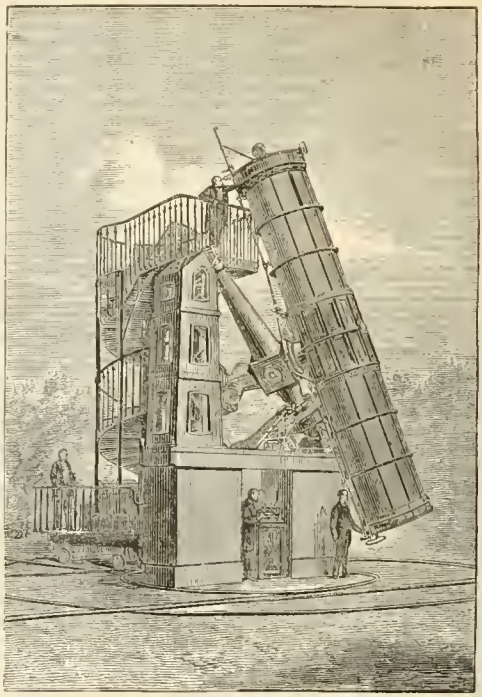
quires from a few days to several months, depending on the size of the glass—the lens is rigorously tested, and from this point the highest skill of the optician develops itself. The effect of every flaw in the glass itself or imperfection caused by the grinding process must be counteracted by polishing here and there each of the four surfaces, if it be an object-glass. The finger alone, or the finger with a little of the finest rouge and water, is used in this process. It will be readily understood that the most patient trial and perseverance, coupled with conscientiousness, are necessary to produce a fine object-glass.

The prices of object-glasses, as established by the firm of A. Clark & Sons, are fixed by the rule that a 4-inch glass costs $100, and to add one-fourth to its diameter doubles the cost of the glass; thus, a 5-inch glass costs $200, a 6¼-inch, $400.

The tube holding the object-glass and eye-piece of a telescope in the large German instruments is made of Spanish mahogany, but several of the largest modern equatorials have their tubes constructed of steel or iron riveted in plates. In the case of some kinds of telescopes the tube is partly or wholly wanting. Thus, in the photographic telescope, suggested by Prof. Winlock and used by the U. S. transit-of-Venus expeditions in 1874, the object-glass is on one pier, and a glass plate placed on a pier 40 feet distant receives the image formed by it, a mirror being used before the object-glass to avoid the necessity of pointing so long a telescope itself. The great equatorial of the Washington Observatory is illustrated under the heading OBSERVATORY. We add here an engraving of the large Paris equatorial reflector, completed in 1875 under Le Verrier. It is of the Newtonian construction, and its mirror is silver on glass, deposited by the processes of M. Ad. Martin upon a surface which is truly parabolic. The weight of the whole instrument is 10,000 kilogrammes, and the total cost of the instrument and its building amounted to 190,000 francs.

Subjoined is a table of the largest telescopes in existence, for which the writer is indebted to the *Popular Science Monthly* for Mar., 1877.

FIG. 11.



The Paris Equatorial Reflector.

Size of Principal Telescopes in the World.

(1 French inch = 12 Paris lines; 1 English inch = 11.26 Paris lines; 1 mètre = 443.30 Paris lines.)

Owner or director, and observatory.	Constructed by—	Aperture.			Focal length.		Remarks.
		English inches, etc.	French inches.	Mètres.	English feet, etc., and inches.	Mètres.	
REFRACTORS.							
Lyman, Yale College	A. Clark & Sons	28	...	...	.....	...	Constructing.
Littrow, Vienna	Grubb	27	...	...	.....	...	Constructing.
McCormick, (?)	A. Clark & Sons	26¼	...	...	33 feet.		
C. H. Davis, Washington	A. Clark & Sons	26	...	...	390 ins.		
Newall, Gateshead	Cooke	25	...	...	29 feet.		
Buckingham, London	Buckingham	21					
University of Chicago	A. Clark & Sons	18.5	...	...	23 feet.		
Winnecke, Strasbourg	Merz	18	...	...	.....	...	Constructing.
Pickering, Harvard College	Merz	14.95	...	...	270 ins.		
O. Struve, Pulkova	Merz	14.93	...	...	270.6ins.		
Lord Lindsay, Dun Echt	Grubb	15	...	...	15 feet.		
Huggins, Royal Society, near London.	Grubb	15					
Downsede College, Bath	.....	14.5	...	...	.....	...	Destroyed by fire in 1867.
Cooper, Markree Castle	(?)	14	...	...	25 feet.		
Oom, Lisbon	Merz	...	14				
C. H. F. Peters, Clinton	Spencer	13.5					
Boss Albany	Fitz	13	...	...	15 feet.		
Rutherfurd, New York	Rutherfurd & Fitz	13	...	...	.....	...	Photographic.
Watson, Ann Arbor	Fitz	12.5	...	...	17 feet.		
Airy, Greenwich	Merz & Simms	12.5	...	...	16.6 ft.		
Mitchell, Vassar College	Fitz, reworked by Clark	12.5					
Pritchard, Oxford	Grubb	12.25					
Pritchett, Glasgow, U. S	A. Clark & Sons	12.25	...	...	17 feet.		
Le Verrier, Paris	Secretan & Eichens	.....	12				
Littrow, Vienna	A. Clark & Sons	12	...	...	.....	5	
Adams, Cambridge	Cauchoix	12	...	...	20 feet.		
Ball, Dublin	Cauchoix	12 (?)	12 (?)				
H. Draper, near New York	A. Clark & Sons	12					
Main, Oxford	Cauchoix	12 (?)	12 (?)				
Pritchard, Oxford	Grubb	12					
Stone, Cincinnati	Merz	11.5					
And many others.							
REFLECTORS.							
Lord Rosse, Birr Castle	Rosse	6 feet	...		55 feet.		
William Herschel, Slough	W. Herschel	4 "	...	...	40 "	...	Out of use.
Lassell, Liverpool, etc	Lassell	4 "	...	...	37 "	...	Since destroyed.
Ellery, Melbourne	Grubb	4 "	...	...	32 "		
Le Verrier, Paris	Martin, Eichens	.....	...	1.20	.....	7	Silvered glass.
Lord Rosse, Birr Castle	Rosse	36 ins.	...	.....	.....	...	Silvered glass.
Tissérand, Toulouse	Foucault	.....	...	0.80			
Stephan, Marseilles	Foucault, Eichens						
H. Draper, near New York	H. Draper	28 ins.	...	0.80	13 feet.	4.80	Silvered glass.
Lassell, Maidenhead	Lassell	24 "	...	.....	20 "	.....	Metal.
W. & H. Herschel, Slough, and C. G. H.	W. & J. Herschel	18 "	...	.....	20 "	.....	Several mirrors.
H. Draper, near New York	H. Draper	15 "					
Maclean, Tunbridge Wells	With & Browning	15 "					
Pritchard, Oxford	De la Rue	13 "	...	.....	10 feet.		
Worthington and Buxendell, Manchester	With & Browning (?)	13 "					
And many others.							

Literature.—Robert Grant, *History of Physical Astronomy* (London, 1852); William Chauvenet, *Manual of Spherical and Practical Astronomy* (Philadelphia, 1871); J. F. W. Herschel, *The Telescope* (from the *Encyclopædia Britannica*, Edinburgh, 1861); T. W. Webb, *Celestial Objects for Common Telescopes* (London, 1868); S. Parkinson, *A Treatise on Optics* (London, 1870); G. A. Grunert, *Optische Untersuchungen* (Leipsic, 1816); the volumes of the *Monthly Notices* of the Royal Astronomical Society of London; the volumes of the *Astronomische Nachrichten*, where will be found Bessel's valuable paper on the method of determining the focal length of a compound (achromatic) object-glass, Bd. xvii. col. 289. L. Waldo.

Temperaments, Human. W. Byrd Powell, M. D., classified the human temperaments as follows: *Four Primary Temperaments.*—1st, sanguine; 2d, bilious; 3d, lymphatic; 4th, encephalic. He styled the two first *vital*, and the other two *non-vital*.

The Combinations of the Elementary Temperaments.—I. *Binary Combinations.*—1st, the sanguine bilious; 2d, sanguine lymphatic; 3d, sanguine encephalic; 4th, bilious lymphatic; 5th, bilious encephalic; 6th, encephalo lymphatic.—II. *Ternary Combinations.*—1st, the sanguine bilious lymphatic; 2d, sanguine encephalo-bilious; 3d, sangoine encephalo-lymphatic; 4th, bilious encephalo-lymphatic.—III. *Quarternary Combination.*—1st, sangoine bilious encephalo-lymphatic.

He entertained the opinion that physiological incompatibility should be regarded as an unlawful marriage, and laid down two laws illustrating this point: (1) The marriage of a person with another of the same temperament is incompatible. (2) When an adjunctive temperament enters into the constitution of both progenitors or parties to a marriage, it will be incompatible. These two laws he held as sufficient to enable those who understood the temperaments to distinguish accurately all incompatible parties.

He gave cases to illustrate both of these laws: (1) When both of the parties to a marriage have the sanguine encephalic temperament, their children will die young of dropsy of the brain or tubercular inflammation of its membranes. (2) When both of the parties to a marriage have the bilious encephalic temperament, their children will be idiotic. (3) When both of the parties to a marriage have the bilious encephalic lymphatic temperament, their children, in the proportion of 5 to 7 or 9 to 11, will be dead-born, and the others will not live two years respectively. These three cases illustrate both laws.

He then illustrated the second law: (4) When one party is bilious lymphatic, and the other is sanguine bilious encephalic, their children will all die young of tubercular consumption of the lungs or abdominal glands, although neither of these forms of disease was ever in the ancestry of either party. (5) If one party be sanguine encephalic, and the other bilious lymphatic, the progeny will die young of tuberculous forms of disease. (6) If one party be bilious encephalic, and the other sanguine encephalic bilious lymphatic, the children will sooner or later become insane, for the reason that both parties partake constitutionally of an adjunctive temperament. All such marriages are incompatible.

Law 3.—In all marriages with a view to or expectation of progeny, one of the parties should have an exclusively vital temperament, and the other more or less adjunctive. *First Illustration.*—One party sanguine, the other bilious encephalic or lymphatic bilio-encephalic. *Second.*—One party bilious, the other sanguine encephalic, or lymphatic, or sanguinio-encephalic lymphatic. *Third.*—One party sanguine bilious, the other sanguine lymphatic, or bilious lymphatic sanguine, or bilious encephalic, or bilio-encephalic lymphatic. These are all physiological marriages. Robert S. Newton.

Ter'ni, Falls of, otherwise called the **Cascade of the Marmore,** about 5 miles from the town of Terni, formed by the waters of the Velino, which are brought hither by an artificial canal and dashed over an almost perpendicular precipice, the height of which is variously estimated at from 700 to 1200 feet, and the foot of which they reach by three unequal leaps. The canal, cut through the living rock of the Marmore Mountains, was executed by the Roman censor M'. Curius Dentatus in the year of Rome 481, the object being to drain the marshes near Rieti. The extraordinary beauty and grandeur of the surrounding scenery, added to the highly-imposing character of the falls themselves, which in fine weather are either spanned by a single lofty iris-colored arch or seen through a thousand smaller rainbows, shifting and crossing as the breeze sinks and swells, makes this cascade one of the most attractive in Europe. Caroline C. Marsh.

Tes'timony (in law) is the oral statement of facts made under oath by witnesses upon the trial of a civil or criminal action, or upon the hearing of any other judicial proceeding, as contradistinguished from the evidence furnished by written instruments, or by any other mere physical facts or appearances which can be exhibited to the court or jury. "Evidence" is the generic term, while "testimony" is specific. (See the article Evidence.) At the common law the witnesses in a legal action must be produced before the jury, unless they are without the kingdom or state, in which case their examination is taken in writing by means of a commission sent to the foreign country. In the English equity, admiralty, probate, and ecclesiastical proceedings the testimony was always taken by deposition and read on the trial. The modern radical changes in procedure have altered most of these ancient rules. Even the testimony in legal actions, both in many of the American States and in England, may now be written if the parties agree to that method; while by the practice of some States and of the U. S. tribunals it may always be in the form of a deposition if the witness lives at a fixed distance from the court or in certain counties other than that in which the trial is held. There is one important exception to this relaxation made necessary by the national and State constitutions. In all criminal trials the prisoner must be confronted by the witnesses against him, so that the testimony for the prosecution must be produced and delivered orally before the jury. Wherever the reformed American procedure prevails, with the exception of three or four States, the testimony in equitable suits is given in the same manner and is governed by the same rules as that in legal actions; in the few exceptions just mentioned the parties may elect between the ancient and the new methods; while in the U. S. courts and in a few States which still retain a separate administration of equity the original form of deposition continues to be used. The recent reform in the English procedure allows the parties a free selection between the written and the oral modes. (In respect to the compelling the attendance of witnesses, the administration of the oath or of the affirmation, the examination and cross-examination, and the rules as to the competency of witnesses, see Subpœna, Oath, Trial, and Witness, in Cyclopædia.)

John Norton Pomeroy.

Test Oath. By the act of 25 Car. II. ch. 2, all persons holding any office—except a few of a very inferior degree—or holding any place of trust under the Crown, including members of Parliament, were required to take certain oaths—viz. that of allegiance, which was purely civil, that "of supremacy," which acknowledged the Crown as the lawful head of the English Church and abjured all civil or ecclesiastical allegiance to any foreign potentate, and to subscribe a certain declaration against transubstantiation, and finally to partake of the communion in the Church of England. Those who disobeyed any of these provisions were not only unable to hold office, but were also liable to fine. The effect of these statutes, which were collectively known as the "Test-Oath acts" or the "Test acts," was to prevent all Romanists, dissenters, and Jews from attaining to any public and official position. After a long political struggle the severity of these requirements was broken by the 9 Geo. IV. ch. 17, which partly abolished the restrictions laid upon Romanists, and the reform gradually but steadily proceeded, until finally all tests except the oath of civil allegiance have been removed, and members of the Church of England, dissenters, Jews, and Romanists are alike admitted to Parliament and to any other official positions and places of trust.

Test oaths have been largely resorted to in the U. S. as a consequence of the civil war. Prior to and at its close statutes were enacted by Congress forbidding any member of Congress to take his seat, or any U. S. officer to enter upon his duties, or any person to be admitted as an attorney or counsellor in a U. S. court, unless he should take an oath, in substance, that he had not been engaged in the rebellion, nor had in any manner given it aid and comfort. Many States repeated this legislation, extending it not only to State officers, but even to members of professions, such as lawyers, clergymen, college professors, teachers, and the like. The validity of these statutes, national and State, was soon brought before the Supreme Court of the U. S. That tribunal held that these oaths were highly penal in their nature; that their effect in some instances was to deprive persons of political rights which they would otherwise have enjoyed, and in other instances was to deprive persons of vested civil rights which the law regarded as tantamount to property. The Supreme Court finally declared that so far as the test oaths were made applicable to persons who had been connected with the rebellion, or who had given it aid and comfort prior to their enactment, and so far as their object was to destroy vested civil rights by preventing persons from pursuing their various callings, the statutes creating them were null and void, either as

ex-post facto laws or as bills of attainder. (See EX-POST FACTO and BILL OF ATTAINDER, in CYCLOPÆDIA.)

JOHN NORTON POMEROY.

The'atre [Gr. θέατρον, a "show-place"]. The ancient theatre, established by the Greeks and only slightly modified by the Romans, reflects very strikingly in its architectural construction the ideal character of the ancient drama. In the centre of the whole building stood the thymele (θυμέλη), an altar raised in honor of Dionysus (Bacchus), and every dramatic representation was opened and closed by a sacrifice being offered up on this altar; for in ancient Greece theatrical representations formed a kind of religious festival. The buildings in which these religious festivals were celebrated were often of enormous size, capable of seating 80,000 spectators; for, since theatrical representations had become an official form of public worship, recognized and supported by the state, it was necessary that every citizen should be provided with a seat. No less striking are the circumstances that these enormous and costly buildings were originally used only twice a year, and only for a few days; that the ornamentation of the stage and the actors was entirely conventional, without any attempt at imitating nature; that the building was roofless, admitting the natural light's full influx, and thereby excluding illusion, and forcing the actor to give any allusion to natural objects which the text might contain—as, for instance, Iphigenie's farewell to the sunlight—a direct application, etc. Such circumstances show that in studying the ancient drama and its theatrical representation it is best to start from a comparison with the modern sermon, the divine service, and the church; and, indeed, as soon as the ancient drama lost its religious signification, it withered away and disappeared; and as soon as the ancient theatre attempted to adopt illusion as the principle of its representation, it sank into utter depravity, was deserted, and fell into ruins.

The ground-plan of an ancient theatre may be most easily understood by imagining a circle divided by a diameter. In the centre stood the thymele. The space on the one side of the diameter, between the thymele and the first row of seats, which rose in semicircles, one behind the other, was called the orchestra (dancing-place), and was occupied by the choir, which here sang their hymns and performed their choral dances. On the other side of the diameter, a little behind the thymele, rose the stage, a long parallelogram of comparatively little depth, raised to the same height as the first row of seats, and closed on the three sides by walls of the same height as the last row of seats. For location was generally chosen the slope of a hill with a natural inward curve, which facilitated the construction of the auditorium; the theatre of Athens was situated on the south-eastern slope of the Acropolis. In many cases, however, the whole amphitheatre had to be raised on immense substructures. Access to the auditorium was effected partly from below, through the passages between the stage and the auditorium, partly from above, whence stairs led down to the different rows. The lowest rows nearest the orchestra were reserved for the dignitaries of the community; the highest and farthest off were left to the women. The scene generally represented the front façade of a palace, and was stationary. It could be altered, however, or even entirely changed, by opening the back wall and showing the interior of the palace, and by turning the wings (περίακτοι), which bounded the proscenium on both sides, to the left and to the right. But as a rule the scene was stationary, and its ornamentation entirely conventional. Thus, the back wall showed three doors, and the very character of a person was indicated by the door through which the actor entered the stage. A flight of steps led from the stage down into the orchestra, and by these the choir sometimes ascended the stage; the actor never descended into the orchestra. A machine—rather formidable, it would seem, from the effect it sometimes produced—was employed for bringing the gods down from heaven or carrying the mortals up into the heavens. The costume of the actors was also essentially conventional. Women's parts were always performed by men. The tragic actor wore cothurni, a mask, sometimes of marble, and a prodigious amount of padding, and his means of representation were thus confined to attitudes and modulations of the voice, facial expression and all gesticulation proper being excluded. Between the lips of the mask was fixed a metallic device which greatly increased the strength of the actor's voice, and sounding vases were placed at fixed intervals in the auditorium. The oral delivery of the part was song rather than speech, probably very much like the recitative of modern opera. Performances took place, originally, only twice a year, in spring and fall, at the great festivals of Dionysus; and as a rule the same drama was never played more than once, though instances occurred in which a drama first brought out in spring was repeated in the fall. Several dramas by various poets were represented on the same occasion, and the representation often began at sunrise and ended after sunset. The expenses—often very considerable, as it took several months to prepare a drama for representation—were defrayed by wealthy citizens, and a competition was established between the actors, the poets, the patrons, etc. The prize was a laurel crown, and was one of the greatest honors the ancient community could confer; on the other hand, an actor who once happened to mispronounce a word was immediately dragged down from the stage and flogged in the orchestra. Poor people received from the state treasury one day's wages, besides the entrance-fee, in order that they should not be prevented by poverty from being present in the theatre.

The changes which the Romans introduced in the construction of theatres were comparatively small. The first stone theatre in Greece was built in Athens in the time of Themistocles; the first in Rome by Pompey. The most interesting remains of ancient theatres are those of Ephesus, Miletus, Cnidus, Syracuse, Tauromenium, Rome (the theatre of Marcellus), Nimes, etc. The principal writers on the subject are, among the ancients, Pollux and Vitruvius; among the moderns, Schneider, Geppert, Strack, Ferrara, Donaldson, etc.

The history of the modern theatre is closely connected with the history of the modern drama, and its origin has been traced in the article on MYSTERIES. From the time when the miracle-plays and moralities disappeared, and up to the time when theatres were built and theatrical representations maintained at every court as a part of the royal household, during the whole period from the fifteenth to the seventeenth century, in which strolling bands acted in the courtyards of the inns or in temporary buildings of wood, all theatrical matters are involved more or less in obscurity. Certain general traits, however, are well authenticated. In most cases only the stage was roofed, while the pit was left open. Hence the custom that noble and wealthy people were seated on both ends of the stage itself—a custom which continued a long time after the circumstances which had caused it disappeared; it was Voltaire who finally drove this intrusive kind of spectators back into the boxes. That a stage thus occupied by spectators could have no decoration resembling the scenery of our days is self-evident. The stage directions with which Jacob Ayrer accompanies the texts of his plays, an old print dating from Shakspeare's time and representing the stage of the Red Bull Theatre in London, the technical construction of Shakspeare's dramas, etc., give us some ideas of the general outfit of the stage. In the centre of the background was found a platform raised a few steps from the floor. From front corners of this platform arose two pillars on which rested a balcony, and the space between the pillars was filled with a movable curtain hanging down from the balcony. This device, which probably originated from the use of the inn-door as the centre of the background of the stage, formed the principal feature in the scenery of that time. Here Banquo was murdered and Desdemona strangled; here Romeo met Juliet; here the blind Gloucester sprang into the abyss and was carried by angels into the arms of Edgar, etc. Meanwhile, the revival of letters in Italy, and the attempts at representing the antique tragedy, occasioned the construction of stages and theatres after the antique model. In the middle of the sixteenth century Palladio built theatres in Vicenza and Venice after the rules of Vitruvius. The stage had here a merely architectural ornamentation, and its various parts—doors, balconies, etc.—a merely conventional signification. This plan was afterward adopted in France, and carried out in the tragic stage of the Palais Royal, erected by Richelieu in 1639, and forming the scene on which the tragedies of Corneille were enacted, and in the comic stage of the Hôtel de Bourgogne, finished in 1645. The combination, however, and gradual amalgamation of these two types of stages, the mediæval originating from the courtyard of the inn, and the classical originating from an imitation of the Greek scene, cannot be traced in details; but in the middle of the eighteenth century it was consummated, and by this combination the modern stage was formed. It is said that movable scenery was invented in 1657 by Bibbiena, and the curtain introduced in 1698 by Dorbay, but the dates of both these devices, the two most characteristic features of the modern scene, are uncertain.

The first theatre in England was probably the London Theatre, a wooden but stationary structure erected before 1576. In Shakespeare's time London had three private and four public theatres; his own plays were enacted in the house in Blackfriars and at the Globe. The first theatre in America was opened at Williamsburg, Va., in 1752; the next in Nassau street, New York, in 1753. The two largest theatres are the Della Scala in Milan and the San Carlo in Naples, seating between four and five thousand people; the two most magnificent are the opera-house in Vienna, opened in 1869, and the Grand Opéra in Paris,

opened in 1875. The principal writers on the subject are Tieck, Ulrici, Lehwald, Magnin, Taillandier, Leroy, Wright, and Doran. CLEMENS PETERSEN.

Thermal Springs. Warm water having a greater power of dissolving the mineral constituents of the rocks through which it passes, thermal springs are usually at the same time *mineral* springs and are used for medicinal purposes. They are classified, in this respect, according to the characteristic and prevailing gaseous or mineral elements which they contain. Carbonic acid gas abounds in the gaseous, *acidulous* waters of Pyrmont and Seltz, in Germany, Spa, in Belgium, and Vichy, in France. Sulphur compounds predominate in the *sulphurous*, like the celebrated waters of the Virginia Springs, in the Alleghanies, and Saratoga; Barèges, in the French Pyrenees; Loueche, in Switzerland; Aix, in Savoy: common salt, associated with many others, in the *saline* waters of Plombières, in the Vosges; Aix, in Provence; Schlangenbad, in Germany; Baden, in Switzerland; Seidlitz, in Bohemia: a great variety of salts, without especial preponderance of any one, in the *complex* springs of Carlsbad and Töplitz, in Bohemia; Wiesbaden, Ems, and Baden-Baden, in Germany: salts of iron in the *chalybeate* springs which abound in all countries rich in this metal. The number of mineral springs is very great: there is scarcely a country which cannot boast of many. Europe, however—in which, among all the continents, the earth's crust is most broken and dislocated—is perhaps also the richest in mineral springs. Over 800 have been described in France, 400 in Spain, a greater number still in Germany, Bohemia, Switzerland, Italy, and England, their various temperatures ranging as high as 180° F. In this country the numerous springs found in Arkansas vary from 110° to 165° F. (See, further, EARTH, VI.) A. GUYOT.

Ther'mo-Chemistry. Like every other human study, chemistry includes a science of facts and a science of law; the latter, the highest aim of the science, consisting of the investigation and exposition of the *laws of change* in nature. That branch of the study called thermo-chemistry in its widest sense must be admitted to cover the whole science of chemical change and chemical law, because no chemical change probably occurs, or is possible, without disturbance of thermal equilibrium. The investigation of thermal changes in chemical transformations has therefore of late years been placed in the highest rank of human pursuits, and has occupied some of the best intellects. It cannot, however, be claimed as yet that much substantial progress has been accomplished, the field being too great and the laborers too few. The measurement of the exact amounts of positive thermal development, and of negative thermal absorption, accompanying various kinds of chemical operations—such as combinations, oxidations, combustions, decompositions, solutions, fermentations, explosions, and so on—has occupied much of the labor of such investigators as Bunsen, Berthelot, Thomsen, Favre and Silbermann, Andrews, Woods, Joule, and others. Many important classes of facts have been put on record, but as yet scarcely sufficient to justify any very broad generalizations. It would appear also that the modes of *measurement* of the thermal changes accompanying transformations are subject to errors and uncertainties that have not yet been eliminated, by reason of which independent observers do not yet attain results of sufficient uniformity to inspire implicit confidence. The practice of these modes of measurement is known as the art of

Calorimetry.—This art differs from those of THERMOMETRY and PYROMETER (which see) in seeking to determine not merely the temperature or calorific *intensity* that may appear during a chemical change, but the total *quantity* of heat—or, more correctly speaking, of heat-force—that appears or is developed. According to the view taken in the article TEMPERATURE, NATURE OF (which see), that temperature is energy or motion of the *molecule* as a whole, calorimetry may be defined as the measurement of the amount of potential chemical energy of the atom inside the chemical molecule, that appears or is transmuted into actual or kinetic energy of the molecule itself in the course of changes of constitution of the said molecule. Under VOLUMES, MOLECULAR, it is further explained how, according to the new views of the writer, such conversion of atomic energy into molecular energy is necessarily accompanied by a change in the volume of the molecule by reason of a change in the amplitude of the atomic motions. The importance of calorimetry thus becomes apparent, as furnishing an index to the changes of internal chemical constitution of matter.

The first calorimetric work was done by Lavoisier and Laplace almost a century ago, in 1780. They operated only to determine heat of *combustion*, and adopted the device—often since used by others, including Bunsen among the latest experimenters—of determining the amount of ice melted by the products of combustion. The most important disturbing cause or source of error in making this determination precise is the loss of temperature of these products of combustion through transmission by radiation and conduction to other bodies before reaching the ice to be melted. Every known precaution is therefore taken to confine the heat by means of non-conducting materials, such as eider down, etc. Our great American philosopher, Rumford, invented a beautiful device looking to the elimination of this cause of error. He cooled his calorimeter before beginning the experiment to a temperature just as much below that of the air as it was found to rise above it during the combustion going on within it, the latter having been ascertained by a preliminary experiment. Then the heat lost during the later stages of the process was about compensated by that gained during the earlier stages, absorption being equal to radiation. When the melting of ice is the criterion, there seems another error, on which too little stress has been laid. It appears from experiments of Person that there is an intermediate state between ice and water, during which the ice absorbs a little *latent heat of fusion* without a corresponding appearance of liquid water. This absorption begins at about 3½° F. below the putative thermometric "melting-point of ice." In other words, the change involved in the melting of ice is not precise or sharp, but extends throughout three and a half degrees of temperature. Those methods, therefore, in which the effect is measured by the rise in temperature of a known weight of liquid water through which the products of combustion are passed are preferable. This was done by Favre and Silbermann, and by Andrews, to whom we owe the most extensive and valuable determinations of the calorific development during *combustion*, that branch of thermo-chemistry which has the most immediate *practical* importance. The methods of these experimenters, described in detail, would require cuts and occupy too much of our space. They will be found in the chemical books of reference. The following are some of the more important of their results that bear upon the subjects of fuel, practical calorifics, and metallurgy. The figures represent the number of pounds of water heated 1° F. by 1 pound of the substance while burning with pure oxygen:

Substance.	Burning to—	Water heated.	Experimenters.
Hydrogen	Water	60986	Andrews.
		62032	Favre & Silbermann.
Charcoal	Carbonic acid	14220	Andrews.
		14524	Favre & Silbermann.
Diamond	" "	13986	Favre & Silbermann.
Carbonic oxide	" "	4325	Andrews.
		4376	Favre & Silbermann.
Sulphur	Sulphurous acid	4153	Andrews.
		4032	Favre & Silbermann.
Phosphorus	Phosphoric acid	10345	Andrews.
Iron	Magnetic oxide.	2848	"
Copper	Black oxide	1085	"
Zinc	White oxide	2394	"

In the case of gaseous substances it is usually of much more immediate practical interest to know the comparative calorific power or effectiveness of *equal volumes*, instead of equal weights of combustible, as in the above statement. In the following tabulation, therefore, the comparative weights of water heated equally by equal volumes of some combustible gases, burning with pure oxygen, are given; the standard volume adopted being that of 1 pound of hydrogen gas, in order to bring them into direct comparison with the above:

Equal volumes of	Burning to—	Water heated 1° F.	Experimenters.
Hydrogen	Water	60986	Andrews.
		62032	Favre and Silbermann.
Carbonic oxide	Carbonic acid	60559	Andrews.
		61261	Favre and Silbermann.
Marsh gas	CO_2 and H_2O	188101	" "
Olefiant gas	" " "	298841	" "
Carbon disulphide	CO_2 and SO_2	232560	" "
Sulphuretted hydrogen	H_2O and SO_2	83878	" "

It must be noted that these are the total amounts of heat-energy developed during these combustions with pure oxygen; that is, the products of combustion being cooled down to the same temperature as the combustible and the oxygen were before burning, that temperature, moreover, being below 212° F., the temperature of steam. When these combustible bodies burn practically in air, and the flame is applied for practical purposes, modifying conditions of great magnitude step in. The products of combustion often remain at a high temperature after being used, generally above 212° F.; and therefore, in cases where hydrogen is a constituent of the combustible, there is not only lost the energy corresponding to this residual temperature, but also the latent heat of the steam produced by the combustion. The great volume of nitrogen in the air carries off its proportion of the energy, and so many and various new factors are introduced that calculations of some complexity are required in connection with prac-

tical calorifics; the figures in the above tabulations giving no idea in most cases of the practical calorific effectiveness of the bodies named.

Apart from so-called combustion, other chemical operations are now occupying, with reference to the determination of the thermal changes accompanying them, the labors of some eminent minds. Few general principles have yet been established, and only a few examples of the results that have been obtained can be cited. For mixtures of *oil of vitriol* and *water* Thomsen obtained heat-developments as follows:

	Total heat.
O_4SH_2 with $1H_2O$	6513
" " 2 "	9757
" " 3 "	11598
" " 4 "	12777
" " 5 "	13662
" " 6 "	14416
" " 7 "	15008
" " 8 "	15474
" " 12 "	16537
" " 16 "	17020
" " 20 "	17243
" " 24 "	17384
" " 28 "	17471
" " 32 "	17536
" " 36 "	17579
" " 40 "	17612

Up to the *sixtieth* molecule of water added, some molecular change still occurred as a little heat still appeared. Favre and Silbermann found for the thermal development by the union of equivalents of nitric and muriatic acids, with equivalents of various bases, the following:

	Nitric acid.	Muriatic acid.
Potash	15510	15656
Soda	15283	15128
Ammonia	13676	13536
Baryta	15360	15306
Lime	16943	16982
Magnesia	12840	13220

(In Watts's *Dictionary of Chemistry*, article "Heat," will be found an extremely useful account, by Prof. George C. Foster of University College, London, of the various researches in thermo-chemistry, to which the inquiring reader may refer.) HENRY WURTZ.

Thomp'son (RICHARD M.), b. in Culpeper co., Va., June 9, 1809; received a classical education; was a clerk in a store in Louisville, Ky.; afterward a school-teacher in Lawrence co., Ind., but studied law at the same time, and was admitted to the bar in 1834. In the same year he was elected to the State legislature of Indiana, and re-elected in 1835. In 1836 he became a State senator: in 1841 was chosen to Congress, and again in 1844 and 1847. Various appointments which were offered to him by the administration he declined, but took part very actively in politics; was a delegate to the Republican conventions of 1860, 1864, 1868, and 1876, and entered Pres. Hayes's cabinet in 1877 as secretary of the navy.

Tides, Theories of. In the article TIDES, OCEANIC WAVES, AND CURRENTS, a popular explanation is given of the cause of the tides. In Fig. 1 of that article is shown how the moon causes "high water," not only immediately under itself, but at the point diametrically opposed, while "low water" occurs on a great circle along which the moon is in the horizon. Were the earth a solid spheroidal body *held fixed in space* and covered by an ocean, a foreign attraction (*e. g.* that of the moon) would move *all* the waters, both those directly under and those opposite, *toward* the attracting body; those under it would be elevated, those opposite depressed. But the earth is *not* thus held fixed in space; its solid nucleus and its enveloping waters are alike affected by the foreign attraction, the convergence of lines of direction of which toward its source, and the *law of distance*, generating differential action on the fluid particles and the rigid nucleus. The latter obeys the attraction as if exerted upon its centre, the actual motion the earth thus receives being a recognized element in our astronomical tables. The waters nearer the moon than that centre are more powerfully attracted—those more remote less so—than the solid nucleus. Let D be the distance from the moon to centre of the earth, r the radius of the earth, and M* the moon's mass. Then the attraction upon the earth's centre will be $\frac{M}{D^2}$; upon a particle of water immediately under the moon $\frac{M}{(D-r)^2}$; upon a particle opposite $\frac{M}{(D+r)^2}$. The first of these attractions is less than the second and greater than the third; hence the difference between the first expression and the two latter, $\frac{2Mr}{D^3}$ (very nearly), will express, in either case, a force drawing the particles (respectively) *away* from the earth's nucleus. With respect to particles along the great circle to which the moon is on the horizon, there is a compressing component (*i. e. toward* the diameter directed to the moon), expressed by the total attraction, $\frac{M}{D^2}$, into $\frac{r}{D}$, or $\frac{Mr}{D^3}$. This component is due to the convergence of lines of attraction upon centre and upon external point, and is equal to $\frac{M}{D^2}$ into sine, $\frac{r}{D}$, of the minute angle. If we consider an intermediate superficial particle, in any plane, at an angular distance ϕ from a radius directed to the moon, we find it subject to *both* these actions, as expressed by components:

$$-2\frac{M}{D^3}r\cos\phi \text{ and } \frac{M}{D^3}r\sin\phi \qquad (a)$$

(in which ϕ is counted from 0 to π only).

By the superadded foreign components of force (a) the spherical form of fluid surface will evidently be *elongated*, the water will be *raised* at the point under the moon and its antipodes, and it will be depressed along the perpendicular circle to which the moon is in the horizon. The disturbing forces, very minute compared to forces (b), being equal all around the axis of elongation, the induced figure will be one of revolution, which we may *assume* to be an ellipsoid, prolate and of slight eccentricity. That it should be a surface of *equilibrium*, its normal at any point must coincide in direction with the resultant of the forces. But when we come to consider gravitation as proceeding from an ellipsoid, and not a sphere, its components are themselves modified by the induced change of form; "that is, one of the elements necessary to the determination of the form depends itself on the form" (*Airy*).

Fortunately, the attraction of homogeneous ellipsoids has been determined, and if we develop, with neglect of powers of the eccentricity above the square, and apply the known expressions (*Méc. Cél.*, Bowditch, vol. ii. p. 54; Airy, *Figure of the Earth*, § 23; or Thomson and Tait, § 771) to the earth considered as a homogeneous, slightly-prolate ellipsoid of revolution, we shall find the expressions (E representing the *mass* of the earth)

$$\frac{E}{r^2}(1-\tfrac{2}{5}e^2)\,r\cos\phi,\ \frac{E}{r^2}(1+\tfrac{1}{5}e^2)\,r\sin\phi. \qquad (b)$$

The small increments of these components of gravitation (terms in e^2) are due only to the change of form—*i. e.* to the *raised or depressed superficial matter;* and if the earth is not homogeneous, if (covering a solid and denser nucleus) this is water, its *relative density*, δ, must be introduced as a factor. Combining these forces thus modified with the foreign attractions (a), the total forces, normal and parallel to the axis of figure, become (since $\frac{E}{r^2}=g$, or gravity)

$$\left[g(1+\tfrac{1}{5}e^2\delta)+\frac{Mr}{D^3}\right]\sin\phi,$$

$$\left[g(1-\tfrac{2}{5}e^2\delta)-2\frac{Mr}{D^3}\right]\cos\phi.$$

Their quotient expresses the tangent of the angle made by *resultant* with axis. The tangent of angle made by the *normal* to the ellipsoid is the quotient

$$r\sin\phi \div (1-e^2)\,r\cos\phi.$$

That there should be equilibrium, these quotients should be identical, and their equalization (developing with neglect of quantities of the second order of minuteness) gives

$$e^2=\frac{3Mr}{D^3g}\cdot\frac{1}{1-\frac{2}{5}\delta}.$$

We find, therefore, that a prolate ellipsoid of revolution of the slight eccentricity thus determined satisfies with sufficient exactness the conditions of equilibrium.

The polar equation of the generating ellipse, referred to its centre, may be written $r^2=\frac{b^2}{1-e^2\cos^2\theta}$, in which b is the *lesser* axis. If we take a for the mean radius of the generated ellipsoid—*i. e.* the radius of sphere of same volume $=b(1+\frac{1}{5}e^2)$, and put $r=a(1+y)$, and substitute in above and omit higher powers of eccentricity, we get (taking, finally, a for unity)

$$y=\tfrac{1}{2}e^2(\cos^2\phi-\tfrac{1}{3}).$$

Substitute the value previously found (for the ellipsoid of equilibrium) of e^2, putting $r=1$, and we get

$$y=\frac{3M}{2D^3g}\cdot\frac{1}{1-\frac{2}{5}\delta}(\cos^2\phi-\tfrac{1}{3}), \qquad (c)$$

in which y expresses the amount of elevation or depression of the water, in terms of earth's radius as unity, for any point for which the zenith distance of the moon is ϕ.

* The moon, as the most influential agent of the tides, is *mentioned*, but what is said applies equally to the sun.

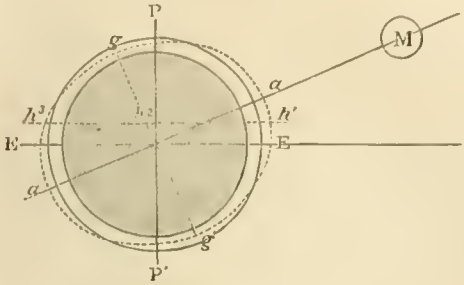
If ϕ be zero, or 180°, $y = \frac{M}{D^3 g} \cdot \frac{1}{1 - \frac{3}{2}\delta}$.

If ϕ be 90°, $y = \frac{1}{2} \frac{M}{D^3 g} \cdot \frac{1}{1 - \frac{3}{2}\delta}$.

The maximum elevation of the water is therefore double its maximum depression. In case of the earth, δ is about $\frac{2}{311}$, and the factor in which it enters amounts to but $1\frac{1}{8}$. But were the earth a *homogeneous fluid throughout*, this coefficient would become $\frac{3}{2}$; and we find in that case the *direct effect* due to the foreign attraction exaggerated in that ratio by the mutual attractions (or want of them) in raised and depressed portions. The factor in question will be omitted hereafter, its effect being understood.

We have now to refer the tidal configuration we have

Fig. 1.



Tidal Configuration.

found to the co-ordinates by which we usually express position on the surface of the earth. Since it revolves daily about its axis P P', while the configuration remains fixed in relation to the moon, any point of the nucleus, as h, will be borne along a parallel of latitude, and will at h^1 have, above it, high water—at h^2 (when the great circle $g\,g$ is intersected), its lowest water—at h^3, high water *again*, but yet of inferior height to that belonging to position h^1; unless, indeed, the moon be on the equator, when the two opposite high waters will be equal. In the difference between the high tides h^1 and h^3 we have what is called the *diurnal inequality*; and the phenomena just delineated indicate the analysis into *diurnal* and *semi-diurnal* tide.

Let θ represent the polar distance (complement of the latitude) of a fluid particle; $\tilde{\omega}$, its longitude measured from a meridian fixed on the earth's surface; nt, the angle that this diurnally-rotating meridian makes at any moment with a fixed *celestial* meridian (in which t represents the time and n the angular velocity of the earth's rotation on its axis); ψ, the moon's right ascension (measured from the same celestial meridian), and v its declination N. or S. as may be.

The cos ϕ of the foregoing equation (a) becomes transformed, so that the equation reads thus:

$$y = \frac{3}{2} \frac{M}{D^3 g} \left\{ [\cos\theta \sin v + \sin\theta \cos v \cos(nt + \tilde{\omega} - \psi)]^2 - \tfrac{1}{2} \right\}.$$

The foregoing may be developed as follows:

$$\text{(I.)}\quad y = \frac{M}{4D^3 g} \left\{ \sin^2 v - \tfrac{1}{2}\cos^2 v \right\} \left\{ 1 + 3\cos 2\theta \right\} \text{ (secular).}$$

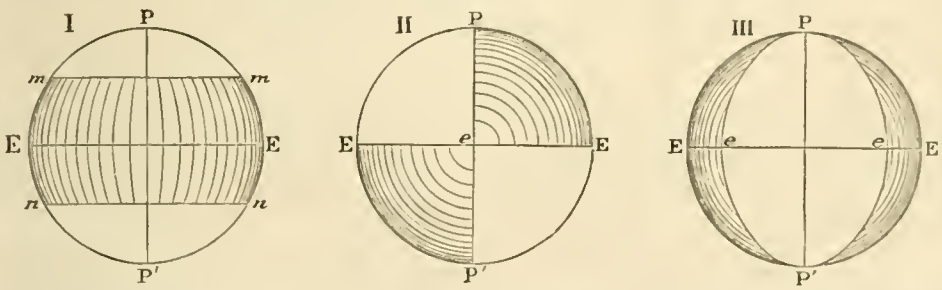
$$\text{(II.)}\quad + \frac{3M}{D^3 g} \sin\theta \cos\theta \sin v \cos v \cos(nt + \tilde{\omega} - \psi) \text{ (diurnal).}$$

$$\text{(III.)}\quad + \frac{3M}{4D^3 g} \sin^2\theta \cos^2 v \cos 2(nt + \psi - \tilde{\omega}) \text{ (semi-diurnal).}$$

The value of y is thus made up of three terms of marked characteristics, indicated by the diagrams I., II., III. of Fig. 2, on which protuberant portions are shaded. (I.) is independent of the earth's diurnal rotation nt, and also of the longitude, $\tilde{\omega}$, of the locality. It is the same, therefore, at all hours, and the same throughout each parallel of latitude. It is zero for latitude which makes $1 + 3\cos 2\theta = 0$, or for lat. 35° 16′ (N. or S.); it is negative (a depression) for higher latitudes: it is positive (a protuberance) for the equatorial belt between these parallels. It is least when the moon has its greatest declination, but is the same whether that be positive or negative (N. or S.). It is a *secular* disturbance, depending on the moon's variable angular distance from the equator, and is what would be produced were an imaginary moon and anti-moon each of half the mass of the actual moon distributed in two parallel circles of radius equal to the moon's distance from the earth's axis. "As these circles of matter gradually move each fortnight from the equator to maximum declination and back, the tide produced will be exactly the 'fortnightly tide.'" (Thomson and Tait, *Nat. Philos.*) A "half-yearly" one will also be due to the sun.

The term II. (Fig. 2) goes through all its phases as the

Fig. 2.



Secular Tides. Diurnal. Semi-diurnal.

arc $nt + \tilde{\omega} - \psi$ increases from zero to 360°, whether (for the same place) it depends on the *time*-term, nt, which thus increases in 24 hours, or (for the same instant) the longitude, $\tilde{\omega}$. It gives high tide in the northern hemisphere (*vice versâ* for the southern) when, the moon's declination being northern, the meridian of the *locality* is under the moon, low tide when opposed to it. Its highest or lowest water occurs for the parallel of latitude for which the product $\sin\theta \cos\theta$ is maximum —(*i. e.* when $\theta = 45°$). Its neutral lines are the equator and the meridian PeP' at right angles to that passing through the moon. As depending on the declination, it is maximum when that has its highest attainable value, and vanishes when that is zero.

The *oblateness* of the earth, as having no sensible influence on the amount and distribution of tidal elevation, has not been hitherto referred to. But, as pertinent to this diurnal tide, I remark that if we attribute to Diagram II. the small ellipticity e of the earth, the distortion expressed is a slight turning *of the figure* about an equatorial axis perpendicular to the plane of the diagram through the angle $\frac{3}{2} \frac{M}{D^3 ge} \sin v \cos v$; but if the spheroid were *wholly* fluid, the distortion would be magnified two and a half times (by coefficient of formula (c)), and if it have a rotation, n, about PP', then $ge = \frac{5}{4} n^2$, and the above angle becomes $3 \frac{M}{D^3 n^2} \sin v \cos v$. If the planes of diurnal rotation (or parallels of latitude) be tilted through the small fraction of this angle denoted by $2e$ (through about $\frac{1}{30}$ *second* of arc)—that is, if they all be that much deviated from true perpendicularity to the axis of rotation—the distortion of Fig. II. will result; hence, *this* is the *internal motion* by which this tidal development would be accomplished in a homogeneous fluid ellipsoid of revolution; a fact important in its relations to the phenomenon of the precession of the equinoxes.

The term III. (Fig. 2) goes through all its phases *twice* while $nt + \tilde{\omega} - \psi$ increases from zero to 2π, whether by increments of time for the same place, or without change of time, by following a parallel of latitude. It is a *semi-diurnal* tide. As effected by latitude, it is proportional to the $\sin^2$ of the polar distance of the locality. If we reckon longitude from the meridian under the moon, the neutral (or zero-elevation) lines will be the two meridians PeP': the line of low water will be the meridian at right angles to that which passes through the attracting body.

Thus, we find the total distortion represented by our Fig. I to be susceptible of analysis into the three distinct distortions represented by Diagrams (Fig. 2) I., II., III. (*spherical harmonics*), which, superimposed one upon the other, would reproduce it.

In what precedes, the earth has been treated as if it were a truly spherical solid enveloped by water. No account has been taken of the diurnal rotation (except as it

relates to the *manifestation*), none of *the motion required in the waters themselves* to assume the attributed forms.

When we consider diurnal rotation, and the centrifugal force developed by it, the *primitive form* on which the tides are generated must be taken as that of an ellipsoid of revolution equatorially oblate. But this oblateness being really very slight, the tidal developments *upon it* are essentially the same as upon the perfect sphere. Disregarding the motion of the water required to produce them (and depths not *very* many times greater than found in existing seas are sufficient to allow the motions to be disregarded), the forms I., II., III. would be the *actual* tidal forms developed in an ocean *covering the whole earth*.

In the foregoing we have what is known as the "equilibrium theory" of the tides, first indicated by Newton, and developed into its ultimate form by Daniel Bernoulli in his work *Du Flux et Reflux de la Mer*.

If the *motion* of the water necessary to the development of tides and the *resistances thereto* (for any assumed ocean depths and configurations) could be subjected to calculation, we should have not only a "dynamic" but a *true* tidal theory. The so-called "dynamic theory" of Laplace takes account of "motion," but neglects the inseparable "resistances." If a particle of fluid be running southward with angular velocity $\frac{du}{dt}$ (in which u is the *displacement in latitude* of a particle of which the normal latitude is θ), with an *acceleration* represented by $\frac{d^2u}{dt^2}$, there must to produce this acceleration be an increment of the pressure (or head) northward, $-\frac{dp}{d\theta}$ (negative sign due to θ decreasing northward). But if it be running likewise toward the E. with small angular velocity $\frac{dv}{dt}$ (v being displacement in longitude of particle of which ω is the longitude), its centrifugal force is increased from $n^2 \sin\theta$ to $\left(n + \frac{dv}{dt}\right)^2 \sin\theta$, or by $2 \sin\theta \frac{dv}{dt}$; the horizontal or southern component of this force southward is $2 \sin\theta \cos\theta \frac{dv}{dt}$. Hence,

$$\text{A.} \begin{cases} \frac{dp}{d\theta} = -\frac{d^2u}{dt^2} + 2n \sin\theta \cos\theta \frac{dv}{dt}; \text{ and the similar ex-} \\ \text{pression can be found—viz. } \frac{dp}{d\omega} = -\sin^2\theta \frac{d^2v}{dt^2} - 2n \\ \sin\theta \cos\theta \frac{du}{dt}. \end{cases}$$

To these two conditions of tidal *motion* must be added another derived from the principle of fluid *continuity*. It is not necessary here to introduce the analytical expression.

It is clear that the pressure, the differential coefficients of which are expressed by equations (A), will (divided by the gravity or weight of the water) be so much height taken from or added to the tidal rise expressed by I., II., III., so that, for the *diurnal tide*, for instance, we should have $y = \text{II.} + \frac{p}{g}$, in which the *diurnal* currents only are considered in calculating p.

The secular disturbance expressed by I. is so slowly developed* that (Thomson and Tait, *Nat. Philos.*, § 844) it may in all cases be expressed with sufficient accuracy by I., multiplied by the coefficient $\frac{5}{5-3\delta}$, which, for the case of nature ($\delta = \frac{1}{3}$, nearly) differs little from unity.

The equilibrium configuration indicated by Diagram II. for *the diurnal tide* has its axis of figure at c normal to the plane of the paper; a situation quite incompatible with the relative motion around the earth's axis of this figure as an ordinary wave. It may be regarded, however, as a *stationary* wave† developing itself meridionally between the northern and southern hemispheres, the equator being the locus of its "nodes," and its *phases* varying progressively from meridian to meridian. It can, however, be shown (see *Proceedings A. A. A. S.*, 1876) that (if the ocean be *continuous* and the depth *uniform*) the relative motions of the water due to a shifting of the axis of diurnal rotation of the fluid (as *if* it were a solid shell), through the angle already mentioned, $\frac{3M}{D^3n^2} \sin v \cos v$ (scarcely more than three seconds of arc for moon), will give values to p, as resulting from expressions (A), exactly neutralizing the action of the attracting body to produce the tidal elevations, y, of II. If, while uniform along parallels of latitude, there be an increment (or decrement) of depths along meridians proportionate to $\cos^2\theta$, such a shifting of axis through a somewhat different angle will not only neutralize the attractive force, but sustain the abnormal elevations due to the *displacement* of the quasi-solid shell. A slight separation of the axes would (geometrically) require the resulting *displacements*, u and v, of the fluid particles in lat. and lon. to be expressed by (C being a small arbitrary constant)

$$u = C \cos(nt + \tilde{\omega} - \psi); \quad v = C \frac{\cos\theta}{\sin\theta} \sin(nt + \tilde{\omega} - \psi);$$

and if *the depth be uniform*, and C made equal to $\frac{3M}{D^3n^2} \sin v \cos v$, we shall have from the expressions (A)—

$$\frac{p}{g} = -\frac{3M}{D^3g} \sin v \cos v \sin\theta \cos\theta \cos(nt + \tilde{\omega} - \psi),$$

which exactly neutralizes II. (the lunar attraction), and reduces y to zero. The expressions just given for the displacements u and v indicate an elliptical orbit, very much elongated meridionally as we approach the equator (where it is purely a *meridional* oscillation) to each particle. It appears by the foregoing that the motion in such an orbit more or less completely neutralizes the diurnal (II.) tide-producing force.

In what precedes is found the *rationale* of Laplace's discovery, that for uniform ocean-depths there is no diurnal tide. It relates to a continuous ocean, and depends upon the exclusion of the right ascension and *declination motion* of the attracting body. A continuous change in the angle of separation is made necessary by the latter—a change which cannot be effected without disturbing this equalization of pressures by which the diurnal tide is neutralized. The right-ascensional motion is even more incompatible with the theorems. This celebrated *dictum* expresses, therefore, a mere mechanical theorem alien to essential conditions under which the "tides" of nature are generated.

With regard to the semi-diurnal tide, III., supposing a uniform depth to a continuous ocean, or an ocean limited by parallels of latitude equidistant from the equator, or, finally, a depth increasing from nothing at the poles, with the $\sin^2$ of the polar distance, we find that elevations (or depressions) and motions corresponding to a *wave* of semi-diurnal period having the same neutral lines as Fig. III., fulfil the condition $y = \text{III.} + \frac{p}{g}$. But, curiously, for small or even moderate depths these elevations and depressions under certain circumstances change places. "*By a remarkable singularity, the low water takes place when the two bodies*" (sun and moon) "*are in the meridian, and the high water when they are in the horizon; so that the tide subsides, at the equator, under the body that attracts it.*" (*Méc. Céleste*, Bowditch.)

The kind of motion required for this tide may be inferred by reference to Diagram III., considered as representing a wholly fluid spheroid revolving around its axis P P′. In *this* case it is that of a minute approximation of normally equidistant meridional planes toward the meridian under or opposite the moon (where there is high tide), and an eloignment of those at right angles (low tide). As a consequence, the former are moving slower, the latter faster, than the earth's rotation; both, however, by differences quite inappreciable. If there be, however, a solid nucleus with uniform ocean depth, and we conceive the water down to the bottom divided by equidistant meridians, their relative motions to produce the same elevations will become quite sensible, and, through the equations (A), give rise to *meridional* motions which importantly augment the development of these elevations. The waters on the meridians of low tide will be running *east*—those on meridians where there is high water running *west*, or retrograde; at the place of mean elevation the current will be slack. And were it the question of a cylindrical instead of a spherical surface, this would be throughout a true wave-motion, as it will be so quite nearly on the earth's surface between the tropics, where the elliptical orbits of the fluid particles lie nearly in *vertical* planes, of which the range from low to high water is the dimension of the conjugate diameter. The single case which furnishes a finite integral (*i. e.* when the depth increases from pole to equator *as* $\sin^2\theta$) illustrates this. The meridional motion disappears at the equator, and the oscillation becomes that of a true wave. This motion, increasing the centrifugal force at place of low water and increasing it at high water, has the same tendency as the superficial elliptical motion of the diurnal

* This stationary wave, rising and falling synchronously with the waxing and waning of the forces which generate it, would tend, however, to an indefinitely increased development, as Laplace's analyses show, were it not for the counteracting resistances of friction, etc.

† The motion (progressive) of the folds of a shaken carpet, or of the waves seen rolling up our sea-beaches, is, as regards *form-motion*, illustrative of the ordinary wave; that of a vibrating string with "nodal points" (see art. VIBRATION, Fig. 6) illustrates the stationary wave.

tide to *diminish* the tidal elevations; but the range of these tides, when resistances are disregarded, depends not upon what motion the foreign attraction, opposed by resistances, is capable of generating and maintaining, but upon what, when *initially impressed*, that attraction can *maintain*. Thus (Airy, *Tides and Waves*, § 100) they increase indefinitely as the equatorial depth at the equator diminishes to about seven miles; become *negative* (*i. e.* inverted—a "singularity" already alluded to), diminishing from indefinitely great to small negative magnitude as depth farther increases. But such are not the tides of nature, wherein the resistances to motion control all approach to indefinite magnitude of development, in retarding or accelerating the time of high water, corresponding to the above theoretical "direct" or "inverted" wave.

From the foregoing we readily conclude that the "dynamic theory," the results of which have been sketched, is equally at fault with the equilibrium theory as an exponent of the tides of the actual oceans. Indeed, to quote the language of its illustrious author, "*The irregularity of the depth of the ocean, the manner in which it is spread over the earth, the position and declivity of the shores, their connections with the adjoining coasts, the currents and the resistances which the waters suffer, cannot possibly be submitted to accurate calculation, though these causes modify the oscillations of this great fluid mass.*" (*Ibid.* See also article LAPLACE.)

The theoretical investigation of the celebrated Dr. Thomas Young appeared nearly at the same time as the last (5th) volume of the *Mécanique Céleste*. "He distinguishes the results of the *forced* and *free* oscillations of the sea; the former resulting from the direct action of the sun and moon, combined with the rotation of the earth, and whose periods of rise and fall are determined solely by those external causes (external, I mean, to the mass of the ocean); the *free* waves, on the contrary, derived from the former, are transmitted with velocities depending on the mechanism of the fluid itself, on its depth, and on the resistances arising from friction to which those motions are exposed." This work of Dr. Young's, rather a sketch than a full development (*Encyc. Brit.*, 6th, 7th, and 8th eds.), anticipates Mr. Airy's *wave-theory*, and though not carried out to the same detail of application, the results are "generally coincident."

It remains to notice the "wave-theory" of Mr. Airy (*Encyc. Metrop.*). The link between "waves" and the "tides" is found in the determination of the law which defines the "forced" wave, for which the periodically waxing and waning action of the sun or moon shall supply the needed force. The dynamic theory, indeed, seeks this in the most general manner; but, except in a few restricted cases, it fails, or rather it attempts more than our mathematics can carry out and give expression for. It is easily accomplished for *canals* of uniform section; and by considering ocean tides as "waves in canals," expressions for their development can be obtained with a completeness of detail far exceeding what the "dynamic theory" has yielded. "Its great and important defect," in the words of its author, "as applied to the explanation of the tides of the earth, is that, in the case of nature, the water is not distributed over the surface of the earth in canals of uniform breadth and depth, or in any form very nearly resembling them." But, besides ocean tides, the wave-theory deals with an important class of tidal phenomena with which none other can deal—viz. the propagation of free waves, originating in the ocean tides, up tidal rivers and estuaries.

A reference to the article TIDES, OCEANIC WAVES, etc., or a glance at the "tidal charts" of an atlas of physical geography, will show that even our Atlantic does not offer the longitudinal scope necessary for the large semi-diurnal tides which are observed on its shores. "They are but the offspring of the great *parent tide* from the Pacific" (or rather the great Southern Ocean), and as *waves* they reach our shores. Hence a "wave-theory" would seem to be the true instrument of analysis. But Mr. Airy tells us "the power of mathematics fails totally in the attempt to express the transmission of the tide-wave or waves through the Atlantic Ocean. It has some analogy to a canal, . . . but not so much as to enable us to predict what will become of the tide-wave in its general progress; and of course the analogy fails totally as regards the effect of these very important features which have no existence in a canal: huge promontories projecting into its sides, or vast bays opening large lateral expanses for the spread of the tide-wave."

Dr. Young demanded for the application of his theory a "series of minutely accurate observations," of which there was at that date an almost absolute destitution. Mr. Lubbock took up this matter in 1829 (see *Philos. Trans.*, 1831), and was soon followed by Mr. Whewell. Their joint researches extend through ten successive volumes (1831–44) of the *Philosophical Transactions*. To them we are indebted for the chart of co-tidal lines (see article TIDES), first sketched by Dr. Young, for comparison of theory with observation at certain places, and for investigation of the diurnal tide. The "theory" with which their observations are compared is the equilibrium theory. "By referring the tide not to the moon's preceding transit, but to one of one, two, or more days preceding, the theory is brought in near accordance with observed irregularities in the heights and times of the tides due to changes in the moon's parallax; but in one respect it is unsatisfactory, . . . for at the same place different anterior epochs are required for the several irregularities."

Both the "equilibrium" theory (Bernouilli) and the "dynamic" theory (Laplace) neglect friction and other resistances to the motion of the water. Under this aspect of the problem the foreign attraction *does no work*. Indeed, the resulting tides themselves are not *their* work. They are motions which once *initially established* will be *maintained*, the foreign attraction being merely the agent of *interchange of vis viva* between different parts of the fluid mass. Such, at least, is the state in which Laplace ultimately leaves the problem—a defective basis for an otherwise defective solution. *Hence* the crests (positive or negative) of the tidal elevations are always exactly under the attracting body. But when *resistances* are taken into account, the foreign attraction *must do work*;* but to do "work" it is essential that the tidal crests should *lag behind* the meridian of the luminary. Dr. Young has exhibited by analysis this "lagging," of which he says, "for this simple reason only (*i. e.* the *resistance* encountered) the highest spring tides ought to be a day later than the conjunction and opposition of the luminaries." Mr. Airy's wave-theory also exhibits it. Besides which, there is the retardation due to the time of travelling of the tide as a free wave to the point of observation from that part of the ocean where it is actually generated. In the Atlantic the diurnal tides are believed to come mainly as waves from the great Southern Ocean, and to be one and a half days old when they reach our shores.

The great continental barriers are *meridional* in their extension. They lie across the track of the semi-diurnal waves in all but high southern latitudes, in *non*-accordance with the conditions which the Laplace solutions impose. The semi-diurnal tides *of these oceans* could only be theoretically arrived at by the methods first pointed out by Dr. Young. The Southern Ocean presents, however, zones of continuous longitudinal water-surface, and from these in great degree our Atlantic tides are believed to proceed; the great exaggeration of height they show at certain localities being attributed to the action upon them, as "free waves," of shore or bottom configuration.

The diurnal wave has been spoken of as a "stationary wave" of meridional development. For such development both the great oceans offer ranges almost from pole to pole. They furnish scope for the development of this tide on the equilibrium theory—they are wanting in the conditions requisite to the very peculiar motion† of Laplace's dynamic theory.

"If," says Mr. Airy, "we look to the Pacific Ocean with reference to diurnal tides, and consider the Southern Sea as a part of it, we seem to have a case which possesses considerable analogy with Laplace's assumption. Yet it is remarkable that here we appear to find a more complete failure than anywhere else of Laplace's celebrated result as to the non-existence of diurnal tide (all the large diurnal tides being in that sea). It is true that this failure might be explained by supposing the depth of the sea to be extremely unequal."

We have seen that in order that there should be *rise* or *fall* of this tide, according to Laplace's solution, a *continuously* increasing (or decreasing) depth from equator to poles is demanded, they being due to the *bodily* moving of ocean masses as rigidly solid *on to* shoaler (or deeper) sea-bottoms. *Such* a tidal rise and fall is evidently out of the question, except under the absolute and complete existence of the conditions Laplace's solution is based upon; and it is moreover evident that mere irregularity of bottom, *without* continuously progressive shoaling or deepening from equator to poles, would not *alone* greatly interfere with Laplace's result for that case.

On our Pacific coast, and almost everywhere in the Pacific, the diurnal tide is of considerable magnitude, and as well marked and regular in its developments as is the semi-diurnal tide. On the Atlantic coast, where the regu-

* Hence the "retardation" of the earth's rotation by tidal friction, as propounded by M. Delaunay to account for *a part* of the moon's *apparent* "acceleration," for which Mr. Adams has shown Laplace's discovery (see LAPLACE) does not account.

† The requisite shifting of rotation-axis of the water, as that of a continuous and solid shell, is of course out of the question; nevertheless, throughout these oceans the shore outline is not wholly incompatible with the requisite horizontal elliptical orbits of the fluid particles.

lar semi-diurnal tides are large and easily reduced to the forms prepared by Lubbock and Whewell, the diurnal, though easily recognized at certain periods, when it is quite characteristic, is in general difficult to trace. Portions of our Gulf of Mexico coast (*e. g.* mouths of the Mississippi) exhibit the peculiarity of an almost *exclusively* diurnal tide of small range (about 1½ feet). It is beautifully illustrative of the equilibrium theory, disappearing, and shifting as it should its interval from lunar culmination, 12 hours (about), with the moon's passage of the equator. It evidently has its origin in the Atlantic, whence it is propagated as a wave; the elimination of the semi-diurnal being conjecturally explained by the supposition that the two separately-propagated waves through the Florida and Yucatan channels arrive with epochs differing by a quarter of a day, and thus neutralize each other.

The diurnal tide is observable (though of relatively very inferior magnitude) on the eastern and Channel coasts of England, and throughout the coast of Ireland, "approaching from the W., and flowing round the island N. and S., enters the Irish Sea at both extremities, meeting off the coast of Down and Antrim." Their range is slight (2 to 12 or 15 inches), while the semi-diurnals in the Irish Channel range from 10 to 20 feet. A discussion of these tides by the Rev. Samuel Haughton will be found in *Transactions of the R. Irish Acad.*, vol. xxiii, 1855, based on observations styled "the most perfect that have ever been made on so large a scale and for such a length of time" (*i. e.* twelve to sixteen months).

On the equilibrium theory the maximum elevation due to the sun would be 0.6 foot (in which the small effect of the attraction of the water itself is considered), and that due to the moon 1.35 feet. The maximum depressions are one-half the elevations, and, taken together, the greatest *range* of height would be nearly 3 feet.

If we consider separately the absolute maximum of diurnal and semi-diurnal elevations (expressed by II., III.) as functions both of θ and $\bar{\omega}$, and of the declination v (which cannot *exceed* 23° to 28°), we find them to be about as 2 to 3. The existing ocean configurations are apparently quite as favorable to the development of the diurnal tide as of the other; the above fractional ratio is not, therefore, small enough to account for the comparative inconspicuousness of this tide. That Laplace's theorem of *nil* diurnal elevations does not really apply to the case, I have shown; but nevertheless there is a strong presumption that the motion developed in our actual oceans is similar to that which his theorem implies, and that it, to an important degree, neutralizes the diurnal tides.

Since the observed tides are due to the joint action of the sun and moon, and their individual effects are (on the equilibrium theory) directly proportional to their respective *masses*, and inversely to the cubes of their *distances*, the tidal phenomena furnish a clue to the ascertaining of their masses relatively to that of the earth. Newton made, on the imperfect data at his command, an estimate of $\frac{1}{40}$th as ratio of moon's mass to earth's. Laplace, after an elaborate investigation founded on observations made at Brest (*Méc. Céleste*, vol. v), fixed the ratio at $\frac{1}{75}$th. Mr. William Ferrell of the U. S. Coast Survey has made a similar investigation based on observations in Boston harbor, with result not greatly different. A ratio of $\frac{1}{80}$th is, however, in better harmony with other astronomical phenomena.

Although theory fails in exhibiting either the actual development of the tides or the time of their culminations, there is in the equilibrium theory of Bernouilli and the dynamic theories of Laplace, Young, and Airy, a perfect confirmatory demonstration of their *cause*, and such a general *resemblance* to actual developments as to make them valuable in reducing observations and in establishing empiric formulæ for particular ports. And in this respect none has thus far done greater service than the much-decried equilibrium theory—a service which has been hinted at in alluding to the works of Messrs. Lubbock and Whewell. The volumes of the U. S. Coast Survey reports from 1851 to the present date furnish numerous examples of the adaptation of their labors to the reduction of tidal observations made throughout our extended coasts, along which, Atlantic, Pacific, and Gulf, every variety of tidal phenomena finds place for characteristic exhibition. The Coast Survey charts of our seaports give, in a tabular form, the "corrected establishment," "rise of highest observed tide," "fall of lowest tide," "mean low water of spring tides"—all referred to a fixed plane, usually that of ordinary low water. Also the "mean rise and fall of spring tides," "mean rise and fall of neap tides," "mean duration of rise," "mean duration of fall," and the "mean duration of stand." They also give a table of "tidal currents," showing their "set" (direction) and "drift" (velocity in nautical miles), for the more important localities embraced in the chart.

The interval between the moon's passage over the meridian of a place and the time of high water is styled the "establishment" of the port, or the luni-tidal interval—a constant as regards *lunar* high water. As the *actual* high water depends upon the combination of the lunar and solar tides, this interval is subject to a variation known as the semi-monthly inequality. The mean of all the luni-tidal intervals for this period is called the "mean" or "corrected" establishment, to distinguish it from the "vulgar" establishment, which (the observed interval at full and change) is that which belongs to the lunar (or solar) tide taken by itself. J. G. Barnard.

Till'man (Samuel D.), A. M., LL.D., b. at Utica, Oneida co., N. Y., Apr. 1, 1815; graduated at Union College in 1831; studied law at Canandaigua; practised for several years there and at Seneca Falls, but removed subsequently to New York; gave up his profession, and devoted himself exclusively to the study of science; was a prominent member of the American Association for the Advancement of Science; became a member of the American Institute in 1863, and afterward its corresponding secretary and editor of its *Transactions*. D. Sept. 4, 1875. Possessing a remarkably active and inventive mind, he was the originator of a number of ingenious contrivances, among which may be mentioned a rotating planisphere to serve as a substitute for the artificial globe, for the use of schools; and also a revolving musical scale, called the tonometer, designed to illustrate the theory of temperament, and exhibiting visibly the relations between the true and tempered notes in every key. H. L. Stuart.

Timber and Timber-Trees. Although the more important of these have been treated of or mentioned under their names or under appropriate heads, yet the most prominent species of timber-trees used in this country may here be referred to, although very briefly.

Indigenous North American Timber-Trees.—(1) *Coniferous Division.*—Of those of the Atlantic U. S. and Canada, the most important, and for its uses the best in the world, is white pine (*Pinus strobus*), in England called Weymouth pine. Hard-pine lumber, variously called yellow pine, pitch pine, etc., is most largely furnished, and of best quality, by *P. australis*, the long-leaved pine of the Southern States. *P. rigida*, the Northern pitch pine, both in the Northern and Southern States furnishes a similar but inferior and generally smaller timber; and excellent hard pine is yielded by the short-leaved pine (*P. mitis*); while the loblolly pine at the South (*P. tæda*) and the red or Norway pine at the North (*P. resinosa* or *rubra*) furnish a softer and less resinous lumber. Larch or hackmatack (*Larix Americana*) of the North furnishes a very valuable lumber, important in shipbuilding. Next are the spruces, with wood tougher than white pine, but more liable to shakes and splits. Black spruce (*Abies nigra*) has the widest range and yields the best lumber, especially prized for spars. White spruce (*A. alba*) is a smaller tree, and the wood inferior. Hemlock spruce (*A. Canadensis*) furnishes at the North a valuble but coarse lumber, very liable to shakes and of moderate durability. The balsam-firs, both the Northern species (*A. balsamea*) and that of the mountains in the South (*A. Fraseri*), are of no account for timber, being small trees, with soft wood, lacking strength and durability. Of the cypress tribe, the bald cypress of the Southern States (*Taxodium distichum*) furnishes lumber of great size and much durability, but light and shaky; while the arbor-vitæ or white cedar of the North (*Thuja occidentalis*) and that of the Middle and Southern States (*Cupressus thyoides*) yield small timber of exceeding durability, especially for posts; and red cedar (*Juniperus Virginiana*) furnishes a red and fragrant fine-grained wood of the greatest durability and value. The yew occurs as a tree only in a limited part of Florida, as does its relative the stinking cedar (*Torreya taxifolia*), rendering their excellent timber practically unimportant.

In the Pacific States and Rocky Mountain region the coniferous trees are numerous, and some of immense height and girth. Of soft-wooded or white pines no one equals our white pine of the East. The sugar pine (*Pinus Lambertiana*), with its immense trunks, takes its place, but the wood is much coarser-grained. *P. ponderosa*, with its heavy wood (as the name denotes), furnishes excellent hard-pine lumber, less resinous than our Eastern species; and there are several other species intermediate as to the character of the wood. For spruces, the *Abies Douglasii* or Douglas spruce, of Oregon and California, is far the best of the race, as well as the largest. The hemlock spruce and the larch are represented by species very like the Eastern; while the Menzies spruce (*A. Menziesii*) surpasses our black spruce; and our balsam-firs are represented by several nobler species, which furnish better lumber. The cypress tribe is represented by several cypresses of considerable value; also in Oregon and northward by an arbor-

vitæ (*Thuja gigantea*), vastly surpassing the Eastern species in size and value for timber, and in California by the famous redwood (*Sequoia sempervirens*), the light and reddish wood of which is incomparable for building purposes and excellent for interior finish. (For an account of this tree, and of its even more gigantic relative (*S. gigantea*) of the Sierra Nevada, see article SEQUOIA.) The yew (*Taxus*) of the Pacific coast is very like the European.

(2) *American Trees.*—The oaks are the most important, and the most valuable species is the white oak (*Quercus alba*), which in the Atlantic States takes the place of the *Q. robur* of Europe. It grows to a height of 70 to 80 feet and a diameter of 6 or 7 feet, and yields handsome logs. The wood is of a pale reddish color, straight-grained, compact, tough, strong, durable, and shrinks but little. It is used for frames of structures where strength and durability are required, coachmaking, coopering, shipbuilding, and for a great variety of purposes in the domestic arts. For cabinetmaking and interior decoration it is highly valued. The other annual-fruited species come next to this in value—viz. chestnut-oaks, post-oak, bur-oak, etc. At the South, along the coast, the live-oak (*Q. virens*) represents a peculiar type, and for shipbuilding is prized above all others, but it does not give large timber. Its height is from 40 to 50 feet; diameter, 1 to 2 feet. The wood is of a yellowish color when first cut, which deepens to a dark brown with age; it is hard, tough, strong, heavy, and very difficult to work, on account of the grain being waved or twisted. The pores are minute, and the silver-grain very bright and distinct. The biennial-fruited oaks have a more porous wood, unfitted for casks to hold liquids, less durable, and less strong. The best of them—viz. black oak (*Q. tinctoria*)—is found on poorer soils than the white oak, and grows to the height of 80 to 90 feet, with a diameter of 4 to 5 feet. The wood is reddish in color, porous, and coarse-grained. The outer bark is greatly used for tanning, and the inner bark, called quercitron, for dyeing. Red oak (*Q. rubra*) is used for similar purposes, though it is inferior in quality. Spanish oak (*Q. falcata*) and willow-oak (*Q. Phellos*) are superior; and so are laurel or shingle oak (so called because the wood was used for shingles). California and Oregon have oaks of peculiar species, some of them valuable timber-trees, but none which equal white oak. Chestnut (*Castanea vesca*) is a large tree, of the Atlantic States only, essentially of the same species as the European, yielding a coarse-grained and porous but durable lumber, easily worked, and valuable for wainscoting, etc. The medullary rays cannot be traced in it. The American beech (*Fagus ferruginea*) has a very close-grained and hard wood, like that of the European species, of which joiners' tools are made. Ironwood (*Ostrya*) and horn-beam (*Carpinus*), as the names denote, have very hard wood, but they are rather small trees, peculiar to the Atlantic States, with corresponding species in the Old World. The hickory, in several species, is peculiar to the Atlantic States. The shell-bark or shagbark (*Carya alba*) is the best, but all have a very tough and hard wood of remarkable strength, much prized for tools and the like. The walnut (*Juglans*) is known in the Atlantic States by two species—*i. e.* white walnut or butternut (*J. cinerea*), the favorite wood for gunstocks and of late for wainscoting and cabinet-work, but a small tree; and black walnut (*J. nigra*), the most important of our woods for the cabinetmaker, a tree of ample size. The heart-wood is of a violet color when first cut, but upon exposure becomes dark. It is far superior to the European walnut; it is strong, tough, durable when seasoned, and not apt to warp and split. It has a fine and compact grain, and is susceptible of a high polish. The birches are valuable timber-trees of the second class, having a hard and fine-grained wood, valued by cabinetmakers. Of the five species which in the Atlantic States and Canada form good-sized trees, the black or sweet birch, sometimes called cherry birch (*Betula lenta*), is most prized, being excellent for furniture; and yellow birch (*B. lutea*) is equally good, but lighter in color. Poplars or cottonwoods (*Populus*) make large trees, as do some willows, but the wood is weak, soft, and of no durability.

(3) *Other Deciduous Trees.*—Only the most important can be mentioned. Plane tree, buttonwood, or sycamore (*Platanus occidentalis* of the Atlantic States, and a corresponding species in California) deserves notice on account of the size which the trunk may attain, but it soon becomes hollow, and the wood, which is handsome on account of the strong silver-grain, is useless for the purposes it would otherwise be well adapted for. The laurel family is represented in the East by the sassafras, and in California by a laurel (*Tetranthera Californica*), the light-colored and variegated wood of which is extremely beautiful. Elms are given only to the eastern side of our continent, and white elm (*Ulmus Americana*) is the most noted species, a large tree, with handsome but not very durable wood. Slippery elm (*U. fulva*) is a smaller tree, and the reddish wood is tougher. The ashes are timber-trees of the first class, of which there are six species in the Atlantic and two in the Pacific States. The yellowish wood is very firm and tough, but comparatively light, straight-grained, and easy to work. White ash (*Fraxinus Americana*) is the best and most used, and is unexcelled for purposes where strength, elasticity, and durability are needed, and it is preferred to chestnut for interior finish. Black ash (*F. sambucifolia*), a smaller tree, has tougher wood, easily separable into layers, and is therefore used for hoops and strong basket-work. American holly (*Ilex opaca*) of the Atlantic States, like the European species, has a very fine-grained and compact white wood, used for ornamental cabinet-work, wooden screws, etc. Tupelo, pepperidge, or sour-gum trees (*Nyssa*) of two or three Atlantic States species, and sweet-gum (*Liquidambar styraciflua*), mostly have a very tough wood, of various uses, but not much used as timber; and flowering dogwood (*Cornus florida*), although the wood is prized, is seldom large enough to form a timber-tree. The Kentucky coffee tree (*Gymnocladus Canadensis*) is a stately tree, of peculiar aspect, with handsome rosy or brownish wood, well suited for cabinet-work. Honey-locust is of little account, but the true locust (*Robinia pseudacacia*) affords a timber equal to live-oak and red cedar in durability, especially valued for treenails and in naval architecture generally. Maples are fine trees, of which one species on the Pacific coast and two or three on the Atlantic side are important for timber. Sugar-maple (*Acer saccharinum*) is much the most valuable, having a hard and close-grained wood, of light color and silky lustre when polished, and the varieties called "curled" and "birdseye" maple are greatly prized for cabinet-work. The soft maples, so called from the character of their wood, are the white or silver maple (*A. dasycarpum*) and the red or swamp maple (*A. rubrum*), the former a large and the latter a medium-sized tree, the wood of which is used for lasts, for carvings, etc. Lindens or limes, here commonly called basswood, of which there are two well-marked species in the Atlantic, but none in the Pacific States, are first-class forest-trees for size, and their soft and white fine-grained wood is excellent for coach-bodies, interior of cabinets, and various purposes where lightness with moderate strength is demanded. Tulip tree (*Liriodendron tulipifera*), sometimes called white-wood, but in the Western Atlantic States (where it abounds and develops its noblest proportions) commonly known as poplar, has a light and soft wood, like that of the linden, but more valuable and much more extensively employed for the same purposes. This noble and most valuable tree is of the magnolia family, which in the cucumber tree and in the great-flowered magnolia of the Southern States furnishes two other fine trees of the same character of wood, but of comparatively small use.

EXOTIC TIMBER TREES.—Those of Europe need not be enumerated, as they are analogues of our own—*i. e.* different species of pine, larch, spruce, oak, beech, elm, ash, linden, etc., only the chestnut being the same or nearly so—but are far fewer in species and in kind, tulip trees, gum trees, locusts, hickories, sassafras, bald cypress, redwood, etc., being wholly wanting. As to foreign woods of tropical regions imported for the use of cabinetmakers—such as mahogany, Spanish cedar (*Cedrela odorata*), rosewood, lignum-vitæ, and the like—they are mostly treated under their names in the pages of this work. (See PRESERVATION OF TIMBER and ARBORICULTURE.) ASA GRAY.

Time Signals. In 1852 the astronomer-royal, with Mr. C. V. Walker, began the transmission of standard time from Greenwich to London by telegraph. The system thus originating has gradually spread until all the principal cities of England are furnished with standard time from some one of its observatories. On the Continent as well clocks are controlled and the time furnished from the astronomical observatories. In the U. S., through the exertions of Prof. Abbe at Cincinnati, Prof. Langley at Pittsburg, Prof. Winlock at Cambridge, and the U. S. Naval Observatory at Washington, the matter has been brought before the public. At the present writing the observatories at Washington, Cambridge, Allegheny, Cincinnati, Albany, and Chicago all furnish the standard time by telegraph to the railroads and jewellers of their locality. Two methods of transmitting time are in common use. A standard clock at an observatory, which is kept as nearly free from error as possible, and has its small error corrected daily, so that its face indicates the true mean time it is desired to furnish, breaks or makes an electric current automatically each second. This circuit, in one method, passes through the various cities or buildings which are to receive the time. By merely introducing a number of electro-magnets the beats of the standard clock are audible at various points through-

out the entire circuit. The beginning of each minute is indicated by the omission of one clock-beat, and the beginning of the five minutes is indicated by the omission of any other given number of clock-beats, these omissions being made automatically by toothed wheels in the standard clock. In the second method the clocks are placed in the same circuit as the standard clock, and the electric current is used as a regulating power by causing a helix so placed in the clock to be controlled as to alternately encircle two magnets placed with their opposite poles toward each other, and attached to the bottom of the pendulum, to attract and repel the two magnets. This latter method, known as the Jones plan, has superseded the methods in which the electric current passing through the standard clock was used as a motor-power. The controlled clocks in the Jones system, in case a circuit is interrupted, run on, merely accumulating their individual errors, since they are clocks of the ordinary construction with the addition of the electric apparatus. Where electricity is the motor, however, and the current is interrupted for any reason, the clock stops running entirely. For long circuits, especially over several hundred miles, the introduction of the electro-magnet into the same circuit with the standard clock is found to be the simplest and most effective method of distributing standard time. For distributing it over large areas at any fixed moment a gun may be fired, or a bell may be struck, or a ball may be dropped from the top of a flagstaff, by means of the electric current, controlled automatically by the standard clock. (See a valuable paper on this subject by W. Ellis, F. R. A. S., *Horological Journal*, Apr., 1865; also *Nature*, vol. xi. p. 431; *ibid.*, xiv. pp. 50 and 110—all on the Greenwich time system; *Amer. Jr. Arts and Sci.*, vol. cviii. p. 377, on the Allegheny system of electric time signals, by S. P. Langley; *Bulletin de la Société des Sciences naturelles de Neufchâtel*, Dec. 9, 1875, M. Hirsch on the system at Berne for time signals.)

L. Waldo.

Tin, Geology of, or **Tin-Mines.** Though found abundantly in certain localities, and very extensively used by all civilized nations, tin is more sparsely distributed over the earth's surface than perhaps any other of the useful metals. It also has a very limited geological range, and is almost always found in the oldest rocks. The most important mines of tin are those of Cornwall, England, Island of Banca, Malayan Peninsula, and Australia. The Cornwall mines have been worked from the time of the Phœnicians, and for nearly 2000 years were the chief source of supply of this metal to the world. Here, as elsewhere, the tin occurs in the form of oxide (cassiterite), and it is found in the surface deposits, in veins, stock-works, and contact-deposits in crystalline rocks—granite, porphyry, and slate, called by the Cornish miners respectively *growan*, *elvan*, and *killas*. The tin ore of Cornwall is associated with copper and gold, both of which have contributed so much to the revenues derived from the mines that without their aid they would long since have become unprofitable. The excavations are becoming constantly deeper, mining more expensive, and the yield of tin diminishing, so that the markets of the world are already chiefly supplied from other sources.

From its great weight and indestructibility, the oxide of tin is left behind and concentrated by the erosion of the rock which contains it; hence, in all tin-producing districts a large part of the ore collected is obtained from the superficial deposits. This is called *stream tin*, as it is specially found in stream-beds, and is washed out of sand, gravel, and clay much as gold and platinum are obtained. The tin of the island of Banca and the peninsula of Malacca is obtained exclusively from the surface-deposits, where it has accumulated by the decomposition of the underlying granitic rocks which formed its original matrix. The process of mining in these localities is very simple, and consists merely of the excavation of a series of trenches or pits, by which all the surface materials are worked over for the removal of the tin ore they contain. The greater part of the work is done by Chinese laborers, and the method pursued is not unlike that followed in the gold-diggings of California. In commerce, the tin of the Malay Peninsula is known as *Straits tin*, while that from the island of Banca, a Dutch colony, is known as *Banca tin*; this latter is chiefly sold at auction at Rotterdam and Amsterdam.

Quite recently very extensive deposits of tin have been found in Australia and Tasmania. Those of the latter country have not yet been fully explored, but the Australian tin-fields are already extensively worked, and are producing large quantities of metal. The geological position of the tin ore in Australia is apparently similar to that of Banca—viz. it is sparsely distributed through granitic rocks, which have been decomposed at the surface, and the tin ore is now obtained by "diggings" in the superficial material. The tin-ground of Australia is said to extend along the MacQuarie River for 150 miles, and the quantity of tin obtainable there is reported to be so great that the entire demand of the civilized world could be supplied for an indefinite period from that source.

Tin occurs in several localities upon the continent of Europe in sufficient quantity to make it an object of exploitation, as at Altenburg and Zinnwald in Saxony, etc., but the quantity produced here is insignificant as compared with that derived from the Cornwall and East India mines. In France and Spain tin ore has been discovered, but the annual production of these countries amounts to but a few tons.

The American continent seems to be remarkably deficient in the ores of tin, and at present the entire consumption of that metal in this country is supplied from England and the East Indies. Tin is known to occur, and perhaps in considerable quantity, in Guanuni in Bolivia, but it is only worked to a trifling extent. In North America the only tin-deposits yet discovered which can have any economic importance are those of Durango in Mexico, and we have no accurate information in regard to the quantity obtainable there. A few tons of stream-tin have been collected from hasty and superficial excavations, and this has been sent to San Francisco, but the expenses of transportation and the unsettled state of the country make it impossible to work the mines there profitably at present.

Within the U. S. tin is known to occur at what is called the Temescal Mine in the southern part of California and in some parts of Montana, but up to the present time no considerable quantity of ore has been found in either locality. In the Eastern States tin exists in Maine, New Hampshire, and Massachusetts, but only as a mineralogical curiosity. The so-called tin ore of Central Missouri, about which there was so much excitement a few years since, has been found to contain little or no tin, and it is generally supposed that this mining scheme, like a similar one of which the scene was laid on the N. shore of Lake Superior, was a pure and unqualified fraud. Within the great area of North America there still exists so much unexplored territory that there is room for the discovery of important deposits of tin; but with our present knowledge of the subject it appears very doubtful whether tin can ever be reckoned as an important element in our mineral resources.

J. S. Newberry.

Todd (Sereno Edwards), b. at Lake Ridge, Tompkins co., N. Y., June 3, 1820; engaged in farming, and wrote on agricultural and horticultural subjects; is author of Todd's *Young Farmer's Manual* (2 vols. 12mo), *The American Wheat-Culturist*, Todd's *Country Homes, and How to Save Money*, and Todd's *Apple-Culturist*. Mr. Todd was for ten years agricultural editor of the New York *Times* and New York *Herald*.

Ton [Ang.-Sax. *tunne*, a "tun," a "large vessel;" Fr. *tonne*; D. *ton*], the unit of weight in Great Britain and the U. S. for heavy and bulky commodities. It is equivalent to 20 cwt., and as, in Britain and in the U. S. custom-houses, the hundredweight is reckoned at 112 pounds, the ton contains 2240 pounds. In the domestic commerce of the U. S., however, it has become customary to reckon only 100 pounds to the cwt., and 2000 pounds to the ton; and this usage, in some of the States, if not in all, has received the sanction of law. Thus, in the revised statutes of the State of New York it is provided that "the hundredweight shall consist of one hundred avoirdupois pounds, and twenty hundredweight shall constitute a ton" (2 *Rev. Stat.*, 800, § 7, 6th ed.). This law was passed in 1851. Connecticut has a similar provision, and the same is probably true of other States. In New York State selling less than 100 pounds of coal to the cwt. is declared by law to be a misdemeanor punishable by fine or imprisonment, or both. In the *Revised Statutes of the U. S.*, sec. 2951, taken from the tariff act of Mar. 2, 1861, it is declared that "wherever the word 'ton' is used in this chapter in reference to weight, it shall be construed as meaning twenty hundredweight, each hundredweight being one hundred and twelve pounds avoirdupois." The ton of 2240 pounds is commonly called "the long ton," that of 2000 pounds "the short ton."

The words *ton* and *tun* are etymologically the same, but the former orthography is usually applied to weights, and the latter to measure. The tun in old British ale or beer measure was equal to 216 gallons of 282 cu. in. each, and in old British wine measure to 252 gallons of 231 cu. in. each. A tun of water of the larger of these measures weighs a little over 2200 pounds; and hence it is supposed that the ton weight was originally derived from the tun measure, of which it is a rough equivalent. (See Weights and Measures.)

F. A. P. Barnard.

Ton'nage, a measure of the capacity of a ship, used for the purpose of registry at her port and for levying harbor and other dues. The rule of measurement prevailing

in England prior to the year 1835 was erroneous in principle and led to mischievous consequences. It was arbitrarily assumed in the so called "old measurement" (O. M.) that the depth and the breadth of the ship were equal. One step in obtaining the cubic contents of a ship was to multiply the length by the square of the breadth, and the tonnage dues were levied accordingly. This rule led ship-builders to build vessels that were narrow and deep, and accordingly dangerous in rough weather, as well as highly faulty in their plan of structure. The English Parliament adopted in 1835 a new plan, suggested by Mr. Riddle of the Royal Hospital, Greenwich. The statute of 1835 was modified in 1854, and the Merchants' Shipping act of that year (17 and 18 Vict. c. 104) is the basis of the legislation existing in the U. S. This runs out into detail, and cannot be brought within the compass of this article. Suffice it to say, that the principle at the outset is to establish a mode of ascertaining the length, breadth, and depth of the ship, as well as a *tonnage deck* for the purpose of measurement. This is the upper deck of ships of less than three decks, and the second from below in those having three or more. The length of the "tonnage deck" is then ascertained by the following rule: Measure the length of the vessel in a straight line along the upper side of the tonnage deck from the inside of the inner plank, average thickness, at the side of the stem, to the inside of the plank on the stern timbers, average thickness, deducting from this length what is due to the rake of the bow in the thickness of the deck, and what is due to the rake of the stern timber in the thickness of the deck, and also what is due to the rake of the stern timber in one-third of the round of the beam. The "tonnage length" as thus ascertained is then divided into a number of equal parts, depending upon that length. The statute thus creates six classes of ships for the purpose of measurement. The principle of the classification is to commence with vessels not exceeding fifty feet in "tonnage length" (measured by the prescribed method), and to proceed with a regular increment of fifty feet. Vessels belonging to these classes are then respectively divided into six, eight, ten, twelve, fourteen, and sixteen parts, according to their length.

The next thing is to find the "transverse area" of the vessel. For this purpose the depth of the ship is to be measured at each point of division as above given, according to a prescribed rule. If the depth at the midship division of the length do not exceed sixteen feet, each depth is to be divided into four equal parts. "Then measure the inside horizontal breadth at each of the three points of division, and also at the upper and lower points of the depth, extending each measurement to the average thickness of that part of the ceiling which is between the points of measurement. Number these breadths from above, numbering the upper breadth one, and so on down to the lowest breadth; multiply the second and fourth by four, and the third by two; add these products together, and to the sum add the first breadth and the last or fifth; multiply the quantity thus obtained by one-third of the common interval between the breadths, and the products shall be deemed the transverse area." When the midship depth exceeds sixteen feet, the "transverse area" is obtained by dividing each depth into six equal parts, instead of four, and with corresponding changes in other respects. This mode of reckoning gives the "transverse area" at each point of division of the length of the vessel, as already noticed.

The final step is to obtain the register tonnage. For this purpose the "transverse areas" found as above are numbered, commencing with the extreme limit of the length at the bow. The even-numbered areas are multiplied by four, and the odd, with the exception of the first and the last, by two. These products are added together, and to the sum the first and last "transverse areas," if they "yield anything," are added. The quantities thus obtained are to be multiplied by one-third of the common interval between the areas. This product is the cubical contents of the space under the tonnage deck. Divide it by 100, and the quotient is the "register tonnage," subject to certain special additions now to be named. Additions (in accordance with a fixed rule) are made to the tonnage under deck, as above ascertained, in case there be a break, a poop, or any other permanent closed-in space on the upper decks or spar deck available for cargo or stores or the "bertbing" or accommodation of passengers or crew. The same addition is to be made when a vessel has a third deck or a spar deck, the tonnage of the space between it and the *tonnage deck* being ascertained in a specified way.

In ascertaining the tonnage of open vessels the upper edge of the upper "strake" (line of planking extending from stem to stern) is to form the boundary-line of measurement, and the depth is to be taken from an athwart-ship line extending from the upper edge of such strake at each division of the vessel's length.

The register of the vessel at the custom-house must express the number of decks, the tonnage under the tonnage deck, that of the between decks above the tonnage deck, and that of the poop or other enclosed space, each separately. It is deemed of such importance that the registered tonnage should be known that the law provides that it shall be deeply carved or permanently marked upon the main beam of the vessel, and so continued, or it shall no longer be recognized as a registered vessel of the U. S.

The measurement of a foreign vessel is made upon a different principle. Double and single decked vessels are distinguished from each other. If the vessel be double-decked, the course is to take the length from the fore part of the main stem to the after part of the stern-post above the upper deck, and the breadth at the broadest part above the main "wales" (lines of planking in a ship's side), half of which breadth shall be accounted the depth of the vessel. Then deduct from the length three fifths of the breadth; multiply the remainder by the breadth, the product by the depth, and divide this last product by 95. In the case of single-decked vessels the depth is ascertained specifically by measuring from the under side of the deck-plank to the ceiling in the hold. In other respects the same rule is followed as before.

No vessel need be registered for tonnage that is used for cabins or state-rooms, and constructed entirely above the first deck, which is not a deck to the hull; nor do the provisions concerning this kind of measurement apply to any vessel not required by law to be registered or enrolled or licensed, unless otherwise specially provided.

On these principles the system of tonnage duties now prevailing is based. It is not necessary to state these *in extenso*, but only to refer to the principles governing them. (1) Discriminations in the rate of duties are made between vessels of the U. S. and those belonging wholly or in part to subjects of foreign powers, though these are not to be held to impair any rights or privileges acquired by any foreign nation under the laws or treaties of the U. S. (2) Tonnage duties imposed on all vessels engaged in foreign commerce are levied but once a year. This rule does not apply to vessels belonging to any foreign port which vessels of the U. S. are not ordinarily permitted to enter and trade with. The amount is regularly payable at their first clearance from or entry at (according to priority) a custom-house in the U. S. in each calendar year. If not collected then, it may be afterward. Vessels making regular daily trips between any port of the U. S. and any port in the Dominion of Canada wholly upon interior waters not navigable to the ocean, shall only be charged tonnage fees upon the first clearance of such vessel in each year. (3) No tonnage duties are to be levied upon any licensed, registered, or enrolled vessel of the U. S. belonging to a citizen and trading from one port of the U. S. to another; nor are any tonnage duties to be paid by enrolled or licensed vessels on the northern frontiers of the U. S. trading from a port in one district to a port in another, though they may touch at intermediate foreign ports. (4) A duty of fifty cents per ton, to be denominated "light-money," is levied and collected in the same manner as strict tonnage duties on all vessels not of the U. S. which may enter their ports. Unregistered vessels, but carrying a sea-letter, etc., belonging to citizens of the U. S., are under certain restrictions exempted from the operation of this rule. In other words, they are not to be regarded as vessels "not of the U. S." (5) None of these rules impair any rights or privileges obtained by any foreign nation under any treaties or laws of the U. S. (6) Yachts belonging to a regularly-organized yacht club of a foreign nation extending like privileges to yachts of the U. S. need not pay any tonnage tax on entering our ports. (7) In certain cases tonnage duties are imposed in connection with forfeiture or a penalty for an evasion of the laws for the collection of duties upon merchandise or for non-compliance with other statutory regulations. (*Rev. Statutes Cong.*, § 3110 and § 4335.) (8) The decision of the collector of the port at which the vessel enters as to the rate of tonnage duties applicable to the case is final, unless an appeal is taken from his decision within a specified number of days.

A word should be added as to tonnage *fees*. Consuls, etc., are not to exact tonnage fees from any vessel of the U. S. touching at or near ports in Canada on her regular voyage from one port to another within the U. S., unless they perform some official services required by law for such vessel when at a Canadian port. (§ 4224.) Another section of the statutes provides that no consul, etc., is to be allowed tonnage fees for any service, actual or constructive, rendered any vessel owned and registered in the U. S. that may touch at a Canadian port. (§ 1722.)

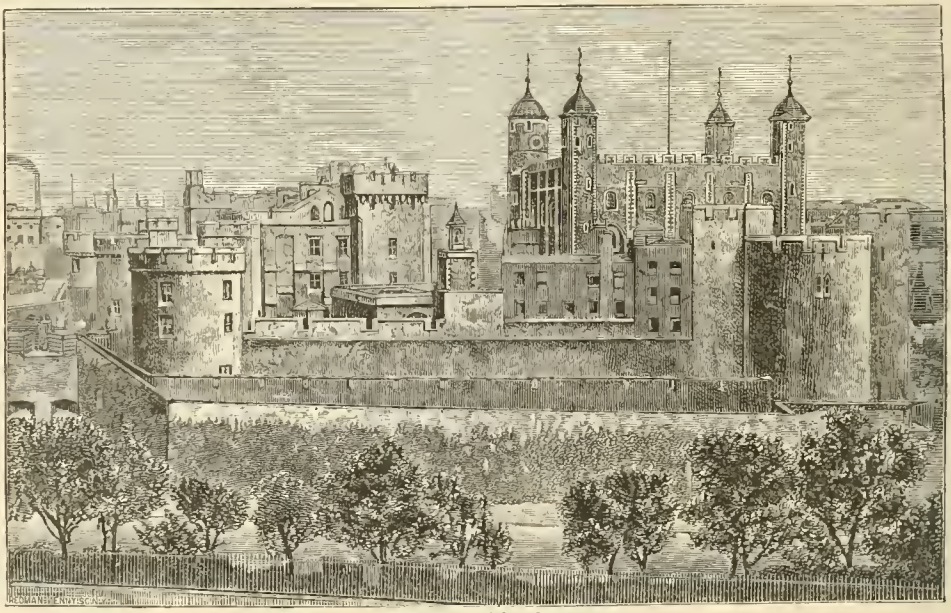
Tonnage duties, as already considered, are levied exclusively by Congress. Under Art. I. § 10 of the U. S. Constitution such duties may be levied by a State with the

consent of Congress: without such consent a State has no power to levy them. While a tonnage duty may be considered as a part of the taxing power, it may also be regarded as a regulation of commerce. The constitutional provision is unquestionably a wise one, as it restrains a State from doing an act which as an interference with commerce might act injuriously upon the interests of other States. (Reference should be made for further information to the following sections of the *Revised Statutes of Congress*: § 1722, § 2793, § 2931, § 4150–54, § 4216, § 4219–27.) T. W. DWIGHT.

Tor'rey (CHARLES WARREN), M. D., b. in New York City Sept. 16, 1836; educated at Columbia College; studied at the universities of Paris, Göttingen, and Halle, and graduated in medicine and surgery at Würtzburg; entered the army during the civil war, and was assistant surgeon U. S. volunteers and medical inspector in the department of Virginia and North Carolina; was for a time associate editor of the *American Gaslight and Mining Journal*, and has contributed to various journals.

Torrey (JOSEPH W.), b. at Bath, Me., Apr. 22, 1828; graduated at the Roxbury Latin School in 1846; went to Hong Kong in 1859, where he was for a short time editor of the *Hong Kong Times*; was made rajah of Ambong and Maloodu, on the N. coast of Borneo, in 1867, and as such was acknowledged by the U. S. in 1868; he governs a territory of 22,000 sq. m. and about 2,000,000 inhabitants, and holds under the sultan of Borneo, to whom he pays a small yearly tribute; and is also president of the American Trading Company of Borneo. JOSEPH G. TORREY.

Tower of London, The, stands just *without* the ancient city, on the left bank of the Thames. "This tower" (says Stow) "is a citadel to defend or comfoand the city; a royal palace; a prison of state for the most dangerous offenders; the armory for warlike provisions; the treasury of the ornaments and jewels of the Crown; and general conserver of most of the records of the king's courts of justice at Westminster." Its government has been entrusted since the days of the Conqueror to a high officer called the constable, which office has been held by



The Tower of London.

the duke of Wellington, Field-Marshals Sir John Burgoyne, Sir George Pollock, Sir William Gomm. The present constable is Gen. Sir Charles Yorke. The oldest portion is the isolated donjon or keep called the *White Tower*, built by William the Conqueror. This is now surrounded by a rampart and moat, with inner wall (the *Inner Bail*), flanked by half-circle towers, each of which has a distinctive name, as the *Bell Tower*, the *Beauchamp Tower*, *Wakefield Tower*, *Bloody Tower*, *Bowyer Tower*. There is also within the enclosure the Jewel-House, where are kept the regalia; the Horse-Armory, a museum of ancient armor; St. Peter's church, where are interred the remains of Anne Boleyn, Katherine Howard, dukes of Somerset ("Protector") and Northumberland, Lady Jane Grey and her husband, and many other celebrated victims of the headsman. Closely adjacent to the Tower is *Tower Hill*, the famous place of execution for persons delivered from the Tower to the sheriffs of London for execution. Here suffered (among others) Bishop Fisher, Sir Thomas More, Lord Guilford Dudley, earl of Strafford, Archbishop Laud, Algernon Sydney, and (1747) Lord Lovat, the last person beheaded in England. Queen Anne Boleyn and Lady Jane Grey were beheaded on scaffolds within, the site of which is shown, as also the block on which the former suffered. Within the Bloody Tower took place the murders of the princes, sons of Edward IV., and, elsewhere within the precincts, of Henry VI., of the duke of Clarence, of Sir Thomas Overbury, and of the earl of Essex. The history of the Tower may be called the "tragedy of England." (See *Historical Memorials of the Tower*, by Lord de Ros.) J. G. BARNARD.

Town'send (FRANKLIN), b. at Albany, N. Y., Sept. 28, 1821; educated at Pittsfield, Mass., and Albany, N. Y.; has served as alderman (1847), supervisor (1848–50), mayor (1850–51), of his native city and county, and in 1857 was a member of the legislature; was adjutant-general of the State of New York 1869–72, 1875–76, and again since 1876.

Tribe (*gens*, *phratry*, *tribe*, and *confederacy* among the American aborigines). *Gens*, γένος, and *ganus*, in Latin, Greek, and Sanskrit, have alike the primary signification of *kin*, springing from the same root as *gigno*, γίγνομαι, and *ganamai*, "I beget," and implying in each of these languages a common descent. A gens, therefore, is a body of *consanguinei*, of persons descended from the same ancestor, and as such it represents the most primitive social organization, contains the first germ of government, and is found in the earliest stages of the history of all nations. In American ethnography, *tribe* and *clan* have been used for *gens*, and *nation* for *tribe*, but there is no sufficient reason for this deviation, and in the following explanation of *gentes*, *tribes*, and *confederacies*, as developed among the American aborigines, we shall use the words in their common acceptation.

The *gentes* of the Iroquois will be taken as the standard exemplification. They carried out their plan of government from the gens to the confederacy, complete in each of its stages, and furnish an excellent illustration of the capabilities of the gentile organization in the archaic period.

I. THE GENS AS AN INDIVIDUAL ORGANISM.—The Senecas, Cayugas, and Onondagas were each composed of eight gentes, arranged and named as follows:

First,	1, Wolf;	2, Bear;	3, Beaver;	4, Turtle.
Second,	5, Deer;	6, Snipe;	7, Heron;	8, Hawk.

The Mohawks and Oneidas, the two remaining Iroquois tribes, had but three gentes, the Wolf, Bear, and Turtle, and have but three at the present time. When the confederacy of the Iroquois was formed (about A. D. 1450), seven of the eight gentes were in existence, as is proven by the fact that sachemships were established in them; but the Mohawks and Oneidas had apparently at that time but the three named.

A description of the rights, privileges, and obligations of the members of a gens, considered as the unit of the social system, will show both its own internal organization

and the manner into which it entered into the higher organizations of a tribal and confederate government.

1. *The Right of Electing its Sachems and Chiefs.*—Nearly all the American Indian tribes had two grades of chiefs, who may be distinguished as sachems and common chiefs, the office of the former class being hereditary, and the other non-hereditary. The office of sachem was made perpetual in the gens by filling the vacancy as often as it occurred, while that of chief was bestowed as a reward of merit, and died with the individual. Moreover, the duties of a sachem were confined, theoretically, to the affairs of peace. He could not go out to war in his capacity of sachem. On the other hand, the chiefs, who were raised to office for personal bravery, for wisdom in affairs, or for eloquence in council, were the superior class in ability, but not in authority over the gens. The relations of the chiefs were primarily to the tribe, composed of several gentes, as that of the sachem was primarily to the gens, of which he was the father and official head.

Upon the death of a sachem, among the Iroquois, a council of the gens was convened to fill the vacancy. After the choice was made it still required the acceptance of the candidate by the other gentes before the election was complete. If the councils of the remaining gentes, separately convened, refused their assent, a new choice was made by the gens. When the person nominated by the gens was accepted by the remaining gentes, it was still necessary that the new sachem should be installed by a council of the confederacy before he could assume the duties of the office.

2. *The Power of Deposing its Chiefs.*—As the members of the gens had the right to elect, so they possessed the equal power to depose their chiefs. Unworthy behavior, followed by a loss of confidence, furnished a sufficient ground for deposition. When a sachem or chief had been deposed in due form by a council of his gens, he ceased thereafter to be regarded as an official character, and became a private person.

3. *The Right of bestowing Personal Names upon the Gentiles.*—Among savage and barbarous tribes single personal names are in common use, but they have none for the family or indicating a family connection. Their personal names, however, are usually sufficient to indicate the gens of the individual. As a rule, each gens had its names for persons which were its special property, and as such could not be used by other gentes. These names either proclaimed by their signification the gens to which they belonged, or were known as such by common reputation. After the birth of a child a name was selected by its mother from those not in use belonging to the gens, with the concurrence of the chief and nearest relatives. It was then bestowed upon the infant, but it still required to complete the christening that the birth and name of the child, together with the names of its father and mother, should be announced at the next ensuing council of the tribe. There were two classes of names in use—one adapted to childhood, and the other to adult life—which were exchanged at the age of fifteen or sixteen in the same formal manner. In some tribes the youth was required to go out upon the war-path and earn his new name. If a person was elected a sachem or chief, his name was "taken away," to use their form of expression, and a new one bestowed in its place.

4. *Mutual Rights of Inheritance of the Property of a Deceased Member of the Gens.*—In savage, and also in barbarous tribes below the Middle Status, the amount of property was inconsiderable, consisting of personal effects, to which possessory rights in houses and garden-beds were superadded after cultivation commenced. The most valuable personal articles were interred with the body of the deceased owner. Nevertheless, the question of inheritance was certain to arise, to increase in interest with the growth of property in variety and amount, and to result in a settled rule of inheritance. Accordingly, we find, as a substantially universal custom, that the property remained in the gens of the decedent and was distributed among his gentiles (pro. *gen'ti-les*) as the nearest of kin. Among the Iroquois the distribution was made under the auspices of the chief to the nearest of kin; the right of inheritance was, theoretically, in the gentiles at large, and it was in the power of the gens to make an arbitrary distribution without regard to the nearness of persons; but, practically, a discrimination had begun to be made in favor of those nearest in degree.

The land-tenure of savage tribes, and of tribes in the Lower Status of barbarism, is perfectly simple. Lands are universally owned in common by the tribe. After tillage had commenced, among the American aborigines occupation of land gave a possessory right to so much as was brought under cultivation, and it passed by inheritance, the same as personal effects. In these two principles of the ownership in common of the public domain, and of a possessory right to cultivated tracts, the natural basis is found of the arable mark, common pasture, and common waste of the Teutonic and Hindoo village communities discovered by Nasse and Maine.

5. *The Obligation not to Marry in the Gens.*—The prohibition must have originated in a powerful motive, which seems to lie on the surface—namely, to provide a permanent shield against promiscuity, and against the intermarriage of brothers and sisters as well. We are led by necessary inferences to accept the gentile organization as the result of an organic movement of society by means of which it was extricated from the evil against which this prohibition was directed. The condition of savage tribes who have not advanced to a knowledge of the gens, or who possess it in an inchoate form, and of barbarous tribes now organized in gentes, but whose systems of consanguinity have survived the state of society in which they originated, indicates that the intermarriage of brothers and sisters was practised in ancient times. In the midst of this condition, or when but slightly removed from it, and in the midst of the conjugal system which then prevailed, the gens was instituted. The main object at which it aimed was fully accomplished by the prohibition of intermarriage in the gens. Brothers and sisters would in any event be of the same gens; and since the paternity of children was unknown, descent was necessarily reckoned in the female line. Moreover, the gens at the outset did not look beyond this prohibition. An explanation of the origin of the gens at once adequate and complete is thus obtained. Had it attempted to uproot the entire conjugal system of the period, there is not the slightest probability that it would have worked its way into final establishment. Brothers still shared their wives in common, and sisters their husbands the same: which practice must have been coextensive with the punaluan family in the midst of which the gens was instituted, and which prevailed as widely as the Turanian system of consanguinity.

6. *Reciprocal Obligations of Help, Defence, and Redress of Injuries.*—Accustomed to look to the state for the protection of personal and property rights, there has been in civilized society a corresponding abatement of the strength of the bond of kin. But in the previous conditions the individual depended for security upon his gens and kinsmen.

Among the Iroquois, and other Indian tribes generally, the obligation to avenge the murder of a kinsman was recognized. It was the duty of the gens of the slayer and of the slain to attempt the adjustment of the crime if possible before proceeding to extremities. A council of each was held separately, and propositions were made for the condonation of the offence, usually in the nature of expressions of regret and of presents of considerable value. If there were justifying or extenuating circumstances, and the matter was judiciously managed, it generally resulted in a composition; but if the relations of the slain person were implacable, one or more avengers were appointed by the gens from among its members, who were charged with the duty of pursuing the criminal and of slaying him wherever he might be found. If they accomplished the deed, it was no ground for offence to any of his gentiles. Life having answered to life, the demands of justice were appeased.

7. *The Right to Adopt other Persons into the Gens.*—Another distinctive attribute of the gens was the right of adoption. Captives taken in war were either put to death or adopted by the different gentes. Women and children usually experienced clemency in this form. In no other way could a status be gained in the tribe than by adoption in a gens. Adoption not only conferred gentile rights, but also the nationality of the tribe. Among the American aborigines the person adopting a captive placed the latter in the relation of a son or daughter usually, but sometimes in that of a brother or sister, and ever afterward treated the person in all respects as though born in that relation. The Iroquois ceremony of adoption was performed at a public council of the tribe, which gave to it the solemnity of a religious rite.

It may be further remarked that the gauntlet had some connection with adoption, because the person who succeeded in running through the lines was entitled to this reward for his hardihood and endurance. Captives, when adopted, were often assigned the places in the family of persons destroyed in battle in order to fill the broken ranks of relatives. The concurrence of the other gentes was not essential to the exercise of this right. Through the practice of adoption a declining gens might be, and probably was, replenished in its membership.

8. *The Council of the Gens.*—The history of the council, gentile, tribal, and confederate, is the history of the growth of the idea of government. The simplest and lowest form of the council was that of the gens, which was a democratic assembly, because upon the most important questions

every member had a voice. It elected and deposed chiefs, avenged or condoned the crime of murder, elected "keepers of the faith," performed the ceremony of adoption, and distributed the property of a deceased member. It was the germ of the higher council of the tribe, and of that still higher of the confederacy, each of which was composed exclusively of chiefs.

Such and so substantial were the rights, privileges, and obligations of the members of a gens in its archaic form, as it is still found in full vitality among the American aborigines.

At the epoch of their discovery the American aborigines in general were organized in gentes, with descent in the female line. In some instances, as among the Dakotas and the tribes in the valley of the Columbia, the gentes had fallen out, but with every probability that they once possessed them. In some cases, as among the Omahas and Ojibways, descent had been changed from the female line to the male. But in no case had any of the tribes advanced out of gentile society into political society, out of a government founded upon persons into a state founded upon territory and upon property.

Throughout aboriginal America the gens took its name from some animal or inanimate object, and never from a person. In some tribes the members of a gens claimed to have descended from the animal whose name they bore, having been transformed by the Great Spirit from the animal into the human form.

With respect to the number of persons in a gens, it varied with the prosperity of the tribe, and again with the number of the gentes. Three thousand Senecas divided equally among eight gentes would give three hundred and seventy-five to a gens. Fifteen thousand Ojibways divided equally among twenty-three gentes would give six hundred and fifty-one persons to a gens. The Cherokees would average more than a thousand to a gens. In the present broken and reduced state of the tribes the number in each gens will range from a hundred to a thousand.

II. The Indian Phratry.—The phratry (φρατρία) is a brotherhood, as the term imports, and a natural growth from the organization into gentes. It is an organic union or association of two or more gentes of the same tribe for certain common objects. The gentes united in a phratry were usually such as had been formed by the segmentation of an original gens.

The phratry existed in a large number of tribes of the American aborigines, where it is seen to arise by natural growth, and to stand as the second member of the organic series, as it did among the Grecian and Latin tribes. It did not possess original governmental functions, as the gens, tribe, and confederacy possessed them, but it was endowed with certain useful powers in the social system, from the necessity for some organization larger than a gens and smaller than a tribe, and especially when the tribe was large.

The Seneca-Iroquois phratry presents the organization in its archaic form and with its archaic functions. A knowledge of the Indian phratry is necessary to an intelligent understanding of the Grecian and the Roman. The eight Seneca gentes are in two phratries, as follows:

First Phratry.

Gentes.—1, *Bear.* 2, *Wolf.* 3, *Beaver.* 4, *Turtle.*

Second Phratry.

Gentes.—5, *Deer.* 6, *Snipe.* 7, *Heron.* 8, *Hawk.*

Each phratry is a brotherhood (De-ā-non-dā'-a-yoh), as this term also imports. The gentes in the same phratry are brother gentes to each other, and cousin gentes to those of the other phratry, but the two are equal in privileges and functions. The phratries concerned themselves with the public games, in which the people divided by phratries, with cases of murder, with the funerals of distinguished men, and with the confirmation of the nomination of sachems and chiefs made by the gentes.

III. The Indian Tribe.—The tribe was not only a well-marked organization, but the principal or ultimate stage of organization of the great body of the American aborigines. Their striking characteristic was the large number of independent tribes into which they had fallen by the process of segmentation. Each tribe was individualized by a name, by an independent dialect, by a supreme government, and by the possession of a territorial area which it claimed and defended as its own. It was composed of several gentes gradually developed from two or more, all the members of which were intermingled by marriage and spoke the same dialect. As the gens was founded upon consanguinity, so the tribe, as an assemblage of gentes of the same lineage, was founded upon dialect. The instances are extremely rare among the American aborigines in which the tribe embraced peoples speaking different dialects. When such cases are found, it resulted from the union of a weaker with a stronger tribe speaking a related dialect, as the union of the Missouris with the Otoes after the overthrow of the former.

A constant tendency to disintegration, which has proved such a hinderance to progress in savage and barbarous life, existed in the elements of the organization into gentes. New tribes were constantly forming by natural growth, and the process was sensibly accelerated by the great expanse of the American continent. The method was simple. In the first place, there occurred a gradual outflow of people from some geographical centre possessing superior advantages in the means of subsistence, which was continued from year to year until a considerable population was developed at a distance from the original seat of the tribe. In course of time the migrants became distinct in interest, strangers in feeling, and last of all divergent in speech; separation and mutual independence followed, although their territories were contiguous. This is a concise statement of the mode of formation of the existing tribes of the American aborigines, taking it as a general proposition.

At the epoch of their discovery the eight Missouri tribes occupied the banks of the Missouri for more than 1000 miles, together with the margins of its tributaries, the Kansas and the Platte and the smaller streams of Iowa. Their dialects show that they were in three tribes before their last subdivisions occurred—namely, first, the Punkas and Omahas; second, the Iowas, Otoes, and Missouris; and third, the Kaws, Osages, and Quappas. The three original tribes were undoubtedly subdivisions of one people, because their several dialects are still much nearer to each other than to any other dialects of the Dakotan stock-language to which these dialects belong. There is therefore a linguistic necessity for their derivation from each other and from an original tribe.

Numbers within a given area were limited by the amount of subsistence it afforded. Where fish and game were the main reliance, it required an immense area to maintain a small tribe. After horticultural products were superadded to fish and game, the area was still a large one in proportion to the number of the people. New York, with its 47,000 square miles, never contained at any time more than 25,000 Indians, including the Algonkins on the E. side of the Hudson and upon Long Island. A personal government founded upon gentes was incapable of developing a central power able to follow and control its increase of numbers after they had spread over wider areas. Divergence in speech completed the work of disintegration.

Among the Village Indians of New Mexico—which was doubtless equally true of those in Mexico and Central America—an increase of numbers in a small area did not change the result. Each pueblo was an independent self-governing community. When several were seated near each other on the same river or stream, they were usually kindred in speech, and a confederacy for mutual protection was the highest organization they were able to form. The relations concerning Coronado's expedition to New Mexico in 1540–42 mention the seven villages of Cibola and the seven villages of Tucayan, thus implying that each group was composed of kindred tribes standing in close governmental relations; they were probably confederated. No Indian confederacy has been found in North America which extended beyond the bounds of a stock-language, excepting when a fragment of an overthrown tribe had been admitted as a favor, as the remains of the Natchez in the Creek confederacy. Thus the Indian tribe appears to have been a very simple as well as humble organization, requiring but a few hundred, and at most but a few thousand, people to place it in a respectable position in the Ganowánian family.

The following are its principal attributes: (1) The possession of a tribal territory and a tribal name; (2) the possession of an independent dialect; (3) the right of investing chiefs elected by the gentes; (4) the possession of a religious faith and worship; (5) a supreme government through a council of chiefs; (6) in some cases a head-chief of the tribe.

IV. The Indian Confederacy.—A tendency to confederate for mutual defence would spring up very naturally among kindred and contiguous tribes. When its advantages were appreciated by actual experience, the organization, at first a league, would cement into a confederate unity. To such a union of tribes speaking dialects of the same stock-language the individual gens, and the individual tribes composed of gentes, were eminently adapted. The chronic state of warfare in which they lived and the severe straits to which they were frequently reduced would quicken this tendency into action among such tribes as were sufficiently advanced in intelligence and in the arts of life to perceive its benefits. It would be simply a growth from a lower into a higher organization by an extension of

the principle which united the gentes in a tribe. Several confederacies, as might have been expected, were found in different parts of North America when discovered, some of which were quite remarkable in plan and structure. Among the number may be mentioned the Iroquois confederacy of five independent tribes, the Creek confederacy six, and the Dakota league of "the seven council fires." To these may be added the Aztec confederacy of three tribes in the Valley of Mexico, and the Tlascalan, and perhaps Cholulan and Michoacan confederacies, in other parts of Mexico. It is probable that the Village Indians of Central and South America were thus confederated, but if such were the fact, the knowledge of it has been lost in the general shipwreck of their historical affairs at the Spanish conquest.

The two highest exemplifications of Indian confederacies were the Iroquois and the Aztec. From their superiority as military powers and from advantages of position, their confederate organizations, which were externally singularly complete, led in both instances to remarkable results. Our knowledge, however, of the structure and principles of the Aztec confederacy is limited, and far from satisfactory, but measurably definite with respect to that of the Iroquois.

The Iroquois tribes furnish an excellent illustration of the manner in which a confederacy was formed by natural growth, assisted by skilful legislation. When discovered (A. D. 1608) they occupied the whole area between the Hudson and the Genesee river, and southward down the Susquehanna into Pennsylvania. In numbers they never at any time exceeded 20,000 persons.

When the confederacy was formed, about A. D. 1400–50, they were in five independent tribes, occupied contiguous territories, and spoke dialects of the same stock-language which were still mutually intelligible. Beside this, three gentes were common in the five tribes—namely, the Wolf, Turtle, and Bear; and four other gentes—namely, the Beaver, Snipe, Heron, and Hawk—were common in the Seneca, Cayuga, and Onondaga tribes. Three common gentes in all the tribes afforded an ample basis for the confederacy; the remaining five in the three tribes, being in excess, interposed no hinderance, while they served to bind the three more closely together. With all the necessary elements in their hands, the formation of a confederacy became a question of intelligence and progress. It is affirmed by the Iroquois that the confederacy was formed by a council of the wise men and chiefs of the five tribes, which met for that purpose on the N. bank of Onondaga Lake, near the site of the present city of Syracuse, and that before its session was concluded the organization was perfected and set in immediate operation. They further affirm that the confederacy, as formed by this council, with its powers, regulations, and mode of administration, has come down to them through many generations to the present time, with scarcely a change in its internal organization. When the Tuscaroras were afterward (1712) admitted as a sixth tribe into the confederacy, their sachems were allowed, by courtesy, to sit in the general council of sachems, but they were never recognized as forming a part of the ruling body.

The general features of this confederacy may be indicated by the following propositions: (1) A union of tribes composed of the same gentes, and on the basis of equality, each tribe remaining independent in all matters pertaining to local self-government within its own territories. (2) A general council of sachems, limited in number, equal in rank, and holding the supreme authority over all matters pertaining to the confederacy. (3) Sachemships were created in perpetuity in certain gentes of the several tribes, with power in the latter to fill vacancies as often as they occurred; but the right to invest the sachems with office was reserved to the general council. (4) The sachems of the confederacy were also sachems of their respective tribes, and the council of the tribe was left supreme over all matters pertaining to it exclusively. (5) In the general councils of the confederacy unanimity was made essential to every public act. (6) The council of each tribe had power to convene the general council, but the latter had no power to convene itself. (7) The general council was open to the orators of the people for the purpose of discussing public questions, but the council alone decided. (8) The confederacy recognized no official head: in the administration of its affairs one sachem possessed as much authority as another. (9) They had reached the idea of general military commanders, but they created two principal war-chiefs of the confederacy, instead of one, and made their powers equal. This was probably the office held by Montezuma among the Aztecs, that of a general commander, which grew in a more advanced condition of society into the *basileus* of the Greeks and the *rex* of the Romans.

As the central tribe in position, the Onondagas were made the "keepers of the council brand," which made the Onondaga Valley in effect their seat of government. But each tribe had power to summon the general council, and in its own territory, if it chose to do so, and to appoint the time and place. Originally, the principal object of the general council was to raise up sachems to fill vacancies in the ranks of the ruling body occasioned by death or deposition; but it transacted all other business which concerned the common welfare. In course of time, as they increased in numbers and strength, and their intercourse with foreign tribes became more extended, the council fell into three distinct kinds, which came to be distinguished as the "civil" (Ho-de-os'-seh), the "mourning" (Hen nun-do-nuh'-seh), and the "religious." The first declared war and made peace, sent and received embassies, made treaties, regulated the affairs of subjugated tribes, and took all needful measures for the common welfare. The second raised up sachems to fill vacancies. It received its name from the first of its ceremonies, which was a lament for the deceased ruler whose vacant place was to be filled. The third was held for the observance of a general religious festival. It was made the occasion for the five tribes to unite, under the auspices of a general council, in common religious observances, and for the celebration of their public games. But as the mourning council was always attended with religious ceremonies, it came in time to answer for both.

With respect to the mode of conducting business adopted by the council, there was a prescribed way in which it was summoned, and five days was the usual length of the session. Unanimity was necessary to any decision, in arriving at which they voted by tribes, which ensured the independence of each. These councils were opened and conducted with established forms and ceremonies, and were great occasions in Indian life, particularly when sachems were installed, when the structure and principles of the confederacy were explained from belts of wampum for the instruction of the newly-inducted sachem.

"This belt preserves my words," was a common expression of an Iroquois chief in councils held with the colonial authorities, at the same time delivering the belt as the evidence of what he had said. They experienced the necessity for an exact record of a proposition made, because it involved their honor in its execution. The belt or string of wampum was devised to this end. Into it "was talked," to use their expression, the proposition or statement made, of which it became the sole evidence, but it required an interpreter to render its meaning.

The Iroquois name for a sachem (Ho-yar-na-gó-war), which signifies "a counsellor of the people," was singularly appropriate to a ruler in a species of free democracy. It not only defines the office well, but suggests the analogous designation of the members of the council among the Grecian gentes. They also are described as "counsellors of the people" (δήμου πρόβουλοι). (Æschylus, *The Seven against Thebes*, 1005.) From the nature and tenure of the office the chiefs of the gentes among the Iroquois were not masters, ruling by independent right, but holding from the gens by free election, with the reserved right in the gens to depose. It is worthy of notice that an office which originated in savagery and continued through the period of barbarism should reveal its archaic character after the gentes had carried a portion of the human family to the confines of civilization, as among the Greeks. It shows further how deeply inwrought the principle of democracy became under gentile institutions.

The designation for a chief of the second grade signifies "an elevated name" (Hä-seh-no-wä'-na). Among the Iroquois the celebrated orators, wise men, and military commanders were chiefs of this grade. One reason for this is found in the provision which limited the duties of the sachems to the affairs of peace. As the office of chief was bestowed in reward of merit, it fell necessarily upon their ablest men. Red Jacket, Brandt, Cornplanter, Frost, Johnson, and other well-known Iroquois were simply chiefs.

Under the confederacy the office of a general military commander makes its first appearance. The introduction of this office as a permanent feature of the government was a great event in the history of human progress. At a later stage of advancement it became identified with a materially-changed condition of society. It was the beginning of a chief executive magistrate, the germ from which in the course of time sprang both the king and the president. In the Lower Status of barbarism, with property inconsiderable and numbers small, the affairs of society were simple, and the military office unimportant; but in the Middle Status, with an increased amount of property and augmented numbers gathered in villages, affairs became more complex, suggesting the need of administrative officers, and making the general military commander more conspicuous. When the Iroquois confederacy was formed, a necessity was felt for general commanders. Accordingly, two war-chiefships were established, one of which was made hereditary in the Wolf gens and the other in the Turtle gens of the Senecas.

The reason for giving both to the Senecas was the greater danger apprehended from the West. They were elected, and afterward raised up by the general council, the same as the sachems, and were equal in rank and authority. Gov. Blacksnake, recently deceased, held one of these offices. As general commanders they had charge of the military affairs of the confederacy, and commanded in person the confederate forces when united on an expedition. The creation of two instead of one argues a calculating policy, an unwillingness to entrust the military command to a single person.

The character and functions of the council, the mode of its appointment, the limitations upon its authority, and the tenure and powers of the office of chief, are the principal points to be considered to understand the structure and principles of a confederacy of tribes. That of the Iroquois is an excellent exemplification of a society or *populus* under gentile institutions. It seems to reveal nearly all the capabilities of gentile society in the archaic state, leaving no subsequent plan of government radically different until political society was attained and the gentes themselves were overthrown. The intermediate stages, which were transitional, gave nothing higher than a military democracy resting upon the gentes. LEWIS H. MORGAN.

Triodon'tidæ [from *Triodon*—τρεῖς, "three," and ὀδούς, "tooth"—the generic name of the type], a family of teleost fishes of the order Plectognathi and sub-order Gymnodontes, and comprising the most generalized forms of the sub-order and those nearest the Scleroderm. The body is oblong, with a very dilatable abdomen, and with a slender conic tail; the skin is covered with "small osseous, scale-like, spiny subimbricate laminæ;" the lateral line well marked; the head oblong, with the snout rather long; the opercular apparatus concealed by the skin; the nostrils represented by two distinct openings on each side; the mouth is terminal and small; the upper jaw divided by a median suture, the lower undivided (thus together forming three tooth-like pieces, whence the name); the teeth are only represented by the trenchant edges of the jaws; the branchial apertures are narrow clefts in front of the pectoral fins; the branchiostegal rays entirely concealed; dorsal and anal fins very short and far behind, the former more advanced forward than the latter; caudal separate and emarginated; pectorals rather narrow; ventrals entirely wanting. An air-bladder is present. The skeleton is tolerably well ossified, and distinct ribs are developed; the so-called pelvic bone is large, and serves to keep expanded the abdominal sac-like expansion, "the lower part of which is merely a flap of skin into which the air does not penetrate" (*Günther*). The family is especially interesting on account of its relations, and as serving to demonstrate the affinity of the gymnodonts with the scleroderms. But one species is known, the *Triodon bursarius* of the Indian Ocean and Archipelago. THEODORE GILL.

Trionych'idæ [from *Trionyx*—τρεῖς, "three," and ὄνυξ, ὄνυχος, "claw"—the typical genus], a family of reptiles of the order Testudinata (tortoises), containing the soft-shelled tortoises, and distinguished by the leathery and scaleless shell. The head is oblong, covered with a naked skin, and without plates, with the eyes near the front, and with the snout produced and attenuated, and the nostrils terminal; the jaws are covered by fleshy lips; the neck is elongated and retractile in a longitudinal axial curve; the shell has its upper and lower parts (carapace and plastron) connected by broad bridges, and covered with a soft skin having an expanded and reflexible margin; the pelvis is attached to the vertebral column, and not connected with the plastron; the feet are expanded; the toes spreading, but connected by a web, their internal margins provided with a web-like membrane, and the three outer toes clawed. The family includes the soft-shelled turtles. "The principal habitat of the members of this family is the muddy bottom of shallow waters. They bury themselves in the soft mud, leaving only the head, or a small part of it, exposed. They take breath from time to time, without moving the body, by raising up the long neck and head and carrying the leathery snout above water. They sometimes stay under water a long time without taking breath; in one instance, a specimen has been seen to remain under water for more than half an hour without raising its snout above the surface. The nature of the habitat is clearly connected with some of the prominent family characteristics." They rarely emerge from the water to take to the land, and when on the land their locomotion is laborious and constrained. In the water, however, they are very active and quick in their movements. "They feed upon shells, especially upon anodontas and paludinas." "They lay from twelve to twenty and more eggs, of a spherical form and above the size of a musket-ball, which they deposit on the shore by the water's edge. The shell of these eggs is thick, but very brittle." Such are the principal features of the habits of the American species, as observed by Agassiz. (*Contributions to the Natural History of the U. S. of A.*, vol. i. pp. 333–334.) Representatives of the family are found most abundantly in the tropical regions of Asia and Africa, but a number of species also extend through a considerable area in the U. S., and equally far northward in Asia. The number of known species has been considerably increased within the last fifteen years, and by Dr. J. E. Gray they have been classified under three families (which would by most authors be regarded as not more than sub-families) and nineteen genera. N. American species, according to Agassiz and Cope, are (1) *Amyda mutica*, (2) *Platypeltis ferox*, (3) *Aspidonectes spiniferus*, (4) *A. asper*, (5) *A. nuchalis*, and (6) *A. emoryi*. The first and third of these extend northward to the St. Lawrence basin, and elsewhere are inhabitants of the northern as well as middle tributaries of the Mississippi River; the others are more southern in their range. THEODORE GILL.

Trochil'idæ [from *Trochilus*—the Greek name, τροχίλος, of an unknown bird, but perhaps the wren—applied by Linnæus to the humming-birds], a family of birds peculiar to America, and constituted of the humming-birds. The general physiognomy is familiar in connection with the common North American form; the bill is slender and elongated, but otherwise very diversiform; the gape moderate; the tongue is "composed of two lengthened cylindrical united tubes, capable of great protrusion, and bifid at the tip" (*Gould*); the nostrils are linear, and near the base of the upper mandible; there are no rictal bristles; the wings are long and narrow, and have ten (rarely nine) primaries, rapidly graduated from the first (or second) to the tenth, and only six very short secondaries; the tarsi are very short and slender; the toes small, three in front and one behind; the tail is composed of ten feathers, but in shape is extremely diversiform. The most notable features of the internal organization are as follows: The skull is essentially like that of the Cypselidæ (swifts) and Caprimulgidæ (goatsuckers), though of course very much modified in many minor respects; the sternum has a very deep keel, and its posterior margin is rounded; the humerus is extremely short, and the manus quite elongated; the hyoid bones are very long, "in their position resembling those in the Picidæ (woodpeckers); trachea of uniform diameter, destitute of muscles of voice [?]; bronchia very long; œsophagus funnel-shaped, slightly contracted on approaching the proventriculus, which is small and scarcely perceptible; gizzard small, moderately muscular" (*Eyton*); the ambiens muscle is wanting in the knee; the primary femoro-caudal is present, but the accessory femoro-caudal, semitendinosus, and accessory semitendinosus are deficient; the pectoral muscles are very large. The affinities of these birds were long misappreciated, and by the older authors they were universally approximated to the "tenuirostral" Passeres (such as creepers, hoopoes, etc.), but it is now proved that they are most nearly related to the swifts. The two families have indeed by some authors (*e. g.* Nitzsch and Garrod) been even combined in one family (called Macrochires), on account of their general agreement, and especially in the relative shortness of the humerus and length of the manus. They are, however, generally (and apparently with great propriety) regarded as two quite distinct families. The Trochilidæ are very numerous in genera and species: Mr. Gould, in his great monograph, has admitted 416 species, ranked under 123 genera, and Mr. G. R. Gray, in his *Handlist*, has recognized 469 species grouped under 2 sub-families, 10 genera, and (including generic types) 163 sub-genera. The species differ extremely in the form of the bill and that of the tail: the bill, *e. g.*, varies in extent from almost less than the length of the head to that of the rest of the body, and is sometimes upcurved (*e. g. Avocettula*), sometimes straight, and sometimes, again (*e. g. Eutoxeres*), boldly decurved; while generally, too, the mandibles are unarmed, sometimes (as in *Grypus*) they have "a row of numerous and thickly-set teeth," and "a strong hook at the end of the mandibles" (*Gould*). The tail is equally variable; "in some species (*e. g. Lesbia amaryllis*) it is four times the length of the body, in others (*e. g. Calothorax micrurus*) it is so extremely short as to be entirely hidden by the coverts;" in some, again, it is extremely forked, while, on the contrary, in others, it is to an almost equal degree wedge-shaped. It is chiefly on such modifications that the numerous genera are based. Much yet remains to be done in the combination of the genera into natural groups. The species, as already intimated, are most numerous in equatorial countries, but heat is by no means a necessary condition of their existence, as in those countries not a few species dwell in the high mountainous, and consequently cold, regions. On Chimborazo, "just below the line of perpetual congelation," one notable species (*Oreotrochilus chimborazo*) is found. Several species also ascend far into

the uplands or plains of North America, the most northern being the common humming-bird (*Trochilus colibris*) of the Eastern States, which wanders as far N. as British America, and the rufous-backed humming bird (*Selasphorus rufus*) of the Pacific States, which is said to extend upward to British Columbia and Alaska. Other species migrate to equally cold regions in Patagonia. There is a remarkable difference between the males and females in most of the members of the family: the males are generally very brilliantly colored, their head, neck, and breast feathers especially reflecting iridescent hues of various kinds, while their feathers are frequently developed in some fantastic manner; the females, on the contrary, are mostly quite plain in their colors, and have little exuberance of plumage. The species are mostly the smallest of birds, the largest of the family, the *Patagona gigas* of the western slope of South America (Ecuador, Peru, Bolivia, and Chili), being about eight inches long, or the size of a swallow, while the smallest, the *Mellisuga minima* of Jamaica and San Domingo, is barely an inch and a quarter in length. The species frequently stop, poised in mid-air, rapidly vibrating their wings and producing a humming sound, which has procured for them their popular name. They especially exhibit this peculiarity in their visits from flower to flower in search of the nectar and the minute insects contained therein. They are fearless little creatures, and readily accommodate themselves to the presence of man, but are very difficult to keep in confinement. They mostly build in bushes or vines or on the sides of rocks cup-shaped nests, and therein lay generally two eggs (but sometimes, it is believed, only one), which are hatched in about two weeks or little more. Thirteen or fourteen species are found within the limits of the U. S. (See also HUMMING-BIRD, in CYCLOPÆDIA.) THEODORE GILL.

Troglodyt'inæ, or Troglodytidæ [from *Troglodytes*—τρωγλοδύτης, a "cave-dweller"—the name of the typical genus], a sub-family or family of passerine birds, containing the wrens. The characters have been best formulated by Baird, who considers the group as a family. The form is exemplified in the familiar wren: the bill is slender, and the upper mandible is generally entire, but sometimes notched; no rictal bristles are developed, but the loral feathers have bristly points; the nostrils are diversiform, "exposed or not covered by feathers, and generally overhung by a scale-like membrane;" the wings are rounded, and have ten primaries, the first of which is generally about half as long as the second; the tarsi are moderately long and scutellate; the toes are moderate; the middle "usually united to half the basal joint of the inner and the whole of that of the outer, or more," and the lateral about equal, or the outer a little longer; the hinder one enlarged; the tail is moderate. The group comprises the wrens of the northern hemisphere and numerous related species, the greater part of which are American. By G. R. Gray, 126 species are recognized as members of the group, dignified by him as a family, and are grouped under two sub-families—viz. Troglodytinæ, with 5 genera (20 sub-genera), and Tatarinæ, with 1 genus (2 sub-genera). By most authors, however, about 15 genera are admitted under the first group. The species of the northern hemisphere are rather plain-looking but prepossessing birds, and the attitude of the common species—head stretched forward and upward and tail bent upward while singing—is characteristic. They are chiefly insectivorous. Their nests are mostly built in trees, often in cavities, and the eggs are rather numerous (seven to nine in *Troglodytes ædon*), and short for their length. The North American species admitted by Baird, etc., are *Campylorhynchus brunneicapillus*, *C. affinis*, *Salpinctes obsoletus*, *Catherpes mexicanus*, *Thryothorus ludovicianus*, *Thryomanes Bewickii*, *Troglodytes ædon*, *T. parvulus* or *hyemalis*, *Cistothorus stellaris*, and *C. palustris*, besides varieties. THEODORE GILL.

Trogon'idæ [from *Trogon*—τρώγειν, to "gnaw"—the designation of the typical genus], a family of birds common to the tropical and subtropical regions of America, as well as Asia and Africa. The bill is rather short, stout, broad at the base, and rapidly narrowed forward, with the culmen decurved and with the edges more or less toothed; the gape is furnished with bristles; the cleft is quite deep; the nostrils are sublaterally basal, and more or less concealed by bristly feathers; the wings are moderate and rounded or angulated at about the fifth primary; the legs are rather weak; the tarsi short and partially or entirely covered with feathers; the toes separated in pairs, the first and second directed backward, and not versatile, and the third and fourth forward, the anterior connected by their basal joints; the tail is more or less elongated and graduated. The species are mostly rather large and showy birds, which in great part live in the depths of the equatorial forests, often perched on the highest branches. They are believed to subsist to a large extent on fruits and berries, but also prey on insects. About 50 species are known, which have been variously grouped in genera. About 35 species represent the family in America and constitute the genera *Pharomacrus*, *Temnotrogon*, *Trogon*, *Leptonus*, and *Pharomacrus* (=*Calurus*); some dozen or more are found in Asia and form the genus *Harpactes* and its subdivisions; and a couple of species in Africa have been isolated to form the peculiar genus *Hapaladerma*. The relations of the family are with the Momotidæ, Alcedinidæ (kingfishers), Cuculidæ (cuckoos), and allied forms, and it is a member of the sub-order Coccygomorphæ of Huxley or Coccyges of some other authors. THEODORE GILL.

Trout [derived through the Fr. *truite* from the mediæval Latin *tructa*], a name variously applied in different countries. (1) Primarily, and by right, however, the name belongs alone to the well-known fish so called of Great Britain and related species of northern countries. These species belong to the family Salmonidæ, and, as generally understood, to the genus *Salmo*, and form a group distinguished by their habits as well as structure. They are in the main confined to fresh waters, and there reside during the whole of the year, feeding therein and propagating near their habitual abiding-place. In this respect they contrast with the salmons and salmon-trouts. They are also generally spotted with red or black. Although thus contrasted with the salmons as non-anadromous fishes (*i. e.* not living for the greater part of the year in salt, and returning to fresh waters for merely breeding purposes), they are not averse to salt water, and may even be, to a limited extent, anadromous. Species are found in clear and cold streams and lakes of most northern countries. They are voracious fishes, and possess great agility, and are therefore favorite fishes for anglers. About 20 species are found in Europe, 4 or 5 in Siberia, and over 20 in North America. The pre-eminent species, however, are the *Salmo fario* of Europe and the *S. fontinalis* of North America.

(*a*) The *Salmo fario* belongs to a group distinguished by dentition; the vomer has a triangular head, broader than long, and across its front is a transverse series of teeth, while on the shaft is a double row of strong teeth placed opposite to each other or alternately, and which are persistent throughout life; the scales are of moderately small size, about 120 being along the lateral line; the trunk and head are usually thickly covered with red spots and black ones, bordered with a light rim; these are often more or less irregular in shape; the dorsal and anal fins at their anterior margins and the ventrals along their outer edges are yellowish; the dorsal is also spotted with red and black. The species attains a length of about thirty inches, although individuals become able to procreate when about eight inches in length.

(*b*) The *Salmo fontinalis* is the representative of another group, distinguished by the vomerine dentition; the vomer has also a broad head and teeth on its front portion, but there are none on its shaft; the scales are very small, there being somewhere about 200 along the lateral line; the skin on the trunk as well as head is covered with yellowish spots, and more or less dotted with vermilion; the dorsal has five or six transverse rows of dark spots; the ventral and anal edged with whitish, followed by a slightly oblique blackish band crossing lengthwise the second and third rays, and the rest orange; the pectorals are margined along the upper rays with black. It does not attain as large a size as the European species, but is regarded by many as even a superior fish for the table and sport.

(2) The name "trout" is also applied in the Southern U. S. to the species of *Micropterus* (black bass) and *Cynoscion* (weak-fish), and elsewhere to many other fishes, but always quite erroneously. (See also SALMONIDÆ, etc.) THEODORE GILL.

Trum'bull (HENRY CLAY), A. M., b. at Stonington, Conn., June 8, 1830; was educated at Williston Seminary, East Hampton, Mass.; settled at Hartford, Conn., in 1851; was appointed State missionary of the American Sunday School Union for Connecticut in 1858, and ordained as a Congregational clergyman in 1861; served during the war as chaplain of the 10th Connecticut Vols., and was taken prisoner before Fort Wagner in 1863; was appointed missionary secretary for New England in 1865, and normal secretary in 1871, and removed in 1875 to Philadelphia, where he became the editor of the *Sunday School Times*. He has published *The Sabbath School Concert* (1861), *The Knightly Soldier* (1865), *Memorial of E. B. Preston* (1866), *Falling in Harness* (1867), *Childhood Conversion* (1868), *The Captured Scout of the Army of the James* (1869), *Children in the Temple* (1869), *The Worth of an Historic Consciousness* (1870), *Review Exercises in the Sunday School* (1873), etc.

Tun. See TON, by F. A. P. BARNARD.

Tupai'idæ [from *Tupaia*—a latinized form of a native name—the typical genus], a family of mammals of the order Insectivora and sub-order Animalivora, peculiar to the East Indies and neighboring islands. In form they resemble the squirrels: the head, however, runs out in a pointed snout; the pelage is soft and abundant; the hind legs are notably larger than the front ones, and all have five well-developed toes; the tail is long; the teeth are 38—viz. M. $\frac{3}{3}$, P. M. $\frac{3}{3}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$; "upper molars with four more or less marked cusps and an external cingulum, which tends to form, with the two outer principal cusps, two triangular prisms;" lower with two subequal halves (anterior and posterior), the posterior being almost as much developed as the anterior, triangular and narrowed outward; canines more or less remote from the sutures between the premaxillaries and supramaxillaries; the skull has the dorsum of the muzzle transversely convex; the orbits are more or less encircled by bone; there are no suboptic foramina; alisphenoid canals are developed; malar bones perforated; the lachrymal foramina open at the margin of or outside the orbits; the tibiæ and fibulæ are separate; the metatarsi are moderately long—*i. e.* little or no longer than the tarsi; the pubic symphysis is elongated; the intestinal canal has a large cæcum. The family embraces mammals about the size of squirrels; the resemblance to those animals is an adaptive one, and, like the squirrels, the tupaias live chiefly in trees; their resemblance to the squirrels is sufficiently striking to have obtained for them in certain places the same name, the native word "tupaia" being applied to the animal in question as well as true squirrels. The species are most abundant in the islands of Sumatra, Borneo, and Java. They are generally grouped in two genera, *Tupaia* and *Ptilocercus*. They are truly insectivorous. THEODORE GILL.

Tur'diuæ, or **Turdidæ** [from *Turdus*—the ancient Latin name of the thrush—the typical genus], a sub-family or family of passerine birds, typified by the common thrushes, and comprising the cathird, mocking-bird, and related species. The form is familiar in connection with the species just enumerated, and all are essentially alike in that respect; the bill is rather slender, elongated, and subulate, compressed toward the tip, with the culmen more or less curved from the base, and with the upper mandible generally notched near the tip; the loral and frontal feathers are bristly; the mouth is also usually well provided with bristles: the nostrils are oval and naked; the wings furnished with ten moderate and rounded primaries, and with the "spurious primary sometimes half the length of second quill; the second quill shorter than the fourth; in the closed wing the outer secondary reaches three-fourths or more the length of longest primary" (*Baird*); the legs are moderately developed; the tarsi in some (Turdinæ) anteriorly "booted"—*i. e.* covered with an undivided sheath; in others (Miminæ) scutellate; the toes rather long, the outer united to the middle by the basal joint, the inner mostly separate; the tail is well developed, and generally even or concave. Such are the characters assigned by Gray, Baird, Coues, Lilljeborg, and others to this group, by all of whom it is considered as a family. Like almost all other so-called families of Passeres, however, it requires confirmation by osteological characters, and is probably of less than family value. The group is extensively represented in almost all countries except the polar regions, though sparingly in Australasia and Polynesia. The species feed upon insects and their larvæ, as well as berries and fruit. Among the members of the group are some superior songsters, such as the mocking-bird and wood-thrush of North America, etc. They mostly build their nests in trees or bushes, and lay about four or five eggs. Not far from 250 species have been made known (G. R. Gray recognizing 232 species in his *Handlist*), of which about 100 are inhabitants of America and represent some 13 genera. Fourteen species are found within the limits of the U. S., and belong to five genera. The most notable are the *Turdus mustelinus* (wood-thrush), *T. fuscescens* (tawny thrush), *T. migratorius* ("robin"), *Harporhynchus rufus* (brown thrasher), *Mimus polyglottus* (mocking-bird), and *Galeoscoptes carolinensis* (catbird). THEODORE GILL.

Turkish Language and Literature. The Turkish language belongs to the Ural-Altaic or Scythian or Turanian group, and is allied to the Finno-Hungarian, Samojedic, Tungusian, and Mongolian languages. It is spoken in various dialects over a vast tract of land stretching from the Lena across Central Asia, Asia Minor, and the Balkan peninsula to the Adriatic. Several of these dialects, or rather branches, of the primitive stock-language have obtained a literary development, such as the Uigur, the Jagatai, and the Osmanli, but none of them have as yet received a thoroughly scientific investigation. Of the Uigur, most of its literary monuments have been lost; the Jagatai, which flourished E. of the Caspian Sea from the time of Tamerlane to that of Baber, is very little known; best known is the Osmanli, spoken at present throughout the whole Turkish empire in Europe, Asia, and Africa, and much used both in literature and in political and commercial business. It is very mixed with respect to its materials, half of its words being either Persian or Arabian; it has no relative pronoun but that borrowed from the Persian, and no conjunctions but those borrowed from the Arabic. Its grammar, however, is strictly Turkish, and places a sharp difference between it and the Indo-European and Semitic languages, with which it in other respects has intermingled very freely. It is generally written with Arabic letters, which are very poorly suited to express it; sometimes, however, Armenian characters are used. There are grammars by Davids (London, 1836), Redhouse (Paris, 1846), and Kasem-Beg (translated into German, Leipsic, 1848), and dictionaries, Turkish-French, by Kieffer and Bianchi (1846) and Redhouse (1857).

The Turkish literature is rich, but not very original. Much of what it contains is translation or imitation, especially from the Persian, but also from the Arabic, and, of late, even from various European literatures. Lyrical poetry flourished among the Turks even before the establishment of their empire in Europe, but the influence of Persia is very marked, even with the most prominent poet of that period, Mohammed Tschelebi, whose romantic epics and mystical lyrics are still highly appreciated. The golden age of Turkish poetry was the times of Solyman the Magnificent, when Fasli (d. 1563) and Bâki (d. 1600) wrote. The former is the author of the celebrated poem, *Gul u Bulbul* ("The Rose and the Nightingale"), which has been translated into almost all European languages; and the latter is by his countrymen placed equal to Hafiz and Motanebbi. Of great importance among the numerous historical productions are the annals of the empire from its establishment to the end of the eighteenth century, commenced by Saad-ed-din, and continued by Naima (1591–1659), Reschid (1660–1721), Tschelebisade (1721–27), Sami (1730–43), Issi (1744–52), and Wasif (1752–73). Particularly interesting are the so-called *Fetwas*, judicial decisions of entangled juristical cases, of which there are several collections—by Sheikh Mustafa-el-Kudusi (1822), Mufti Abdur-Rahim (1827), Numan Effendi (1832), etc.—giving a vivid picture of the life of the people and of the peculiar connection between its religion and its legislation. (See *Litteratura Turchesca*, by Toderini (1787), and *Geschichte der Osmannische Dichtkunst*, by Hammer (1836), which contains numerous specimens of Turkish lyrical poems, excellently translated.)

U.

Ubii, the name of a Germanic people settled, in the time of Cæsar, on the right bank of the Rhine, from the Sieg to the Lahn, between the Sigambrii to the N. and the Suevi to the S. Cæsar describes them as being quite familiar with Gallic manners and civilization, and he found them ready to make an alliance with him and furnish him with vessels for the crossing of the Rhine. Afterward they remained faithful to the Romans, and when they were too hard pressed by their wild neighbors, the Suevi, Agrippa removed them, in the time of Augustus, to the left bank of the Rhine. Agrippina, the daughter of Germanicus and the wife of Claudius, was born in their capital, *Ara* or *Civitas Ubiarum*, which after her was called *Colonia Agrippinensis*, the present Cologne. The whole people was sometimes called *Agrippinenses*. In the insurrection of Civilis (70 A. D.) they participated only for a short time, and because they were compelled by force. Soon after, however, they became merged into the Franks, and disappeared as an independent nation.

U'lybuschew, or **Oulibichef** (ALEXANDER DMITRIWICH), b. in 1794 in the government of Nizhnee-Novgorod, Russia, descended from a Tartar family; studied at various German universities; entered the Russian ministry of foreign affairs, but resigned his position in 1831; devoted himself exclusively to the study of music. D. in Nizhnee-Novgorod Feb. 5, 1858. He wrote, in French, *Nouvelle Biographie de Mozart* (3 vols., 1843) and *Beethoven, ses Critiques et ses Glossateurs* (1857), which were translated

into both German and English. In Russian he wrote a great number of musical essays and criticisms in various periodicals, which exercised a great influence on the development of musical taste in Russia.

Um'bridæ [from *Umbra*—the ancient name of a fish—the typical genus], a family of fishes of the order Teleocephali and sub-order Haplomi, represented in North America and Eastern Europe. In form they resemble the "killie fishes" or "minnows" (Cyprinodontidæ); the body is covered with cycloid scales, which are moderately large and destitute of radiating striæ; the lateral line is obsolete; the head is oblong, conic in profile, transversely arched, and covered with moderate scales like those on the body; the eyes are lateral; the operculum normally developed and unarmed; the mouth is moderate, and has a lateral oblique cleft; the upper jaw is formed by the intermaxillaries as well as supramaxillaries; teeth are developed on the jaws as well as palate; the branchial apertures are ample; branchiostegal rays five or six; the dorsal fin has articulated and branched rays, and is submedian and above the ventrals; the anal is smaller and farther back than the dorsal; the caudal well developed; the pectorals normal; the ventrals abdominal and with six rays. The intestinal canal has a simple stomach and no pyloric cæca; the air-bladder is simple. The species of the family live in fresh and brackish water ponds and the waters in the eastern parts of Europe (*e.g.* in certain parts of Austria, Hungary, and the Crimea) and many portions of the U. S. The European representatives have been designated *Umbra Crameri*; the American *Umbra limi*, *Melanura limi*, etc. Although there may be generic differences between the American and European forms, they have not yet been demonstrated. The American species live, it may be said, in the mud itself, and patches of water which appear destitute of fishes may yield considerable numbers of this kind by being dragged and the bottom stirred up. The species are generally about three to five inches long. THEODORE GILL.

Ungula'ta [Lat. *ungulus*, a "hoof"], a name applied in various senses to placental mammals having digits terminated by hoofs.

I. By Ray, and especially Linnæus, the name was employed for all the hoofed mammals in contradistinction to the clawed and muticate (finned) mammals. These, again, were differentiated by Linnæus into two orders—(1) Pecora, including all the ruminating forms, and (2) Belluæ, embracing the equine and hippopotamine forms: *Rhinoceros* was referred to the Glires (rodents), and *Elephas* to the Bruta (chiefly edentates).

II. The errors of Linnæus in his references of the genera *Rhinoceros* and *Elephas* were soon corrected by his successors, and in their works (*e.g.* Pennant's *Synopsis of Quadrupeds*, 1771) all the true ungulate mammals were combined together under the name Ungulata or hoofed quadrupeds.

III. By Cuvier (1817, etc.) the ungulate mammals were differentiated into two orders—(1) "les Pachydermes," equivalent to the Belluæ of Linnæus after the inclusion of *Rhinoceros* and *Elephas*, and (2) "les Ruminans," identical with the Pecora of Linnæus. This classification for a long time prevailed, and is the one found in most of the popular works on natural history up to within a few years past.

IV. By De Blainville (in 1816) the group, under the name "les Ungulogrades," was restricted to the ordinary hoofed quadrupeds, the elephants being isolated as the representatives of a distinct order named "les Gravigrades." The Ungulogrades were in turn differentiated into two groups—(1) those with unpaired digits, embracing the normal pachyderms and equines, and (2) those with paired digits, including the suilline forms as well as the ruminants. The manatee was added, erroneously, as an anomalous form of the order. These modifications, except the last, constituted a very decided advance in classification. They, however, attracted but little attention till Owen (in 1840, etc.) revived the same views, and adopted the groups in question under other names. Accepting the division of ungulates as a natural whole, he divided it into three subordinate ones—(1) Isodactyle or Artiodactyla, answering to the paired-toed Ungulogrades of De Blainville; (2) Anisodactyle or Perissodactyla, equivalent to the odd-toed Ungulogrades of De Blainville; and (3) Proboscidea, identical with the Gravigrades of De Blainville. These three divisions were finally raised to ordinal rank by Owen.

V. By Huxley and later writers the living ungulate mammals have been mostly distinguished into three orders, characterized by placental as well as skeletal features. (1) The name Ungulata has been reserved for the bulk of the species, which have again been divided into the sub-orders Perissodactyla and Artiodactyla; (2) the term Hyracoidea has been introduced as an ordinal term by Huxley to cover a form (*Hyrax*) which had been confounded with the perissodactyle ungulates and approximated to the *Rhinoceros* by Cuvier and others; (3) the group Proboscidea has been accepted as another order.

VI. In addition to the recent forms of ungulate mammals, there are several extinct types which are also by some authors regarded as the representatives of other orders; such are the Toxodontia of South America, the Dinocerata of North America, etc.

The order Ungulata, in the sense now generally used, is characterized as follows: The teeth are, archetypically, in full number (44), but often a number are suppressed; the molars have generally grinding surfaces, and are two or three rooted; the canines are very diversiform, generally rudimentary or wanting, sometimes (as in Tragulidæ, Suidæ, etc.) extremely developed; the incisors are, typically, six in each jaw, but often wanting entirely in the upper, and are implanted by simple roots and have incisorial crowns; the legs at their proximal joints (humerus and femur) are more or less enclosed in the common abdominal integument (least in the camels); the feet are upraised, and their palmar and plantar surfaces are invested in a hairy skin undistinguishable from the rest of the integument; the carpal bones are in two interlocking rows; the cuneiform narrow, and affording a diminished surface of attachment forward for the ulna (which is retrorse beside the radius); the unciform and lunar articulating with each other, and interposed between the cuneiform and magnum; the hind foot has the astragalus at its anterior portion scarcely deflected inward, and articulating more or less with the cuboid as well as navicular; the scaphoid and lunar are separate; the toes of all the feet are never more than four in number, and the terminal joints are invested in thick nails or "hoofs;" the brain is well developed, and the cerebrum covers more or less of the olfactory lobes and cerebellum; the placenta is non-deciduate; the rectal and generative apertures are well separated; the testes more or less exposed. The order thus defined embraces a large number of species, about 225 now living. The existing forms are grouped under two sub-orders and fourteen families—viz. (I.) Artiodactyla, with the families (1) Camelidæ, (2) Giraffidæ, (3) Suigiidæ, (4) Bovidæ, (5) Antilocapridæ, (6) Cervidæ, (7) Tragulidæ, all of which are ruminants, and (8) Phacochœridæ, (9) Suidæ, (10) Dicotylidæ, and (11) Hippopotamidæ, which are non-ruminants; and (II.) Perissodactyla, with the families (12) Equidæ, (13) Rhinocerotidæ, and (14) Tapiridæ. Of these, the second, third, seventh, eighth, ninth, eleventh, twelfth, and thirteenth are now peculiar to the Old World, and the fifth and tenth to the New World. But in ancient times the case was very different, the Rhinocerotidæ and Equidæ having abounded in the Miocene epoch in North America. A large number of extinct forms are now known which connect together types that are at present far removed. Among the most notable are the Anoplotheriidæ, Oreodontidæ, and Hyopotamidæ, which bridged the existing chasm between the ruminant and non-ruminant ungulates. These had fully-developed upper incisors, combined with the characteristic double lunate-ridged molar teeth of the living ruminants, and thus on the one hand were related to the typical ruminants, and especially the Tragulidæ, and on the other to the omnivorous artiodactyles, and perhaps most to the peccaries. Also to be noticed in this connection are Orohippidæ and Anchitheriidæ, as well as *Hipparion*, which form a series with the Palæotheriidæ, and demonstrate the relation between the Rhinocerotidæ and Equidæ of the present epoch. The order was represented by typical examples as early as the commencement of the Eocene period, and undoubtedly very long before, although no remains of an earlier date have been yet discovered. Nearly twenty families, now entirely extinct, are known from their fossil remains. The order has therefore played a very important part in the earth's past history, and the extinct types already known outnumber the recent. Why certain of the forms formerly existent in America, but now confined to Africa and Asia, became extinct, can scarcely be surmised, as when reintroduced (as have been the horse and hog) they multiply and flourish as much as in their native lands. The order is also noteworthy as furnishing by far the largest portion of the meat food which man uses, as also the beasts of burden which he employs. Almost all the species—and, above all, the ruminants—are hunted or kept for the meat they yield, and even the perissodactyles—horse, rhinoceros, and especially tapir—are esteemed as food by some peoples. Beasts of draught and labor are obtained chiefly from the Equidæ (horse and ass, etc.), the Bovidæ (ox, buffalo, etc.), and Cervidæ (reindeer). Their contributions in other ways are manifold, of which the most noteworthy are milk, hides, glue, etc. (For further information see the names of the different sub-orders and families, as well as the domesticated animals, and especially the article HORSE, in CYCLOPÆDIA.) THEODORE GILL.

V.

Van der Wey'de (Peter Hendrik), Ph. D., M. D., b. in Nymwegen Feb. 5, 1813; studied in the University of Delft; obtained in 1845 a gold medal from the Society for the Advancement of Science in Amsterdam for a new textbook on physics in 3 vols.; edited from 1843 till 1849 a journal in Amsterdam devoted to the diffusion of mathematical and physical knowledge; took an active part in the politics of his country as editor of two dailies, and was the author of pamphlets advocating republican principles; came in 1849 to the U. S., and settled in New York City as a private teacher. He studied medicine in the New York University 1852–56; graduated there, and became a physician of the New York City North-western Dispensary; later, professor of chemistry in the New York Medical College, and in 1859 of physics and mechanics in the Cooper Institute; was called in 1864 to Girard College, Philadelphia, to fill a new chair, that of industrial sciences, but resigned in 1866 and returned to New York, where he has since occupied the chair of chemistry in the Dental College and in the Medical College for Women; is now editor-in-chief of a mechanical paper, the *Manufacturer and Builder*, founded by him in 1859, and is preparing a new textbook on the theory and practice of mechanics.

Van Len'nep (Henry John), D. D., b. in Smyrna Mar. 18, 1815, descending from a distinguished Dutch family of scholars and writers; was sent to the U. S. at fifteen; attended school at the Mount Pleasant Institution in Amherst, Mass., and graduated at the college in the same town in 1837; studied theology in Andover, and returned as a missionary to the land of his nativity in 1839; first acted as a pioneer, and established new posts in European Turkey, Asia Minor, and Syria; was subsequently, and during most of his thirty years' foreign labor, connected with collegiate and theological institutions in Constantinople, Smyrna, and Tocat; made many exploring tours, travelling extensively in Greece, Roumelia, Asia Minor, Syria, Palestine, and Egypt, and became familiar with most of the Oriental languages, so that he can read and write in ten different dialects and preach extempore in five. Having lost his eyesight from cataract, he returned to the U. S. in 1869, and devotes himself to literary labors. He has published *Travels in Asia Minor* (2 vols., 1870) and *Bible Lands* (1875).

Van Rens'selaer (Maunsell), D. D., LL.D., b. Apr. 15, 1819, at Albany, N. Y.; educated at the Albany Academy; graduated at Union College in 1838, and at the General Theological Seminary of the Protestant Episcopal Church in 1841; was admitted to holy orders June 30, 1841; was missionary at Whitehall, N. Y., till 1845; founder and first rector of Grace church, Albany, till 1847; was rector in succession of St. John's church, Mount Morris, St. Paul's, Oxford, and Grace, Rochester, in the diocese of Western New York; president of the De Veaux College from 1859 to 1869, and of Hobart College from 1872 to 1876.

Vege'tius (Flavius Renatus), probably b. in Rome about the middle of the fourth century A. D.; wrote an *Epitome* (*Institutionum*) *Rei Militaris*, which was dedicated to the emperor Valentinian II. (375–392); Teuffel (*Hist. Rom. Lit.*, § 424) says to Theodosius I. (378–395). The work is in five books, and is chiefly a compilation from previous writers. The first book treats of the levying and training of soldiers; the second of the early discipline and of the formation of the Roman army; the third of strategy; the fourth of the art of defending and of assaulting fortified places; the fifth of naval warfare. From some expressions of Vegetius it is believed that he was a Christian. Best editions by Schwebel, with the notes of Oudendorp and Bessel (Strasbourg, 1806), and with revised text by C. Lang (Leipsic, 1869). Henry Drisler.

Vel'vet [It. *velluto*, from Lat. *vellus*, a "fleece," or more probably from Lat. *villus*, a "flock of hair or wool," "the nap of cloth"], a woven fabric composed of a warp and weft, usually twilled, as in what is called Genoa velvet, with a thick additional filling consisting of single, double, or formerly triple (whence *three-pile*) threads of a finer quality passed under the ordinary weft and brought up in loops on the *right* side. The loops are so close as entirely to cover the proper web, and are generally cut and evenly singed or sheared, so as to form a soft and somewhat lustrous surface, like the fine fur of small quadrupeds; but they are sometimes left uncut. The term velvet is usually applied only to fabrics of silk or silk and cotton, and we shall treat only of such tissues, though the word generically embraces all stuffs of similar texture with a face of *pile* or loops woven into the fabric, by which they are distinguished from cloths having a *nap*, or furry surface composed of filaments spontaneously loosened from the yarn or raised by *teasing* the web.

It has been generally supposed that velvet, like other fabrics of silk, is of Chinese origin, but we find no evidence that it was anciently manufactured in China or in any other Oriental country, or that it was first introduced into Europe from the East. Merchandise of foreign production usually brings its native designation with it, or is called by a name indicative of the locality of its growth or manufacture. Most silk and cotton stuffs are, or have been, known in commerce by such terms, but we believe that velvet is not called by an Oriental name in any European language. Italian velvets were exported from Venice to Persia before the discovery of the Cape of Good Hope, and we do not find this article specified in any of the old tariffs as an object of importation from the East. It is a curious fact that velvet was common in Europe long before any specific name seems to have been generally applied to it. An apparently related word, indeed, occurs in the twelfth century, and even earlier, but very rarely, and with some uncertainty of signification, and velvet took its ordinary designation from its color, probably because rich colors show to best advantage in this rich stuff. Hence, in the early literature of the modern languages it is spoken of simply as *pourpre, cramoisi, écarlate* (It. *porpora, chermisi, scarlatto*), though these terms were probably sometimes used to designate other fine fabrics. *Samit* indeed (Gr. ἑξάμιτος) appears often to have signified velvet, as *sammt* now does in German, but it was frequently applied to stuffs clearly distinguished from velvet. It is worth noticing that an inferior quality of velvet, probably a tissue with a web of cotton and a pile of silk, was known at a very early period, for in the old poem of *Parzival*, in a passage where there is every reason to believe that *samit* means velvet, mention is made of

> "Ein grüener samit,
> Des niht von der hohen art;
> Er was ein samit pastart."

The old German *phelle*, which often occurs, and in a great number of forms, as *phellel, pfeller*, etc., is thought not to be cognate in etymology with velvet, but derived from Lat. *pallium*, and it appears to signify a mantle or other vestment composed of silk, but of a texture different from velvet, though sometimes possibly of similar fabric.

The silk industry is commonly said to have been introduced into Western Europe by the Norman dynasty in Sicily about the middle of the twelfth century, but Amari, a very high authority, believes that it was exercised in Sicily at a much earlier period. If the hitherto received opinion on this point is correct, and if velvet was known in France or Italy before that date, it could not have been of domestic manufacture, but must have been imported from Greece (where the fabrication of the more costly silk stuffs, probably including velvets, appears to have been an imperial monopoly and confined to the precincts of the palace of the sovereign himself) or from some remote Eastern country. But there is no direct evidence of the production of this particular fabric in those regions at the period in question, and, so far as we can positively trace the history of velvet, its primitive annals belong exclusively to insular and peninsular Italy.

The most ancient existing specimens of velvet, as of other European silk tissues, consist of fragments of ecclesiastical and regal vestments, covers of books, scabbards, and saddles, still preserved in public museums or church treasuries, and especially of broad strips of fine fabrics of silk or other soft material found in illuminated mediæval manuscripts, where they served, like modern tissue-paper, to protect the miniatures, borders, and ornamented capitals. Thus, a manuscript of one of the works of Theodulf, a bishop of the time of Charlemagne, which Michel appears to consider as contemporaneous with its author, contained originally sixty-six of these *guards*, of which fifty-three still remain in the volume, including one of velvet and several of other curious textures, several of which have lately been reproduced by French industry. But though from these and from purely literary sources we gather sufficient proof of

the existence of velvet at a remote period of the Middle Ages, we are not able to point out with certainty any of the seats of its production before the establishment of the silk-works of Italy, and especially those of Lucca and Florence, in the thirteenth and fourteenth centuries. The secrets of the processes of this complicated industry were jealously guarded, like those of other mediæval *mysteries*, and but slowly extorted from the Italian producers by the cunning of foreign artisans; but the manufacture of velvet is now not confined within geographical limits, and great as is the skill of the dyers and weavers of Genoa and Lyons, the descendants of Huguenots driven out from France by religious persecution now send forth from the looms of Crefeld, in Rhenish Prussia, velvets not surpassed in quality by those of any other country. The velvets of France are protected against foreign competition by a considerable import duty, but nevertheless those of Crefeld have been and still are largely exported to France, where they are able to undersell the native fabric.

Velvets shot with gold or silver thread, and figured velvets in which the design only was provided with a cut pile, were formerly in vogue, but the simple elegance of the plain fabric is more pleasing to modern taste. The beauty of velvet, its warmth, its durability, and the skill required for its fabrication, have made it at all times a costly stuff. In our day the increased demand for velvet, and the diminished supply of the raw material in consequence of the prevalence of the silkworm disease, have rendered it still dearer, and there is perhaps no material of dress the price of which has risen so much in the course of this generation as that of velvet.

The principal defect of velvet is its liability to lose the regularity and beauty of its surface by *crushing* from folding or pressure. This arises partly from a want of elasticity in the filaments of which the pile is composed, and partly from their adhesion to each other by a sort of felting, and the surface thus injured is very difficult to restore. Some manufacturers have succeeded in overcoming this defect to a considerable extent, and there is reason to believe that further improvement in this respect may be looked for.

There are no climatic reasons why this and all other branches of silk industry should not succeed in the U. S.; but, though the cost of the purely mechanical processes of weaving and dressing may be diminished by American ingenuity, yet the high rates of manual labor make the gathering of the mulberry leaves, the feeding and tending of the worms, and other preliminary processes far more expensive with us than in Europe or the East, and form a minor obstacle to the prosperity of this manufacture in America. (See Francisque Michel, *Recherches sur le Commerce, la Fabrication et l'Usage des Étoffes de Soie d'Or et d'Argent et autres Tissus précieux* (Paris, 1852, 2 vols. 4to). Pietro Pinchetti, *Corso Teorico-Pratico per la Fabbricazione delle Stoffe di Seta*, a valuable work now in course of publication at Como, illustrated with engravings and with specimens of silk fabrics, will embrace a special treatise on velvets.) GEORGE P. MARSH.

Venereal Ulcer, or Chancroid, an acute, contagious ulceration, recognized as resulting from venereal contact. It is a purely local disease, possessing characteristics which entitle it to be considered, *par excellence*, the highest type of acute ulcerative action. In the great majority of cases it is the result of inoculation of the purulent secretion of an already existing ulcer of a similar character. Applied to sound integument or mucous membrane, it is capable, under favoring circumstances, of effecting a solution of continuity of the part, and of communicating to it at once its destructive and contagious properties. More commonly and readily it is established upon an abrasion of the skin or mucous membrane produced *in coitu*. On application of the purulent secretion of the *venereal ulcer* to an abrasion, either on the person already affected or on one previously free from the disease, congestion, inflammation, suppuration, rapid destruction of tissue follow in quick succession. The ulcer thus formed presents all the characteristics of rapid destructive action; it is sharply cut, with ragged edges and pultaceous floor, and secretes pus freely. Chiefly characterized by its contagious property, the venereal ulcer is seldom single, several distinct lesions usually presenting at the same time. Occurring under circumstances of good general health, cleanliness, and temperate living, its progress is usually self-limited; gradually increasing from two to five weeks, it acquires a diameter of from six to twelve lines; the loss of tissue is then slowly restored, and a scar like that of an ordinary burn is left. From first to last its secretion is inoculable, and the sore is capable of being reproduced upon the person bearing it. When reproduced by artificial inoculation (see article SYPHILIZATION) it loses its contagious power in each successive inoculation until the secretion from it is no longer inoculable. It will thus be seen that the tendency of the disease, under favoring conditions, is always toward recovery. When acquired, however, under unfavorable conditions, such as a depraved constitution, irregular life, filth, and alcoholic excess, the chancroid assumes its most vicious type. Characterized now by a high grade of inflammatory action and an increased destructiveness, it not unfrequently takes a peculiar action which is termed phagedenic (from Gr. φαγεῖν, to "eat"), through which, in a few days or even hours, important loss of tissue ensues, not rarely resulting in irretrievable mutilation, and possibly in loss of life. In other rarer instances the *chancroid* takes on a sluggish but persistent form known as the *serpiginous*, with a gradual irregular loss of tissue, involving the integument only, but continuing often for years in spite of every means and mode of treatment. The extension of the *chancroid*, usually by continuous tissue, not unfrequently takes place through the entrance of the contagious secretion into a lymphatic vessel (opened by chancroidal ulceration), and its passage along that vessel to the adjacent lymphatic gland. This accident may occur at any period during the continuance of the chancroid. The gland in this manner affected (usually in the groin, and known as the chancroidal bubo) becomes tender and swollen. Evidences that the peculiar destructive chancroidal action is going on within the substance of the gland become daily more distinct, until in a few days an abscess is formed. On the discharge of the purulent contents of this abscess, they are found to possess the peculiar properties of pus from the original ulcer, and the open bubonic abscess takes on the appearances and other characteristics of the typical chancroid.

The *venereal ulcer* or *chancroid*, in its early stages, is promptly amenable to judicious remedial measures. The application of any caustic, of sufficient power to destroy completely all the tissue which has been implicated in the diseased action, suffices to change the contagious venereal ulcer to a simple sore, when it goes on to recovery without other treatment than such simple sores require. The conditions which determine the severer forms of the venereal ulcer are recognized, as already stated. It is also found that the particular lesion which may present partakes in great degree of the activity, greater or less, which characterized the lesion from which it was derived, so that every grade from the simple excoriation to the sharply-defined and most active ulcer may be met. Hence, all do not require the prompt and energetic course necessary to arrest and cure the typical chancroid. In the milder varieties the judicious application of carbolic acid, iodoform, sulphate of iron, and other, even simpler, antiseptic, sedative, and astringent agents, may suffice to bring about an arrest and cure. In the lightest forms it is often difficult to distinguish from non-venereal pustules which result from acrid sebaceous secretions, or from connection with a female suffering from an acute form of simple leucorrhœa.

In regard to its history, the venereal ulcer or chancroid is conceded to be of ancient origin, even to antedate the advent of *syphilis*. It has various synonyms—viz. "pseudo-syphilis," "soft chancre," "non-infecting chancre," "chancroid," etc. By the latter term, *chancroid*, it is almost universally known at the present day. It was distinctly recognized and described by the ancients as a disease known from the earliest times. Notwithstanding this, shortly after the recognized appearance of syphilis in Europe in 1494, it became confounded with that disease. Its purely local character was lost sight of, and it was subjected to constitutional treatment as a form of syphilis. Its chief characteristics, however, always most marked, were never quite lost sight of. Evincing its destructive property *at once* on inoculation of its secretion upon healthy tissue, and commonly associated with inflammatory enlargement and suppuration of contiguous lymphatic glands, it was thus directly opposed to the sluggish course of the syphilitic local affection and its non-suppurating glandular concomitants. Yet it was so often found associated with and followed by the constitutional manifestations of syphilis that its distinctive significance was doubted; and when, after a time, the well-known acute venereal ulcer was occasionally observed to exchange its soft edge and base for the indurated tissue known to characterize the early syphilitic lesion, the fallacious theory of *post hoc ergo propter hoc* prevailed, and thus the confusion of the two distinct diseases became complete. From this time *all* the contagious venereal diseases, gonorrhœa, chancroid, and syphilis, were accepted as practically identical, requiring the same constitutional treatment. It was found, however, after the habitual mercurialization of persons afflicted with soft sores or with gonorrhœas, for more than two hundred years, that constitutional syphilis did not necessarily follow the occurrence of the soft ulcer nor of a gonorrhœa, even when no treatment was resorted to, while the ulcer with indurated base and edge was invariably succeeded by the general manifestations of syphilis. John Hunter in

1786 was the first to recognize publicly the value of the induration characteristic of the venereal sore which was followed by constitutional syphilis, thus making the first positive step toward identifying and restoring to the different venereal disorders their distinctive individuality. Hunter, however, misled by an experiment upon his own person, taught that while the local manifestations of the venereal diseases were different, their source of origin was identical, and that the peculiar form and nature which they assumed in any given case was dependent upon some peculiar condition or idiosyncrasy of the affected individual. In 1798, Benjamin Bell of London claimed a simple origin for gonorrhœa, and in 1830, M. Ricord of Paris, after a series of observations and elaborate experiments in inoculating the purulent fluid of gonorrhœas and of the soft and hard venereal lesions, demonstrated the purely simple, non-specific nature of gonorrhœa, thus completely and for ever eliminating it from among the manifestations of syphilis. Ricord, however, notwithstanding his numerous and carefully-observed inoculations, and while distinctly recognizing the local and ultimate differences between the hard or Hunterian chancre and the soft sore or chancroid, yet accepted and taught Hunter's view, that the difference between them was not one of origin, but of personal condition or idiosyncrasy. It was reserved for M. Bassereau of Paris (a pupil of M. Ricord) in 1852 to demonstrate the fact that in the disease then known as syphilis, comprising the soft local venereal ulcer and the indurated infecting venereal sore, with its consequences, two separate diseases existed. Upon the confrontation (*i. e.* personal comparison) of a very large number of persons affected by venereal disease with those from whom their disease had been acquired, Bassereau found that in every person presenting a venereal ulcer, accompanied by well-pronounced evidence of constitutional syphilis, the person from whom the disease had been acquired was also, or had recently been, the subject of ulcers which were followed by constitutional syphilis, and that in no case was syphilis ascertained to originate from a person bearing the local venereal ulcer alone. Similar observations by confrontation were made by Messrs. Dron, Clerc, Diday, Rollet, and Fournier in 1856, and in 1857 by Messrs. Fournier and Caby, under the supervision of M. Ricord, with the result of proving that in all cases of chancroid the type of ulcer remained unchanged in passing from one individual to another. Nevertheless, M. Clerc, while accepting and confirming the observations above alluded to, claimed to have produced the typical chancroid by inoculation of the secretion of an infecting (syphilitic) chancre upon a person previously the subject of syphilis, and thus to have demonstrated that the chancroid was the product of the inoculation of the syphilitic virus upon persons then or previously affected with syphilis. Clerc also claimed that while, as a rule, the chancroid, thus originated, usually transmitted only chancroid, yet on being inoculated upon a healthy person it was capable of reverting to its original type, and hence of communicating syphilis; thus asserting the unity of origin of the two diseases; and those holding this view were known as *unicists*. Rollet and others held, on the contrary, that not only were chancroid and chancre (the initial lesion of syphilis) separate and distinct diseases, but that they owed their origin to separate and distinct poisons; and thus the school of so-called *dualists* was initiated. The position of M. Clerc was supported by the observations of Henry Lee of London, the late Prof. Böck of Christiana, Melchior Robert, and others, who succeeded in producing the typical chancroid upon persons syphilitic and non-syphilitic by inoculations of pus from an irritated syphilitic chancre. It was required that the degree of irritation in all cases should be sufficient to induce a free *purulent* secretion. Sores produced in this manner were inoculated in successive generations upon persons quite free from syphilitic taint, and behaved in all respects like the ordinary venereal chancroid. It was, however, found that when the superinduced irritation subsided, and the secretion was no longer purulent, it was no longer auto-inoculable; and hence it became evident that the property of inoculability was consequent upon a peculiar action resulting from the persistent irritation of an already-diseased surface. The fact that the chancroid could be established upon persons entirely free from syphilitic taint, and not be followed by syphilis, demonstrated that its existence was not necessarily dependent upon the syphilitic principle. Experiments were then made by Pick, Bidenkap, Koebner, Böck, and others to ascertain the effect of inoculations of pus from simple lesions on persons free from syphilitic taint. The result showed that affections in non-syphilitic persons which are of slight virulence, the secretions of which are not inoculable, can be made to produce an inoculable secretion by the application of an irritant. Kaposi states that in his experiments the pus taken from acne and from scabies in non-syphilitic individuals has produced pustules, the pus from which was inoculable in generations on the bearer as well as on other non-syphilitic persons. In 1866, Dr. Edward Wigglesworth, Jr., of Boston (reported by Dr. Bumstead in his paper *On the Unity and Duality of Venereal Sores*, read before the Centennial Medical Congress at Philadelphia), while studying under Prof. Zeissl of Vienna, and being entirely free from any suspicion of venereal taint, but in somewhat impaired general health, inoculated his own arm with pus taken from a simple pustule of acne. This produced a similar pustule at each of the three points of inoculation. Pus from these being again inoculated, a third generation was established. Nine distinct sores, the result of the inoculations, were present at the same time, and, pursuing a similar course, finally healed, leaving as many distinct cicatrices, indicative of loss of tissue through the process of ulceration. This experiment during its progress was under the personal observation of Prof. Zeissl, and was repeatedly exhibited to his class as demonstrating the contagious and destructive properties of non-specific pus under certain circumstances unconnected with syphilis or with any venereal influence. Observations (personal) have shown that the muco-purulent secretion from non-specific nasal catarrh will sometimes produce excoriations of sound cuticle, and that contact with secretions from non-specific leucorrhœas will sometimes promptly cause pustular eruptions (*herpes*) of the preputial mucous membrane of the male; and these more or less rapid in development and progress according to the degree of activity of the inoculating secretion—in some instances so simple that they are scarcely more than sero-purulent vesicles, and in other cases observed so vicious that in appearance they do not differ at all from the typical chancroid, the secretion being also *auto-inoculable*, as proven by the occasional occurrence of similar lesions upon opposing surfaces.

Mr. John Morgan of Dublin, in his work on venereal diseases (1873), cites numerous instances in which he has observed the typical chancroid to result from inoculation of the muco-purulent secretions of leucorrhœas in syphilitic women upon other women, also subjects of syphilis. Vidal cites a case where pus taken from a pustule of simple ecthyma, in a patient suffering from typhoid fever, was promptly inoculable on the patient, but failed when inoculated upon a healthy person. It is therefore shown that the quality of pus is variable, according to the circumstances under which it is produced and the condition of the person upon whom it may be inoculated—that a low condition of the general system from any cause predisposes the healthy tissues to take on ulcerative action and to elevate the accompanying purulent secretion to a point of contagiousness. Lesions, especially of mucous membrane of the human genital apparatus of both male and female, are common under the circumstances peculiar to the venereal act. Inflammations of mucous membrane in the same locality are frequent, and characterized by muco-purulent secretions, often profuse and acrid; and this, too, when the subjects of them are in good general health and living under the most favorable hygienic conditions. When, therefore, it comes to be considered that the most frequent habitat of the venereal ulcer or chancroid is in localities where venereal excess and every kind of debauchery abound, when to this are often added the potent elements of syphilis and scrofula, hereditary and acquired, filth, and irregular living, and when (as has been shown by Fournier and others) chancroid is found by far the most frequent in proportion to syphilis among the debased and dissolute, the conclusion is inevitable that chancroid is, and of necessity must be, a self-engendered disease, possessing no specific virus, but acquiring its power for destruction and contagion through the stimulation and vitiation of benign natural processes.

The venereal ulcer or chancroid acquires its chief importance from its liability to be mistaken for, and treated as, the initial lesion of syphilis; and the more so as it is often through the lesion established by the destructive agency of the chancroid that the syphilitic principle or disease-germ is permitted entrance into the system. The distinction between the two lesions at the outset is often impossible. The active characteristic of the chancroid is recognized as a necrosis—that of the syphilitic lesion one of growth or proliferation. The surface of a sore, then, may be the field of chancroidal action, while the living tissue beneath may be at the same time a centre of proliferation of syphilitic disease-germs, which are constantly gaining access to the general circulation through the contiguous lymphatic vessels. These germs may be originally deposited upon a simple abrasion or one already the seat of chancroidal action, or may be subsequently inoculated through the breach of tissue made by the chancroid. If the former, the imposition of the secretion of a chancroid upon the same point, if the disease-germs have been freshly deposited, might cause their destruction, and thus leave

only the chancroidal element; but once the syphilitic principle has extended below the surface and has entered a lymphatic vessel (see article on SYPHILIS), it has gone beyond the sphere of action of the chancroid. The only method of determining whether a given chancroid or other lesion, occurring after a suspicious venereal contact, is or is not to be followed by constitutional syphilis, is to reserve a final decision for a full month subsequent to the exposure. This course should be pursued even though during the interval the suspected lesion, possessing all the characteristics of the typical chancroid, should have fully healed. If during or after the month no hardening of the tissues composing the edge and base of the sore, nor, if healed, of the cicatrix, nor any enlargement of the adjacent lymphatic glands, can be discovered, then, and not until then, can the patient be assured that he has had an uncomplicated chancroid, and that no syphilis will follow. Those milder forms of ulcerative action which are just within the line of distinction between the simple so-called herpes and the chancroid are the most frequent to exhibit subsequent evidences of syphilitic infection. By reason of their inactivity they are less likely to destroy any of the germs of syphilis which may come in contact with their surface.

The frequent association of chancroid with syphilis will never lead to mistaken identity if it is constantly borne in mind that syphilis is always, in all its manifestations, a process of growth, of proliferation, of *exaggerated life*. The most scientific and critical examination of the products of syphilis, from the *initial lesion* to the *gummy tumor*, has never been able to detect any abnormal material—nothing but excessive accumulations of tissue-building cells. Chancroid, on the other hand, from its inception to its cicatrization, is a process of necrosis—literally, *death* of tissue. So that *syphilis* and *chancroid* are always and only in relation to each other as *life* to *death*—each the highest type of its own peculiar action. F. N. OTIS.

Ver'tebrates [Lat. *vertebratus*, from *vertebra*, "provided with a backbone"], the most important and the most natural and distinct branch or sub-kingdom of the animal kingdom. Vertebrates may be briefly defined as those animals provided with an axial skeleton and two cavities—one dorsal, or above the vertebral column, for the accommodation of the cerebro-spinal nervous system, and the other ventral, or below the vertebral column, and containing the intestinal canal and other viscera. The animals possessing these characteristics are the Mammals or viviparous warm-blooded quadrupeds and cetaceans, the Birds, the Reptiles, and Amphibians, and those known under the collective name of Fishes. The relative affinities of these groups were recognized from an early period, and even to some extent their consociation and segregation were realized, for even Aristotle contrasted them as *Zoa enaima* (ζῶα ἔναιμα—*i. e.* animals with blood) with all others collectively designated as *Zoa anaima* (ζῶα ἄναιμα—*i. e.* animals without blood). It was not, however, until 1812 that the distinctness and contrast of the types in question with other animals were fully recognized in the systematic nomenclature under the name now adopted. Cuvier in that year (in *Annales du Museum d'Histoire naturelle*, vol. xix.) proposed the name Vertebrata, and contrasted the branch ("embranchemen") so designated with three others, under which were combined all other animals. The branch has remained unaltered as to its limits since its introduction, but various views have been entertained as to the taxonomic value of its several constituents, as well as the nature of their mutual relations. The principal of the various propositions for the classification of the branch will be briefly considered.

(1) By Cuvier, as by Linnæus and his predecessors generally, the Vertebrates were separated into four classes—the Mammals, the Birds, the Reptiles, and the Fishes. These were the only classes generally recognized for many years, although several propositions were made by different writers, from time to time, for the introduction of other groups of that value. (See HERPETOLOGY and ICHTHYOLOGY.)

(2) By De Blainville the old class of reptiles was differentiated into two classes—Reptiles proper and Amphibians: or, as he preferred to call them, Squamifera and Nudipellifera. The five classes were called Pilifera (Mammals), Pennifera (Birds), Squamifera (Reptiles), Nudipellifera (Amphibians), and Pinnifera (Fishes). Naturalists were very tardy in the adoption of the two classes proposed in place of the old Reptiles, but they finally gained acceptance.

(3) By recent naturalists the branch has been divided into a still greater number of classes, and chiefly at the expense of the old class of Fishes: thus, some recent authors recognize as classes of Vertebrates, (1) the Mammals, (2) the Birds, (3) the Reptiles, (4) the Amphibians, (5) the Fishes, (6) the Elasmobranchiates or Selachians, (7) the Marsipobranchiates (lampreys, etc.), and (8) the Leptocardians.

The various modifications, it will be thus seen, have affected the class in the following way:

(1) The class of Mammals has remained intact.

(2) The class of Birds has also been retained without modifications except as to diagnosis, wherein change has been necessitated on account of the discovery of fossil forms.

(3) The old class of Reptiles is now universally admitted to be unnatural, and its differentiation into the two classes Reptiles proper and Amphibians is entirely accepted.

(4) The ancient class of Fishes is also now very generally conceded to be a heterogeneous mixture. By some of the best systematic zoologists in its place four classes have been established: (*a*) Fishes proper, or Teleostomes, (*b*) Selachians, (*c*) Marsipobranchiates, and (*d*) Leptocardians.

The views relative to the relations of these classes have also undergone very considerable modifications.

(1) By some (*e. g.* De Blainville) the Mammals have been contrasted as a sub-type ("Vivipara") with another sub-type ("Ovipara"), containing all the other classes.

(2) For a long time it was customary to distinguish, as did Linnæus, on the one hand, the Mammals and Birds as a natural group named "Warm-blooded animals," or *Calida animalia* by Storr and *Hæmatotherma* by Owen, and on the other hand the Reptiles and Fishes as another group, designated "Cold-blooded animals," or *Hæmatocrya* by Owen. This condition of the blood, however, is simply the result of complete circulation and aërial respiration on the one hand, and incomplete circulation or respiration through the medium of the water on the other; it is a physiological adaptation correlated with no morphological distinctions, and is now conceded to be of little systematic value.

(3) The Mammals, Birds, and Reptiles have as common characters an amnion and allantois, and breathe air directly through lungs; contrasting with these are the Amphibians and Pisciform Vertebrates, which are destitute of an amnion, and for the most part of an allantois, and breathe air through the intervention of branchiæ. The first series has, therefore, been antagonized under the term Abranchiate Vertebrata, against the last, which have been grouped under the name Branchiate Vertebrata.

(4) By Prof. Huxley and some of his disciples several classes have been grouped under three primary divisions or provinces—viz. "(I.) The Ichthyoids (comprising Fishes and Amphibia), defined by the presence of branchiæ at some period of existence, the absence of an amnion, the absence or rudimentary development of the allantois, nucleated blood-corpuscles, and a parasphenoid in the skull; (II.) the Sauroids, defined by the absence of branchiæ at all periods of existence, the presence of a well-developed amnion and allantois, a single occipital condyle, a complex mandibular ramus articulated to the skull by a quadrate bone, nucleated blood-corpuscles, and no parasphenoid, comprising Reptiles and Birds; and (III.) the Mammals, devoid of branchiæ, and with an amnion and allantois, but with two occipital condyles and a well-developed basi-occipital, and no parasphenoid: a simple mandibular ramus articulated with the squamosal, and not with the quadratum: with mammary glands, and with red non-nucleated blood-corpuscles."

(5) By recent zoologists a still different combination has been proposed, and appears destined to increase in popularity. The main features of the method in question are due to Haeckel and Gegenbaur. Ignoring previous essays, they have divided the branch, first, into two groups—(1) Subphylum Leptocardia or Acrania, with the class of Leptocardians; and (2) Subphylum Pachycardia or Craniota, containing all the others. The Craniota are then separated under three minor groups—(1) a cladus "Cyclostoma" (formed for the Marsipobranchiates), (2) a cladus "Anamnia" (embracing the Fishes and Amphibians), and (3) a cladus "Amniota" (containing the Reptiles, Birds, and Mammals). This classification is recommended by many important considerations, and seems to be a better exposition of the degrees of differentiation of the several classes from a common stock, and their mutual relations, than any of the older schemes.

The most apt expression of the structural modifications and relations of the classes admitted will probably be slightly modified from the arrangement last referred to. The classes are combinable as follows:

BRANCH VERTEBRATA.

SUB-BRANCH CRANIOTA.

Super-class Malleifera.
  Class Mammalia (Mammals).
Super-class Sauropsida.
  Class Aves (Birds).
  Class Reptilia (Reptiles).
Super-class Batrachopsida.
  Class Amphibia (Batrachians).
Super-class Lyrifera.
  Class Pisces (Fishes).
  Class Elasmobranchiata (Selachians).

Super-class Monorrhina.

Class Marsipobranchiata (lampreys, etc.), adopted as a class by Agassiz, Haeckel, Gegenbaur, Cope, Schmidt, Wilder, Jordan, etc.

SUB-BRANCH ACRANIA.

Super-class and class Leptocardia, etc.

Class Leptocardia (Branchiostoma), adopted as a class by Isidore Geoffroy St.-Hilaire, Bonaparte, Moquin-Tandon, Haeckel, Gegenbaur, Schmidt, Cope, Jordan, Wilder, and by many others under different names.

(Generalizations respecting the morphology of the Vertebrates and the constituent classes will be found under the heads COMPARATIVE ANATOMY, MORPHOLOGY, OSTEOLOGY, TEETH, the English names of the different classes, as well as SAUROPSIDA, and also HERPETOLOGY, ICHTHYOLOGY, MAMMALOGY, ORNITHOLOGY, etc.) THEODORE GILL.

Veterinary Science [Lat. *veterinum*, "beast of burden"], the application of the principles and practice of medicine and surgery to domestic animals. Etymologically, the word *veterinary* applies to *draught* animals, but in actual use to all that come under man's influence or control. It is therefore as intimately connected with comparative anatomy, comparative physiology and pathology, as human medicine and surgery are with the anatomy, physiology, etc., of the human body. This gives it immense scope, and opens fields of investigation directly connected with veterinary science which are absolutely limitless; and not only so, but promising and achieving results of great importance to the welfare of mankind. There is so much that is crude and constantly changing in all medical and surgical practice, and we are learning so much year by year to modify views as to animal structure, the nature and causes of disease, animal chemistry, etc., that it may be confidently predicted that great advances will soon be made in this as in other branches of the healing art. The facts that man is heir to many of the identical maladies that afflict his domestic animals; that he takes disease from them to an alarming extent; that their diseases may not only be communicated to him, but many which are not affect him perhaps even more seriously in diminishing his supply of food, in influencing disastrously commercial interests, in rendering beasts of burden and draught unfit for use in peace, and, more frequently, in war, where their energies are most severely taxed, indicate, considered separately or altogether, the bearing and importance of veterinary knowledge. It is certain that all nations in all past time that were devoted either to pastoral or warlike pursuits have not only regarded the health of their animals with solicitude, but have made more or less successful efforts to cure their ailments and to preserve them in health and soundness. This led to the shoeing of horses, and formed a natural connection between the proper healing art and that of the farrier—a connection, by the way, which led almost throughout Europe, and especially in England, to the great degradation of the veterinary profession, and to its being practised almost solely by blacksmiths and horse-shoers for several centuries: while in Arabia and Turkey, and among allied peoples, and through the influence of the Moors in Spain also, the animal physician and the farrier were entirely distinct. The medical treatment of animals, especially of horses, was especially valued and its practitioners honored by the Greeks and Romans. A work on horse-medicine was indeed attributed to Æsculapius—with how little of probability that he was its author it would be hard to tell. Ancient military and agricultural writers, however, wrote frequently and well upon the general subject, and among the Arabians there have been many books and treatises written, some of them having great antiquity and considerable value.

Modern veterinary medicine and surgery dates from the founding of the school at Lyons, France, in 1762. The French government appropriated some $10,000 to this end, and entrusted its expenditure and the whole management of the school to M. Bourgelat, an eminent advocate and political economist. This school increased rapidly in popularity and efficiency. It was attended by pupils sent by all the more powerful European states, and through these graduates of the school similar institutions sprang up, first or last, in Russia, Prussia, Austria, Denmark, Sweden and Norway, Würtemberg, Holland, and Belgium, and doubtless others in smaller states. So rapidly did the number of students increase that it was soon necessary to establish other schools, and M. Bourgelat selected and purchased the site of the school at Alfort, not far from Paris, and established that famous veterinary school and hospital, as well as also the institution at Toulouse; and it is not detracting from the undisputed excellence of other institutions to say that in all important veterinary matters France still maintains this early pre-eminence.

Nothing was done in Great Britain toward the establishment of veterinary colleges until M. St. Bel, a graduate of the Lyons school, visited London armed with an enthusiasm for his art, great perseverance, and good letters of introduction. This was in 1788. He labored with little encouragement until 1791, when the Veterinary College of London was organized. The next year it was opened to students, and the next (1793) St. Bel died. The college, however, lived, and veterinary education in London, and subsequently in Edinburgh, was established.

In America there have been several attempts made to establish veterinary colleges. A charter was granted for one by the State of Pennsylvania in 1853, and again in 1866, but nothing came of either. In 1855, George H. Dadd and others obtained a charter from the legislature of Massachusetts for the Boston Veterinary Institute, and announced lectures and a faculty; and that was the end of it. In 1857, Dr. John Busteed secured a charter from the State of New York for the New York College of Veterinary Surgeons, which after one false start was finally successful in offering in the city of New York educational facilities of a high order to students. Its classes increased rapidly, its diplomas were valued and honored, and its permanence seemed assured, when an unfortunate rupture occurred, the entire faculty of instructors withdrawing with the students and establishing themselves as the American Veterinary College, which is now the only institution of its kind in America. Its professors are all graduates in medicine, while those of anatomy, surgery, theory and practice, cattle pathology, and obstetrics are veterinary surgeons having large outside practice. A veterinary hospital is connected with the college, and free "clinical" lectures are given in connection with it. Several of the agricultural colleges of the different States have chairs of veterinary medicine and surgery, and some with but a single veterinary professor give or propose to give degrees and diplomas.

The vast amount of our national wealth which consists of horses, cattle, sheep, and swine, and the industries which depend upon them or their products, make the whole subject of their health and profitable breeding one of immense importance, and as a matter of commercial interest one vital to every citizen. The total value of the live-stock of the country, exclusive of poultry—which should of right be considered—is variously estimated at from $1,400,000,000 to $2,000,000,000. Alarming murrains or epizoötics have occasionally broken out and had considerable sway for a time, causing general alarm; for instance, the pleuro-pneumonia among cattle in Massachusetts and Connecticut in 1859, the Texas fever in 1868, the influenza among horses in 1872, with hog cholera occurring at various times, and the foot and mouth disease, which appeared and died out again among our cattle a few years ago, while its results have been so serious in Great Britain.

The study of comparative anatomy and physiology has been the most important means by which physicians and physiologists have arrived at conclusions in regard to the structure and functions of the human body, while at the same time the knowledge of animals has been increased in like degree. Consequently, many of the most distinguished physicians of the world have been and are contributors to our knowledge of veterinary matters. Among purely veterinary practitioners, however, the number who have distinguished themselves, either by original research or by their erudition, is very small. The art of healing is the same whether applied to man or animals, and the fact that so many of our American veterinarians are graduates in medicine, who take up animal practice as a specialty, as it were, indicates the elevation of veterinary practice in this country above its position in other lands. M. C. WELD.

Vin'cent of Le'rins (VINCENTIUS LERINENSIS), so called from the monastery to which he belonged in the islands of LERINS (which see), flourished in the middle of the fifth century A. D., but little is known of his life. He was the author of a treatise entitled *Commonitorium pro Catholicæ fidei Antiquitate et Universitate* (A. D. 434), directed against the heretics, which came to be regarded as a textbook of orthodoxy, in which he lays down as the test of catholic doctrine, "*Quod semper, quod ubique, quod ab omnibus creditum est.*" D. A. D. 450. The best edition of his work is that of Balusius (Paris, 1684). HENRY DAISLER.

Vin'ci (veen'chee) **da** (LEONARDO), painter, sculptor, architect, engineer, inventor, and man of science, b. at Vinci, near Empoli, in the Val d'Arno, in 1452. He was the natural son of one Piero, an obscure notary of Florence, and a woman named Catarina. His father took him home, treated him as his son, and gave him a good education. The boy showed such an aptitude for the arts that Piero placed him with Verrocchio, a distinguished Florentine painter and sculptor, with whom he remained from his fourteenth to his twentieth year. In 1480 or 1483 he went to Milan, having offered his services to the duke Lodovico

il Moro in a remarkable letter, of which an autograph copy exists in the Ambrosian Library at Milan. In this letter Leonardo appears less as an artist than as a military engineer; he declares himself prepared to undertake any work that may be required for military offence or defence—to make bridges, scaling ladders, cannon, batteries; and after long detail of his skill in such matters, only at the end of his letter refers to his accomplishments as a sculptor, architect, and painter. In the service of Lodovico he executed several important works—the model for the equestrian statue of Lodovico Sforza, the duke's father, the plans for the Martesana Canal, and the famous *Last Supper*, a fresco in oils painted on the wall of the refectory of the convent of Sta. Maria delle Grazie. The model for the statue has disappeared; it was probably destroyed in the course of the war between France and Milan. The fresco, owing partly to ill-treatment and partly to the process by which it was painted, is so damaged that it cannot be said to exist. In 1499, Leonardo returned to Florence, but after a short stay he entered the service of Cæsar Borgia, who made him his chief engineer and employed him in studying various plans for the improvement of the territory of the Romagna and Urbino. At this time he was invited by the seignory of Florence to paint the walls of the council-hall of the Palazzo Vecchio in conjunction with Michelangelo. He began the work, but wearied of it, and abandoned it on the invitation of Charles d'Amboise, who called him to Milan, where he governed as the lieutenant of Louis XII. of France. Leonardo remained in Milan till it was abandoned by the French, when he went to Rome in the company of Giulian de' Medici, who was to assist in the consecration of his brother, Leo X., as pope. He found no employment under Leo, and hearing that Francis I. had entered Lombardy, he hastened to join that monarch, who had already in 1507 desired to attach him to his service, and had named him his court-painter. He was welcomed by the king, whom he accompanied to France in 1516, and who gave him a house at Cloux, near his château of Amboise, with a pension of 700 gold crowns. Leonardo's health failed after his arrival in France, and beyond some engineering projects he accomplished nothing during the three years and a half that elapsed between his coming and his death in 1519 (May 2). The authentic existing paintings of Leonardo are few in number, and of these the Louvre possesses the finest. These are the *Virgin of the Rocks*, the *Portrait of Madonna Lisa del Giocondo* (called *Monna Lisa* or *La Joconde*), the *Virgin on the knees of Saint Anna*, and the *John the Baptist*. It is impossible in the space at command to give an account of Leonardo's scientific labors. He made perhaps no distinct discovery, but his curiosity and his ingenuity led him to investigate in every direction, and had he not been of so unstable and discursive a mind he might have produced some fruit from his speculations. No doubt much more would have come of them if they had been made common property by being printed, but they were only committed to writing, and remain to this day in manuscript. (Vasari, *Lives of Painters, Sculptors, and Architects*; Charles Clément, *Michel-Ange, Léonard de Vinci, Raphael*, Paris, 1866; Arsène Houssaye, *Histoire de Léonard de Vinci*; De Stendhal, *Histoire de la Peinture en Italie*; *Leonardo da Vinci and his Works*, consisting of the *Life*, by Mrs. Charles Heaton, and an *Essay on his Scientific and Literary Works*, by C. C. Black, illustrated by twenty permanent photographs, London, 1875.)

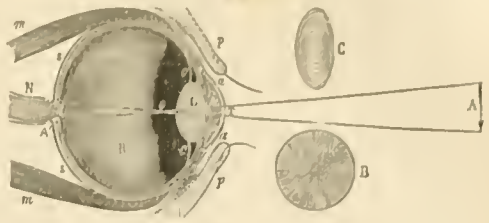
CLARENCE COOK.

Vin'ton (SAMUEL FINLEY), LL.D., b. at South Hadley, Mass., Sept. 25, 1792; graduated at Williams College, Mass., in 1814; studied law in Middleton, Conn., and was admitted to the bar in 1816; removed to Ohio, where he practised with eminent success; was a member of Congress from 1823 to 1837 and from 1843 to 1851; was appointed a commissioner under the act emancipating the slaves in the District of Columbia in 1862. D. in Washington in May, 1862.

Virginius Expedition. See RYAN (GEN. WILLIAM A. C.).

Vi'sion [Lat. *visio*, "seeing," *videre*, to "see"], the power or faculty by which we perceive the forms and colors of objects through the sense of sight. The faculty itself it is impossible to explain, but the physical conditions necessary to its manifestation are capable of very explicit statement. The medium of vision is light, and the organ of vision is the eye. Of this organ the structure has been described under its proper title, and the anatomy of its tissues has been given under HISTOLOGY. It remains to consider its functions. In Fig. 1 here given is represented a vertical section of the eye made through its axis. We have here a closed cavity bounded by opaque walls, and filled in its interior with perfectly transparent humors, into which light can find admittance only through a single small aperture, immediately behind which is placed a double convex lens. The construction answers in every essential point to the definition of a camera obscura. Accordingly, if an

FIG. 1.



Vertical Section of the Eye.

object, as A, be situated at some distance before the eye, its image will be formed inverted as at A' in the interior. This theoretic conclusion is easily verified by experiment. Let the eye of an animal recently killed, after having been freed from the surrounding muscular and fatty substances, and having had the sclerotic coat carefully reduced in thickness until it becomes translucent, be held between the observer and the distant landscape, and an exquisitely beautiful picture of the scene will appear inverted on the membrane. In the eyes of albino rabbits, the sclerotic is naturally translucent, and the images are seen without any special preparation; and in those of any animal they may be observed through a puncture made in the sclerotic anywhere near the front of the globe. This image is the immediate physical cause of the sensation of vision, and the seat of this sensation is the retina. The two propositions here stated may be experimentally demonstrated together. If any small object—as, for example, a pin—be held at a little distance before the eye and gradually brought nearer, it will be seen distinctly up to a certain limit, which to the ordinary eye is found at the distance of six or eight inches; after which, if the distance is still further diminished, it will appear indistinct, or with hazy or shadowy borders. If while this is the case, a card in which a minute perforation has been made be placed immediately before the eye, the distinctness of the object will be restored; but if the card have two such perforations not more distant from each other than the diameter of the pupil, the object will appear not only distinct, but double. Then, while continuing to look through the two perforations, let the object be gradually removed to a greater distance, and the two images will be seen to approach each other and finally to coalesce in one. On removing the card it will be found that the distance now reached is precisely the limit up to which, in the first experiment, distinct vision was maintained, and beyond which it ceased. The interpretation of the phenomena here described is easy. When a candle is placed at some distance before a convex lens, a screen placed behind the lens at the distance of the conjugate focus will receive a distinct image of it inverted. If the candle be brought near the lens the image will become confused. By placing a diaphragm of very small diameter before the lens, however, the distinctness will be sensibly restored, not because the pencils of rays from the different points of the object are truly converged to corresponding points of the image, but because they are so slender as to approximate a true focalization. If instead of a simple diaphragm we employ a plate with two small perforations, the rays passing through these will meet the screen before coming together at their common focus, which is more distant, and therefore two images will appear. Then as, by withdrawing the candle, this distant focus is brought forward toward the screen, the images will necessarily approach each other, and when the focus reaches the screen, they will unite in one. In like manner, in looking through the perforated card, the object will be seen singly when the image formed by the crystalline lens falls on the surface which is the seat of sensation, and double when it is virtually more distant. Also, in this case, on the removal of the card, vision becomes confused. Now the seat of sensation must be either the retina or the choroid, since the light is wholly arrested by this last. It is natural to suppose it the retina, since this is the expansion of the nerve by which unquestionably the sensation is communicated to the sensorium. Yet some, among them Brewster, have expressed doubts on this point, founded on the curious fact, first observed by Mariotte, that the point of the internal surface of the eye where this nerve enters the ball is nearly insensible to light. Of the fact any one may satisfy himself by a personal experiment. Let a small bright object, as a dime, be placed upon a dark-colored table, and let the observer, closing one eye, place the other directly over the coin. Then, as the insertion of the optic nerve is at a little distance from the centre of the ball toward the nose

(about ⅛ inch), if the right eye is open, push the coin gradually toward the right, and if the left eye is open, toward the left, keeping the eye in the mean time motionless. The object will presently go into eclipse, or disappear, and on being pushed still farther will emerge, or reappear. During this time the image moves over the insensible point. This phenomenon, however, offers no substantial reason for presuming the retina not to be the seat of sensation; for it is not at all surprising that the trunk of the nerve should possess a less sensibility to light than its delicate ramifications. Moreover, if the retina be not the seat of vision, it has no assignable function whatever, while it is one of the most curious developments of nervous tissue to be found in the system.

Adjustment of the Eye to Distance.—When a photographer desires to take a view, he adjusts the focus of his camera, by either moving the lens or varying the length of the body, until the image is seen distinctly formed upon the screen. A similar adjustment takes place in the eye when it is directed toward objects differently distant from the observer. The adjustment takes place without the observer's consciousness, although it is determined by a distinct effort of the will. When there is no such effort, the eye relapses into its normal condition, which appears to be that in which parallel rays, or rays from objects infinitely distant, are brought to a focus on the retina. The question how the adjustment is effected has been a subject of much discussion. Some, among whom may be mentioned Kepler, Boerhaave, Rohaut, and Olbers, imagined that, as the object observed is brought nearer, the globe of the eye becomes elongated, and *vice versâ*; attributing this effect to the reciprocal action of the straight and oblique muscles which control it; but this hypothesis is untenable, for the reason that such an elongation would alter the curvature of the cornea, an effect which demonstrably does not take place. Moreover, a case is recorded by Graefe, in which a man who had suffered paralysis of the muscles of the eye continued to distinguish objects perfectly at different distances. Kepler admitted the alternative supposition that the crystalline might be drawn forward by the ciliary processes as the object of vision approaches the eye; and this view found favor with Scheiner, Porterfield, Zinn, and Camper; but such a displacement could not occur without a transfer of some portion of the aqueous humor from one side to the other of the crystalline, and without changing, as before, the curvature of the cornea. Jurin, Musschenbroek, and others believed that a change of curvature of this membrane does actually take place, but numerous experiments made by Young show conclusively the contrary. This investigator very carefully measured, by means of a telescope and micrometer, the distance between the images formed by the reflection of two candles from the anterior surface of the cornea of an eye which, while remaining motionless, was adjusted successively to the different distances of several objects situated in a common direction before it, and found this interval to remain unaltered. He found also that when his own eye was completely immersed in water, of which the refracting power is almost exactly that of the aqueous humor, thus neutralizing the effect of any change of curvature in the cornea, it was still capable of adjusting itself to distinct vision at different distances. Another hypothesis in regard to this matter was that of Lahire, entertained also by Haller, Leroy, and Treviranus, and more recently by Pouillet, which supposes the crystalline lens to be composed of strata of different densities increasing from the surface to the centre, in such a way that, provided the rays be more and more intercepted from the borders inward as the object is brought nearer, the image will remain at a constant distance. As it is a fact of observation that the pupil of the eye contracts when an object under constant illumination is brought nearer, this theory has in it so far something plausible; but it would apparently be an optical impossibility, under the conditions supposed, to produce perfectly distinct vision at any distance. The theory of Descartes, afterward adopted by Hunter and by Young, regarded the adjustment of the eye as due to changes in the form of the crystalline effected by means of a contractile power residing in the crystalline itself. Though this body is transparent, it is made up of fibres regularly arranged, and these fibres were presumed to possess the properties of muscle. In order to make this structure manifest, it is necessary to macerate the crystalline for a long time in warm nitric acid. It thus becomes white on the surface and bright yellow in the interior, when the fibres are distinct and easily separated, resembling raw silk. The arrangement of these fibres is at once complicated and regular. They form several layers superimposed upon each other. Radiating sutures extend in each layer from the centre to the circumference, formed by the meeting of fibrillæ at a very oblique angle. These sutures are most numerous in the outer layers, and diminish in number in those beneath. In the outermost layer there are as many as sixteen; in the layers near the centre not more than three. The appearance of the fibrillæ and sutures, as seen with a lens, after coagulation in alcohol has commenced, is shown in Fig. 1 at B, while C shows the laminated structure of the crystalline in section. The sutures do not correspond in position on the two sides of the crystalline, but are alternate to each other; each fibrilla after passing round the edge of the body taking an opposite curvature to that which it had on the front, and those which originate near the centre on one of the faces terminating near the margin on the other. The discovery of this fibrous structure naturally led to the supposition that the crystalline might be capable of changing its own form by the contraction of the fibrillæ. Moreover, the investigations of Cramer and Helmholtz have conclusively demonstrated that it does actually undergo such a change of form in the adjustments of the eye for distance. The demonstration is made as follows: A light is placed near a person in a darkened room, and the person is required to look at an object as distant as possible. In the eye of the person thus situated the observer perceives three images of the light—viz. a first, erect and small, formed by reflection from the cornea; a second, also erect, behind the first, and formed by reflection from the anterior surface of the crystalline; and finally a third, smaller and inverted, produced by reflection from the posterior surface of the crystalline, which acts as a concave mirror. If the person under experiment now fix his attention upon a much nearer object in the same direction as the first, the eye remaining motionless, the first image undergoes no change, the second abruptly moves forward nearer to the first, becoming at the same time somewhat smaller and brighter, and the third maintains its position sensibly unaltered, but is also diminished in size and increased in brilliancy. These phenomena indicate that the curvature of the cornea remains unaltered, while both surfaces of the crystalline have an increased convexity. But while it is thus demonstrated that the adjustments of the eye for distance are due to changes of figure of the crystalline, the more recent investigations of Dr. Allen Thomson have made it evident that these changes are produced not by the contractile power of its own fibres, but by a compression exerted by the combined action of the ciliary muscle and the iris, which latter is in immediate contact with the crystalline in its capsule. This action only takes place when the eye is fixed on objects at finite distances, and is more energetic in proportion as these are nearer; but when attention ceases the organ resumes its normal state by its own elasticity.

Character of the Eye as an Optical Instrument.—Many writers have spoken of the eye as the most perfect of optical instruments. The normal eye must be here intended, since among the eyes actually encountered it is rare to find one unaffected by some more or less obvious defect. But the statement is not true even of the normal eye, since in this there may be detected a very sensible amount of aberration of color, and there are indications also of the existence to some slight extent of aberration of sphericity. The small size of the organ, however, and the consequent nearness of the image to the lens, make practically imperceptible the effects of errors of convergency sufficient to introduce in a larger instrument manifest confusion of details in the image. Spherical aberration is supposed to be almost entirely prevented by the form of the cornea, which is that, or nearly that, of an ellipsoid of revolution around the major axis. That the surface is not spherical, and that its curvature decreases from the centre outward, is manifest from the change of apparent form and magnitude of the image of a window seen reflected from it as the position of the eye under observation is changed. In the case of the eye of an ox, the form was more exactly determined by Chaussat, by projecting a magnified image of it upon a screen by means of a megascope, and after tracing its contour measuring co-ordinates to its several points from axes of reference. The curve which satisfied these was an ellipse. The same result was obtained by Sœmmering from an examination of the eye of a horse. Chaussat found in the cornea of an elephant the curvature of a hyperboloid, and Demours is of opinion that that of the human eye is similar, which may be true in near-sighted persons; but the inference justified by the numerous investigations of Chaussat, Vallée, and Krause is that, in general, the human cornea is ellipsoidal in form. While, however, this figure would favor the suppression of aberration of sphericity, the form found by Chaussat for the curvature of the surfaces of the crystalline, which is that of an ellipsoid of revolution around its minor axis, would have an opposite effect. It is asserted by many writers that the density of the crystalline diminishes from the centre outward, and that it is to this cause that the freedom of the organ from spherical aberration is owing. Others, who regard this imperfection

as not wholly absent, suppose that its manifestations are checked by the varying aperture of the pupil, which (illumination remaining constant) always contracts as the object approaches, and dilates as it recedes. There can be little doubt that the absence of any perceptible spherical aberration in the eye is largely owing to the cause here pointed out.

Chromatic Aberration.—It was long a popular belief that the eye is perfectly corrected for color. In a badly-corrected microscope or telescope bright objects are seen bordered with colored fringes which impair the distinctness of their outlines. No such fringes attending natural vision, the conclusion seemed to be justified that the eye is achromatic. Here again, however, the seeming perfection of the organ is due mainly to its small dimensions, and to the short distance between the lens and the retina. It is nevertheless by no means difficult to prove that rays of different colors require different adjustments to bring them correctly to focus on the retina. One of the simplest of such demonstrations is found in an observation of Wollaston, that the spectrum of a luminous point—as, for instance, of a star—seen through a prism held before the eye, does not appear to be what it really is, a simple uniform line of light, but has this character only in the small portion to which the optic axis of the eye is immediately directed, being dilated in the parts distant from the centre of the field of vision. Thus, when we look at the red, the violet is dilated, and when we look at the violet the red is dilated; and if we direct attention to the middle of the spectrum, both ends are dilated. An experiment of Matthiessen is equally conclusive. A sharply-defined figure is traced upon a plate of glass, and this, in a dark room, is illuminated from behind. It is then advanced by sliding along a scale toward the observer, until the limit of distinct vision is reached, and this point is marked on the scale. By successively illuminating with lights of different colors, there is found a different limit for each, the red giving the longest limit, and the indigo or violet the shortest. In long-sighted persons, the difference between the extremes is sometimes as great as two to one. A curious effect of this want of achromatism in the eye is often observed in looking at the figures of a carpet of strongly-contrasted colors. The red figures will appear to be situated in a plane some inches higher than the green or blue.

Field of Vision.—According to Brewster, the eye is capable of receiving rays from an angular space extending 150° in a horizontal direction and 120° in a vertical. This is called the field of view. Its unequal dimensions in the two rectangular directions are not owing to anything in the construction of the eye itself, but to the interference of the neighboring features of the face, principally the brow. It is remarkable that, in some animals, such an inequality is favored by the form of the pupil, which being elongated and not circular, increases the range in the direction of the longer axis. It is also remarkable that this elongation has an obvious relation to the habits of the animal, since in the climbing animals, as those of the feline tribe, it is vertical, and in the grazing, as the bovine, it is horizontal.

But notwithstanding the wide extent of the field of general vision, the field of distinct vision is quite limited. It is confined to a very small space about the point where the optic axis of the crystalline meets the retina. The retina itself presents here a peculiarity, there being a circular spot with a faintly yellowish border subtending an angle of about 4° at the centre of the ball, in which it is transparent. This spot, which is called the *foramen centrale*, might be supposed to be conterminous with the field of distinct vision, if observation did not prove that the latter is not so large, and that, moreover, it has not a definite boundary, but shades off insensibly into indistinctness. It is a fact which when first stated seems scarcely credible, that the field of distinct vision is hardly large enough to cover, on a surface ten inches before the eye—as, for instance, on the page of a book—a space an inch in diameter; but this assertion may be verified by directing the axis of the eye to a given letter, and noticing to how small a distance from this, in any direction, other letters are distinguishable. The prevalent impression, that the field of distinct vision is large, is owing to the extreme mobility of the eye, which enables it to gather up the details of an object in so rapid succession that we imagine them to be seen simultaneously.

Sharpness of Vision.—Between distinctness and acuteness of vision we may note this difference, that while vision is distinct in which all the boundaries or markings of an object are well defined, acuteness is the power of discerning minute details. It is not true that all persons who see with equal distinctness possess the same degree of acuteness of vision. But there is probably a limit below which it is physiologically impossible for any eye to discriminate details. Assuming, as we must, that it is by a tremor in the nervous fibrillæ that the sensation of vision is excited, we are compelled to believe that this tremor will to some extent be communicated to the neighboring fibrils, so that the agitation will not be confined exclusively to the point on which the light immediately falls. The little space to which the disturbance extends has been named by Durin the circle of dissipation of energy. If, therefore, the separate images formed on the retina by the details of an object are not distant from each other by at least a diameter of a circle of dissipation, these circles will overlap, and the details can no longer be separately perceived.

Sensibility of the Retina.—It is only to light that the retina is sensible. It may be compressed, injured, or torn without producing pain, as has been proved by the experiments of Magendie on living animals, and by analogous experiments upon men in operations for cataract. Mechanical action, such as pressure, or more remarkably a blow, upon the ball of the eye, excites the sensation of light, the effect resembling a brilliant scintillation or an electric flash. The force of the impression produced by light varies with the intensity. There is doubtless a minimum of intensity below which no sensible impression would be produced, but this, which has been estimated at about $\frac{1}{50000}$th of the light of the full moon, has been but vaguely ascertained. In regard to this sense, moreover, as to every other, the differences of sensibility between different individuals are great; and even in the same individual, in different conditions, similar differences occur. Some investigators—as, for instance, Lavoisier—in order to prepare themselves for experiments on photometry, have spent several days in darkness, and have found the retina under these circumstances to acquire an extreme sensibility. It is a matter of common experience, moreover, that continued exposure to a strong light depresses the sensibility of the organ; every one who has ever entered a dimly-lighted apartment from the full light of a summer day being aware that some little time must elapse before the objects around him will be distinctly visible. What is called snow-blindness, which is sometimes quite lasting, is owing to this cause. On the other hand, an excess of light so overpowers the nerve that it is impossible to distinguish anything. Thus it happens that after remaining in a dark apartment until we see clearly in it, on sudden emergence into full day we are dazzled.

The iris fulfils a very important function in regulating the amount of light admitted into the eye. It is excessively sensitive, expanding and contracting in sympathy with the stimulation of the optic nerve, and on a sudden exposure to excessive illumination it closes the aperture of the pupil almost entirely. In darkness, on the other hand, the pupil so enlarges as to reduce the iris to a narrow border. These changes are particularly noticeable in the eyes of animals which prowl by night. In these during the day, the pupil, which is elongated vertically, is reduced to a mere line; but at night it is circular and the iris is scarcely seen.

Extinction of One Impression by Another.—When two luminous impressions fall upon the retina together, if the intensity of one greatly exceeds that of the other, the feebler will cease to be perceived. The minimum ratio of intensities necessary to produce this effect has been stated at 64 : 1, it having been experimentally proved by Bouguer that, of two shadows cast by two equal lights upon the same screen, one becomes imperceptible when the light producing it is carried eight times as far off as the other. On this principle is explained the invisibility of the stars by day, the brightness of the atmosphere derived from the sun exceeding that of these objects more than 64 times. It is nevertheless true that the stars may be seen by day by a person in the bottom of a well. This phenomenon, which is somewhat difficult of explanation, would seem to indicate that, if Bouguer's proposition is true independently of the absolute intensities of the lights compared, the brightness of the stars must be more than $\frac{1}{64}$th part of that of the atmosphere. It is certain that the observer at the bottom of the well receives, at the point of the retina on which the image of the star falls, quite as much light directly as one in the open atmosphere; yet the first sees the star and the other does not. The explanation suggested by Arago is, that the humors of the eye scatter more or less the light which enters them from whatever direction, so that when the whole sky is visible there is added to the direct light coming from the region of the star, an amount of diffuse light derived from other quarters sufficient to make a total more than adequate to overpower the brightness of the star. Another explanation would seem to be possible. Since the observer in the free air receives the atmospheric light in all directions, the entire retina is subject to the depressing effect of excessive illumination; and the sensibility at each point is depressed not only by the direct action of the light which falls upon that point, but

also indirectly by sympathy with the diminished sensibility of other portions. And as the power to distinguish differences of brightness must be a function of the sensibility, it is probable that this power will be greater in proportion as the extent of that portion of the sky which is visible to the observer is reduced.

Irradiation.—It is a fact very generally known that a bright object upon a dark ground appears larger than a similar and equal dark object upon a white ground. Also, if a dark screen be held before a candle so as to intercept a portion of the blaze, the screen will appear indented where it crosses the flame. A striking example of a similar effect is afforded by the crescent moon, while still so young that the body within the crescent is visible by the earth's reflected light. The bright and the dark limbs seem to belong to two unequal spheres, the bright being materially the larger. So, also, if a chessboard of which the squares are alternately white and black be observed under strong illumination at a little distance, the dividing lines of the several vertical or horizontal rows will appear broken at all the intersections. The term *irradiation* has been employed to denote the phenomenon here described. The explanation of it is not entirely simple. It is attributed by Plateau to the propagation of the nervous tremor to a small portion of the retina bordering that which receives the direct stimulus of the light—an explanation identical with that above given in accounting for the necessity of a *minimum visibile;* but this is not satisfactory, since irradiation manifestly very much exceeds the extent of the *circle of dissipation,* as determined by the observation of minute objects. Moreover, irradiation absolutely disappears at the distance of distinct vision, a fact quite inconsistent with the explanation proposed. A different theory suggested in 1854 by Mr. Trouessart assumes that the image formed on the retina is not simple but multiple, the individual images being not quite concentric, so that in their superposition they cover a somewhat larger space than would be covered by a simple image. He ascribes the formation of these images to the presence of opaque or imperfectly transparent points in the cornea, the crystalline, or the humors of the eye, which are presumed to produce an effect like that seen when a distant luminous point is observed through a reticulated grating, in which case multiple images of the point appear; but this still fails to explain the disappearance of irradiation at the distance of distinct vision. The theory of Helmholtz, and of recent physiologists generally, is that irradiation is caused by an irregular aberration of sphericity due to imperfections in the form or structure of the crystalline. These imperfections are supposed to scatter a portion of the light beyond the boundaries of the true image, but not in quantity sufficient to be perceptible unless the object is bright. To the same cause they ascribe the phenomenon considered under the title next following, which is not in their view essentially different, but only a different form of irradiation.

Radiancy.—In looking at a minute and distant brilliant object, such as a star, we seem to see rays shooting from it to some distance in different directions. These rays have certainly their cause in the eye itself, since when the head is inclined to right or left, the rays turn with it. Young was disposed to attribute the phenomenon to the sutures of the crystalline, an opinion accepted by Dugès. Trouessart explains it upon the principle applied by him to irradiation; that is, the formation of a multitude of images in consequence of imperfections in the crystalline or of imperfectly transparent points in the vitreous humor. The view of Helmholtz, above referred to, differs very little from this. It does not appear, however, that the two phenomena can properly be ascribed to the same cause, since one of them, irradiation, disappears at the limit of distinct vision, while the other, radiancy, does not.

Duration of the Impression upon the Retina.—Experience proves that the sensation of light continues to be perceived for an appreciable time after the cause which produced it has ceased to act. If, in a disk mounted so as to rotate upon an axis passing through its centre, there be made a series of equidistant perforations forming a circular row of apertures, and this series be made, by turning the disk, to pass slowly before the eye, the view of objects on the other side will be intermittent; but when the rotation is very rapid the view is constant, the sensation excited by the light received through any one aperture persisting until reinforced by the passage of the next. In like manner a brilliant object moving rapidly (as a shooting star) seems to draw after it a luminous train; and a dark object moving with similar rapidity over a bright surface is unperceived. The absolute duration of the sensation of light has been ingeniously determined by Aimé and Plateau, by experimenting with two disks rotating in opposite directions upon a common axis, one of these being perforated with numerous equidistant and narrow rectangular openings, while the other has but a single such opening. If the rotation take place in front of a source of light, there will be seen intermittently, while it is slow, a single luminous rectangle. By accelerating the rotation, two rectangles will become simultaneously visible; with greater velocity, three, and so on. When two only are seen, of course one of them is due to an impression which has lasted as long as the interval in time between two successive coincidences of the perforations. Mr. Plateau's conclusions from experiments of this kind are the following: (1) The mean duration of the sensation of sight is about 0.84 sec. (2) Some little time is necessary that the excitation may become the greatest possible under a given intensity of light; in other words, that the impression may be complete. (3) This maximum impression persists undiminished for a time which is greater in proportion as the impression is less energetic, but which is always exceedingly brief, being less than 0.008 sec. for light from a sheet of white paper in full daylight. (4) The total duration of the impression is greater as the intensity of the light is greater. (5) The total duration is diminished by a long exposure of the eye to the light producing it.

The optical toys known as the thaumatrope and the phenakisticope depend for the illusions they produce upon the persistence of impressions upon the retina. The thaumatrope is a disk made to revolve rapidly around one of its own diameters. On one side of this disk is drawn a part of a design, and on the other side the remaining portion; during the revolution of the disk the design will appear complete. The phenakisticope is a disk also, but revolving around its axis and not around a diameter. It bears, arranged in a circular order, a series of equidistant designs of the same subject in successive attitudes, each differing slightly from the last, and as many perforations or sight-holes, also equidistant, near the circumference. The disk is made to rotate rapidly before a mirror toward which the designs are turned, and the observer, looking through the sight-holes, sees them by reflection. The effect is that the subject appears to be stationary in position, but executing a rapid succession of movements. In another form of this instrument the designs are made to line the interior of a hollow cylinder which revolves around a vertical axis, openings for observation being made through the sides of the cylinder near the top.

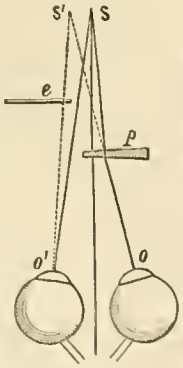
Time necessary to excite the Sensation of Vision.—When a body is in rapid motion—as, for instance, a rotating wheel—the persistence of impressions upon the retina causes the successive images formed by it in different positions to be superposed upon each other, so that the details of its structure are indistinguishable. Thus, a wheel with radial arms presents the appearance of a shadowy disk. But if such a wheel be looked at through the apertures of a rapidly-moving screen, like the disk of a phenakisticope, each glimpse will be of so brief duration as to permit the arms of the wheel to be distinctly visible. Moreover, if the wheel and the disk have precisely the same angular velocity of rotation, or are both firmly attached to the same axis, and the number of equidistant apertures in the disk is just equal to the number of arms of the wheel, the appearance presented will be that of a wheel absolutely motionless. If each aperture occupy but one $\frac{1}{100}$th part of an entire circumference, and if the disk revolve ten times in a second, it is evident that a perfect impression of the wheel is received on the retina in $\frac{1}{1000}$th part of a second. But this is an immensely longer time than is necessary; for if, in a room entirely dark, a wheel rapidly revolving, as above supposed, be momentarily illuminated by an electric spark, it is still distinctly seen, and appears of course stationary. Thus far, the minimum of time necessary to produce an impression upon the retina has not been ascertained. Some very interesting experiments in reference to this point were made in 1871 by Prof. Rood of Columbia College, New York, of which the results were communicated in April of that year to the National Academy of Sciences. In these experiments a grating of 600 lines to the inch was observed, in a mirror revolving 340 times per second, under the illumination of the spark from a small Leyden jar. The image of the grating appearing perfectly sharp and distinct, it followed directly from the data that the duration of the spark could not exceed $\frac{1}{1000000000}$ths of a second; and indirectly, that this minute interval of time is more than sufficient for the purposes of vision, while probably not a tenth part of that interval would be necessary to excite the sensation.

Why Vision is Erect while the Image is Inverted.—The question has been very much mooted why it is that objects appear to us erect although their images on the retina are inverted. Metaphysicians, among them Locke and Condillac, have ascribed our judgments of the positions of things to the experience acquired by comparing visual impressions with those derived from touch; but persons blind from birth who have been restored to sight have,

without any such experience, seen objects upright from the beginning. Geometers like Descartes and Kepler have taken the view that we necessarily refer any point of an object to the direction of the axis of the pencil of rays which comes to the eye from that point. Brewster takes substantially the same view, but expresses it differently; saying that we refer the object to the direction of the perpendicular on the retina drawn from the point where the ray from the object strikes it. Lamé suggests further that as, in order to see any given point of an object distinctly we must direct the axis of the eye toward it, the movement of the ball of the eye necessary for this purpose compels us to refer the object to its proper position relatively to the ground, the sky, and to the members of our own body. It is a little curious that, though the image in the eye is reversed from right to left as well as inverted, the question has never been raised why we see objects unreversed. But certainly this ought to be as puzzling a question as the other, if there is any puzzle in either. Perhaps, in regard to both, it should suffice to remark, that though the sensation is in the eye, the perception is in the sensorium; and that the thing perceived is the object, while the inversion of the image is not a fact of consciousness, but of acquired knowledge, and of knowledge, moreover, which the majority of mankind do not acquire.

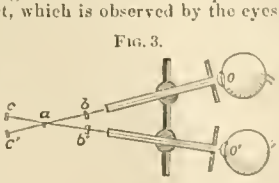
Single Vision with Two Eyes.—Another question which has some analogy with the foregoing, has been much discussed—viz. why the object of vision appears single though two images of it are formed, one in each eye. There is nothing in this more surprising than in the fact that an object handled by both hands still appears single—a fact which continues to be true though the experiment be made with the hands behind the back, so as to ensure that no sense but that of feeling is concerned in the perception. Here, again, we remark that it is the external object which is perceived, while we remain unconscious not only of the duplicity, but of the existence of the images. We are even unconscious, until careful observation has assured us of the fact, that we ordinarily attend or look with one eye only though both eyes are open. In order, however, that an object may appear single, it is necessary that the axes of both eyes should be directed toward it. A simple experiment proves this. Let any small object—as, for example, a pencil—be held between the observer and a window: if the axes of the eyes be directed toward the object, the window-bars will appear double; if toward the bars, the object will appear double. If while the axes of both eyes are directed toward a given object, the position of one be disturbed by pressing the ball with the finger, the object will appear double. Again, if we close one eye and look at any near object with the other, on opening the closed eye the object will appear momentarily double, but the two images will promptly coalesce; the axis of the eye while closed assuming the normal position, or that in which it is parallel to the other, but becoming immediately convergent on opening.

Fig. 2.



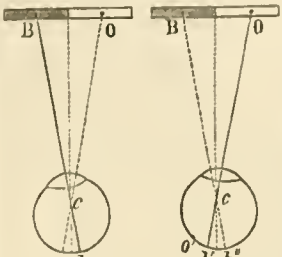
The proposition above stated admits of some curious experimental illustrations. In Fig. 2 suppose a light at s to be observed by the two eyes at o and o'. Then let a prism of small angle (2° or 3°) be interposed in the way of o, as at p; the deviation produced by the prism will cause the light to appear at s' for that eye, while it is at s for the other; but by the readjustment of the eyes the two soon coalesce. Place now a second light at s' which is concealed from the eye o' by the screen e, and then suddenly remove the prism p; the two lights will appear as one. Fig. 3 represents an experiment of Wheatstone. Two tubes blackened internally converge toward a, at which point is placed a well-defined object, which is observed by the eyes at o, o'. On removing the object at a, and placing two objects precisely similar to it at b and b', or at c and c', both in the axes of the two tubes produced, the impression continues still to be that of a single object. This simple experiment naturally led to the investigation of the agency of binocular vision in assisting perceptions of solidity, and to the invention of the stereoscope.

Fig. 3.



Accidental Colors.—It is matter of common observation, that, after the eye has rested for some time upon any strongly lighted object, and is then turned suddenly away, an image of the object still continues to be visible, usually faint, but sometimes quite intense, and of different color from the object itself. The color is that which united with the color of the object produces white—hence called *complementary*. Thus, a portrait in which the colors are the reverse of those of nature—as, for instance, in which the hair is white, the complexion greenish, the eyes yellowish-red, and the teeth black—after being intently viewed in a strong light, will reproduce, upon a white surface to which the eyes may be immediately after directed, a counterpart exhibiting tints perfectly natural. Colors appearing under such circumstances are called *accidental*, and are of course purely subjective. They make their appearance even if, without turning the eyes away from the object, the eyelids merely are closed; but in this case the natural colors usually persist for a time, and are succeeded by the complementary; after which there may occur several successive alternations between the real colors and their complements. Scherffer has shown that the color which results from the combination of two accidental colors is the same as the resultant of two similar real colors. Fig. 4 illustrates this. B and O are two squares (seen in section), one being orange and the other blue. On the left, the axis of the eye b B is directed to the centre of the blue square, a blue image being formed at b in the middle of the retina, and an orange image at o toward the left from the middle. On the right, the axis, b' O, is directed to the centre of the orange, and an orange image is formed where the blue was formed before, in the middle of the retina, while a blue image is formed at b'' to the right of the middle. Now, if with this arrangement an observer alternates his view from B to O many times, say thirty or forty, pausing about two seconds at each alternation, and then suddenly looks upon a white surface, he will see three images, the extremes being severally complementary in color to the squares on the same side with them, and the middle one exhibiting a color compounded of the two—in the case supposed, white. This last would therefore not be visible upon a white ground, but on a colored ground of any tint it would appear.

Fig. 4.



Two theories have been proposed to explain the phenomenon of accidental colors. The first is that of Scherffer, who holds that the sensibility of the retina to any particular color is enfeebled by a long continuance of its action, while not similarly enfeebled as to the other colors contained in white light. In this condition of the eye, white light appears deficient in the tint for which its sensibility is blunted, or in other words appears of the tint complementary to that. This theory, however, fails to account for the colors seen when the eyes are closed, and is therefore not wholly satisfactory. The theory of Plateau is founded on the fact above referred to, that the accidental colors seen on closing the eyes are not immediately complementary, and that, if the eyes after having been strongly impressed are kept closed long, the accidental image appears, and fades many times successively, passing even from the complementary to the direct and from the direct to the complementary by a sort of oscillation. Plateau supposes, in fact, that such an oscillation does really take place: that the highly-excited nerve returns to its state of repose only after passing, like a pendulum, repeatedly from one side to the other of that condition; and that these alternations are the cause of accidental colors. This theory does not necessarily exclude that of Scherffer, which, though not a complete explanation, is without doubt to a certain extent true.

Range of Vision.—As the normal eye forms a perfect image on the retina with parallel rays, the range of vision is unlimited, or limited only by the diminution with distance of the intensity of radiant light. Thus, the fixed stars at unknown distances are visible. But the range of *distinct* vision for an object of any determinate magnitude is limited by the consideration that there is a *minimum visibile*, and that when an object is so remote that its image is reduced to this limit, it can no longer be perceived as a magnitude. The fixed stars are visible because of the intensity of their light, but they have no sensible disks.

Judgment of Distance.—Within certain moderate limits all persons judge pretty accurately of distance by sight. Practice and experience enable men whose vocations take them much into the open country, greatly to extend these

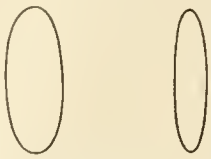
limits, but no one can extend them indefinitely. The means by which we form these judgments are various, partly depending on the conditions indispensable to distinct monocular vision, and partly on the relation of the two eyes to each other. We have seen that a certain adjustment of the eye is necessary in order that a well-defined image of an object before it may be formed on the retina. This adjustment is apparently made instantaneously, but from the nature of the case the process by which it is made must be tentative. The distance of the object is unknown. The eye as it were feels it out. And as a different adjustment is found for each different distance, we learn by experience to associate a particular adjustment with a particular distance. What we are conscious of, it is true, is not the adjustment, but the effort required to make it, and the sense of this effort becomes the measure of distance. Beyond a very limited range, however, this adjustment becomes a very imperfect guide; and it is only in the case of persons who, having had the misfortune to be deprived of one eye, have been compelled to rely on the remaining one alone, that sufficient experience is acquired to make it trustworthy. The judgment is aided in this case by comparing the visual angle under which the object is seen with that which the same object subtends at a known distance. This too fails when the distance is extreme, and moreover it requires that the object be known, or that it belong to a class of which the mean dimensions are familiar. A third aid to the judgment is perspective. The relative apparent positions of the various objects in a landscape, especially when arranged according to geometrical law, the architectural features of buildings, and the converging lines of streets, serve as means of carrying forward a measurement of distance step by step. Hence the well-known difficulty of accurately estimating distances over surfaces where such diversity of features is absent. In such cases our judgments almost invariably fall short of the truth.

It is, however, upon the conspiring testimony of the two eyes that our usual and most correct estimates of distance are founded. The optic axes of the eyes always intersect upon the point to which the vision is directed, and the inclination of these axes to each other must vary with variations of distance. Here also, however, it must be said that for remote objects the test becomes very uncertain, since for such the axes approach parallelism, and change their inclination very little throughout a large range of differing distances.

Judgment of Magnitude.—Of a number of bodies equally distant we judge of the relative magnitude by comparing the visual angles which they subtend, whether vertical, horizontal, or oblique: in other words, we infer their real magnitudes to bear to each other the same relation as their apparent magnitudes. But when the distances are different, the process of judgment is more complex, and involves an estimate of the effect of varying distance upon the visual angle. It is only by experience that we learn how to make this estimate; but as the experience of all of us in this respect has been largely acquired in our earliest years, our judgments of the magnitudes of objects immediately around us are seemingly instinctive and are approximately just. In respect to objects more remote, the differences between individuals are very great, persons whose lives are spent in the open country or at sea acquiring a power of discernment of the dimensions of distant objects which most inhabitants of towns do not possess.

Judgment of Form.—The images of objects on the retina are pictures of only two dimensions, yet we conceive of bodies without difficulty as solids, having not only length and breadth, but also depth. This facility arises from the fact that the two images formed in the two eyes are not identically similar, as they represent the object from different points of view; and there is no possibility of reconciling them with each other as images of the same object except by imputing to the object a third dimension. To a person possessing from birth but a single eye, the earliest conceptions of all objects must be that they are plane pictures. The touch, however, for such persons soon corrects the error of the sight; and after the conception of solidity has been formed, the effects of perspective become practically familiar after a little experience, and the true forms of solids, or of surfaces seen obliquely, are inferred by observation unaided by contact. Thus, though the image of a circle on the retina, unless its plane be perpendicular to the axis of the eye, is not circular but elliptical, yet after experience its true figure is not liable to be mistaken. The possession of two eyes, however, makes an experience of this kind unnecessary in judgments of form. A circle placed obliquely would produce an elliptic image in each eye, but one of these two ellipses would be more eccentric than the other, and nothing could satisfy the two impressions but a circle in an oblique position. It follows that if two ellipses be drawn on the same surface of paper near each other, having the differing degrees of eccentricity which would belong to the images thus formed in the two eyes by a circle seen obliquely, and if these drawings be so placed before the eyes that each eye can see but one only, the two will be referred to a single non-existent object which the observer will imagine himself to see as a circle placed obliquely. This can easily be proved by an experiment with the following small figures. Placing a card upright between the two, each eye will see but one only, and the combined images will produce the impression of an oblique circle more distant than the paper. Or, without attempting concealment, let the point of a pencil be held above the two figures, so as to range between the left eye and the right ellipse, and at the same time between the right eye and the left ellipse; then on directing the axes of both eyes to the point of the pencil there will presently be seen above the paper and apparently suspended in the air, a circle in an oblique position as before, but inclined in the opposite direction. It was upon this principle that Wheatstone founded his beautiful invention of the STEREOSCOPE (which see).

FIG. 5.



At great distances, the inclination of the axes is too slight to be of much assistance in judging of the forms of bodies. In such cases we must depend on perspective, which, except in the case of geometrically regular bodies, is an uncertain reliance. Shadows, however, particularly the strong shadows cast by the sun, are of great assistance in these judgments.

Pseudoscopic Effects.—If we take the designs of any object intended for the two eyes in the stereoscope, and transpose them, placing each under the eye for which it was not intended, we obtain the singular result that all the reliefs in the real object appear as depressions, and all the depressions as reliefs. Such effects are called pseudoscopic. An interesting example of pseudoscopic effect may be produced by the simple experiment of placing a coin or medal on the window-seat or on a table in the sunlight, and observing the inverted image of it formed by a convex lens. The coin appears as an intaglio, and cannot be conceived otherwise. The reason is that the shadows are on the side from which the sunlight is known to come, which fact we can only reconcile with the supposition that they fall into depressions. The illusion may, however, be dispelled by fixing a pin into the wood on which the coin rests, so as to be seen with it through the glass; the shadow of the pin gives an irresistible evidence that the direction of the source of light is not what we had before supposed, and the device of the coin appears in relief once more.

Defects of Vision.—The imperfections of vision most frequently occurring are myopism, or short-sightedness, and presbyopism, or long-sightedness. The cause of short-sightedness, is, in general, too great a curvature of the crystalline, but it may also arise from excessive convexity of the cornea or malformation of the ball, causing the image in either case to be formed in front of the retina within the vitreous humor, unless the object is near. This defect varies much in degree. There are cases occasionally in which distinct vision can hardly be obtained at any distance, however short. There are others in which the eye seems to have no power of adjustment at all, so that vision is distinct only at one particular distance, but these are rare. Short-sightedness is sometimes congenital, and is sometimes the consequence of the habitual limitation of the view to near objects, as in the case of students, engravers, etc. It is more rare in the country than in the city, and is said to be unknown among savages or among nomadic peoples like the Arabs, Tartars, etc. The indistinctness of vision occasioned by this defect may be removed by placing before the eyes concave lenses of a degree of curvature to be ascertained by trial.

Long-sightedness is rare except among people of advanced years. Persons whose sight is good in early life usually become long-sighted in age; while those who are short-sighted when young sometimes find the imperfection gradually to diminish as they grow older. Long-sighted persons see very well at a distance, but for objects near at hand the vision is confused. Relief under this imperfection is obtained by the use of convex glasses.

A more serious defect than either of those above named arises from inequalities of curvature of the crystalline sometimes found in the different planes passing through the optic axis. There are usually two planes at right angles to each other in which occur the maximum and minimum curvatures; so that the surface resembles that of a portion of an ellipsoid around the major axis. To this defect has been applied the term *astigmatism*. When it exists, perfect distinctness of vision is impossible at any

distance. It may be obviated by a lens with a contrary astigmatism, or by a cylindric lens either concave or convex, having a curvature equal to the difference of the maximum and minimum curvatures of the crystalline. This defect is probably not very uncommon, though extreme cases are rare. It was discovered in himself by Prof. Airy, the present astronomer-royal of Great Britain, who also invented the remedy. Prof. Stokes of Cambridge has proposed the following method of ascertaining the kind of lens adapted to correct astigmatism in any particular case: Let a plano-convex and a plano-concave cylindrical lens of moderate but equal curvature be set in a circular frame with their plane surfaces in contact, so that one may be made to rotate on the other. When the axes of the two are parallel, the combination will not affect the inclination of rays transmitted through them, since the curved surfaces are parallel; but when the axes are perpendicular to each other, the compound lens will be convex in the direction of one axis and concave in that of the other, while at 45° from either of these directions it will be neither. By diminishing the angle between the axes, the effective convexity and concavity in the two rectangular directions will be gradually diminished, and when the axes are once more parallel, will be zero. By trial, such a difference may be found as will correct the astigmatism of the eye under examination. As the astigmatism of the eye is not necessarily in the vertical and horizontal planes, the correctional combination should be tried in different azimuths about the optic axis. When the proper correction has thus been found, simple lenses may be constructed for the use of the person laboring under the defect.

Another imperfection is COLOR-BLINDNESS, or DALTONISM, which has been noticed under those titles. Numerous instances of this have been cited by Seebeck, D'Hombres-Firmas, J. Herschel, Brewster, and others. No very satisfactory explanation of this phenomenon has been given. It has been suggested that the filaments of the retina, like the strings of a harp, respond only to those vibrations with which they are severally in unison, and that in the color-blind the filaments which correspond to certain tints are either wanting or are insensible. This explanation assumes that the color-blind are actually blind, at least to some extent; but no evidence has been produced to show that their vision, except as it respects colors, is less acute than that of other persons.

The subject of vision is very fully treated in all extended works on optics. The most important special work on the subject is Helmholtz's *Handbuch der physiologischen Optik* (Leipsic, 1867). F. A. P. BARNARD.

Vital Statistics may be defined as that branch of statistical science which has for its office the collection and arrangement of facts relative to the three epochs of human life, including special information bearing upon the preservation of health and the causes of disease; and from the study of these facts the discovery of certain laws bearing upon the increase of population and the duration of human life. The birth, the marriage, and the death of an individual are the three events which should be recorded and preserved among public archives for future reference; and with these should be included whatever attending circumstances may serve to substantiate the main statement—the names of proper vouchers or witnesses, and, in case of death, the remote and immediate causes of the event. Certain information concerning the pedigree of each and every subject of these records should also be included, that no question may arise in subsequent years as to identity should it become necessary to appeal to such records for the settlement of matters in dispute or litigation. In all well-regulated cities and towns it is provided that no interment shall take place or that no dead body shall be removed for interment without a permit from the properly-constituted authorities; which permit is based upon a certificate from the physician who last attended the deceased, setting forth in plain language the place and cause of death, duration of sickness, the age, nativity, and social relations of the deceased, and such other items of information as may be required in order to satisfy the authorities of the correctness of the statement made, as well as for proof afforded in case of a necessity for subsequent reference or identification. All accidental deaths, and all deaths from poison, violence, or any illegitimate cause whatever, as well as cases in which the genuineness of the certificate or the integrity of the person signing it is questioned, are referred to the coroner of the county for investigation. In consequence of this provision, it is extremely difficult to secure the hasty burial of the remains of any human being who has met death by foul or criminal means, and society is to some extent protected, in proportion, at least, as the concealment of crime is prevented. These restrictions also secure full reports of deaths for registration, while for births and marriages very much depends upon the faithfulness of the attending physician in the one case or of the officiating clergyman or magistrate in the other. In order that vital statistics may have their full value, there should be complete registration alike of births, marriages, and deaths, for it is often necessary to appeal to such records for legal as well as scientific purposes; and of such importance are they deemed as aids or evidence in settling questions of litigation, of right to property, pension claims, and various other questions involving the rights of individuals, that in many large cities the entire time of special clerks is occupied in searching records and making transcripts therefrom, in answer to the frequent applications for such documents.

Birth rates are usually estimated in proportion to the entire population or to every 1000 of the population; and in countries where the registration has been brought to any considerable degree of perfection it is found that the annual number of recorded births varies from 29 to 40 for every 1000—more in some countries than in others, and more in the country than in the city. It is also shown that more boys than girls are born, the proportions, according to Quêtelet, being in Russia 108.9 boys to 100 girls, and the mean for Europe 106 boys to 100 girls; while, according to the 34th annual report of the registrar-general of Great Britain, we find that the average proportion was 104 boys to 100 girls; twice within twenty years the ratio reached 105 to 100, and twice it fell below 104 to 100. Several ingenious theories have been advanced in explanation of this excess of male over female births, such as the occupation of the parents, whether it be such as to develop sound physical qualities; the comparative ages of the parents, male births being in excess in proportion as the age and physical development of the father excel those of the mother; and, again, the preference for male infants tending to prevent the increase of the family after the birth of a boy. Whatever value may belong to the first and third of these explanations, it is pretty generally believed that one strong determining cause of the excess of male over female births is the difference in the ages of the parents. It is well known that the husband is generally a few years older than the wife, and that, the world over, more boys than girls are born; and although there may be other causes operating toward this result, the more careful observers regard this difference in age as the predominating one. Times, places, and seasons all exert their influence upon birth-rates. In times of prosperity and plenty we may expect more births than during periods of reverses, pestilence, and famine. In northern countries, where many marriages occur late in life, there will be fewer births than among the more precocious inhabitants of warmer countries. According to the report of the registrar-general, already referred to, the birth-rate is usually highest in the first three months of the year—a calculation based on the birth-records of thirty-four consecutive years; while of the whole number of births recorded in Philadelphia from 1861 to 1873, inclusive, the quarterly divisions were—first quarter, 56,072; second, 50,519; third, 57,256; fourth, 57,454; and of the whole number recorded in New York from 1866 to 1873, inclusive, being a period of eight years, the quarterly divisions were—first quarter, 31,958; second, 28,436; third, 35,125; and fourth, 33,920. The time of day at which the greater number of births occurs has been made a subject of investigation by Quêtelet, Dr. Buck of Hamburg, and others. According to Dr. Buck, of 1000 births, 312 take place between midnight and 6 A. M.; 249 between 6 A. M. and noon; 183 between noon and 6 P. M., and 256 between 6 P. M. and midnight. The approximate proportion of plural to single births may be deduced from the following: In Philadelphia (see report of the board of health for the year 1873) "the whole number of cases of plural births for the thirteen years, 1861–73, was 2088, of which 28 were triplets. One case of twins occurred in every 107.4 births, and one of triplets in every 7903 births." In the report of the board of health of the city of New York for the year 1873 (the last published report) we are told that during the year there were returned 22,683 certificates of children born alive, of which 242 were twins and 4 were triplet births. The number of still-births in the city of Philadelphia during the year 1873 amounted to 891, a percentage of 4.76, or 1 still-birth to every 20.9 births; and during the thirteen years the percentage of still-births was 4.61, or 1 in every 21.8 births. In the city of New York during the year 1873 there were 2312 still-births, the proportion to the number of living births being 1 to 9.81. This apparently large ratio is doubtless due to the imperfect registration, or rather the failure on the part of physicians and midwives to furnish complete returns of living births, while a return of every still-born child is absolutely required, in order to secure the necessary burial permit. In European statistics the proportion of still to living births is found to be nearly the same as in Philadelphia—larger in towns and cities than

in the country, and, as in living births, the proportion of boys excelling that of girls.

The following table, taken from the report of the board of health, already referred to, shows the number of births to 1000 persons living, and the number of persons living to 1 birth, in different countries and cities:

Countries and cities.	Births to 1000 persons living.	Persons living to 1 birth.
England, 1861–70	35.2	28.40
London, 1861–70	35.2	28.40
Prussia, 1861–70	39.6	25.25
Austria, 1861–70	39.8	25.12
France, 1861–70	26.2	38.16
Berlin, 1871	34.	29.33
Massachusetts, 1857–70	37.27	26.83
Boston, 1863–72	30.86	32.40
Providence, R. I., 1855–72	29.54	33.85
Philadelphia, 1870–72	25.26	39.64
Philadelphia, 1873	23.74	42.10

Marriage under ordinary circumstances is favorable to longevity. According to the statistics of France, Belgium, and Holland, as analyzed by M. Bertillon and quoted by Dr. Cameron (*Manual of Hygiene*, p. 28), married men from 25 to 30 years of age die at the rate of 6, unmarried at the rate of 10, and widowers at the rate of 22, per 1000 per annum; from 30 to 35, the death-rates of these several classes are respectively 7, 11, 19½; and from 35 to 40, married men die at the rate of 7½ per 1000 per annum, unmarried at the rate of 13, and widowers at the rate of 17½. On the other hand, men who marry between the ages of 18 and 20 years die as rapidly as men aged from 65 to 70. From 30 to 35 years of age spinsters die at the rate of 11, and wives at the rate of 9, per 1000 per annum, while under 25 the mortality is somewhat greater in wives than in spinsters. The expectation of a man married at 25 is that he will live to the age of 65, while that of the unmarried man of the same age is that he will live to the age of 60. The married woman at 25 may expect to attain the age of 65, the unmarried that of 56. Crime is least rife among the married, more so among the widowed, and most common among those who have never married. From the vital statistics of the city of Philadelphia during thirteen years (1861–73) certain conclusions are drawn by the board of health concerning the probabilities of marriage at different ages, to the effect that the probabilities of marriage under 20 years of age are about 42 times as great with females as with males; between the ages of 20 and 25 the probabilities are nearly equal, though still in favor of females; and after 25 they increase yearly in favor of males. The chances of females being married before the age of 20 are as 1 to 5 of all the probabilities that they will ever marry; at the age of 20, one-fifth, at 25, a little over two-thirds, and at 30, nearly six-sevenths of all their probabilities are lost. At the age of 20 the chances of males being married are scarcely lessened; at 25, three-fifths of their chances remain; but from this period on they diminish, but in smaller proportion than with females. The most favorable period for marriage is between 20 and 25 years of age; the next most favorable is, for females, under 20; for males, between 25 and 30. Causes which affect national prosperity will always exert a marked influence on marriages, more marriages occurring in years when business is lively, wages are good, and crops are abundant than during years when the opposite conditions obtain.

In the report to the registrar-general of the births, marriages, and deaths in Scotland during the year 1872, it is found that during the year there were 25,641 marriages registered in Scotland, and that there were also registered 107,838 live legitimate births, or an average of 4.20 + births for each marriage. During the same year there were registered in England 201,267 marriages and 781,141 live legitimate births, or an average of 3.88 births to each marriage. In Sweden, where the records of vital statistics are kept with a great deal of care, there were registered in 1872, 29,170 marriages and 112,989 live legitimate births, or an average of 3.83 births to each marriage. In the city of New York the ratio of registered births to registered marriages for the year 1873 was 2.55 births to each marriage, and in Philadelphia for the same year, 2.25.

Of the parties contracting marriage in Scotland during 1872, there were 21,637 bachelors with spinsters, 2269 widowers with spinsters, 889 widowers with widows, and 798 bachelors with widows. Of the 8871 registered marriages in the city of New York during 1873, there were 6487 bachelors with spinsters, 627 bachelors with widows, 420 widowers with widows, 716 widowers with spinsters, and in 591 of the marriages the condition of the respective parties is not stated.

Marriages of consanguinity are regarded as tending to some imperfection in the physical and mental development of children. According to French statistics and statistics compiled by Drs. Bemiss and Howe of this country, it appears that there is in the offspring of such marriages a strong tendency to insanity, idiocy, deaf-mutism, scrofula, or some physical deformity, although it is well known that in many instances the marriage of cousins has not been followed by such results. Doubtless, the degree of consanguinity exercises a good deal of influence in either modifying or aggravating this tendency to imperfect development; and cousins in whom the same family traits are prominent—as, for instance, the children of sisters, in whom the characteristics of the mother's family are strongly marked—would incur greater risk in marrying than would persons of the same relationship in whom were most prominent the constitutional peculiarities of their respective fathers, between whom there is no tie of consanguinity. Hereditary tendency to disease, especially to consumption, cancer, or insanity, is often an obstacle to a fortunate marriage, and more especially is this the case when in addition to this hereditary tendency there are ties of blood-relationship.

In order to be able to estimate accurately the value of death-records as indicating the rate of mortality and the sanitary condition of a city or country, it is necessary to have a complete registration of births, the amount of yearly immigration, together with a frequent and correct census of the population. It is customary to estimate the death-rate, as well as the birth-rate, in proportion to every 1000 of the inhabitants as given by the last census or as estimated year by year according to the usual rate of yearly increase. There seems to be a fixed law requiring that at least 11 human beings out of every 1000 of the entire population die annually. These are regarded as inevitable deaths, and any considerable number in excess of these are generally set down as resulting from the ignorant or wilful violation of some one or more of nature's laws. The actual death-rate of some of the more populous American and foreign cities may be seen in the following table, taken from a more elaborate one published in the report of the board of health of New York for 1873. No city with a population of less than 125,000 is included in this extract:

City.	Population estimated for middle of year 1873.	Number of deaths.	Death-rate per 1000 inhabitants.	Deaths under 5 years of age.	Percentage of deaths under 5 years of age to total mortality.	Number of persons married.	Registered births.
New York	1,000,000	29,084	29.08	14,182	48.76	17,744	22,683
Philadelphia	775,000	15,224	19.64	8,260	42.72	15,782	18,702
St. Louis	440,000	8,551	19.44	4,014	46.94	No record.	No record
Brooklyn	435,314	10,968	25.19	5,539	50.50	5,040	5,027
Chicago	400,000	9,557	23.89	5,676	59.39	6,448	9,718
Baltimore	305,000	7,614	24.96	2,301	30.22	2,200	No record.
Boston	276,500	7,869	28.46	3,289	41.79	3,916	9,688
Cincinnati	246,923	5,641	22.84	2,511	44.51	2,772	1,555
Buffalo	170,000	2,336	13.74	1,016	43.49	No record.	No record.
San Francisco	192,000	4,002	20.84	1,460	36.48	3,826	763
New Orleans	200,000	7,505	37.52	2,562	34.13	No record.	No record.
Cleveland	137,000	2,641	19.28	1,431	54.18	No record.	4,752
Pittsburg	133,900	3,519	26.46	1,781	50.61	3,564	5,175
Newark	125,000	3,735	29.88	1,891	50.63	2,560	3,618
London	3,356,074	76,634	22.83	31,789	41.48	66,878	121,100
Liverpool	505,274	13,042	25.81	5,889	45.15	11,470	18,716
Birmingham	355,540	8,990	25.28	4,424	49.12	No record.	14,497
Manchester	354,000	10,015	28.29	4,802	48.04	No record.	13,563
Glasgow	514,295	14,876	28.92	6,805	46.12	9,994	20,202
Edinburgh	208,322	4,577	21.97	1,567	34.23	7,840	6,785
Stockholm	117,249	4,481	30.45	1,838	41.00	2,658	4,347
Rotterdam	125,893	3,963	31.48	No record.	No record.	2,120	5,097
Antwerp	153,645	3,795	24.69	1,733	45.66	2,942	5,133
Mexico	225,000	6,963	30.94	2,667	36.86	1,066	9,273
Montreal	165,000	4,951	30.02	2,986	60.27	2,870	6,086
Vienna	700,000	24,701	35.28	9,202	37.13	14,756	27,880
Dresden	179,678	6,257	34.82	3,080	47.62	4,288	7,251
Munich	169,400	7,705	45.48	3,589	46.58	2,474	7,865
Rome	248,307	8,473	34.14	3,343	39.42	2,996	7,201
Milan	271,155	9,272	34.19	2,852	30.75	5,618	No rec.
Genoa	135,282	4,972	36.75	1,636	32.90	1,914	4,321
Venice	135,644	4,919	36.26	1,873	38.07	1,626	3,648

By examining the above table it will be seen that in each of these cities there is annually a greater or less number of preventable deaths, varying from 7 to 34 for each 1000 persons living, supposing the number of inevitable deaths to be 11 in each 1000. But this system of measuring the sanitary condition of a city or a locality according to the number of deaths occurring therein for every 1000 of its living inhabitants is not altogether without fallacy. One city may have from time to time large numbers of transient visitors, some of whom die during a temporary residence there, without ever having been numbered as a portion of the permanent population. Such is the case with the city of New York, among the temporary sojourners of which may be included large numbers of business men, who make periodical visits to the city in the interests of their respective callings; immigrants, numbers of whom

are constantly arriving on their way to different parts of the country; and paupers from adjoining States and counties, who are easily persuaded that it is more desirable to live and die by the charity of a great commercial emporium than to support a comfortable existence by honest industry. In addition to this, it is well known that the medical talent and medical institutions of New York attract to the city large numbers of invalids for medical treatment, many of whom are suffering with incurable disease. Of these several classes of persons, certain numbers die from diseases contracted elsewhere, and thus contribute to increase the ratio of mortality to the living population. Could New York eliminate these from her bills of mortality, she would be able to exhibit a death record far more creditable to her health administration than appears in the foregoing table. There are many conditions peculiar to cities which exert a considerable influence upon death-rates, and among these not the least in importance is that of the homes of the poor. The crowded tenement-houses of New York give a large percentage of infant mortality, though we shall presently see that this is yearly decreasing, while the more comfortable homes of Philadelphia give a death-rate, both of adults and infants, considerably below that of her sister city. The peculiar shape of one city, bounded as it is by two large rivers and extending only in one direction, makes it necessary, in the absence of cheap and rapid transit, for the laboring classes to reside in near proximity to the places of their daily labors, and hence this apparent necessity of accommodating large numbers of people within limited areas. The other city, its area extending in different directions, affords comfortable homes for its laboring classes without adopting the system of crowded tenements so common in New York. Thus, the poor in Philadelphia have more breathing-space than the city of New York affords to its poor, and are less exposed to contagion, the danger from which is always in proportion to the amount of crowding.

Continued extremes of temperature, it is well known, tend to increase death-rates, in spite of all sanitary efforts to the contrary. During a protracted term of hot weather numbers die from diseases traced directly to the excessive heat, while many invalids and persons debilitated from age and other causes, not being able to withstand this additional tax upon their vital powers, have their deaths hastened by their original complaints plus the exhausting influences of long-continued heat. Excessive death-rates during heated terms are sometimes followed by low death-rates for a number of weeks, from the fact that so many invalids and sickly persons having died during the hot weather, those who are left enjoy more than an average degree of health. Severe cold also has the effect to increase death-rates by pneumonia, pleurisy, etc., while it is well known that the very old and the very young are peculiarly susceptible to the effects of low temperature.

The greatest number of deaths occur during the third quarter of the year, and the smallest during the fourth quarter. The first and second quarters have nearly the same proportion, sometimes one excelling in the number of deaths, and sometimes the other. The time of day at which the greatest number of persons die has been made a subject of study by many vital statisticians, though with somewhat varying results. While Baek of Hamburg, Schneider of Berlin, and Quételet of Belgium found that the greatest number of deaths occurred between midnight and 6 o'clock A. M., Watson of Glasgow and some others found that the greatest number died between the hours of 6 A. M. and 12 noon.

The subject of infant mortality is one of great interest alike to the sanitarian and the philanthropist. It is a melancholy fact, as seen by the foregoing table, that of all the deaths which occur throughout the world, a large percentage is of children under five years of age. This is more so in cities, where there are large tenement populations, and less so in the country, where the children are fed upon good milk and are allowed to breathe a pure atmosphere. In cities it is necessary for health authorities to pay a good deal of attention to the sanitary wants of tenement populations, with a view of saving infant life. The following table of yearly deaths in the city of New York since 1867 will show what sanitary effort in that city has accomplished toward reducing the percentage of infant mortality:

Year.	Total deaths.	Deaths under 5 years of age.	Percentage under 5 years.
1867	23,264	12,274	52.99
1868	24,705	13,067	52.50
1869	25,167	12,859	51.09
1870	27,174	13,333	49.06
1871	26,976	12,971	48.08
1872	32,423	16,188	49.58
1873	29,027	14,182	48.76
1874	28,589	13,956	48.81
1875	30,623	14,839	48.28

From the above table it will be seen that since the year 1867 the ratio of infant mortality to the total mortality has diminished from 52.99 to 48.28 per cent. The percentage of infant mortality in 1867 being 52.99, that of the remaining mortality (all over five years of age) was of course 47.01. If from 30,623, the total number of deaths occurring in 1875, we subtract 14,839 deaths under five years of age, we have left 15,784 deaths of those over five years of age. Now, estimating on the ratio of 1867, we have 47.01 : 52.99 :: 15,784 : x = 17,791, the number of deaths under five years that would have occurred in 1875 had the ratio of 1867 continued. If now from 17,791 we subtract 14,839, the actual number of infant deaths, we find that we have a saving of 2952 children; and furthermore, as it is estimated that for each death there are 28 cases of sickness, 2952 × 28 = 82,656, therefore in the saving of the lives of 2952 children, as compared with the ratio of 1867, we have as a gratifying consequence 82,656 cases of serious illness prevented.

In order that vital statistics may be of the greatest value, it is important that they be complete in every branch of the science. While the necessity for burial-permits secures a full report of all deaths and still-births, those of marriages and living births are not so easily secured. Clergymen may sometimes by negligence forget to make returns of marriages which they solemnize, and physicians may fail to report in full all of the births which occur under their care; and furthermore, many births take place without any medical attendant, and on such an occasion the poor woman who in haste runs in to assist a neighbor in her extremity has not the least suspicion that she is bound by any law to report the event which has occurred under her observation, and thus it is that a considerable number of births among the poor are never registered.

The value of a complete system of collecting and preserving vital statistics is appreciated by the medical man, the sanitarian, and life insurance companies. By it physicians are enabled to determine the percentage of mortality attending each disease, the ages at which certain diseases are most common and most fatal, and many other matters which may be to them of practical value. It will enable sanitarians to determine the degree of success attending their efforts to raise the standard of public health, by comparing the birth and death rates of one year with those of another, a steady decline in the death-rate year by year, with a marked increase in the yearly number of births, showing that the causes of sickness and mortality are diminishing, and that we are nearing the condition in which inevitable deaths alone figure in the records. Some striking evidence of the good results following the introduction of sanitary works is afforded by the following extract from a table compiled by Dr. Buchanan and published in the ninth annual report to the privy council. It illustrates the improvement resulting from the introduction of works of drainage and water-supply, by showing the difference in the ratio of deaths per 10,000 inhabitants before and after the works were introduced:

Population.	Towns.	General death-rates.		Typhoid fever.		Phthisis.		Infant mortality.	
		Before.	After.	Before.	After.	Before.	After.	Before.	After.
160,714	Bristol	245½	242	10	6½	31	25¼	54	52
68,056	Leicester	264	252	14⅓	7¼	43½	29½	84½	81
52,778	Merthyr	332	262	21½	8⅔	38⅔	34½	80½	61
39,693	Cheltenham	194	185	8	4⅓	28⅔	21½	40½	37
32,954	Cardiff	332	226	17½	10⅓	34¼	28⅔	?	?
30,229	Croydon	237	190	15	5⅓	?	?	?	?
29,417	Carlisle	284	261	10	9⅔	32	35⅔	71	65½
27,475	Macclesfield	298	237	14½	8⅓	51½	35⅔	77½	59⅔
24,756	Newport	318	216½	16½	10⅓	37	25	67½	53½
23,108	Dover	225½	209	14	9	26½	21½	47⅔	46½
10,570	Warwick	227	210	19	9	40	32½	51½	46⅔
10,238	Banbury	234	205	16	8½	26⅔	15⅔	53	45

From a careful study of vital statistics the life insurance actuary derives most of his knowledge concerning the probable duration of life under varying circumstances and conditions and at successive periods. By making himself familiar with the ratio of births to the population, the number of children dying during the first year, ratio of sickness to population, the ratio of deaths to the living, the ages of those who die, and the various other changes in population caused by emigration, immigration, etc., he is enabled to construct his tables of the expectation of life at various ages. The following table, abridged from Dr. Farr's life tables by Dr. Parkes (*Pract. Hygiene*, 3d ed. p. 516), is sufficient to illustrate their construction and signification. (See also, for further information on this topic, the *Table of Mortality* in the article on LIFE ASSURANCE, in CYCLOPÆDIA.)

Expectation of Life in England.

Age.	Males.	Females.	Age.	Males.	Females.	Age.	Males.	Females.
0	39.91	41.85	10	47.05	47 67	70	8.45	9.02
1	46.65	47.31	20	39.48	40.29	80	4.93	5.26
2	48.83	49.40	30	32.76	33.81	90	2.84	3.01
3	49 61	50.20	40	26.06	27.34	95	2.17	2.29
4	49.81	50.43	50	19.54	20.75	100	1.68	1.76
5	49.71	50.33	60	13.53	14.34			

It will be seen from this table that after the first year the chances of living increase up to the fourth year, and that they then begin slowly to lessen. It will also be seen that throughout the different periods of life the chances of females are a little above those of males. The "probable duration of life" is the age at which a given number of children born into the world at the same time will be reduced one-half; while "the expectation of life" is the average length of time a person of any age may be expected to live. This latter is regarded as the true test of the health of the people. But circumstances other than age must be considered as affecting the expectancy of life. According to Mr. Radcliffe, rural laborers may expect on an average to live 45.32 years; carpenters, 45.28; domestic servants, 42.03; sawyers, 42.02; bakers, 41.92; shoemakers, 40.87; weavers, 41.92; tailors, 39.40; hatters, 38.91; stonemasons, 38.19; plumbers, 38.13; mill operatives, 38.09; blacksmiths, 37.96; bricklayers, 37.70; printers, 36.66; clerks, 34.99; and the average population of England and Wales, 39.88 years. Dr. Guy, in the *Journal* of the Statistical Society (London, vol. ix. p. 346), gives the average age attained by persons who have survived their fifty-second birth-day as follows: clergy, 74.04; gentry, 74.00; medical men, 72.95; lawyers, 72.78; navy, 72.62; commercial men, 72.32; literary and scientific (native), 72.10; aristocracy, 71.69; army, 71.58; literary and scientific (foreign), 71.44; fine arts, 71.15; painters, 70.96; chemists, 69.71; kings of England, 64.12. Statisticians of other countries have presented similar statements which do not vary much from the foregoing. According to the studies of Casper of Berlin, of 100 theologians, 42 attained the age of 70 years; and of the same number of commercial men, lawyers, and physicians, the numbers attaining the age of 70 are respectively 35, 29, and 24. It may be inferred from the above references that the condition most favorable to longevity is a life not subject to excess of either bodily or mental labor, but in which a fair competence is enjoyed from moderate and steady occupation at some calling not in itself injurious to health. E. H. JANES.

W.

Wads'worth (STRONG), b. at Hastings, Oswego co., N. Y., Sept. 10, 1833; removed 1845 to Chicago; graduated at Yale College 1851; studied law in the office of J. Young Scammon at Chicago; was admitted to the bar 1853, but soon gave up practice, and was afterward for many years engaged in banking. In 1864 he removed to New York, joined the Stock Exchange 1868, and has since been occupied almost wholly with the business of stock-brokerage. In 1874 he was for a short period connected with the New York *Times* as financial editor.

Wake'ley (JOSEPH B.), b. at Danbury, Conn., in 1804; was apprenticed at an early age to a hat manufacturer of that place, but studied subsequently for the ministry; was admitted in 1828 to the New York conference; labored in New York, Trenton, Jersey City, and Newark; settled in 1857 at Poughkeepsie; was subsequently appointed pastor of the Lexington Avenue church. D. in New York Apr. 27, 1876. He is the author of *Lost Chapters recovered from the History of Methodism*, the *Temperance Cyclopædia*, etc.

Wal'do (LEONARD), b. at Cincinnati, O., Mar. 4, 1853; graduated at Woodward College 1871, and subsequently at Marietta in 1872; spent some little time at the Cincinnati Observatory, and, entering the School of Mines, Columbia College, New York, was appointed assistant in the observatory of that institution, then just completed, in 1873; the following year (1874) was appointed by the secretary of the navy assistant astronomer U. S. transit-of-Venus expedition, and in that capacity, representing Columbia College, accompanied the chief of the expedition to one of the most important stations, Hobart Town, Tasmania; the succeeding year (1875) was appointed assistant at Harvard College Observatory, Cambridge, Mass., where he now resides.

Walk'er (JOSEPH REDDEFORD), b. at Knoxville, Tenn., in 1798; removed to Jackson co., Mo., in 1818; began his career as a mountaineer and guide on the frontier in 1822; was guide to Bonneville's expedition to the Rocky Mountains in 1832; conducted a party from Great Salt Lake to California, discovering Walker's River and Lake and Yosemite Valley in 1833; found Walker's Pass in 1834; and made many subsequent trips across the Plains. D. Oct. 27, 1876, at Ygnacio Valley, Contra Costa co., Cal., where he resided during the latter part of his life.

Wal'laby, the Australian name applied as an equivalent of the generic name *Halmaturus*. The species so designated are kangaroos (Macropodidæ), which average next in size to the typical kangaroos of the genus *Macropus*, ranging up to fifty pounds in weight. The upper incisors of the third pair are comparatively elongate, and have rather narrow crowns and deep grooves, and the premolars are well developed and mostly persistent through life; they mostly "have a bridle-mark behind the shoulder and a horizontal stripe across the haunch." They are chiefly nocturnal in their habits. According to Krefft, sixteen species of the genus are known: of these, six are large and attain to nearly or quite fifty pounds in weight, and are the wallabies *par excellence*; three others range more or less below thirty pounds, and seven vary between ten and fifteen pounds. "The largest species live in Tasmania; the smallest are found in New South Wales and in West Australia." (*Krefft.*) THEODORE GILL.

Wallaroo', a name given to two species of kangaroos, constituting a section of the genus *Macropus*—viz. (1) *Macropus antilopinus*, the red wallaroo, and (2) *Macropus robustus*, the black wallaroo; the former inhabits the country about Fort Essington, and the latter the mountain-ranges of the coast of New South Wales.

THEODORE GILL.

Wal'ler (ELWYN), A. M., E. M., PH. D., b. in New York City Mar. 22, 1846; graduated at Harvard College in 1867, and at the School of Mines, Columbia College, in 1870; was appointed instructor of analytical chemistry in the latter institution in 1871, and assistant sanitary inspector (analyst to the metropolitan board of health) in 1872, and has published—*Disinfection and Disinfectants*, *Notes on Petroleum of San Domingo*, *New Method for the Quantitative Estimation of Carbolic Acid*, and several papers in the *American Chemist*.

Wal'ling (GEORGE WASHINGTON), b. in Monmouth co., N. J., May 1, 1823; prepared himself for the profession of the law until the death of his father in 1842; took employment on a steamboat as engineer; served during the Mexican war on a U. S. revenue cutter; settled in New York City after the close of the war; was appointed a police officer in 1847; promoted to captain in 1853, and to inspector in 1869, and was chosen superintendent of the entire police force of the metropolitan district in 1874.

Wal'ton (WILLIAM), D. D., b. at Teddington, Middlesex co., England, Aug. 30, 1810; came to New York in 1821; graduated at Columbia College in 1828; studied law, and was admitted to the bar, but gave up practising in 1835, and devoted himself to the study of theology; was ordained a deacon in 1838 and a priest in 1840; was rector of St. Paul's church, Tompkinsville, S. I.; editor of the *Churchman* 1849–52, and professor of Hebrew in the Theological Seminary of the Protestant Episcopal Church in New York. D. Sept. 21, 1869.

Wanderoo'. (I.) The common name of a monkey of the coast of Malabar—the *Macacus silenus* of authors—distinguished by its long hair and venerable appearance; whence it has been also called *Silenus veter*. The head is oblong and the face rather produced; the hair on each side of the face and on the neck and chest is elongated and forms a sort of ruff round the face, and is of a gray or whitish color; the face about the eyes is naked and flesh-colored; the snout black; the fur is mostly black on the back and sides, and whitish beneath and inside the limbs; the tail is rather short and tufted; it is chiefly brown, but its tuft is whitish. The species lives in the depth of the forests, and its appearance has given rise to several legends, and to the idea that it is the lord of the monkey race. It was known to the ancients, and has been supposed to be the "race of men" described by Ctesias as "inhabiting the mountains of India, having heads like dogs, but with larger teeth. They have nails, but larger and more rounded. They bark, but do not talk; they have tails like dogs, but

more hairy." It attains a length of about eighteen inches. II. The name is also given to, and in fact appears to have been primarily employed for, species of the genus *Semnopithecus*, and especially for the *S. leucoprymnus* of Ceylon, where the name is said to have originated.

THEODORE GILL.

Wap'iti, a name of the *Cervus canadensis*, or large deer of the Northern U. S. and British provinces. It is more generally called elk, but very improperly, inasmuch as that name belongs by right to the *Alces malchis*, otherwise called moose. The wapiti is very closely related to the common red deer or stag of Europe, but is a still larger and more noble looking beast, attaining the dimensions of a moderate sized horse. The color above and about the lower jaw is yellowish-brown; the circles around the eyes brown; the rump has a large pale disk extending far above the base of the tail, and with a black streak on each side of it; the tail is very short; the hoofs are broad and semicircular. Such are the chief characters alleged to differentiate the species from the *Cervus elaphus* of Europe. (See further DEER and ELK, in CYCLOPÆDIA.) THEODORE GILL.

War'blers, the popular name of numerous species of birds, mostly belonging to the so-called families Sylviidæ and Sylvicolidæ. The groups thus designated have been best distinguished by Baird, and essentially defined as follows:

I. The Sylviidæ have a slender, broad, and at base depressed bill, which is decurved and distinctly notched at the tip; the culmen is sharp-ridged at base; the rictal bristles extend beyond the nostrils; the frontal feathers reach to the nostrils; the nostrils are oval, protected by membrane, and overhung (but not concealed) by a few bristles or a feather; the wings are moderate and more or less pointed, and have each ten primaries, of which the first or spurious is almost half as long as the second; the tarsi are booted or scutellate; of the toes the lateral are subequal, and the middle has its basal joint attached for its whole length externally and halfway internally. The group as thus defined is quite comprehensive, and has been differentiated into the sub-families Sylviinæ, Regulinæ, and Polioptilinæ. It is to the first that most of the warblers of England and the Old World generally belong. This contains nearly 150 species, most of which are confined to Europe, Asia, and Africa, although a few are peculiar to Australia, and one species (*Phyllopneuste borealis*) is an occasional visitor to North-western America from Asia. The species resemble considerably in external appearance and habits the warblers of North America, which belong to the family Sylvicolidæ, but their differences may be appreciated by a comparison of their characters above given with those of the latter, below appended.

II. The Sylvicolidæ have also a slender bill, which is conical or depressed, and has the culmen straight or convex; there is no distinct notch; rictal bristles are variously developed; the nostrils are oval and rounded; the wings are moderate and rather rounded or bluntly angulated, and have each nine primaries, of which the first is nearly as long as the second or third; the tertials are generally not longer than the secondaries, and not emarginated; the tarsi are distinctly scutellate along their entire front faces; the lateral toes are nearly or quite equal; the middle has its basal joint nearly free to its base externally, but united for about half its length internally; the claws are all much curved, and the hind one not much longer than the median anterior. The forms thus combined, according to Baird, "are essentially characterized among the Oscines with nine primaries by their small size, the usually slender and conical insectivorous bill, shorter than the head, without angle in the gape near the base; the toes deeply cleft, so as to leave the inner one free almost to its very base (except in Mnioltilteæ), etc. The shallow notch at the end of the tongue, instead of a deeply-fissured tip, distinguishes the family from the Cœrebidæ, to some of which there is otherwise so great a resemblance. The absence of abrupt hook and notch in both mandibles separates it from such of the Vireonidæ as have nine primaries." The distinction of the group as a family is of very questionable policy, but the group as defined by Baird is apparently a natural one, and has been adopted by recent authors (*e. g.* Carus, Gray, Sclater and Salvin, etc.) either under the name Sylvicolidæ or Mnioltiltidæ. The forms are peculiar to America, and are quite numerous, between 110 and 120 species being known. They are all of small size; they feed mostly on insects. Some are quite agreeable songsters, and, as their name indicates, "warblers," but none are famous for musical ability. About 18 genera are recognized by the most recent writers on American birds, and by Baird, etc., they have been segregated under four sub-families and minor sections—viz. (1) Sylvicolinæ, with the sections Mnioltilteæ, Vermivoreæ, and Sylvicoleæ or Dendrœceæ; (2) Sciurinæ, with the groups Sciureæ and Geothlypeæ; (3) Icteriaæ, with the groups Icteriæ and Teritristeæ; and (4) Setophaginæ, with the groups Setophageæ, Myiodioeteæ, and Cardellineæ. THEODORE GILL.

Warehousing System, a plan adopted by governments for lessening the pressure of the duties levied by the tariff upon the importer by retaining the goods on which they are levied in the possession of the government, and postponing the payment of the duties until the goods are to be delivered to the parties to whom they are sold. The cost of maintaining the bonded warehouses with their storekeepers comes out of the importer in storage charges, which are a little higher than those of private warehouses, but the interest of the money saved by the postponement of the payment of duties usually more than offsets this. Although this would seem to be the most obvious method of relieving the importer from the hardship of having to pay duties long before the goods could be sold, it is somewhat remarkable that the system has been adopted but recently in Great Britain and in the U. S. It was first proposed in Great Britain by Sir Robert Walpole in 1733 as a part of his excise scheme, but was defeated. The principle was first recognized in 1802, but has been repeatedly and materially modified at each change and consolidation of the customs laws. In 1846 there was a separate "act for the warehousing of goods." In 1853 the warehousing system formed a considerable portion of the text of the customs consolidation act. In the U. S. the warehousing system, though agitated and petitioned for by the Philadelphia Chamber of Commerce in 1828, and urged by both the Philadelphia and New York chambers in 1838, was not established till Aug. 6, 1846. Previous to this time, and probably as early as 1819 or 1820, it had been the practice of the government to give the importers credit on the payment of the duties upon their filing satisfactory bonds. It was proposed in 1828 and in 1838 to require the cash payment of all duties in connection with the warehouse system; this proposition was strongly opposed by the New York Chamber of Commerce on both occasions, though accepted by the Philadelphia Chamber. When it was finally established the old credit system on importations was abandoned, and the immediate payment of duties was only postponed on those goods which were warehoused. The principal provisions of the act of Aug. 6, 1846, were—that the payment of all duties in cash on the entry of the goods was henceforth to be the rule, but that unclaimed goods, and goods not wanted for immediate consumption by the importer, might be sent to the public stores or such other warehouses as the collector and importer might agree upon, the importer giving bonds with sufficient sureties in twice the amount of the duties for their payment, together with all other charges, when the goods were withdrawn from the warehouse. As there might be cases in which the importer would desire to withdraw from bond a portion of his goods at a time, it was provided that where the goods were in packages, nothing less than an entire package should be withdrawn, and where they were in bulk, not less than one ton, except on special order from the secretary of the treasury. Subsequent provisions were made at a later date for the repacking under proper supervision and conditions of goods in bond where this was found necessary. By the act of Aug. 6, 1846, goods were allowed to be withdrawn for exportation without the payment of duties on the payment of the storage and other expenses. It was provided also that all goods remaining in the public stores or bonded warehouses for more than a year might be sold at auction after appraisal, and the excess, if any, over duties and expenses should be paid over to the importer, consignee, or agent, a receipt being taken therefor; but if such excess was not claimed within ten days, the collector was directed to pay it into the U. S. treasury, giving complete information concerning the sale to the treasury department, and that department then assumed to itself the responsibility for all claims of the owners of the goods, releasing the master or owners of the vessel which brought them from such claims. Perishable and explosive goods might be sold in less than a year if not removed and the duties and expenses paid. Provision was also made for the transportation of goods from one port to another by the giving of bonds in double the amount of the duties, such bonds being cancelled when they were deposited in a bonded warehouse in the collection district to which they had been transported, but the time during which they should be kept in the warehouse should not be extended in consequence of this removal. Suitable penalties were prescribed for removing or fraudulently gaining access to warehoused goods, and for any attempt to alter or efface any marks placed thereon by a revenue officer. The collector was required to make quarterly (afterward changed to monthly) returns of all goods remaining in the warehouses, which returns were to be published in papers in Washington. The secretary of the treasury was authorized

to make such regulations, not inconsistent with the laws of the U. S., as he should see proper from time to time, and to report the same to the next session of Congress. In Aug., 1854, this act was amended in some important particulars. Hitherto, the policy of the government had been to own or lease its warehouses, and store all goods under bond therein: but its policy was now changed, and the establishment of private bonded warehouses encouraged, the proprietors of which were required to pay the salary of the government storekeeper and other government charges, and to collect from the importers or consignees of the goods certain rates of storage, cartage, etc., which should be established by a joint board. Where these private bonded warehouses were established in sufficient numbers, the whole warehousing business was to be relinquished to them, the government neither leasing nor owning any bonded warehouses; but in those ports where there were no private bonded warehouses the collector was authorized to maintain government warehouses. There are now no government warehouses in the port of New York, nor, we believe, in any other of our largest ports. There have been some later amendments to this act, affecting only minor details. The regulations of the secretaries of the treasury are issued from time to time, but concern only the classification of warehouses and the details of their management. Under the provisions of this act and the amendments thereto the warehouses in which unclaimed and bonded merchandise may be stored are divided into six classes—viz. *Class I.* Stores owned or hired by the U. S. These are to be maintained only in those ports and cities in which there are no private bonded warehouses, and are intended for the warehousing of unclaimed goods and of foreign goods. In these the labor and charges for storage, etc., come directly from the owners of the goods. *Class II.* Warehouses in the possession of an importer and in his sole occupancy, which he may desire to place under the customs lock, in addition to his own lock, for the purpose of storing dutiable merchandise imported by himself or consigned to him, or purchased by him in bond. The entire building must be appropriated to this sole purpose, and the importer must pay for the services of the customs officer in charge such sum as the collector of the port deems fair and proper. *Class III.* Warehouses in the occupancy of persons desiring to engage in the business of storing dutiable merchandise under the warehouse acts, and of performing the labor on such goods in what is usually termed the storage business. These warehouses must be used solely for the storage of warehoused goods and of unclaimed and seized goods, and must consist of an entire building. *Class IV.* Yards or sheds of suitable construction for the storage of wood, coal, mahogany, dyewoods, lumber, molasses, sugar in hogsheads and tierces, railroad, pig, and bar iron, anchors, chain cables, and other articles specially authorized. These yards or sheds must be built and enclosed in a prescribed way. *Class V.* Bins or parts of warehouses or elevators separated from the rest of the building may be bonded for the storage of grains. *Class VI.* Cellars or vaults may be used, under certain prescribed conditions, as bonded warehouses for the storage of wines and distilled spirits only. Warehousing when practised under the third class, and to some extent under the fourth, is usually known as general-order business. In the port of New York there are about 260 bonded warehouses belonging to Class III.; 2 belonging to Class II.; 15 belonging to Class IV. The number belonging to Classes V. and VI. is small, but is not reported. The rates of storage and labor in New York for the different kinds of goods imported are prescribed by a joint committee appointed by the Chamber of Commerce, the collector of the port, and the proprietors of private bonded warehouses.

Date of monthly reports.	Warehoused.	Withdrawn from warehouse.	Remaining in warehouse.	Total withdrawn and remaining in warehouse.
	$	$	$	$
July 1, 1870	76,874,135	18,078,327	58,795,808	76,874,135
July 1, 1871	89,691,281	21,366,622	68,324,659	89,691,281
July 1, 1872	155,791,265	33,579,999	122,211,266	155,791,265
July 1, 1873	96,144,964	18,560,986	77,583,978	96,144,964
July 1, 1874	75,850,707	16,150,589	59,700,218	75,850,707
July 1, 1875	70,409,346	13,702,344	56,707,002	70,409,346
July 1, 1876	56,230,663	13,125,711	43,104,952	56,230,663

Annual statement.	Entered for consumption.	Entered for warehouse.	Entered for immediate transportation.	Total importation of the year.
	$	$	$	$
For year ending July 1, 1875	393,371,697	152,562,872	7,971,584	553,906,153
For year ending July 1, 1876	338,987,753	128,567,978	9,122,140	476,677,871
Decrease, 1876	54,383,944	23,994,894	*1,150,556	†77,228,382

* Increase. † Decrease.

The foregoing table shows the amount of goods warehoused, withdrawn, and remaining at the dates named.

(For many facts and statistics contained in this article we are indebted to Samuel P. Rossell, Esq., warehouse superintendent of the New York custom-house, and to George Wilson, Esq., secretary of the New York Chamber of Commerce.) L. P. Brockett.

Warm-blooded Animals, those vertebrates possessed of warm blood, and which is such simply by virtue of a complete circulation of the fluid, and its aëration through the medium of lungs at each revolution. The animals must consequently all breathe air direct, and this is done by the fish-like whales and porpoises as well as by the true terrestrial quadrupeds and birds. The only warm-blooded animals are the mammals and birds, and these were almost always collocated by the older naturalists under the name above signalized or its equivalents, "Calida animalia," "Hæmatotherma," etc. This combination is now known, however, not to be a natural one, inasmuch as the birds are much more nearly related to the reptiles than to the mammals, and the character combining them is a mere physiological adaptation for the same functions of life. (See also Vertebrates.) Theodore Gill.

Warming and Ventilation of Buildings. These two subjects are so closely connected as to make it desirable to treat of both in the same article; for it is now generally admitted that no system of warming inhabited buildings can be pronounced complete which does not include arrangements for ventilation.

When a building or room exposed to outside cooling influences has once attained the proper temperature, it is only necessary, in order to maintain its warmth, to furnish sufficient heat to replace the continual loss by transmission through the walls, window-glass, and roof, in addition to what is needed for warming to the temperature of the room all the cold air that may enter. When the heating apparatus is outside the apartments, sufficient air must be admitted to convey the heat generated by the heater into the rooms; and this air may be more than is required for ventilation. A cubic foot of air at zero and atmospheric pressure requires 0.02 heat-unit to warm it 1°, and therefore 1.4 heat-units to warm it to 70°.‡ The transmission of heat is in direct proportion to the difference between the temperature of the air outside and inside the walls. According to Peclet's data, when the outside air is calm at −10° and the inside air at 70°, the transmission per square foot of wall-surface through a solid wall and through a wall lined with lath and plaster 1 inch thick, separated from the wall by a 2-inch air-space, is as follows:

Kind of wall.	Thickness of brick or stone.				
	8 ins.	12 ins.	24 ins.	30 ins.	
Solid wall, brick	23	18	11		Heat-units per hour.
" stone	...	31	24	22	
Plastered wall, brick	17	14	10		
" " stone	...	21	17	16	

These numbers apply to partitioned buildings or to buildings having several stories, but not to high empty buildings, like churches, for which the transmission is less. Each square foot of window-glass from $\frac{1}{16}$ to $\frac{3}{8}$ inches thick, in a building warmed to 70°, transmits 40 to 45 heat-units per hour in calm weather, when the outside air is at −10°, and nearly twice as much when exposed to a high wind at that temperature. With double windows not less than 1 inch apart the loss in calm weather is about two-thirds the loss through a single window, but the saving by their use is much greater when the wind blows than when the air is quiet. In a cold climate the maximum cooling influences may be of long duration; the heating apparatus therefore must be of sufficient capacity to provide for the maximum loss of heat, instead of the mean loss, and to furnish enough heat during a few hours of the morning to compensate for a deficiency which may result from a less active heating effect through the night.

It is customary in designing a heating apparatus for any building to make the heating surface proportional to the cubic contents of the apartments; but as the cooling of the rooms does not depend on their capacity, but on the quantity of cold air supplied to them, and on the extent and character of their walls, no general rules can be useful which do not take these details into account.

Only a few of the many appliances for utilizing the heat of fuel can be noticed in this article.

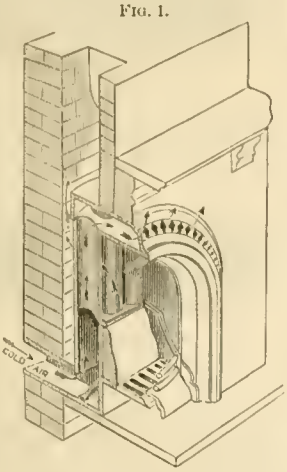
Although the open grate is the most popular device for warming apartments in dwellings, it cannot be depended on in its common forms as the only source of heat in a cold climate. The large volume of air which passes into the open

‡ In this article English units and Fahrenheit temperatures are used. (See article Heat, in Cyclopædia.)

chimney-throat must be replaced by out-door air, which flows into the room through the crevices of the doors and windows, and produces uncomfortable and dangerous draughts. Experiments show that only 12 to 14 per cent. of the heat produced by the fuel is rendered available in an open chimney-grate of good form and proportions, being only from one-fourth to one third of the heat due to radiation alone. The grate is then uneconomical, and, in view of the other defects, cannot be pronounced desirable as the only means of warming a room. Yet certain advantages are recognized universally. The genial effect of the luminous rays striking directly on the person, and the benefit of inhaling cool air while the surrounding objects are warmed sufficiently to prevent undue abstraction of heat by radiation from the body, cannot be overlooked. These render the open fire a delightful source of heat when used in connection with a hot-air furnace, which introduces into the room the supply of air demanded by the chimney warmed to a comfortable temperature, and prevents an inflow at doors and windows by supplying the demand through the registers. The ventilating power of the open chimney, then, becomes an invaluable means of changing the air of an apartment and maintaining a healthful atmosphere.

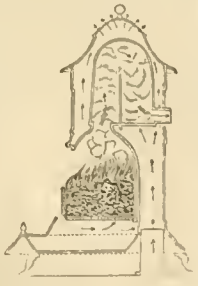
The advantages secured by combining the fireplace and furnace can be obtained also from "ventilating fireplaces" and from "ventilating stoves," of which the original Franklin stove is an ancient type. The essential features of Franklin's invention are not, however, usually carried out in the stoves which bear his name, for the admission of fresh out-door air to the stove is seldom provided for. A good example of the ventilating fireplace was exhibited in the English department of the Centennial Exposition. The principal features of this grate are shown in Fig. 1. It is virtually a double-cased open stove set in the chimney. The gases of combustion pass into the chimney-flue between pipes which connect the upper and lower portions of the double case at the back. Fresh out-door air is admitted inside the double case, and, after being warmed by contact with the extensive surface afforded by the back of the grate and the inside of the pipes, the air enters the room through openings in the front piece, which has the appearance of the usual ornamental mantel setting.

Fig. 1.



An excellent open-grate ventilating stove, called "the fire on the hearth," was exhibited in the U. S. section of the Exposition. A sectional view is given in Fig. 2. This is a double-cased open stove, intended to stand out in the room. The space between the two cases is open at the bottom, and forms a channel through which the air of the room or fresh air from out doors can circulate and become heated, after which it issues into the room through the perforated top. The course of the hot gases in the stove and of the air between the cases is shown in the figure by arrows. The cast-iron base of the stove, arranged to take fresh out-door air from a cold air-box beneath the floor, is represented in Fig. 3. To secure a uniform temperature at different heights in the room, it is desirable that a portion of the air-supply to the case shall flow from the bottom of the room, and space is left for this purpose around the fresh-air pipe, which, as Fig. 3 shows, does not fill the opening in the base.

Fig. 2.



Close stoves do not assist essentially in promoting ventilation, for the quantity of air withdrawn from the room is only what is needed to support combustion. Morin estimates the ventilation from these to be less than 120 cubic feet of air for every pound of coal consumed. Simple close stoves act imperfectly even in warming a room, for the circulation of air they produce is so sluggish that the temperature of the room varies greatly at different heights. Ruttan, whose observations were made in Canada, states that in a stove-heated basement room over a cold cellar he has frequently seen water freeze on the floor when the temperature of the air at the ceiling was 100°, and has often observed a difference of 1½° in the temperature of the air for every foot of height in a stove-heated school room 16 feet high which was exposed on two sides to outside air at zero. But if a casing is arranged around a stove, with a space between it and the stove for air to enter from near the floor and issue at the top of the stove, a rapid circulation of the air of the room is produced and the temperature equalized.

Fig. 3.

Hot-air furnaces are simply encased stoves placed outside the apartments to be warmed, usually in basements and cellars. They act indirectly by warming air which passes from them into the rooms, and which ought always to be taken from out doors rather than from the cellar, the latter plan being dangerous to health. Several important points must be considered in proportioning and placing a furnace, in order to secure a healthful condition of the heated air. The most essential, perhaps, is a good chimney-draught, which ought always to exceed the draught-power of hot-air pipes, whose powerful action is shown by the force with which the warm air issues from the registers. It is neglect of this requirement, or the inability to meet it, which occasions the prevalent trouble of a leakage of coal-gas into the house; for if the chimney-draught exceeds that of the air-pipes, there will be a tendency for the surrounding air to flow *into* the furnace through whatever open joints there may be, and it will be impossible for the gases to escape in opposition to this inward pressure. But if the chimney-draught be sluggish or its action unduly checked, the contrary effect necessarily results. It is therefore important that the combustion in the furnace be controlled entirely *by regulating the apertures for the admission of air below the grate*, rather than by a damper or draught-check in the smoke-pipe. This can be done only by ensuring that all joints below the grate shall be practically air-tight.

To obtain economy of fuel the heating-surface must be large in proportion to the grate-surface. Gen. Morin recommends that it be made from 150 to 200 times greater, but this proportion is unnecessarily large for a cold climate, at least if the furnace is so arranged that the fresh air will be brought into close contact with the heating-surface and pass rapidly over it. A rule for proportioning the surface which is more nearly in accordance with good American practice is to provide 10 square feet of heating-surface for every pound of coal consumed per hour when the combustion is active, and to make the grate-area about $\frac{1}{20}$th that of the heating-surface. It may be estimated that one-half of the fuel required to warm a dwelling in the coldest month is burned during the ten coldest days, and two-thirds of this daily consumption occurs during the ten hours of daylight; so that the hourly consumption in a cold day may be $\frac{1}{300}$th of the greatest monthly consumption; and the furnace should be proportioned to this demand. Its useful heating efficiency may be from 60 to 70 per cent. of the heat produced by the fuel.

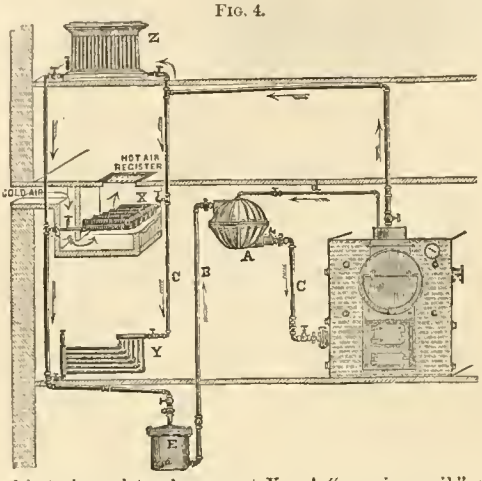
In order that the air which enters the room may not be overheated, it is only necessary to provide sufficiently liberal channels through the furnace for its passage, while suitable ventilation must be secured in the house by which the quantity of air required to absorb the heat without becoming too warm may be drawn through the furnace. The area of the smallest part of the inlet for cold air should be one-sixth of a square foot for every pound of coal burned per hour in cold weather, this being estimated at $\frac{1}{300}$th of the probable monthly consumption, as stated above; and to prevent, in a measure, the possible inconvenience of one pipe drawing air from another, the collective area of the hot-air pipes should not be more than one sixth greater than the least area of the cold-air inlets. These proportions are established by assuming that the heated fresh air shall enter the rooms at a temperature of about 120° when at zero outside, and its velocity in the hot-air pipes not exceed 5 feet per second.

Cast iron when highly heated is permeable to hydrogen and carbonic oxide gases, and on that account wrought-iron plate has been recommended as a more suitable material for the heating-surfaces of furnaces. The liability to the vitiation of the air in this way is greatly lessened by having the fire-pot lined, and by locating it entirely within the furnace-shell, and separate from it, so that the fresh air

cannot come in contact with the fuel-chamber. The diffusion of gases referred to in this connection cannot be prevented by the draught of the chimney, for it will occur in opposition to a considerable counter-pressure.

Steam (for the properties of which see the article STEAM) is the most convenient medium for conveying heat to a distance from its source, and on this account it is generally used in factories and public buildings. Two systems of steam-heating are employed—one corresponding to heating by stoves, and the other by furnaces. In the first or direct method the heater stands in the room which is to be warmed, while in the indirect method it is placed in the cellar or basement, and warms the out-door air which is led into the room. Several forms of steam-heaters are shown in Fig. 4. An indirect heater with its cold-air box

FIG. 4.



and hot-air register is seen at X. A "running coil" of parallel pipes, indicated by Y, serves as a direct heater. These coils lie along the walls of a building, and the ends of the pipes are turned upward to permit unequal expansion of the horizontal portions to take place without straining the joints. Another form of direct radiator or steam-stove is represented at Z, consisting of a cluster of short vertical pipes closed at the top, but opening at the lower ends into a cast-iron box which forms the steam-chamber and base of the radiator. The boiler for supplying steam and the various pipes are shown, also a particular form of steam-trap which will be described. Direct heaters are quite properly called radiators, as they give out heat by radiation as well as by contact with the air of the room. But indirect heaters part with heat chiefly by communicating it to the air which passes over them.

Steam when saturated, which is its ordinary condition, parts with heat only in condensing, and the water which is formed in a steam-heater by the condensation is an exact measure of the quantity of heat given off by the steam to the air and surrounding objects. The quantity of heat given by any form of direct-steam radiator is nearly in proportion to the difference of temperature between the steam within the radiator and the air of the room in which it stands. It varies slightly with the temperature of the walls of the room, and greatly with the form and condition of the radiating surface. The kind or thickness of the metal of the heater has but little effect within practical limits, for the quantity of heat which can be conducted through the thickness of metal usually employed is much greater than can be carried away from the surface by radiation and contact of air. Polishing the surface diminishes its radiating power materially.

A horizontal cast-iron pipe $\frac{3}{4}$ inch thick and 12 inches diameter, and a radiator composed of thin wrought-iron vertical pipes, like the one shown in Fig. 4 at Z, each gave 690 heat-units per hour per square foot of outside surface when supplied with steam at 40 pounds pressure, and standing in a room whose air was maintained at 70°; while a radiator like the last, but with thin, polished brass pipes, yielded only 540 units. It may be assumed that rows of unpolished horizontal iron pipes or short vertical pipes will yield $3\frac{1}{2}$ heat-units per hour per square foot of outside surface for each degree difference of temperature between the steam and the air of the room, when this difference amounts to 300°, and nearly 3 units when the difference is 180°.

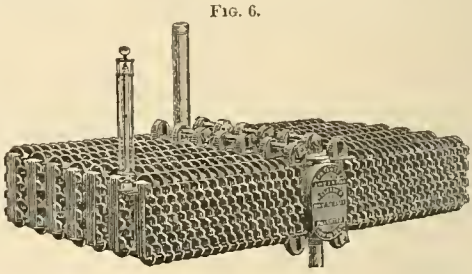
Extensions of the surface formed by projecting spurs or "gills" on the outside of a steam-filled pipe or box are only about half as valuable for direct radiating surface as the plain surface of the box between the spurs; but as both sides of the spurs are exposed, while only one side of the plain surface acts as a radiator, twice as much surface is afforded by the spurs for the same weight of metal as is given by the plain surface; and the extended surface is not uneconomical in first cost.

In indirect heaters some kinds of extended surface are peculiarly valuable. Several forms of these heaters are illustrated. Fig. 5 shows a cluster of plain, flat pipes set

FIG. 5.

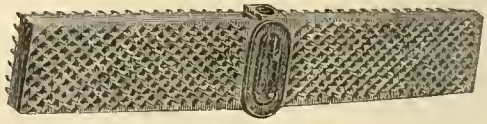
on edge, through which steam circulates, and between and around which the fresh air passes on its way to the room. A similar cluster of steam-boxes, whose outside is provided with extended surface formed by thin projecting gills ar-

FIG. 6.



ranged in rows with the gills over one another, as shown in Fig. 6, while a single element of a cluster is represented in Fig. 7. In this last, however, the extended surface consists of projecting conical spurs which are in quincunx

FIG. 7.



order, by which is meant that the spurs in one row stand over the spaces in the next. This difference of arrangement has an important effect on the heating efficiency of the surface. The heat which an indirect heater yields to the air varies directly with the difference between the temperature of the steam in the heater and that of the cold air when it first strikes the heating-surface; it increases in a peculiar proportion, varying for every different heater, with the velocity with which the air passes over the heater.

In estimating the extent of surface of these heaters, the whole of the exposed surface, even of the projecting spurs or gills, is measured, and their heating effects per square foot of external surface are given below, denoting the indirect heaters shown in Figs. 5, 6, and 7 by the letters A, B, and C, respectively. The heat-units given out per hour for each degree Fahrenheit difference of temperature between the entering air and the steam, with different quantities of air passed over them stated in cubic feet per hour per square foot of surface, are as follows:

Cubic feet of air per square foot.	Kind of heater.			
	A.	B.	C.	
100	1.3	1.3	1.5	Heat-units per hour.
200	1.7	1.9	2.9	
300	2.0	2.5	3.7	
400	2.2	3.0	4.7	

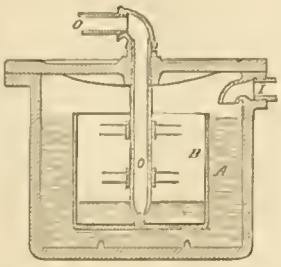
And if the steam be at 40 pounds gauge-pressure, with the entering air at zero Fahrenheit, then the temperature of the air as it issues from the heater will be—

Cubic feet of air per square foot.	Kind of heater.			
	A.	B.	C.	
100	176°	179°	213°	Temperatures Fahrenheit.
200	119°	136°	186°	
300	93°	115°	171°	
400	77°	103°	162°	

The air may lose its heat rapidly after leaving the heater, and if led through exposed pipes its temperature may become reduced many degrees before entering the room. In order that all the interior surface of the heater may continue to have the hot steam in contact with it, the water

resulting from condensation must be removed as fast as it is formed. When the heaters are placed above the level of the boiler, and the steam pressure in them is nearly as great as in the boiler, the removal of the water may be accomplished by allowing it to drain into the boiler through a special return-pipe which enters the boiler below the water-line. Should it be impracticable to return the water of condensation directly to the boiler, it must be blown out by the steam-pressure into the open air; but an automatic device is then necessary to prevent waste of heat by the steam following the water when the latter has been discharged. Such contrivances are called *steam-traps*, and are of several kinds. In one the discharge is controlled by a float which rises and falls with the varying accumulation of the water in a steam-tight case which receives the drainings from the pipes. The principle, but not the details, of one of the best of these is illustrated by Fig. 8. Steam and the water which drains from the heaters flow through I into the case A, which contains an uncovered pail B. This, when nearly emptied of water, floats in the water which surrounds it, and closes the lower end of the discharge-pipe O, which reaches downward into the pail. When, however, the water rises in the case by accumulation and overflows the edge of the pail, this, becoming heavier, sinks and uncovers the end of the outlet-pipe O, which permits the contents of the pail to be discharged by the pressure exerted by the steam on the surface of the water. The discharge continues until the pail becomes so much lightened that it again floats and closes the pipe. The end of the outlet-pipe O is always under water, so that no steam can escape. An entirely different kind of steam-trap is shown at A in Fig. 4, by which the water of condensation may be returned directly to the boiler, even when the heaters are below it, and when the steam-pressure in them is less than the boiler-pressure. A is the case of the trap, containing a float which controls the opening and closing of a pipe *d* leading from the steam-space of the boiler to the top of the case. Another pipe B, proceeding from the bottom of a tank E into which the heaters drain, enters the top of the case, while a pipe C leads from its bottom, which is above the boiler-level, to the bottom of the boiler. The operation is as follows: The case A being filled with steam, the float falls and closes *d*. A check-valve in B prevents the escape of steam from the case, but permits the water from the tank E to rise and fill the case after the condensation of the steam in it forms a vacuum there. As soon as the case is filled with water the float rises and opens the pipe *d*, admitting steam at boiler-pressure above the water, which then drains into the boiler through the pipe C, which is furnished with a check-valve for preventing water from the boiler returning to the case. The float then falls, and the operation is repeated.

Fig. 8.



Automatic air-valves should be provided for releasing air which accumulates in the heaters. Air is heavier than steam of the same temperature and pressure—47 per cent. heavier at 100 pounds, and 61 per cent. at 1 pound gauge-pressure. The air tends then to sink to the lowest points of the heating apparatus, but it will accumulate wherever the circulation is impeded, and will increase the obstruction.

Experience has shown that in warming factories of the usual proportions, 1 square foot of radiating surface heated by steam at 1 pound gauge-pressure will be required for every 150 cubic feet of space in the rooms; and it is therefore safe to estimate that in a cold climate the steam required for 1 horse-power will warm about 12,000 cubic feet of space to 70° by direct radiation, which will allow for a complete change of air every hour by natural ventilation. When low-pressure steam is used for warming dwellings by indirect heaters, it is customary to provide 1 square foot of heating surface for every 40 cubic feet of space in the house.

VENTILATION.—The atmosphere is never found in its natural purity in densely-inhabited places nor in occupied apartments; the act of respiration and emanations from the person, which are constantly taking place, vitiate it in various ways. An adult man gives off in breathing $\frac{6}{10}$ths to $\frac{7}{10}$ths of a cubic foot of carbonic acid in an hour while awake, and from $\frac{5}{10}$ths to $\frac{6}{10}$ths of a cubic foot when asleep. He inhales at least 20 cubic inches of air at each breath, which at 20 respirations per minute gives 14 cubic feet as the quantity passed through the lungs per hour. The air exhaled contains from 4 to 5 per cent. of carbonic acid, or more than 100 times the normal proportion in pure air, and is saturated with moisture, however dry it may have been when taken into the lungs. The vapor given off by the lungs is accompanied by from $\frac{1}{2}$th to $\frac{3}{4}$th of a pound of vapor emanating from the skin each hour, and is diffused through the surrounding air.

The vapor which escapes from even the healthy human system contains volatile substances and effete matter, which it is one of the functions of breathing and perspiration to remove from the body as injurious, and which it is evident should not be again taken into the system. These last impurities when present in comparatively small quantities render air unfit to support life, and when habitually breathed are insidious, and often unsuspected, causes of gradual deterioration of vigor and health. It has been estimated that at least 40 per cent. of all fatal diseases are indirectly due to impure air. Carbonic acid gas itself is not poisonous, but acts rather as an obstructor of respiration by preventing the oxygen of the air from being absorbed by the lungs; and it is not impossible to live for a short time in an atmosphere containing more than 3 per cent. of this gas, produced artificially, without bad consequences. But the presence of a small proportion of carbonic acid in air contaminated by respiration indicates a highly deleterious condition of the air; and although the relation between the quantity of carbonic acid and the poisonous vapors in respired air is by no means a simple and constant one, yet the quantity of carbonic acid serves as an approximate measure of the other impurities which are poisonous; and it is practicable and customary to estimate the quality of air thus vitiated by the excess of carbonic acid in it over the proportion contained in pure air. The carbonic acid of respiration, though heavier than air of the same temperature, does not fall to the floor of a warm room. Its power of diffusion in air is great, and a larger proportion of all the impurities from the breath is found in the higher and warmer parts of a heated, unventilated room than in the lower parts—a condition which is reversed, however, if the room be allowed to cool.

It has been ascertained, from careful observations and experiments on a practical scale, that the air of a room designed to be occupied for a considerable time by any person ought not to be allowed to become vitiated by respiration to an extent which is indicated by the presence of more than $\frac{8}{10000}$ths or $\frac{8}{10000}$ths by bulk of carbonic acid, or an excess of $\frac{2}{10000}$ths or $\frac{4}{10000}$ths over the average proportion in the atmosphere of cities. Yet it is sometimes impossible to realize this condition, for the outside air itself may be below either standard. This, however, rarely happens, and numerous analyses of air from the streets of cities show that the proportion of carbonic acid seldom exceeds $\frac{4}{10000}$ths; but an extreme exceptional case was discovered in Manchester, England, where the air of a street contained $\frac{15}{10000}$ths. The following list is compiled from official reports of careful analyses, and shows how far below the standard of purity the air is permitted to become in rooms habitually occupied for many hours by children and pleasure-seekers. The numbers in the second column give the volume of carbonic acid gas found in air collected from the various sources:

	Carbonic acid.
School-rooms in New York and Boston, mean of 60	15
Worst air in one of the schools	31
A school in Paris	57
Theatres in New York, mean	26
" in London	15
" in Paris	33
Worst air in New York theatre	75
To these may be added—	
Soldiers' barracks at night	9.5
Air in a sick-room	15

parts in 10,000.

In practice, it is found that different quantities of air are required for ventilation under different circumstances. Morin recommends the following volumes of air to be supplied to an apartment for each occupant; and these estimates are generally admitted to be correct:

Volumes of Fresh Air required for Ventilation.

Hospitals for ordinary sickness	2400
" " wounded	3600
" " epidemics	5000
Prisons	1800
Workshops for ordinary trades	2100
" " unhealthy "	3600
Halls for long meetings	2000
" " short "	1000
Barracks at night	1600
Schools for children	500
" " youths	1000

cubic feet per hour.

These quantities seem large when the volume of air actually breathed is considered, but are insignificant when compared with the quantity which comes in contact with

the body when in the open air; for the motion of the atmosphere in a nearly calm day is rarely less than 2 miles an hour, and with this velocity over the 10 square feet presented by the body the ventilation amounts to the enormous figure of 100,000 cubic feet per hour of perfectly pure air.

To permit the proper distribution of fresh air in an apartment, and to provide for a temporary suspension of ventilation, the capacity of a room should be not less than 600 to 1000 cubic feet for each adult occupant, nor the floor-space less than 60 square feet for each, while for hospitals 100 square feet of floor-space and 1500 or 1800 cubic feet of capacity should be allowed for each bed.

The problem of introducing into a room the large quantities of properly-warmed air required for ventilation without producing draughts upon the occupants, and of distributing it thoroughly through the room, is a difficult one. Fortunately, during cold weather a spontaneous ventilation, amounting to more than is generally suspected, occurs through the apparently solid walls of our dwellings when these are of dry, unpainted brick or stone. Pettenkofer states that the interchange of air which takes place in this way varies with the difference of temperature between the inside and outside air, and that for brick and stone walls it amounts respectively to 0.49 and 0.40 cubic foot per hour per square foot of wall-surface for each degree difference of temperature.

A reliable natural ventilation—by which is meant any spontaneous change of air occurring without artificial assistance—cannot be obtained except when a difference of temperature exists between the in-door and out-door air. Hence, open windows cannot be depended on to effect a proper change of air unless the room be kept either warmer or cooler than the atmosphere outside. The open fireplace and open stove are efficient artificial ventilators in winter if suitable fresh-air inlets be provided, but the chimney-flues must be heated in summer also or they will then cease to act. A gaslight in the flue affords the most convenient source of heat, and it may be so placed as to be accessible through an opening over the mantel, which may be hidden by a movable picture or other ornament. According to Morin, 7 cubic feet of gas burned per hour in a flue 11 inches square and 66 feet high will produce a draught sufficient to withdraw 13,300 cubic feet per hour from the room, but 50 cubic feet of gas per hour in the same flue will remove only 22,500 cubic feet, so much higher temperature is required to produce the greater velocity. The size of the flue ought therefore to be so proportioned as to produce the necessary ventilation with a velocity of flow through it of 4 or 5 feet per second. The draught will be in proportion to the square root of the height of the chimney, other conditions being the same.

The source from which air is drawn for ventilation should be carefully selected, for otherwise injuriously impure air may be obtained. The custom of supplying air to a furnace or any indirect heater from the cellar of the house is dangerous. The ground and cement which form the cellar-floor are surprisingly permeable to the deleterious gases which the earth of cities is liable to contain. The first step in arranging for ventilation is to furnish suitable inlets for fresh air, and equally capacious channels for the outflow of foul air. These being provided, the renewal of the air of a room may be accomplished by either of two methods. In the one known as "exhausting ventilation" foul air is withdrawn and fresh air made to enter by reducing the pressure of the air in the outflow passages, and consequently the pressure in the room, to less than the atmospheric pressure. This is done by leading the outlet-ducts to a heated ventilating shaft or chimney, or by applying an exhausting fan to them. In "plenum ventilation" the fresh air is forced by a fan-blower through the inlets at a greater than atmospheric pressure, and the air of the room is expelled through the outlets in consequence. The first plan does not require the employment of machinery, and is the only one suited to dwellings. The plenum process is frequently applied to public halls and extensive public buildings, such as asylums and hospitals, but its installation is expensive, and the cost of maintaining it so great that the use of a ventilating chimney is preferable wherever it is practicable. In applying the ventilating chimney the outlet-openings and their ducts should be so proportioned that the velocities of the air in them shall increase from the openings in the rooms to the chimney to which the ducts all lead. Several outlets from one or more rooms may open into a receiving-duct, of which there may be several leading from different parts of the house into one or more collecting-ducts which proceed to the ventilating chimney. The velocities in these openings and ducts ought to be

1.5 feet per second at the openings;
4 " " " in the receiving-ducts;
5 " " " " " collecting-ducts;
7 " " " " " chimney.

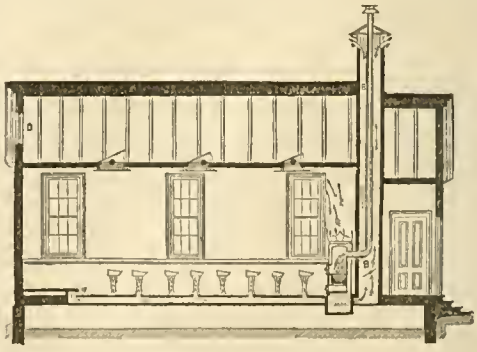
The velocity at the inlets should not exceed 1.5 feet per second if they are near the occupants of the room, but if they are near the ceiling, and the air enters horizontally, the velocity may be from 3 to 4 feet. These velocities can usually be obtained from a chimney 30 or 40 feet high when the temperature of the air in the chimney is 50° or 60° greater than that of the out-door air.

The question as to the best relative positions of the inlets and outlets for the air of a room has until recently been disputed. "Upward" ventilation involves the introduction of the air below the place of its withdrawal, while in the "downward" system the outlets must be the lower. As the quality of the air in a ventilated room does not vary greatly at different levels, this need not enter into the discussion; but the uniformity of distribution of the ventilation over the whole room is the most important requirement to be considered in determining the relative values of the two plans; and from this point of view it can be seen that when the entering air is warmer than that of the room, it is injudicious to place the outlets near the ceiling, unless the inlets are well distributed over the floor, for the tendency of the heated air is to rise to the ceiling directly, and to seek the outlets without diffusing itself thoroughly through the space to be ventilated, while at the same time a large proportion of its heat is wasted and great inequalities of temperature at different levels result. If, however, the outlets are at the bottom, the heated air rises as before, and finding no escape at the top, spreads over the ceiling, while the cooler portions near the floor are removed through the outlets, and are replaced by strata of air which descend uniformly over the whole area, the place of the descending air being constantly filled by a fresh supply rising from the inlets to the ceiling. A nearly uniform temperature at different heights may be secured by this means. In winter, then, when the entering air is warmed, the ventilation should be downward; and a familiar example of a successful application of this system is an open fireplace used in connection with a hot-air furnace. In summer, however, the conditions are changed, for the entering air is cooler than the room, and when the inlets are not numerous the proper distribution of the air requires that it should be introduced near the floor, over which its heaviness causes it to spread. In this case the outlets should be near the ceiling for the removal of the warmest air, which will be displaced by the inflow of cool air filling the lower parts of the room.

When practicable, the gas-jets for lighting a public hall should be placed outside the hall, and the light be admitted through glass skylights, or else the lights ought to be so placed that the products of combustion can be collected and conveyed away through special ventilating-tubes, without being allowed to mix with the air of the room; for the burning of 1 cubic foot of gas yields 0.9 of a cubic foot of carbonic acid gas, or nearly one-third more than the quantity given off by a man in an hour. Either plan avoids the necessity of providing the excessive ventilation required to dilute the products of combustion when they escape into the room. But the special outlets ought to be as small as possible, so as not to interfere with the general system of ventilation.

The limits of this article will admit of illustrating only two examples of practical ventilation. The first is from plans by Mr. A. C. Martin of Boston for heating and ventilating a small school-house, of which Fig. 9 shows a longitudinal section. The heater is an encased stove, by

Fig. 9.

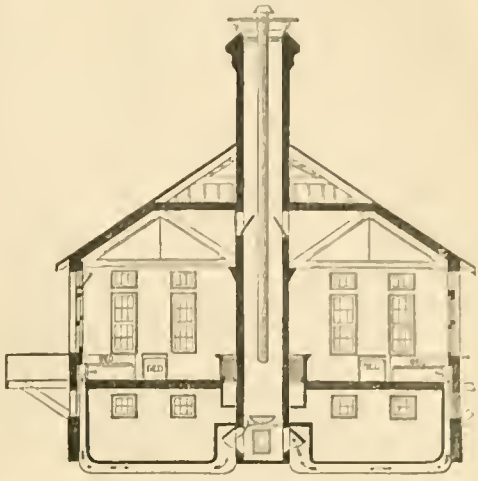


which the fresh air for ventilation, which enters beneath it from outside, is warmed and discharged into the room above the heads of the pupils. The foul air is drawn out of the room through numerous hooded apertures in the floor, which open into four ducts beneath the floor, only one of which can be seen in the figure. The ducts lead to

a ventilating-chimney B, which is kept warm by the smoke-pipe of the stove passing upward inside the chimney. A small stove may be placed in the chimney for summer ventilation. Cold air inlets are provided at the ceiling to temper the air of the room when it is too warm, and to furnish additional fresh air. Horizontal deflectors under these openings direct the currents of cold air along the ceiling. The second example is that of a hospital ward, from plans suggested by Dr. Folsom for the Johns Hopkins Hospital. Figs. 10 and 11 show sections through the heat-

Fig. 10.

Fig. 11.



ing apparatus and the ventilating-ducts. The ward is heated chiefly by two steam-heaters in the basement, to which the out-door air is supplied through two cold-air boxes which cross the basement from side to side, so that the air may always enter from the windward side; a provision which ensures the possibility of regulating the ventilation in windy weather. A mixing valve at V permits the cold air to pass above the heater when it is necessary to cool the air, which enters the ward through two registers situated one each side of a large ventilating-chimney in the centre of the ward. Two open stoves, built into the ventilating-chimney, serve as auxiliary heaters, and their smoke-pipes, which pass upward inside the ventilating-chimney, heat the chimney and produce ventilation. A small grate in the lower part of the chimney can be used to heat it in summer. The main openings for removing foul air are at the floor level. They are ten in number, and distributed at equal distances around the walls of the room. A down-cast flue from each opening leads to the floor of the basement, beneath which all ten ducts converge to the bottom of the central chimney. Two openings into the chimney are provided near the ceiling for summer ventilation, and there are louvres over the windows, all of which can be opened and closed at will.

A general system for ventilating a dwelling can be arranged with a view to utilizing the waste heat from the kitchen fire to produce a motive force which will be active winter and summer. Ducts should be led from all the rooms to a tight collecting-chamber in the basement or cellar. A pipe must pass from this to the bottom of a large ventilating-flue, through the centre of which the hot smoke-pipe from the kitchen range must rise to the roof. If any such general system is adopted for a dwelling, there will be times when some of the openings to the ventilating-ducts will need to be closed; as, for example, when open fires are burning whose draught tends to produce a reversal of the current of foul air. Indeed, it is probable that no system can be designed for any building which will not require some attention to ensure its regular operation, so many variable conditions occur which tend to counteract the necessarily feeble forces by which the movement of the air is produced.

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C. B. Richards.

War'ren (Joseph), b. at Waterbury, Vt., July 24, 1829; studied at the Vermont University; became assistant editor of the *Country Gentleman* in 1849, associate editor of the Buffalo *Courier* in 1853, and chief editor of the latter paper in 1858; was chosen president of the New York State Associated Press in 1870. D. at Buffalo Sept. 30, 1876. He was a very active citizen, labored with great energy for the construction of a public park in Buffalo, and for the establishment there of the State insane asylum, the State normal school, etc., and held various offices of honor and trust.

Was'son (David Atwood), b. May 14, 1823, at Brooksville, Me., of Scotch-Irish ancestry, who came to the country in 1724. In the remote village where he lived school was kept ten weeks in summer and eight in winter. At ten the lad's summer schooling was discontinued; at fifteen he studied Latin with the minister of the place; at sixteen had a term of study at a village academy; at nineteen was a teacher; in 1845 entered Bowdoin College, but stayed only a year; went to sea as a common sailor in hope of restoring tone to an overwrought frame and mind; studied law at Belfast, Me., but practised it for a short time only, being repelled by disagreeable features in it. An acquaintance with Carlyle's *Sartor Resartus* set his spiritual nature aflame. In 1848 he entered the theological seminary at Bangor; finished the course there; was approved by an examining council, and settled in 1851 at Groveland, Mass.; remained in that connection a year; then became preacher of an "Independent" church in the same village; stayed there, with an interval of six months in Worcester, till 1857, when a severe attack of spinal disease put an end to all continuous labor for several years. In the spring of 1865 the society of Theodore Parker, worshipping in the Boston Music Hall, invited him to be their minister, but after some fifteen months of service ill-health compelled him to retire. Since then, save four years of subordinate service in the custom-house in Boston and a residence of two or three years in Germany, he has resided at West Medford, Mass., engaged in literary work. In spite of a hopelessly broken constitution, Mr. Wasson has been a diligent, brilliant, powerful, and original writer. The pages of the *North American Review*, the *Atlantic Monthly*, the *Christian Examiner*, and the *Radical* have been enriched by his contributions in prose and verse. Since his return from Germany he has printed in the *Unitarian Monthly* a paper on "State and Church in Germany," and another in the *Index* on "State and Church in America." For the last eight or nine years Mr. Wasson has given much thought to political theories, and has in preparation two works on government, with especial reference to American problems.

O. B. Frothingham.

Wa'ter-Boatmen, a name given to the hemipterous insects of the family Notonectidæ. These have a boat-like supinate form, the rostrum is free, the antennæ concealed beneath the eyes and four-jointed, and the posterior pair of legs have the coxæ very slightly movable in a longitudinal direction and longitudinally grooved, and the other joints are elongated and provided with a ciliated fringe, which enables them to swim rapidly through the water. Representatives of the family occur very generally in pools, etc. They are good divers, and also fly readily. Their eggs are laid in spring, and are attached mostly to the stems and leaves of aquatic plants. The young are comparatively broad and flattened. THEODORE GILL.

Wa'ter-Gas. This is a term applied to the mixture of *hydrogen, carbonic oxide,* and *carbonic acid* gases, which is produced by the contact of water or steam with carbon at the temperature of incandescence, or higher. It has been considered preferable, in practice, to heat the steam itself to as high a temperature as practicable, before contact with the carbon, by passing it through some superheating apparatus. The general result of this is to produce a mixed gas containing more carbonic oxide and less carbonic acid, the last gas being not only a useless but a detrimental constituent, as involving the consumption of lime (or other adequate purifying agent) in its removal from the gaseous mixture. It would appear that no temperature, however high, altogether prevents the formation of carbonic acid; but the process has been conducted with such success as to involve the formation of but little, if any, more carbonic acid than occurs in ordinary illuminating gas from gas-coal. If *no* carbonic acid were formed, the reaction (supposing the carbon pure) should be as follows:

$$H_2O + C = H_2 + CO,$$

and the resulting gas would consist of equal volumes of hydrogen and carbonic oxide. More than one circumstance conduces, however, to prevent the volume of carbonic oxide from being equal to that of the hydrogen. One is the formation of carbonic acid. Another is the presence of more or less iron pyrites in the carbon (which in America is always *anthracite coal*), the iron of which decomposes some steam without forming the equivalent of carbonic oxide. Another is the fact that no natural form of carbon (anthracite included) is free from hydrogen.

It must also be added, that *marsh-gas,* so far as the analytical experience of the present writer extends, is a constant component of water-gas made from anthracite coal. The consequence of all this is that water-gas, after purification to separate its carbonic acid impurities, has been found to contain a proportion of carbonic oxide as small as 36 per cent., with about 56½ per cent. of hydrogen and 3½ of marsh-gas; the remainder, about 4 per cent., being nitrogen, which latter is derived from several sources. These special figures resulted from analyses by the writer, in conjunction with Prof. Silliman, upon water-gas made at New Haven in 1869 by the plan known as the "Gwynne-Harris process."

Most of the experiments that have been made, involving the preparation of water-gas—of which the most prominent in America have been by the different modifications known as the "Gwynne-Harris," the "Tessie-du-Motay," and the "Lowe" systems—have had as their object to produce a cheaper substitute for ordinary coal-gas for *illuminating* purposes; and the product is therefore usually combined with other gases made from gas-coal, petroleum, and the like, so that in the few chemical investigations that have as yet been conducted of the products of these different systems, there has been scarce any opportunity of analyzing or experimenting upon water-gas pure and simple. Its practical qualities and behavior, therefore, under various conditions, and its peculiarities when handled in the way in which other gases are handled, on a large scale, must be admitted to be in some measure matters of inference. That it can be produced in great volume and with great rapidity from comparatively compact apparatus, whose first cost is much less (per capacity of production) than in case of ordinary coal-gas, has become a demonstrated fact; and, as the great advantages of fuel in gaseous forms have long been admitted, the future of the water-gas manufacture seems an assured one whenever its uses for purposes of heating and in metallurgy shall have become matters of experimental demonstration. HENRY WURTZ.

Wa'ter-Glass [Ger. *Wasserglas*], also called **Soluble Glass,** a term applied to a class of compounds of silica with alkalies which contain a sufficient proportion of the latter to confer solubility in water. The first formation of a definite compound of this kind was by the chemist Fuchs. This has the chemical composition $K_2O.4SiO_2$, and should contain very nearly 72 per cent. of its weight of silica. It may be obtained in *pure* state by saturating a boiling solution of pure potash with amorphous precipitated silica, evaporating to dryness, and fusing; but cheaper methods must be employed in the preparation on a large scale for commercial uses. One of these is by melting together sand or quartz 15, potash 10, and charcoal 1 part. The charcoal decomposes carbonates and sulphates, thus assisting in the formation of a perfect glass. Indeed, the American chemist Ordway found it preferable to substitute sulphate of potash altogether for the potash, using more charcoal, and obtaining thus more readily a purer product. Water-glass may also be made containing soda instead of potash, even more readily and of greater purity. It is stated to contain less silica than the potash glass. It is also often made by dissolving silica under great pressure in superheated alkaline solutions.

Fuchs's soluble glass is not deliquescent, and is insoluble in cold water, solutions being made with boiling water. Such solutions, when strong and pure, are syrupy in consistence, transparent, and colorless, and of specific gravity 1.25 or higher. The material is insoluble in alcohol, and the latter decomposes it when in aqueous solution, precipitating a silicate which contains, according to Forchhammer, twice the amount of silica corresponding to the above chemical formula.

A solution of water-glass, when applied to surfaces, dries to a glossy varnish, which is not removable by cold water, and has been used to protect wood against fire, though such superficial protection can have but very limited value. Yet, as it is cheap, and may often ward off accident, this device cannot be deemed without importance. For this purpose it must be of good quality and purity, as otherwise efflorescences may occur. The water-glass made from soda is regarded as preferable for fireproofing uses. Water-glass solutions are not often used alone, however, for coating surfaces, some pigment being usually combined therewith. Sulphate of baryta has been found well adapted for this. One of the most important adaptations of soluble-glass solutions is in the making of cement-compositions and artificial stone. When brought into contact with lime, or its carbonate or sulphate, insoluble, hard, glassy silicates of lime are formed; and this fact has been extensively applied, not only in hardening the surfaces of artificial-stone compositions, but in compounding the whole mass thereof. In this kind of work there are many chemical characteristics of water-glass solutions which must be familiarly known to ensure success. Thus, many chemical substances are incompatible with these solutions, even some *neutral alkaline salts* being among them. For these essential details the works upon chemical technology must be consulted. Other applications of water-glass are as a detergent, as a dressing for textile fabrics, for reducing the explosiveness of gun-cotton, as a cement for broken glass and porcelain, and even as a substitute for common glue, for some surgical applications, etc. HENRY WURTZ.

Wat'kins (WILLIAM BROWN), A. M., D. D., b. May 2, 1834, in Bridgeport, Belmont co., O.; began the study of law, but abandoned it in 1856 to enter the Pittsburg conference of the Methodist Episcopal Church. His ministry has been about equally spent in the States of Ohio and Pennsylvania, he having been for four years presiding elder of the Steubenville (O.) district, and has been twice appointed to churches in the city of Pittsburg: has lectured very extensively on philological and educational subjects, and prepared a *Graded Spelling-book,* with Dr. Horner a *Cyclopædia of Methodism,* and is engaged in the preparation of a work entitled *An Etymological Dictionary of Ancient and Modern Geographical Names.*

Wed'ekind, von (GEORG WILHELM), BARON, b. at Strasbourg July 28, 1796; was educated at the gymnasiums of Mentz and Darmstadt; studied at the University of Göttingen; fought in the French campaigns of 1814–15; received afterward an appointment in Hesse-Darmstadt in the administration of the state forests, of which he finally became director-general; retired from public life in 1852, and d. at Darmstadt Jan. 21, 1856. He wrote *Grundriss zu einem System der Forststatistik* (1818), *Beiträge zur Kenntniss des Forstwesens in Deutschland* (1819–21), *Anleitung zur Forstverwaltung und zum Forstgeschäftsbetriebe* (1831), *Anleitung zum Betriebsregulirung und Holzertragsschätzung der Forsten* (1834), *Umriss der Forstwissenschaft für Staatsbürger und Staatsgelehrte* (1839), *Encyklopädie der Forstwissenschaft* (1847), *Neue Jahrbücher der Forstkunde* (1828–50).

Wei'gel (VALENTINE), a remarkable mystic and theosophist, b. at Hayn, near Dresden, Saxony, in 1533; became a Lutheran preacher at Zschoppau; strove in his writings to give a profound basis for Lutheranism by the introduction of ideas borrowed from Paracelsus, Tauler, Nicolaus Cusanus, and others. D. in 1594. His life, writings, and influence have been discussed by Hilliger and J. O. Opel. W. T. HARRIS.

Weights and Measures, instrumental means employed for the exact determination of quantity. Such instrumentalities are indispensable in science, in mechanical and ornamental art, and in all the variety of exchanges which constitute commerce. And as the usefulness of a system of weights and measures to those who employ it depends on the unvarying identity of its determinations, it has been a part of the public policy of every organized community, from the earliest period of civilization, to regulate such systems by law, defining the units which shall be used in measuring each species of quantity, with their multiples and sub-multiples, and providing carefully-constructed standards to which the measures in actual use among the people shall be required to conform. The misfortune has been that, in past centuries, this kind of legislation has been left almost wholly in the hands of local magistracies, who have proceeded without any attempt at concert; so that in Europe, previously to 1800, scarcely a town of any commercial importance could be found, from one end of the Continent to the other, which had not its independent system of weights and measures. The embarrassment to commerce growing out of this diversity of systems was enormous. Simply to learn them was a task which few attempted, and fewer accomplished. To transform values from one into another, resort was necessary to tables, or to arithmetical rules mechanically applied, involving a large expense of both time and labor.

It is a rather curious fact that, while the mediæval systems of European weight and measure are so almost endlessly various, the similarity of their nomenclature throughout would seem to indicate a common origin. All the way from Norway, for instance, to Spain, Italy, Greece, and the Mediterranean islands, we find the unit of length called everywhere the foot, and the unit of weight, the pound; and these terms we find, moreover, to have been in use for more than 2000 years, and to have been handed down directly from the republics of Greece and the Roman empire. The word "pound" is simply the Roman *pondus*, a "weight," and the unit it originally represented was doubtless entirely arbitrary; but the word "foot" is significant, and points at once to an original prototype in nature.

The foot, as a measure of length, made its first appearance in Greece. Tradition asserts that the Olympic foot (for there were several Grecian foot-measures) was derived from the foot of Hercules. As Hercules is a mythic character, this is only to say that, at some time, a unit of length of determinate value was adopted for general use, in order to remove the uncertainties which necessarily existed when the human foot was the measure, and every man was at liberty to use his own. This determinate standard may very possibly or probably have been the length of some particular foot—the foot of some chief or hero—but after its adoption it became practically arbitrary, and the unit of length could no longer have been a dimension of the human person, but must have had for its representative an invariable bar of wood or metal.

In this example of the Grecian foot we have an illustration of the manner in which, until the introduction of the modern metric system, all units of measure originated. They were not the creation of legislation. Legislative authorities have only interposed to regulate and secure uniformity and permanence in systems found already in existence. These systems have grown up in the rudest stages of society by a sort of social necessity. Without some standard of measurement, however imperfect, there can be no exchange of commodities founded on the idea of equivalence of value. And even in isolation, the uncultivated savage is forced, by the exigencies of his situation, to adopt some expedient by which to compare magnitudes of length, or bulk, or height, or distance. He will have need of measures in providing for his immediate personal wants—in the construction of his rude dwelling, his garments, his implements of labor, and the weapons with which he pursues his game. These must, of course, bear some convenient proportion to the dimensions of the person whose use they are designed to subserve; and nothing is more natural than that the person itself, or some of its members, should be directly employed as instruments of measurement in their construction. The probability that units of length originated in the manner here suggested is strengthened by the consideration that the idea of an artificial or material scale for the measurement of dimensions is one which involves processes of reflection and abstraction which men in a state of nature have not learned to employ; while the person, with its several members, which is the first thing to be provided for, is always present, so that the same standards of measurement which are employed in satisfying its exigencies are naturally applied to other objects between which in the progress of time similar comparisons become necessary.

In regard to measurements of distance, another idea suggests itself, equally growing out of the circumstances and habits of uncivilized man. Before man had learned to subjugate animals to his service, his only means of locomotion were such as he possessed in common with them; and in estimating the moderate distances from his dwelling to which his daily walks might extend, no expedient would be more likely to suggest itself than to count his steps. Thus arose the fundamental unit of itinerary measure, which is still more or less employed for rude determinations—*i. e.* the pace. The Romans employed this measure, and when the distances to be measured were such as to require a larger unit, they used its third decimal multiple, *mille passuum*, 1000 paces, from which has been derived the "mile" of the present day.

The nomenclature of the metrological systems of all nations furnishes abundant evidence of the original derivation of measures of length everywhere from the dimensions of the human person. The foot is a unit of comparatively modern origin. Long before Greece made any figure in history, the Egyptians, the Assyrians, and the Babylonians, with whom the Israelites were contemporaneous, monopolized whatever of science and cultivation the world then possessed; and among these the cubit, derived from the length of the fore arm of which it is the name, was the unit of linear measure, as it continues to be among their descendants to this day. The cubit is the unit of the Old Testament, of the tabernacle, and the temple, and the ark of the covenant; it was the unit of Cheops when he built the first pyramid; of Ninus when he laid the foundation of the Assyrian capital; and probably of those early post-diluvians who began the erection, on the plains of Shinar, of a tower "whose top should reach unto heaven." With the Israelites, moreover, all the subdivisions of this unit purported to be dimensions of the person. The cubit contained two spans; the span, three palms; the palm, four digits. By a curious accident, one of the identical original rules employed by Egyptian builders has been preserved to our time, and is now in the British Museum. It had been carelessly left in a hollow portion of the masonry of a temple at Karnak, and built up out of sight. Modern inquisitiveness, burrowing among the ruins of 3000 years of decay, at length discovered it in its hiding-place, and brought it out to light perfectly uninjured. It is a two-cubit rule, and it measures exactly the breadth of the descending entrance-passage of the great pyramid of Ghizeh. Considering that the pyramid is some centuries older than the temple in which the rule was found, this accordance furnishes a striking evidence of the care bestowed on the preservation of standards of measurement in that early age.

Other measures derived from the person, of which the origin or date is unknown, are the ell (*ulna*), derived, like the cubit, from the fore arm; the Italian *braccio*, the Portuguese *braça*, the Swiss *brache*, and the South American *braza*, all signifying the length of the arm; the English yard, from the Saxon *gyrdan*, to "gird," as signifying the girdle or measure of the body's circumference; the English fathom, also from Saxon *fadhm*, "embrace," the length of two arms; to which may be added the hand, and perhaps the nail, in England, the *pouce*, or thumb's breadth, in France, and the *pulgada* in Spain, and *pollegada* in Portugal, meaning the same thing.

For standards larger than the person affords, the names of measures early introduced indicate an equal indefiniteness. The Israelites had the reed—probably the average length of a reed of the Nile; the Romans, the *pertica*, a "pole;" the modern Italians, the *canna*, which may mean either "cane" or "reed;" the Germans, the *stab*, a "staff;" the Austrians, the *ruthe*; the Dutch, the *roede*, and the English, the *rod*, all being different forms of the same word; and finally, the French have the *toise*, from the Latin *tesa* (*tendere*, *tensum*), signifying "stretching," which indicates that the earliest toise was a flexible measure.

It is only for measures of length that the dimensions of the human person can furnish prototypes. For other descriptions of quantity the original units must have been chosen very much at random. Measures of capacity may have been derived from the content of some natural vessel, as, for instance, a gourd or the shell of a cocoanut. The smallest measure of capacity among the Hebrews—viz. the *log*—was estimated by the rabbinists to be equal in volume to six hen's eggs, a quantity ascertained by measuring the water they displaced. There is no evidence, however, that the log was originally so derived; the whole subject of the absolute origin of weights and measures being involved in complete obscurity. The *homer* or *chomer*, a measure of dry capacity among the same people, signified a "heap," and the *omer*, a diminutive of this, and the hundredth part of a *chomer*, signified a heap also. These names indicate that the estimate of quantity must have been made by the eye alone, and must have been vague in the extreme. Some

of the capacity-measures in use among the Greeks and Romans bear names no less significant. The *cyathus* of the Romans or κύαθος of the Greeks is derived from κύαρ, a "hollow," and one of its meanings is "the hollow of the hand." It was equal as a measure to two κόγχαι, "mussel-shells," among the Greeks, or two *cochlearia*, "spoonfuls" (from *cochlea*, a "snail-shell"), among the Romans. The cyathus of the Romans was also defined to be as much as one could swallow at a gulp. But none of our inferences from these early forms of nomenclature can give us more than hints of the manner in which particular measures sprang up or acquired the values belonging to them in later times. The similarity in the scale of progression between the Greek and Hebrew measures of capacity indicates a common origin for both; and Boeckh in his *Metrologische Untersuchungen* finds this common origin in Babylon, whence he supposes all the metrological systems of civilized antiquity, and consequently of modern Europe and America, to have been derived.

The use of weights implies some acquaintance with the balance, and therefore some degree of advancement in the arts of industry. Weights were therefore not introduced till some time after measures of length, capacity, and probably surface, had become familiar. Measures of surface were naturally derived from those of length. These four classes —viz. measures of length, of surface, of volume, and of weight—are all that are commonly understood in speaking of weights and measures. But more or less intimately connected with these is the measure of value (treated under MONEY and COINAGE); besides which there are sundry measures belonging more properly to science, such as TIME (treated under that title and under CALENDAR); temperature (treated under HEAT, THERMOMETER, and PYROMETER), and angular quantity (treated under TRIGONOMETRY).

Though the descriptions of quantity to be measured requiring consideration here are only the four first above enumerated, yet the numbers of systems of measurement which have been simultaneously in use in the same country and among the same peoples have been usually much greater, and in our own country are even so still. Thus, of measures of length there are at present among us one unit for carpentry and mechanics, the foot; another for textile fabrics, the yard; another for field-surveying, the chain; and another for road-measure, the mile. The foot is subdivided to inches and lines, or inches and binary sub-multiples; the yard, to quarters and nails; the chain, to links and decimals; and the mile, to furlongs and rods. The superficial measures, which are the squares of these units, are equally diverse, with the addition of the agrarian dimension of the acre. Of capacity-measures, there are, for liquids, the gallon, quart, pint, and gill; for cereals and other dry substances, the bushel and peck; for firewood, the cord; for coal, the chaldron; and for engineering, the cubic perch. Of weights, there are, for ordinary commerce, the avoirdupois pound, with its sexdecimal subdivisions, and for large masses its irregular multiples of the quarter, hundred, and ton; for bullion, plate, and coin, the pound troy, irregularly subdivided; for drugs and medicines, the apothecaries' pound, equal to the troy pound, but differently subdivided; and for gems, the carat. This multiplication of systems, which is wholly unnecessary, has added much to the difficulty of dealing with problems relating to quantity.

When the necessities of organized society demanded that weights and measures should be regulated by law, the rude natural standards previously in use were of course abandoned. Attempts were also made to connect the measures of capacity with those of length, by prescribing their linear dimensions; and weights were connected with measures of capacity, by taking as a unit the quantity by weight of water, wine, or some cereal grains which would fill a given measure. Or this latter process was reversed, and weights were employed to determine measures of capacity — a method which in modern times is of universal acceptance. Thus, the Jewish *log* measure of water is said to have weighed 108 Egyptian drachmæ, each drachma being the weight which would fill a vessel capable of containing 61 barleycorns.

The weights and measures in use in the U. S. have been derived from Great Britain. Although the Constitution gives to Congress the power to establish a national system, this power has never been exercised by any acts of direct legislation except such as concern the coinage. The secretary of the treasury, as stated in the article GALLON (which see), has assumed authority to provide standards of length, weight, and capacity identical with those of Great Britain, and to enforce their use in the public service; and Congress, by providing that copies of these standards shall be presented to the several State governments, has given them its indirect sanction. The earliest legislation of Great Britain, however, relating to this subject, which is contained in the 25th chapter of the reaffirmation of the Great Charter under Henry III. (9 Hen. III., A. D. 1225), throws no light upon the origin of the British weights and measures, but only declares that they shall be uniform throughout the realm; and a more explicit statute of the following year founds the measures of capacity upon weight. A later statute of 1266 (51 Henry III.) founded measures of weight upon determinate numbers of wheat-corns. Moreover, in this early period, as among the ancients, the units of commercial weight were also units of coin-weight. Thus, the statute referred to provided that "an English penny, called a *sterling*, round and without any clipping, shall weigh thirty-two wheat-corns in the midst of the ear, and twenty pence do make an ounce, and twelve ounces one pound, and eight pounds do make a gallon of *wine*, and eight gallons of wine do make a London bushel, which is the eighth part of a quarter." The pound thus determined, known as the tower pound, or the sterling or easterling pound, continued to regulate the metrological system of England down to 1496, when it was superseded for this purpose by the troy pound (12 Hen. VII.). It was a pound of 15 ounces, each ounce being equal to 360 troy grains, or to three-quarters of a troy ounce; whence the weight of the penny sterling was only 22½ grains troy. The grain-weight troy was not, therefore, the weight of a grain of wheat, as the word would seem to indicate. The grain of *mare*, used in France in the time of Charlemagne and later, was about four-fifths as heavy as the troy grain; and this, though still exceeding the grain of wheat, is nearer to it, and was probably derived from it. The easterling pound was the pound of the Eastern nations of Europe, and, as we may infer from Camden, was introduced into England in the time of Richard Cœur de Lion. This writer remarks: "In the time of Richard the First, monie coined in the east parts of Germanie began to be of especiall request in England for the puritie thereof, and was called Easterling monie, as all the inhabitants of those parts were called Easterlings; and shortly after, some of that countrie, skillfull in mint matters and allaies, were sent for into this realme to bring the coine to perfection; which since that time was called of them sterling for Easterling."

It is matter of controversy at what period the troy and avoirdupois pounds were introduced into England. The earliest statute in which the troy pound is mentioned is one of 1414 (2 Hen. V.), intended to regulate the charges of goldsmiths for gilding silver plate. In 1496, however, it was by statute of 12 Hen. VII. substituted for the sterling pound for the regulation of measures of capacity, the sterling pound continuing to be used at the mint; but by a subsequent statute of 1527 (18 Hen. VIII.), this last was definitely abolished, it having been "determined by the King's Highness and his Councille that the foresaid pounde towre shall be no more used and occupied, but al manner of golde and sylver shall be wayed by the pounde troye, which maketh xii oz troye, which exceedeth the pounde towre in weight iii quarters of the oz." As to the name of the pound troy, which some have derived from Troyes in France, and some from the numeral *trois*, "three," in reference to the three principal denominations of pounds, shillings, and pence, the parliamentary commissioners were of opinion that it refers to the monkish name of *Troy Novant* given to London, and therefore means simply London weight. The same commissioners suppose the name avoirdupois, which is that of the weight by which heavy or bulky goods have been weighed in England time out of mind, to have been derived from *avoirs* (*averia*), "havings," the ancient name for portable property or chattels, and *poids*, "weight." This view is corroborated by the fact that, in the earliest statutes in which the word is used—viz. 9 Edw. III. (1335) and 27 Edw. III. (1353)—it is applied not to a system of weights, but to the goods themselves which are to be weighed. The latter statute, for example, declares that, "Forasmuch as we have heard that some merchants purchase avoirdupois woollens and other merchandise by one weight and sell by another, . . . we therefore will and establish that one weight, one measure, and one yard be throughout the land, . . . and that woollens and all manner of avoirdupois be weighed," etc., etc. Two centuries later (1532, 24 Hen. VIII.), it was decreed that "beef, pork, mutton, and veal shall be sold by weight called haverdupois;" showing that the denomination once applied to the goods had now passed to the system of weights by which they were commonly weighed.

The earliest legislation in regard to measures of length found in the British statute-book is of date 1324 (17 Edw. II.), and provides that the inch shall have the length of three barleycorns, round and dry, laid end to end; that twelve inches shall make a foot, and three feet a yard. This form of words, "round and dry," was intended to indicate that the seeds should be fully developed, perfect, and well-seasoned. Previously to the Conquest, the Brit-

ish yard, according to Prof. Wackerbarth of the University of Upsala, Sweden, had about the length of 39.6 inches, exceeding the more modern mètre by less than a quarter of an inch. It was reduced in length in 1101 by being adjusted to the arm of Henry I.; but the artificial standards, deposited in the exchequer, were very ill-cared for, and became soon untrustworthy; which may have perhaps suggested this reference to a new though exceedingly imperfect natural standard, the barleycorn. It is in regard to measures of capacity that the early British legislation was most various and unstable. This has been sufficiently illustrated in the article GALLON.

During the eighteenth century the attention of some very able men was drawn to this subject, and legislation was proposed, if not perfected, aiming at an exactness before unattempted. Careful comparisons of the British, French, and Roman standards appear in the *Transactions* of the Royal Society for 1736, 1742, and 1743. Graham, the eminent horologist, determined the length of the seconds' pendulum in London to be 39.130 inches, afterward corrected to 39.14 inches; and prepared for the society a standard yard in 1742. A committee of the House of Commons was appointed in 1758, which employed the distinguished artisan, Bird, to construct two copies of Graham's standard, one of which was presented to the House with the expectation that it would be adopted as the legal standard; but this proposition at that time failed, although the same or an equivalent standard was adopted later. Another committee was appointed in 1790, which has left no record. Still another, in 1814, after calling on Dr. Wollaston and Prof. Playfair for their opinions, presented a valuable report, which led to no legislation. Finally, in 1818, a royal commission was appointed by a writ of the privy seal, with Sir Joseph Banks, president of the Royal Society, as chairman, and embracing, among others, Dr. Wollaston, Dr. Young, and Capt. Kater as members; which, after making a thorough investigation and presenting three successive elaborate reports, recommended the adoption of certain specific provisions of law for the construction, verification, and preservation of the public standards of weight and measure; and, in regard to measures of capacity, the abolition altogether of the existing system or systems and the adoption of an entirely new one. The recommendations of the commission were embodied in a bill introduced into the House of Commons in 1822, and again with some modification in 1823, and finally passed June 17, 1824, to go into operation May 1, 1825, a date afterward postponed to Jan. 1, 1826. This bill enacted that "the straight line or distance between the centres of the two points in the gold studs in the straight brass rod now in the custody of the clerk of the House of Commons, whereon the words and figures 'Standard Yard, 1760,' are engraved, shall be, and the same is hereby declared to be, the original and genuine standard of that measure of length or linear extension called a yard;" and that the same distance, "the brass being at the temperature of sixty-two degrees by Fahrenheit's thermometer, shall be, and is hereby denominated, the 'Imperial Standard Yard,' and shall be, and is hereby declared to be, the unit, or only measure of extension wherefrom or whereby all other measures of extension whatsoever, whether the same be linear, superficial, or solid, shall be derived, computed, and ascertained." The bill then proceeded to provide that, in case such standard should be "lost, destroyed, defaced or otherwise injured," it should be restored by reference to the length of "the pendulum vibrating seconds of mean time in the latitude of London in a vacuum at the level of the sea;" which length was declared to be 39.1393 inches. In regard to weights, it declared a brass one-pound weight made in the year 1758, then in the custody of the clerk of the House of Commons, to be authentic, and to be "the original and genuine standard measure of weight;" and proceeded to say that "such brass weight shall be, and is hereby denominated, the 'Imperial Standard Troy Pound,' and shall be, and is hereby declared to be, the unit, or only standard measure of weight from which all other weights shall be derived, computed, and ascertained." It further declared that the said standard pound shall contain 12 ounces of 20 pennyweights, each pennyweight containing 24 grains, "so that 5760 such grains shall be a troy pound; and that 7000 such grains shall be, and are hereby declared to be, a pound avoirdupois." For the case in which such pound should be "lost, destroyed, defaced or otherwise injured" provision was made for its restoration by reference to the weight of a cubic inch of water, which, as weighed in a vacuum, "by brass weights also in a vacuum, at the temperature of 62° of Fahrenheit's thermometer," was declared to be "equal to 252.724 grains, of which, as aforesaid, the imperial standard troy pound contains 5760." As to measures of capacity, it was enacted that the standard measure, whether for liquids or for dry goods, should be the gallon, containing, at the temperature of 62° F., with the barometer at 30 inches, 10 pounds avoirdupois weight of distilled water weighed in the air; and the construction of such a measure of brass was ordered, which was to be called the "Imperial Standard Gallon." It is further declared that the standard gallon ascertained by this act is equal in bulk to 277.274 cubic inches at the temperature of 62° F. Before the final passage of this bill, in 1824, the weight of the cubic inch of water weighed by brass weights *in air* (declared to be 252.458 grs. at 62° F. and 30 inches barometric pressure), was substituted for the weight *in vacuo* above given.

In 1834 the houses of Parliament were destroyed by fire, and with them the "original and genuine" standards. Practical difficulties were found in the way of replacing the yard by the means prescribed in the act, and it was restored from accurate copies previously taken, especially one in the possession of the Royal Astronomical Society. The pound was reproduced from the copy in the mint. The new standards were legalized by act of Parliament of 1855 (17 Vict.).

The only more recent legislation in Great Britain practically affecting commercial transactions in which weights and measures are used, is the law of 1835 (5 & 6 Will. IV.), which abolished heaped measure, previously allowed in the case of dry commodities which do not admit of being stricken. But in 1867 a new royal commission was appointed, with Mr. Airey, astronomer-royal, as chairman, to inquire into the condition of the exchequer standards of weights and measures; which commission was reconstructed and continued in the following year, and in five successive reports presented a series of practical recommendations of great interest. The most important of these were a proposition to abolish the pound troy, and another to introduce the metric system into the postal and customs service. Neither of these propositions has as yet prevailed.

No government has probably used more strenuous endeavors during the last half century than that of England, by a wide distribution of local standards throughout its territory, and by an untiring vigilance of inspection, to enforce an absolute uniformity of the weights and measures in use among its people. The importance of such uniformity we have seen to have been set forth in Magna Charta itself between 600 and 700 years ago, and it has been aimed at ever since, especially since the introduction of the imperial standards in 1826; but such is the inveteracy of habit that, so late as 1871, in a debate in the British Parliament on the expediency of adopting the metric system for England, it was stated by a member (Mr. Clare Read) that in Oxfordshire, Norfolk, and Pembrokeshire different articles of merchandise continue to be sold by different kinds of weight, and that in Shropshire there were actually different weights employed for the same merchandise on different market-days.

Early in the colonial history of the U. S. the British exchequer standards of weights and measures had been legalized by many of the colonial legislatures. They were not always specified by name in the earlier acts, but were always implied, and in subsequent legislation were sometimes incidentally named. Thus, in Virginia, an order of the general assembly of Mar. 5, 1623 (N. S. 1624), directed that no weights or measures should be used, but such as should be sealed by officers appointed for the purpose. But by an act of Feb. 23, 1631–32, it was ordained "that a barrel of corn should be accounted five bushels of Winchester measure," which was then the British bushel; and another act, of Oct. 5, 1646, provided that "no merchant or trader, whether English or Dutch, shall trade with other weights and measures than according to the statute of Parliament in such cases provided." In Massachusetts also, an act of 1647 directed the treasurer of the commonwealth to "provide weights and measures of all sorts for continual standards." Other statutes provided that casks should be "of London assize." In 1730, a set of brass and copper avoirdupois weights and measures was imported from the British exchequer, and in 1765, the treasurer was required to procure a balance and a nest of troy weights. After the Revolution, by act of Feb. 26, 1800, the principal provisions of the colonial statutes in regard to weights and measures were confirmed. New Hampshire and Vermont appear to have followed Massachusetts in their colonial legislation as to measures of capacity, but in neither of them was there any distinct recognition of troy weight. Rhode Island passed no statute on the subject at all. In Connecticut, after the Revolution, it was enacted (Oct., 1800) "that the brass measures, the property of this State, kept at the treasury—that is to say, a half-bushel measure containing one thousand and ninety-nine cubic inches, very near, a peck measure, and a half-peck measure, when reduced to a just proportion—be the standard of the corn-measures of this State which are called by those names respectively; that the brass

measures ordered to be provided by this assembly—one of the capacity of two hundred and twenty-four cubic inches, and the other of the capacity of two hundred and eighty-two cubic inches—shall be, when procured, the first of them the standard of a wine-gallon, and the other the standard of the ale or beer gallon in this State; that the iron or brass rod or plate ordered by this assembly to be provided—of one yard in length, to be divided into three equal parts for feet, in length, and one of those parts to be subdivided into twelve equal parts for inches—shall be the standard of those measures respectively; and that the brass weights, the property of the State, kept at the treasury—of one, two, four, seven, fourteen, twenty-eight, and fifty-six pounds—shall be the standard of avoirdupois weight in this State." By the colonial laws of the same State, it appears that there were public standards provided as early as 1670, and in 1752, the gallon of 231 cubic inches had been established. As this was the gallon of Queen Anne (1706), which continued from her time down to 1826 to be the standard wine-gallon of England, and as the gallon of 224 cubic inches is the old gallon of Henry VII. (1496), it is difficult to account for the enactment just cited. The half-bushel of 1099 cubic inches was never at any time a British measure. Connecticut never by express law sanctioned the use of troy weights, but, in her tax-laws, silver plate is rated at one dollar and eleven cents per ounce, by which a troy ounce must have been intended. The earliest legislation sanctioned the London assize of casks. New York, which was early occupied by the Dutch, fell into the hands of the British near the close of the seventeenth century, and on June 19, 1703, an act of the provincial legislature established all the British weights and measures for the province "according to the standards in the exchequer." In 1829, however, in a revision of the statutes, a provision was embodied adopting the then recently-introduced British imperial bushel, and a gallon measure capable of containing 8 pounds of distilled water at maximum density. In the same code it was also provided that the standard yard should bear to the pendulum beating seconds at Columbia College, New York City, *in vacuo*, at the level of the sea, the proportion of 1,000,000 to 1,086,141. In the revised statutes of 1851, however, these provisions were abolished, and the standards furnished by the bureau of weights and measures of the treasury department at Washington were made the standards for the State. New Jersey, in Aug., 1725, adopted the exchequer standards of England. The same was done in Pennsylvania in 1700, in Delaware in 1705, and in Maryland in 1671. North Carolina, by a law of which the date is not definitely ascertained, but which was passed under Gabriel Johnson, the second of the royal governors, whose term of office extended from 1734 to 1753, prohibited the use of any weights and measures but such as should be constructed "according to the standard in the English exchequer." South Carolina, in 1768, passed an act requiring the public treasurer to procure avoirdupois weights of brass or other metal, and also a bushel and other measures of capacity, "according to the standard of London." In Georgia no colonial legislation appears to have taken place upon this subject. After the Revolution, by act of Dec. 10, 1803, the standard of weights and measures established by the city corporations of Savannah and Augusta is declared to be the standard of the State till such time as the Congress of the U. S. shall have made a different provision. Of the States admitted to the Union since the adoption of the Constitution of 1787, some have passed laws similar to those above described, and some have not legislated at all. The case of Louisiana was peculiar. Before the acquisition of that territory by the U. S. the weights and measures used in the province were those of the old standard of Paris. An act of the legislature of Dec. 21, 1814, required the governor to procure, at the expense of the State, weights and measures corresponding with those used by the revenue officers of the U. S., to be deposited with the secretary of state, and to serve as the general standard for the State.

The origin of the standards now in actual use in the U. S. has been sufficiently explained in the article GALLON, to which the reader is referred. There is no act of Congress on the statute-book directly establishing any standard, whether of length or weight or capacity (except for coinage purposes the troy pound). But Congress has provided by law that copies of the standards constructed by executive authority in the treasury department, which are identical with the British as to length and weight, and which represent as to capacity the wine-gallon of Queen Anne (of 231 cu. in.) and the Winchester bushel (of 2150.42 cu. in.), shall be presented to the governments of all the States. A similar distribution has also been ordered of metric standards.

If we are to suppose that our present system of weights and measures will be permanently maintained, and that England will maintain hers also, it must be always a subject of regret that the capacity measures of the U. S. were regulated upon patterns which Great Britain had, only a few years previously, definitely discarded. Early after the adoption of the Federal Constitution, the desirability of a uniform system of weights, measures, and moneys for all the States seems to have presented itself to the minds of many leading American statesmen. So far as money is concerned, the object was very early accomplished, by the adoption, in 1792, of the dollar for a monetary unit, with decimal multiples and subdivisions. This was as direct an interference with popular usages, habits of thought, and methods of transacting business, as could have been the substitution of weights and measures entirely new for those in common use. But it was an interference less likely to provoke complaint, because of the great variety of provincial currencies which then prevailed in different parts of the country. Nevertheless, the spectacle of a great metrological reform then going on in France, and promising to become continental, could not fail to attract attention on this side of the Atlantic also; and there were not a few who believed that it would be an act of the highest political wisdom to introduce here, while our system of metrology, though approximately uniform, was still quite unsettled, the simple and beautiful decimal system founded on the mètre. This feeling found expression in a resolution of the House of Representatives adopted Dec. 14, 1819, calling on the secretary of state—at that time Mr. John Quincy Adams—to report to the House "a statement relative to the regulations and standards for weights and measures in the several States, and *relative to proceedings in foreign countries for establishing uniformity of weights and measures*, together with such a plan for fixing the standard of weights and measures for the U. S. as he might deem most proper for their adoption." An opportunity was here presented, such as rarely occurs to a statesman, of rendering his country a service destined to be memorable for all time; and Mr. Adams missed the opportunity. His report, made in 1821—the importance of which he clearly showed that he by no means underrated, by presenting it, with obvious design, on the birthday of Washington—though very voluminous and very learned, was altogether discouraging to the friends of metrological reform. It was, moreover, so far from being a model of logical method as utterly to bewilder the most attentive reader, and to make it difficult clearly to state its points so that they might be met with argument. But no further argument was attempted. The fog of the report enveloped the whole subject, and it was lost to sight for nearly half a century. Mr. Adams went very largely into the history of British legislation on weights and measures, showing by abundant examples how contradictory and inconsistent it had been; but he dwelt with almost fond admiration upon that feature of the system which provides two different measures of capacity and two different pounds, discovering between these the same ratio as exists between the specific gravities of corn and wine, which gives them what he calls the beautiful property of a "uniformity of proportion." He is, however, by no means insensible to the merits of the metric system, of which he gives a clear exposition and speaks in terms of eulogy sufficiently warm to satisfy its most ardent advocates. More than that, he even predicts the time when that system shall be universally adopted; but when it comes to the question, What shall we do here to further this ultimately inevitable result? what is the "plan" which, in reply to the demand of Congress, the secretary has to suggest? he has nothing better to offer than that the President of the U. S. should invite an exchange of diplomatic communications with France, Spain, and Great Britain "upon the subject of weights and measures with reference to the principle of uniformity as applicable to them:" and that, "in the mean time, should Congress deem it expedient to take immediate steps for accomplishing a more perfect uniformity of weights and measures within the U. S., they should assume as their principle that *no innovation upon the existing weights and measures should be attempted*." The reasons for this lame and impotent conclusion, so far as they can be extricated from the mist of words, seem to be, that it is difficult to induce people to accept new things, even though they be better than the things they have, and still more difficult to force upon them the use of new words; that the decimal system is very nice for computations, but possibly not always the most convenient for the subdivision of commodities; and, finally, that we ought not to move in this matter without England. Five years after this report was rendered, however, England chose to move without us; her whole system of measures of capacity, from which ours were derived, having been, as above narrated, abolished at a stroke, and replaced by the imperial measures, which she still maintains. Yet only six years later, these same measures, discredited and abandoned in the land of their birth, by the action of one of the executive departments at Wash-

ington, and without any legislation by Congress at all, were fastened upon us; and the uniformity between ourselves and the mother-country, which Mr. Adams was so unwilling to disturb, was, in this part of our system, lost for ever.

Nothing has been said, except incidentally, in this article in regard to the history of the metric system of weights and measures, now so widely prevalent throughout the world, nor in regard to the details of the system itself, those matters having been already given under the proper title. The use of this system has been made legal, though not compulsory, in the U. S., and active efforts are now in progress, with a fair promise of early success, for its practical introduction into the every-day affairs of business in this country.

One remark may be added, before concluding, as to the mode of adjusting or verifying standard weights and measures. The adjustment of weights requires no explanation, except to remark that neither the weights under trial nor the prototype standards must be touched by the hand, as any moisture or oxidation would vitiate the result. They must be moved by instruments constructed for the purpose, which, to prevent abrasion, are armed with buckskin. The verification of measures of length is made by means of what is called a comparator, a piece of mechanism upon which the bar to be verified may be placed and determined in length by closely-divided scales and verniers with microscopic observation, or by micrometers with finely-divided screws, and large screw-heads divided on their circumferences to one or more hundred parts. If the bar is an end-measure, or one in which the distance between the terminal surfaces gives the dimension required, the comparator is furnished with levers called *palpi*, touching the extremities of the bar by one end, while the other and longer arm traverses a divided arc. If it is a line measure, or one in which the required dimension is the distance between two lines delicately traced on one side, micrometer microscopes are used to observe these lines, and the bar is not touched. Measurements may thus be made to fractions almost incredibly minute — less than a quarter of a *mikron* (the $\frac{1}{1000}$th part of a millimètre), say the $\frac{1}{100000}$th of an inch. To secure uniformity of temperature, the whole apparatus is immersed in a bath of pulverized ice. An exactness so rigorous as this may seem to be unnecessary, and even, to some, absurd. But its importance will be recognized when it is considered that quite as much of the diversity of length-measures, by which business affairs in past times have been confused, has been owing to careless methods of verifying standards, as to actual original differences between the measures themselves.

Measures of capacity are verified by ascertaining the weight of pure water they will contain at the temperature of maximum density (3.945° C. or 39.101° F.). During the process of weighing, the measure is closed by means of a plate of glass ground truly plane, the upper edge or rim of the measure being similarly ground. It would not, of course, be possible, by any exercise of dexterity, to fill an open vessel exactly full of liquid, and no more; nor, supposing that condition reached, could it be verified by simple observation. Should any air-bubbles be enclosed within the covering, they are brought by management to the centre of the plate, where there is a small perforation through which the deficiency of fluid may be supplied. The filling having been perfectly accomplished, the exterior of the vessel and the cover are then carefully dried before weighing. Though the requisition is that the standard shall contain a certain amount of water at maximum density, and under a barometric pressure of thirty inches, yet the actual weighings are made at the ordinary temperature and in any state of the barometer; the test-weight which the vessel is to contain being that which the expansion of the material from the standard temperature to the temperature of observation would adapt it to hold, of the liquid which also expands simultaneously. If it were true that the capacity of the vessel and the bulk of the contained liquid expanded equally throughout the range to which observation extends, then it would happen that the vessel would hold the same weight of liquid at all temperatures. But this is not the case. Near the standard temperature the capacity is enlarged, by elevation of temperature, more rapidly than the bulk of the liquid; and therefore, for a range of about 12° or 13° above the temperature of maximum density, the vessel is capable of holding a somewhat larger weight than at that temperature. But above 46° F., the volume of the liquid expands faster than the capacity of the vessel; so that at about 52° F. the weight of water which the vessel will contain is once more equal to what it was at the standard temperature. This makes the temperature of 52° F. a particularly favorable one for the practical operations of adjustment, and one which it is more easy to command than that of 39° F. If, however, the weighing is at a temperature above or below 52°, the standard weight must be diminished or increased by a small amount, to be ascertained from a previously prepared table. The barometric correction in this operation is nearly insensible.

The standards now used as prototypes in the bureau of weights and measures of the U. S. are, for length, a copy of the British imperial yard, obtained in 1856; and for weight, a copy of the British imperial troy pound, obtained in 1827, and made by act of Congress of the following year the standard for the coinage. It is deposited at the principal mint in Philadelphia.

(For information in regard to particular weights and measures see their several titles.)

The following is a succinct statement of the more important weights and measures in use in the world at present.

I. Length.

Abyssinia.—The measures are derived from Asiatic Turkey. For dry goods the pik of Smyrna is in use = 27 inches = 685.8 mm. The unit of itinerary measure is the agasche or farsang = 3.1075 miles = 5.001 kilomètres; 1 farsang = 3 berri; 1 berri = 1.0558 miles = 1.667 km.

Algeria.—The metric system is established by law. The former unit of length was the (so-called) Turkish pik = 25.197 inches = 640 mm., which is not, however, that of Constantinople, nor equivalent to any of the various piks in use in the Levant. The so-called Moorish or Arabian pik = $\frac{3}{4}$ths of the foregoing = 18.898 inches = 480 mm., was also used; but this is not the pik used in Morocco or in Arabia. Sub-multiple, the robi = $\frac{1}{8}$ pik.

Annam, or Cochin-China.—For merchants' measure the thuoc = 25.58 inches = 649.7 mm., is the unit base. Multiples, 10 thuoc = 1 troong; 3 truong = 1 that; 10 that = 1 gon = 213.17 yards = 194.92 mètres. Sub-multiples, $\frac{1}{10}$ thuoc = 1 tac; $\frac{1}{10}$ tac = 1 phan; $\frac{1}{10}$ phan = 1 li = 0.0258 inch. For builders' measure, the thuoc = 19.18 in. = 487.16 mm. Multiples, 5 thuoc = 1 ngu; 3 ngu = 1 sao; 10 sao = 1 man = 79.92 yards = 72.8775 mètres. Sub-multiples, as before, the li being $\frac{1}{1000}$th thuoc, or 0.01918 inch = 0.487 mm. For road-measure, the dam = about 0.55 mile = 0.885 km., is the unit; sub-multiple, $\frac{1}{2}$ dam = 1 li = 0.275 mile = 0.4476 km.

Arabia.—There are several measures which are not multiples of each other. The guz = 25 in. = 634.98 mm.; the cobido = 19 in. = 482.6 mm.; the kassaba = 4.1 yards = 3.75 mètres.

Argentine Confederation.—The metric system is established by law. The old measures were those of Spain, and still continue to be used.

Australia.—The same as Great Britain.

Austria.—The metric system has been in force since Jan. 1, 1876. Of former measures, the fuss is the unit = 12.44556 in. = 316.11 mm. Multiples, 6 ft. = 1 klafter; 2 klafter = 1 ruthe = 12.44556 ft. = 3.79332 mètres. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{12}$ linie = 1 punkte. Unit for textiles, the elle = 30.676 in. = 779.2 mm. Surveyor's unit, the ruthe; sub-multiples, $\frac{1}{10}$ ruthe = 1 decimal fuss; $\frac{1}{10}$ dec. fuss = 1 dec. zoll; $\frac{1}{10}$ dec. zoll = 1 dec. linie. Road-measure, the mile = 4000 klafter = 24,000 fuss = 24,891.12 feet = 4.714227 miles = 7.5866 kilomètres.

Belgium.—The metric system was established by law in 1817.

Birmah.—The taim or cubit of Rangoon = 18 inches = 457.2 mm. Sub-multiple, $\frac{1}{8}$ taim = 1 paulgat = 1 English inch. Also, 22 paulgats = 1 saundaung, or royal cubit. For road-measure, 7 saundaungs = 1 dha or bambou; 1000 bambous = 1 dain or taing = 2.4306 miles = 3.9115 km.

Bolivia.—The legal system is the metric, but the old measures, which are Spanish, continue to be used.

Brazil.—The metric system was adopted in 1867 to take full effect in 1873. The old measures were Portuguese.

Central America.—The several states classed under this general name derive their weights and measures from Spain.

Chili.—The system, formerly Spanish, has since 1848 been metric.

China.—The chik of Peking = 13.125 inches = 333.369 mm., is the unit. Multiples, 10 chik = 1 cheung; 10 cheung = 1 yan = 109.375 feet = 33.3369 mètres. Sub-multiples, $\frac{1}{10}$ chik = 1 tsun; $\frac{1}{10}$ tsun = 1 fan. Surveyor's chik = 12.7 in. = 322.57 mm. Chik of Canton = 14.76 in. = 374.9 mm. Road-measure, the li = 1825.5 feet = 556.41 mètres.

Colombia.—The Spanish system was abandoned in 1863 for the metric.

Denmark.—The fod, the same as the Rheinfuss or foot of the Rhine = 12.357 in. = 313.85 mm. Multiples, 2 fod = 1 aln; 3 aln = 1 favn; 5 favn = 1 rode = 30.895 feet. Sub-multiples, $\frac{1}{2}$ fod = 1 tomme; $\frac{1}{2}$ tomme = 1 linie. The road-measure unit is the miil = 12,000 aln = 4.6812 miles = 7.5335 km.

ECUADOR.—The Spanish system was abandoned in 1856 for the metric.

EGYPT.—The metric system was established in 1871. Of the old measures, the derah or pik is the unit. There are several kinds of pik, and the authorities differ materially as to their value. Dourscher gives, as ascertained through the Belgian consulate in 1838, the piks of Alexandria as follows: the pik hendasi, for Indian muslins and cotton stuffs generally = 24.823 in. = 630.5 mm.; the pik beledi, for linens = 22.048 in. = 560.0 mm.; the Constantinople pik, for cloths = 26.378 in. = 670.0 mm. He adds that the French ell of 44 French inches is used and valued at $1\frac{3}{4}$ pik, which gives for the pik 26.796 in. = 680.6 mm. Dourscher also gives the piks of Cairo as follows: the pik hendasi = 25.134 in. = 638.4 mm.; the pik beledi = 22.381 in. = 568.47 mm.; the Constantinople pik = 27.221 in. = 691.4 mm.; the pik mehandese, or itinerary and engineers' pik = 30.374 in. = 771.5 mm. Multiple of the pik, 4 piks = 1 gasab; sub-multiples, $\frac{1}{2}$ pik = 1 kadam; $\frac{1}{3}$ kadam = 1 abdat; $\frac{1}{2}$ abdat = 1 kerat. Multiples for road-measure, $2\frac{1}{2}$ piks = 1 bââh; 2 bââh = 1 cassaba; 500 cassaba = 1 mili = 1.148 miles = 1.847 km.

FRANCE AND ITS DEPENDENCIES.—The system is the METRIC, for which see that title. The old Paris foot, called *pied du roi*, and its sub-multiples, $\frac{1}{12}$ pied = 1 pouce; $\frac{1}{12}$ pouce = 1 ligne; $\frac{1}{12}$ ligne = 1 point, are, however, often encountered. The pied du roi = 12.789 inches = 324.839385 mm. The toise = 6 pieds du roi, is interesting as being the unit employed in the survey of the great French meridian are on which the mètre was founded.

GERMAN EMPIRE.—The metric system has been compulsory since Jan. 1, 1873. Previously to the consolidation, many of the component states had partially or wholly adopted it. Their former measures were very various. A few only are here given:

Baden.—The fuss = 11.457 in. = 291.0 mm., is the unit. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{10}$ linie = 1 point.

Bavaria.—The fuss = 11.491 inches = 291.86 mm., is the unit. Multiples, 6 fuss = 1 klafter; 10 klafter = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie. Cloth-measure, the elle = 32.796 in. = 833.0 mm. Road-measure, the meile = $\frac{1}{15}$ equatorial degree = 4.6143 miles.

Bremen.—The fuss is the unit = 11.386 in. = 289.2 mm. Multiples, 2 fuss = 1 elle; 3 ellen = 1 klafter; 8 klafter = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie. Road-measure, 20,000 Rheinfuss (the Rheinfuss = 12.357 in. = 313.85 mm.) = 1 meile = 3.9 miles = 6.277 km.

Brunswick.—The schuh is the unit = 11.235 in. = 285.36 mm. Multiples, 2 schuh = 1 elle; 8 ellen = 1 ruthe. Sub-multiples, $\frac{1}{12}$ schuh = 1 zoll. Road-measure, the meile = 34,124 Rheinfuss = 6.736 miles = 10.71 km.

Hamburg.—The fuss = 11.279 in. = 286.5 mm., is the unit. Multiple, 2 fuss = 1 elle. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{8}$ zoll = 1 achtel. Road-measure, the meile = 24,000 Rheinfuss = 4.68 miles = 7.53 km.

Hanover.—The fuss = 11.496 in. = 292.0 mm. Multiples and sub-multiples as in Brunswick. The zoll is also divided, as in Hamburg, into 8 achtel. The meile = 25,400 fuss = 4.6086 miles = 7.4168 km.

Hesse-Cassel.—The fuss of the electorate = 11.327 in. = 287.7 mm. Sub-multiples as in Bremen. The surveyors' fuss = 11.217 in. = 284.9 mm.; multiples, 2 fuss = 1 elle; 7 ellen = 1 ruthe = 13.088 feet = 3.9886 mètres; sub-multiple, $\frac{1}{10}$ ruthe = 1 decimal foot = 15.706 inches = 398.86 mm.

Hesse-Darmstadt.—This was one of the earliest German states to assimilate its system to the metric by adopting an aliquot part of the mètre as its unit-base, and making its derivative denominations decimal. The fuss was made in 1818 equal to $\frac{1}{4}$th mètre = 9.843 in. = 250.0 mm. Multiple, 10 fuss = 1 klafter; sub-multiples, $\frac{1}{10}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie. Cloth-measure, the elle = 23.622 in. = 600 mm.

Lubeck.—The fuss = 11.335 in. = 287.9 mm. Multiple, 2 fuss = 1 elle; sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{6}$ zoll = 1 linie; $\frac{1}{12}$ linien = 1 punkte.

Mecklenburg.—The same as Lubeck. The fuss of Baden and the fuss of Hamburg were also used with similar derivative denominations.

Prussia.—The Rheinfuss is the unit = 12.357 in. = 313.85 mm. Multiples, $2\frac{1}{2}$ fuss = 1 elle; 12 fuss = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie; $\frac{1}{12}$ linien = 1 scrupel. As a field-measure the ruthe is divided decimally into 10 feld-fuss = 100 zoll = 1000 linien. Road-measure, the gesetzliche postmeile was fixed in 1816 at 2000 ruthen = 4.6806 miles = 7.5325 km.

Saxony.—The fuss = 11.146 in. = 283.1 mm. Multiples, 2 fuss = 1 elle; 8 ellen = 1 ruthe. Sub-multiples, $\frac{1}{12}$ fuss = 1 zoll; $\frac{1}{12}$ zoll = 1 linie. Road-measure, the postmeile = 1500 ruthen = 4.222 miles = 6.7946 km. The polizeimeile = 2000 ruthen = 5.6294 miles = 9.0594 km.

Wurtemberg.—The fuss was fixed in 1806 at 11.279 in. = 286.5, which is the fuss of Hamburg. Its derivatives are mostly decimal. Multiples, 10 fuss = 1 ruthe; 6 fuss = 1 klafter. Sub-multiples, $\frac{1}{10}$ fuss = 1 zoll; $\frac{1}{10}$ zoll = 1 linie; $\frac{1}{10}$ linie = 1 punkte. Cloth measure, the elle = 2.144 fuss = 24.183 in. = 614.2 mm. Road-measure, the meile = 4.4272 miles = 7.1248 km.

GREAT BRITAIN AND DEPENDENCIES.—The yard is the legal unit. Practically, the foot = 304.8 mm., is the unit for carpentry and mechanical purposes, and the yard = 914.4 mm., for cloth measure. Multiples of the foot, 3 ft. = 1 yard; $5\frac{1}{2}$ yards = 1 rod. Sub-multiples, $\frac{1}{12}$ ft. = 1 inch; $\frac{1}{3}$ in. = 1 barleycorn; $\frac{1}{12}$ inch = 1 line. Sub-multiples of the yard, $\frac{1}{4}$ yard = 1 quarter; $\frac{1}{4}$ qr. = 1 nail = $2\frac{1}{4}$ in. = 57.15 mm. Field and road measure, the chain is the unit = 66 ft. = 20.1164 mètres; multiples, 10 chains = 1 furlong; 8 furlongs = 1 mile = 1.6093 km.; 3 miles = 1 league; sub-multiples, $\frac{1}{4}$ chain = 1 rod; $\frac{1}{25}$ rod = $\frac{1}{100}$ chain = 1 link = 7.92 inches = 201.16 mm.; 1 mile old Scottish = $1\frac{1}{3}$ mile; 1 mile old Irish = $1\frac{3}{11}$ mile. Other measures are the hand = 4 inches; the span = 9 inches; the ell English = 45 inches; the ell Scotch = 37.06 inches; the fathom = 6 feet.

GREECE.—The legal system is the metric, but there is yet great confusion. The mètre is called the pik, and the kilomètre the stadion. The old pik of Patras for textiles generally was = 27.008 in. = 686.0 mm., and the pik for silks was = 25.01 in. = 635.24 mm. The large pik of Scio agreed with the first above named, and the small pik was = 25.996 in. = 660.3 mm.

GUINEA.—The jaktan = 12.005 feet = 3.659 mètres.

INDIA, BRITISH.—The metric system has been adopted, and the local governments are empowered to make it compulsory in the different ports, cities, and provinces at their discretion. The old measures are as follows:

Presidency of Bengal.—The unit is the covid, haut or hath = 18 inches = 457.2 mm. Multiples, 2 covids = 1 guz; 2 guz = 1 fathom. Sub-multiples, $\frac{1}{2}$ covid = 1 span; $\frac{1}{3}$ span = 1 moot; $\frac{1}{4}$ moot = 1 unglee; $\frac{1}{3}$ unglee = 1 jow. These are the measures of Calcutta, in which the guz = 1 English yard = 914.4 mm. The guz of Patna = 33 inches = 838.2 mm. for stuffs generally, and 42.5 in. = 1.0795 m. for fine goods. Road-measure, the coss = 1000 fathoms = 1.1364 miles = 1.8288 km.

Presidency of Bombay.—The cubit or hath = 18.12 in. = 460.248 mm.; $1\frac{1}{2}$ cubits = 1 guz = 27.18 inches = 690.372 mm.; $\frac{1}{16}$ cubit = 1 tussoo. At Surat the cubit is 20.9 inches = 530.85 mm.; at Gaulnah = 18.8 in. = 477.5 mm.; at Ahmednuggur = 14 inches = 355.6 mm. In the district of Anjar the guz = 26.4 inches = 670.55 mm.; at Guzerat = $23\frac{1}{3}$ in. = 592.66 mm.

Presidency of Madras.—The covid at Madras = 18.6 in. = 472.44 mm.; at Masulipatam = 19.125 in. = 485.8 mm.; at Mysore = 19.1 inches = 485.165 mm. Two covids of Mysore = 1 gujah. The kole of Travancore, carpenters' measure = 29.065 in. = 738.2377 mm. Sub-multiples, $\frac{1}{24}$ kole = 1 borrel or Malabar inch = 1.211 in. = 30.76 mm. The ady, the Malabar foot = 10.46 in. = 265.68 mm. Field-measure, the culy = 24 ady = 20.92 feet = 6.376 mètres. Road-measure, the coss = 3.6458 miles = 5.8675 km.; multiple, 2 coss = 1 gavada. This is the coss of Seringapatam. The common coss or hordary is $\frac{3}{4}$ of this = 2.7344 miles = 4.4005 km. There are many values of the coss in use; in the province of Malwah these values vary between $1\frac{1}{2}$ and 2 miles English.

ITALY.—The metric system has been compulsory over the Italian peninsula and Sicily since Jan. 1, 1863. The old measures were different in the different states, and very various. A few of the more important are given:

Naples.—The palmo is the unit = 10.316 in. = 262.015 mm. Multiple, 8 palmi = 1 canna. Sub-multiples, $\frac{1}{12}$ palmo = 1 oncia; $\frac{1}{5}$ oncia = 1 minuto. Field-measure, $7\frac{1}{2}$ palmi = 1 pertica. Road-measure, the miglio = 1.1965 miles = 1.9257 km.

Rome.—The palmo of commerce = 9.803 in. = 249.0 mm. Multiples, 8 palmi = 1 canna. The builders' palmo = 8.796 in. = 223.425 mm.; multiples, 10 palmi = 1 canna; sub-multiples, $\frac{1}{12}$ palmo = 1 oncia; $\frac{1}{5}$ oncia = 1 minuto; $\frac{1}{2}$ minuto = 1 decimo. The sacred palmo (*palmo de ara*) = 4.921 inches = 125.0 mm. = $\frac{1}{8}$ mètre. The pié = $1\frac{1}{3}$ palmo = 11.729 in. = 297.9 mm. Cloth-measure, the merchants' braccio = 33.387 in. = 848.0 mm.; sub-multiple, $\frac{1}{4}$ braccio = 1 palmo = 8.347 in. = 212.0 mm. The weavers' braccio is three-fourths of this, and the sacred braccio = 6 sacred palmi = 29.528 in. = 750.0 mm. = $\frac{3}{4}$ mètre. Road-measure, 5000 piede = 1 miglio = 0.92555 mile = 1.4895 km.

Sardinia.—The pié is the unit. At Turin the pié liprando = 20.227 in. = 513.77 mm.; the pié manuale = 13.485 in. = 342.51 mm. Multiples, 6 piede liprando = 1 trabucco; 2 trabucci = 1 pertica. Sub-multiple, $\frac{1}{12}$ pié liprando = 1 oncia; $\frac{1}{12}$ oncia = 1 punto; $\frac{1}{12}$ punto = 1

atomo. Cloth-measure, the raso = $1\frac{1}{6}$ piede liprando = 23.598 = 599.37 mm. = 14 oncie. Road measure, the miglio = $4333\frac{1}{3}$ piede liprando = 1.381 miles = 2.2263 km.

Tuscany.—The palmo is the unit = 11.488 in. = 291.8 mm. Multiples, 2 palmi = 1 braccio; 4 braccie = 1 canna of commerce; 5 braccie = 1 surveyors' canna. Sub multiples, $\frac{1}{10}$ palmo = 1 soldo; $\frac{1}{12}$ soldo = 1 denaro. Road-measure, the miglio = $2833\frac{1}{3}$ braccie = 1.0275 miles = 1.6535 km.

Japan.—The shaku = 11.93054 = $\frac{10}{33}$ mètre, or 303.03 mm. Sub multiples, $\frac{1}{10}$ shaku = 1 sun; $\frac{1}{10}$ sun = 1 bu. For field-measure, the djo = 10 shaku, is employed.

Mexico. The metric system was established in 1856. The old measures are Spanish.

Morocco.—The covid, as given by Dourslher = 21.0 in. = 533.1 mm. The values given by different authorities are very various. The pik = 26.022 in. = 660.96 mm. In some of the Barbary States the pik is subdivided into 3 palmi.

Netherlands and Dependencies.—In 1817 the metric system was adopted, with the names of the old measures. More recently the metric names have been also adopted.

Norway.—In 1866 the system was reformed and decimalized, but the old names and the value of the unit-base were retained. The unit is the fot = 12.357 in. = 313.85 mm. This is the Rheinfuss in use at Christiania. Some authorities make the fot = 11.6904 in. = 297.0 mm., which may be a provincial value. Multiples according to the old system, 2 fot = 1 aln; 3 aln = 1 faun; 5 aln = 1 rode. Sub-multiples: $\frac{1}{12}$ fot = 1 tum; $\frac{1}{12}$ tum = 1 linie. Multiples according to the new system, 10 fot = 1 stang; 10 stang = 1 ref. Sub-multiples, $\frac{1}{10}$ fot = 1 tum; $\frac{1}{10}$ tum = 1 linie.

Persia.—The gueza of Ispahan = 37.435 in. = 950.8 mm. The covid of Gumron = 37.8 in. = 960.1 mm. The archine arisch = 38.28 in. = 972.3 mm. These measures were probably originally the same. There is an archine schah = 31.46 in. = 799.07 mm. No uniformity prevails through the country.

Peru.—The metric system was introduced in 1863. The old measures, which still continue in use, are Spanish.

Portugal and Dependencies.—The metric system was established by law in 1864. Of the old system the covado is the ordinary unit = 25.985 in. = 660.0 mm. Multiples, $1\frac{2}{3}$ covado = 1 vara; 2 varas = 1 braça. Sub-multiples, $\frac{1}{2}$ covado = 1 pied; $\frac{1}{3}$ covado = 1 palmo; $\frac{1}{3}$ palmo da craveira = 1 pollegada; $\frac{1}{12}$ pollegada = 1 linha; $\frac{1}{12}$ linha = 1 ponto. Sub-multiples of the pied, $\frac{1}{12}$ pied = 1 pollegada; $\frac{1}{3}$ pied = 1 dedo; $\frac{1}{3}$ dedo = 1 grão; $\frac{1}{2}$ grão = 1 linha. A palmo of commerce, called *palmo da craveira avantejado*, or "good-measure palmo" = $8\frac{1}{4}$ pollegadas, was also used. In 1756 the junta da commercio, or chamber of commerce, of Lisbon, introduced a palmo called *palmo da junta*, designed to be a standard-base for all measures, whether of length or capacity. The palmo da junta = 7.882 in. = 200.20 mm. Road-measure, the milha = 1.2785 miles = 2.058 km.; 3 milhas = 1 legoa; $\frac{1}{8}$ milha = 1 estadio.

Roumania.—The metric system has been compulsory since Jan., 1865. Of old measures, the palma = 10.89 in. = 276.6 mm.; the khalebi, for cloths = 26.43 in. = 671.31 mm.; the kot, for silks and linens = 24.86 in. = 631.33 mm.; the endèse = 26.076 in. = 293.6 mm.

Russia.—The sagene is the legal unit = 7 fut = 2.1336 mètres. There are two modes of subdivision: First, $\frac{1}{7}$ sagene = 1 foute; $\frac{1}{12}$ foute = 1 duime; $\frac{1}{12}$ duime = 1 linia; also, $\frac{1}{3}$ sagene = 1 archine; $\frac{1}{4}$ archine = 1 tchetverk; $\frac{1}{4}$ tchetverk = 1 verschok. Road-measure, 500 sagenes = 1 verst = 3500 ft. = 1.06678 km. The meile of Lithuania = 4.9958 miles = 8.039816 km.

Sandwich Islands.—The system is that of the U. S.

Siam.—The ken = 37.835 inches = 961 mm. Multiples, 2 ken = 1 vouah; 20 vouah = 1 sen. Sub-multiples, $\frac{1}{2}$ ken = 1 sok; $\frac{1}{2}$ sok = 1 keub; $\frac{1}{12}$ keub = 1 nion. Road-measure, the röenung = 2000 vouahs = 2.3886 miles = 3.84101 km.

Spain and Dependencies.—Since 1859 the system has been the metric. The vara of Burgos = 32.91 in. = 835.9 mm., was the former legal unit. This value was assigned by Messrs. Ciscar and Pedrayès, Spanish deputies, members of the commission charged with the measurement of the arc of meridian for the determination of the length of the mètre, after a careful comparison at Paris in 1799. The vara in actual use in the present and former dependencies of Spain in America is, however = 33.385 in. = 847.96 mm. Multiple, 4 varas = 1 estadal. Sub-multiples, $\frac{1}{3}$ vara = 1 piè; $\frac{1}{2}$ piè = 1 sesma; $\frac{1}{6}$ sesma = 1 polgada; $\frac{1}{12}$ polgada = 1 linea; $\frac{1}{12}$ linea = 1 punto. Also, 9 polgadas = 1 palma; $\frac{1}{12}$ palma = 1 dedo; $\frac{1}{9}$ dedo = 1 linea. Road-measure, the legua of 1766 = 8000 varas = 4.1508 miles = 6.6800 km.

Sweden.—The fot = 11.688 in. = 296.87 mm. The system has been decimalized, retaining this value of the unit base. The multiples and sub-multiples, new and old, are the same as given above for Norway.

Switzerland. The system, since 1856, is partly decimal, with units in simple relations with the metric. The unit of length is the pied = 11.8112 in. = 300.0 mm. Multiples, 2 pieds = 1 brache; 2 braches = 1 aune; 3 aune = 1 toise. Sub multiples, $\frac{1}{10}$ pied = 1 pouce; $\frac{1}{10}$ pouce = 1 ligne; $\frac{1}{10}$ ligne = 1 trait. Field measure, 10 pieds = 1 perche. Road-measure, 16,000 pieds = 1 lieue = 2.983 miles = 4.8 km.

Tripoli.—The pik or dreah = 26.12 inches = 671.05 mm., is the ordinary cloth-measure. Sub multiple, $\frac{1}{3}$ pik = 1 palmo. A lesser pik = 19.03 inches = 483.35 mm., is used for ribbons and linens from Alexandria and the Levant, and sometimes also for the stuffs of the country.

Tunis.—For woollens the pik or dreah = 26.193 inches = 672.91 mm.; for silks, $\frac{18}{19}$ of the above = 24.852 inches = 630.73 mm.; and for linens, $\frac{3}{4}$ of this last = 18.624 inches = 473.05 mm.

Turkey.—There is no system common to all parts of the empire. In Constantinople the pik halebi, now called the archine, has a metric value = 750. mm. 29.528 inches. The pik of Smyrna = 27.00 in. = 685.8 mm.; the pik of Aleppo = 26.626 in. = 676.3 mm.; and there are many other values. Sub-multiples, $\frac{1}{4}$ pik or archine = 1 parmack; $\frac{1}{2}$ parmack = 1 hatt; $\frac{1}{12}$ hatt = 1 mocktat. Cloth-measure, the pik hendèse or endèse = 27.06 in. = 687.3 mm.; sub-multiples, $\frac{1}{8}$ hendèse = 1 ooroub; $\frac{1}{8}$ ooroub = 1 goirah.

United States of America.—The measures of length are the same as those above given for Great Britain.

Uruguay.—The metric system has been adopted, but Spanish measures continue to be used.

Venezuela.—These measures are also Spanish.

West Indies.—These islands still retain the measures originally introduced from the countries from which they were colonized. They are classified thus:

Spanish.—Cuba, Porto Rico, Isle of Pines, Culebra.

French.—Martinique, Descada, Guadaloupe, Marie Galante, Les Saintes, St. Martin (in part).

Dutch.—St. Martin (in part), Buen Ayre, Curaçoa, Oruba, Tortuga.

Danish.—Santa Cruz, St. Thomas, St. Jan.

Swedish.—St. Bartholomew.

British.—Jamaica, Barbadoes, Grenada, Santa Lucia, St. Vincent, Trinidad, Tobago, Antigua, Barbuda, Dominica, Nevis, Montserrat, St. Kitt's, Tortola, the Bahamas, and various minor islands.

Independent.—Hayti, with the republic of St. Domingo.

In the Spanish islands and in Curaçoa the vara = 33.385 in. = 847.96 mm. The French, with Hayti and St. Domingo, retain the old French measures, except Les Saintes, which has the British system.

Zanzibar.—The ohra = 24.48 in. = 571.0 mm.

II. Surface.

Superficial measures are usually the squares of the measures of length. Some agrarian measures are exceptions. These only will be considered here:

Arabia.—The feddan = 400 cassabas (the cassaba for this purpose = 3.84 mètres = 12.5986 ft.) = 1.4782 acres = 0.589824 hectare.

Austria.—The joch, the unit of land-measure = 1600 sq. klafter = 57,600 sq. fuss = 1.4223 acres = 0.5755 hectare.

Canada, Dominion of.—In the French portion the arpent = 0.8449 acre = 0.33796 hectare.

Denmark.—The töndeland = 14,000 sq. aln = 1.3635 acres = 0.552 hectare.

Egypt.—The feddan = $333\frac{1}{3}$ sq. cassabas (the cassaba for this purpose = 3.55 mètres = 11.6472 feet) = 1.038 acres = 0.42008 hectare; $\frac{1}{24}$ feddan = 1 kérat.

France.—The metric land-measuring unit is the hectare = 100 ares = 2.47112 acres. The old unit was the arpent, of which there were various values, varying from less than 32 to more than 60 ares, or from about $\frac{3}{4}$ acre to an acre and a half. The *arpent d'ordonnance*, or legal arpent = 1.262 acres = 51.072 ares, and contained 100 square perches of 22 pieds du roi on a side.

German Empire.—The land-unit is called the morgen, except in a few states, as Hesse-Cassel, where it is called an acker. The values of the morgen and its modes of subdivision are various:

Baden.—The morgen = 0.8897 acres = 0.36 hectare; $\frac{1}{4}$ morgen = 1 viertel; $\frac{1}{100}$ viertel = 1 sq. ruthe.

Bavaria.—The morgen (otherwise called juchart or tagewerk) = 0.8416 acre = 0.340536 hectare, and is decimally subdivided.

Bremen.—The morgen = 0.6343 acre = 0.2569 hectare.

Brunswick.—The morgen = 0.6208 acre = 0.2502 hectare.

Hamburg.—The morgen = 2.3852 acres = 0.9652 hectare.

Hanover.—The morgen = 0.6472 acre = 0.2619 hectare.

Sub-multiples, $\frac{1}{2}$ morgen = 1 vorling; $\frac{1}{60}$ vorling = 1 sq. ruthe.

Hesse-Cassel.—The acker = 0.5897 acre = 0.2387 hectare.

Hesse-Darmstadt.—The morgen = 0.6178 acre = 0.2500 hectare. Sub-multiple, $\frac{1}{4}$ morgen = 1 viertel.

Prussia.—The morgen = 0.6309 acre = 0.2553 hectare.

Saxony.—The morgen = 1.5216 acres = 0.6166 hectare.

Wurtemberg.—The morgen = 0.7789 acre = 0.3152 hectare.

GREAT BRITAIN.—The land-unit is the acre = 0.404671 hectare. Sub-multiples, $\frac{1}{4}$ acre = 1 rood; $\frac{1}{40}$ rood = 1 sq. rod.

INDIA, BRITISH.—In Bengal and Bombay the land-unit is called the biggah; in Madras, the cawney.

Bengal.—The biggah = 0.3306 acre = 0.1338 hectare. Sub-multiples, $\frac{1}{20}$ biggah = 1 cottah; $\frac{1}{16}$ cottah = 1 chattack; $\frac{1}{20}$ chattack = 1 sq. covid.

Bombay.—The biggah = 0.6074 acre = 0.2458 hectare.

Madras.—The cawney = 1.3223 acres = 0.5352 hectare. In the Carnatic the cawney = 1.0047 acres = 0.4066 hectare. Sub-multiples, $\frac{1}{4}$ cawney = 1 biggah; $\frac{1}{6}$ biggah = 1 maoney; $\frac{1}{10}$ maoney = 1 sq. covid.

ITALY.—The old land-units are different in name and in value in the several states:

Naples.—The moggio is the unit = 0.8584 acre = 0.3475 hectare.

Rome.—The rubbio is the unit = 4.5658 acres = 1.8485 hectares.

Sardinia.—The giornata is the unit = 0.9392 acre = 0.3801 hectare.

Tuscany.—The saccato is the unit = 1.389 acres = 0.5620 hectare.

NORWAY.—The land-unit is the tunna or töndeland = 1.2132 acres = 0.4909 hectare. Sub-multiples, $\frac{1}{2}$ töndeland = 1 spannland; $\frac{1}{4}$ spannland = 1 fjerding; $\frac{1}{4}$ fjerding = 1 kappland.

PORTUGAL.—The unit is the geira = 1.4287 acres = 0.5856 hectare.

RUSSIA.—The deciatine is the unit = 2.6997 acres = 1.0925 hectares.

SPAIN.—The fanegada of 1801 is the unit = 1.5871 acres = 0.642563 hectare. Multiple, 50 fanegadas = 1 yugada.

SWEDEN.—The unit is the square ref = 0.2175 acre = 0.088007 hectare.

SWITZERLAND.—The arpent is the unit = 3.558 acres = 1.44 hectares.

UNITED STATES.—The acre = 4 roods = 10 sq. chains = 160 sq. rods = 0.404671 hectare.

III. VOLUME.

Besides the measures of capacity and solidity here given, the cubes of linear measures are everywhere more or less used as units of volume.

ABYSSINIA.—For liquid capacity the euba is the unit = 0.2684 U. S. gallon = 1.01594 litres. For dry capacity the ardeb is the unit, which is different in different parts of the country. The ardeb of Gondar = 10 madegas = 0.49936 U. S. peck = 4.39902 litres. The ardeb of Massouah = 24 madegas = 1.1991 peck = 10.5635 litres.

ALGERIA.—For liquid capacity the khoullé = 4.4027 gallons = 16.675 litres. For dry measure, the tarric = 0.56295 U. S. bushel = 19.84 litres. Multiple, 16 tarries = 1 caffiso. The saâ is a little less than 3 tarries; it is = 1.646 bushels = 58.0 litres.

ANNAM.—Commodities sold by weight; no ascertained system of measures of capacity.

ARABIA.—For liquid capacity, the gudda or cuddy = 1.999 gallons = 7.567 litres. Sub-multiples, $\frac{1}{8}$ cuddy = 1 noosfia; $\frac{1}{16}$ noosfia = 1 vakia. Dry measure, the teman or toman = about $2\frac{1}{4}$ pints or 2 litres. Its value is not well ascertained; $\frac{1}{10}$ teman = 1 meedema or kella. The teman of rice-weight, 168 lbs. avoirdupois = 76.2 kgm.

ARGENTINE CONFEDERATION.—The legal measures are metric. The old Spanish measures continue also to be used.

AUSTRALIA.—The measures are British.

AUSTRIA.—Liquid capacity, the mass is the unit = 0.3738125 gallon = 1.4149 litres. Multiples, 10 mass = 1 viertel; 4 viertel = 1 eimer; 24 eimer = 1 dreiling; 32 eimer = 1 fuder. Sub-multiples, $\frac{1}{2}$ mass = 1 kanne; $\frac{1}{2}$ kanne = 1 seidel; $\frac{1}{2}$ seidel = 1 pfiff. Dry measure, the metze = 1.745 bushels = 61.496 litres is the unit. Multiple, 30 metzen = 1 muth; sub-multiples, $\frac{1}{4}$ metze = 1 viertel; $\frac{1}{2}$ viertel = 1 achtel; $\frac{1}{2}$ achtel = 1 müller massel; $\frac{1}{2}$ müller massel = 1 grosse massel; $\frac{1}{2}$ grosse massel = 1 kleine massel; $\frac{1}{2}$ kleine massel = 1 becher.

BELGIUM.—System metric.

BIRMAH.—Commodities of all kinds, liquid or dry, are sold by weight.

BOLIVIA.—System metric; old Spanish measures are also used.

BRAZIL.—System metric; old Portuguese measures continue in use.

CENTRAL AMERICA.—The old Spanish measures are used in these states.

CHILI.—System metric; old Spanish measures still used.

CHINA.—Liquid capacity, the shing-tsong = 0.1375 gallon = 0.5205 litre. Multiple, 10 shing-tsong = 1 tan-tsong; sub-multiple, $\frac{1}{10}$ shing-tsong = 1 kop-tsong. Dry capacity, the shing-shi = 0.08708 peck = 0.7671 litres. Multiple, 10 shing-shi = 1 tan-shi; sub-multiple, $\frac{1}{10}$ shing-shi = 1 kop-shi. The foregoing are according to Clarke. Dourster gives the tching, a measure which contains a catty-weight = 6 hectogrammes of rice not heaped, as the principal unit of capacity = 0.70 litre = 1.4794 pints. Multiples, 10 tching = 1 ten; 5 ten = 1 ho; $1\frac{7}{25}$ ho = 1 fu; $1\frac{6}{16}$ fu = 1 tché; $1\frac{8}{8}$ tché = 1 yu; $2\frac{1}{8}$ yu = 1 tchung = 340 tching = 238 litres = 62.87635 gallons. Sub-multiples, $\frac{1}{10}$ tching = 1 ho; $\frac{1}{10}$ ho = 1 cho; $\frac{1}{10}$ cho = 1 chao; $\frac{1}{10}$ chao = 1 ço; $\frac{1}{10}$ ço = 1 quei. The term ho occurs in both series.

COLOMBIA.—System metric; Spanish measures still occur.

DENMARK.—Liquid capacity, the pot = 0.966 litre = 0.2552 gallon, is the unit. Multiples, 2 pots = 1 kande; $19\frac{1}{2}$ kanden = 1 anker; 60 kanden = 1 tönde for tar; 68 kanden = 1 tönde for beer. Sub-multiple, $\frac{1}{4}$ pot = 1 poegel. Dry capacity, the tönde = $4\frac{1}{2}$ Rheinfuss cube = 3.9478 bushels = 139.11 litres. Sub-multiples, $\frac{1}{8}$ tönde = 1 skjœppe; $\frac{1}{4}$ skjœppe = 1 fjerdingkar; $\frac{1}{4}$ fjerdingkar = 1 halvotting.

ECUADOR.—System metric; Spanish measures still occur.

EGYPT.—Legal system metric since 1871. Old liquid measure, the guirbeh = 17.6117 gallons = 66.6639 litres. Dry measure, the kaddah = 0.5049 gallons = 1.9112 litres. Multiples, 2 kaddah = 1 malouah; 2 malouah = 1 roubouh or rob; 2 roubouh = 1 kélé; 2 kélé = 1 oueheh; 6 oueheh = 1 ardeb = 5.2059 bushels = 183.475 litres. Sub-multiples, $\frac{1}{2}$ kaddah = 1 nisf-kaddah; $\frac{1}{2}$ nisf-kaddah = 1 roub-kaddah; $\frac{1}{2}$ roub-kaddah = 1 thoumn-kaddah; $\frac{1}{2}$ thoumn-kaddah = 1 kharroubah; $\frac{1}{2}$ kharroubah = 1 kérat.

FRANCE.—The legal system is the metric. The old unit of liquid capacity for Paris was the pot = 1.8626 litres = 1.9683 quarts. Sub-multiples were, $\frac{1}{2}$ pot = 1 pinte; $\frac{1}{2}$ pinte = 1 chopine; $\frac{1}{4}$ chopine = 1 posson; $\frac{1}{4}$ posson = 1 roquille. Dry measure, the boisseau = 13.01 litres = 0.3692 bushels; multiple, 12 boisseaux = 1 setier; sub-multiples, $\frac{1}{4}$ boisseau = 1 picotin; $\frac{1}{4}$ picotin = 1 litron; $\frac{1}{16}$ litron = 1 mesurette.

GERMAN EMPIRE.—System metric. For a few of the states the old measures are given below:

Baden.—The old mass of Heidelberg for liquids was 1.977 litres = 2.089 quarts, divided into 4 schoppen. This was replaced by a metric mass of 1.5 litre = 1.565 qts. about 1840. For dry measure, the malter = 111.40 litres = 3.1613 bushels, was the unit; sub-multiples, $\frac{1}{4}$ malter = 1 viernsel; $\frac{1}{4}$ viernsel = 1 simmer; $\frac{1}{4}$ simmer = 1 kümpfe; $\frac{1}{2}$ kümpfe = 1 immel.

Bavaria.—Liquid measure, the mass = 2.2593 pints = 1.069 litres, was the unit = 4 quartels and $\frac{1}{60}$ eimer. The dry-measure unit was the metze = 1.0517 bushel = 37.059 litres; multiple, 6 metzen = 1 scheffel; sub-multiples, $\frac{1}{2}$ metze = 1 viertel; $\frac{1}{4}$ viertel = 1 achtel or massel; $\frac{1}{2}$ achtel = 1 maesslein; $\frac{1}{2}$ maesslein = 1 dreissiger.

Bremen.—The viertel = 1.912875 gallons = 7.2405 litres, was the ordinary unit of liquid measure. Multiples, 5 viertel = 1 anker; 4 anker = 1 ohm = 38.2575 gallons = 144.81 litres; sub-multiples, $\frac{1}{8}$ viertel = 1 stübchen; $\frac{1}{4}$ stübchen = 1 quartier; $\frac{1}{4}$ quartier = 1 mingel. The scheffel = 2.10195 bushels = 74.064 litres, is the dry-measure unit. Multiple, 40 scheffel = 1 last; sub-multiples, $\frac{1}{4}$ scheffel = 1 viertel; $\frac{1}{4}$ viertel = 1 spint.

Brunswick.—The stübchen = 0.988 gallon = 3.74 litres, was the unit. Multiples, 40 stübchen = 1 ohm; 6 ohm = 1 fuder. Sub-multiples, $\frac{1}{4}$ stübchen = 1 quartier; $\frac{1}{2}$ quartier = 1 nössel. The dry-measure unit, the scheffel = 8.82676 bushels = 311.03 litres, for wheat, and 10.5922 bushels = 373.24 litres, for oats. Multiple, 4 scheffel = 1 wispel; sub-multiples, $\frac{1}{10}$ scheffel = 1 himt; $\frac{1}{4}$ himt = 1 vierfass; $\frac{1}{4}$ vierfass = 1 becher or löcher.

Hamburg.—The viertel for liquid measure = 1.9127 gallons = 7.24 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 4 viertel = 1 eimer; 6 eimer = 1 tonne; $1\frac{1}{4}$ tonnen = 1 oxhoft; sub-multiples, $\frac{1}{2}$ viertel = 1 stübchen; $\frac{1}{2}$ stübchen = 1 kanne; $\frac{1}{2}$ kanne = 1 quartier; $\frac{1}{2}$ quartier = 1 össel. Dry measure, the scheffel = 2.99399 bushels = 105.50 litres, for wheat, rye, and pease, and = 4.49098 bushels = 158.25 litres, for oats and barley; multiples, 10 scheffel = 1 wispel; 3 wispel = 1 last. Sub-multiples of the wheat scheffel, $\frac{1}{2}$ scheffel = 1 fass; $\frac{1}{2}$ fass = 1 himt; $\frac{1}{4}$ himt = 1 spint; of the barley scheffel, $\frac{1}{3}$ scheffel = 1 fass; $\frac{1}{2}$ fass = 1 himt; $\frac{1}{4}$ himt = 1 spint. It thus appears that $1\frac{1}{3}$ wheat scheffel = 1 barley scheffel.

Hanover.—The viertel, liquid measure = 2.0543 gallons = 7.776 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 8 viertel = 1 eimer; $3\frac{3}{4}$ eimer = 1 oxhoft; sub-multiples, $\frac{1}{2}$ viertel = 1 stübchen; $\frac{1}{2}$

stübchen = 1 kanne; ½ kanne = 1 quartier; ½ quartier = 1 nössel. The dry-measure unit, the malter = 5.2961 bushels = 186.62 litres; multiples, 8 malter = 1 wispel; 2 wispel = 1 last; sub-multiples, ½ malter = 1 himt; ⅓ himt = 1 drittel; ½ drittel = 1 vierfass.

Hesse-Cassel.—The liquid unit-measure is the mass = 0.524145 gallon = 1.984 litres, for wine, and one-eighth more, or 0.589663 gallons = 2.232 litres, for beer. Multiples, 4 mass = 1 viertel; 20 viertel = 1 ohm; 6 ohm = 1 fuder; sub multiple, ¼ mass = 1 schoppen. The dry-measure unit, the scheffel = 2.27685 bushels = 80.23 litres; sub-multiples, ½ scheffel = 1 himt; ¼ himt = 1 metze; ¼ metze = 1 mässchen.

Hesse-Darmstadt.—The old mass for wine = 0.4584 gallons = 1.735 litres, and for beer = 0.51675 = 1.956 litres. Multiples, 4 mass = 1 viertel; 20 viertel = 1 ohm; 6 ohm = 1 fuder. Sub multiples, ¼ mass = 1 schoppen. The metric mass is = 2 litres = 2.1135 quarts. Dry measure, the malter = 3.6325 bushels = 128 litres; sub-multiples, ¼ malter = 1 simmer; ¼ simmer = 1 kumpfe; ¼ kumpfe = 1 gescheid; ¼ gescheid = 1 mässchen.

Lubeck.—The viertel for liquids = 1.9127 gallons = 7.240 litres. Multiples, 5 viertel = 1 anker; 4 anker = 1 ahm; 6 ahm = 1 fuder. Also, 4 viertel = 1 eimer; 7½ eimer = 1 oxhoft; sub-multiples, ½ viertel = 1 stübchen; ½ stübchen = 1 kanne; ½ kanne = 1 quartier; ½ quartier = 1 planke; ½ planke = 1 ort. Dry measure, the scheffel for wheat = 0.94787 bushels = 33.40 litres; for oats = 1.11359 bushels = 39.24 litres; multiples, 4 scheffel = 1 tonne; 3 tonnen = 1 drömt; 8 drömt = 1 last; sub-multiple, ¼ scheffel = 1 fass.

Mecklenburg.—The measures of capacity are those of Lubeck.

Prussia.—The quart, the unit of liquid capacity = 1.20997 quarts of the U. S. = 1.145 litres. Multiples, 30 quarts = 1 anker; 2 anker = 1 eimer; 2 eimer = 1 ohm; 6 ohm = 1 fuder. Sub-multiple, ½ quart = 1 össel. Dry measure, the scheffel = 1.5597 bushels = 54.9577 litres; multiples, 12 scheffel = 1 malter; 6 malter = 1 last; 1½ malter = 1 wispel; sub-multiples, ½ scheffel = 1 viertel; ¼ viertel = 1 metze; ¼ metze = 1 mässchen. Cubic measure, the klafter = 108 Rheinfuss cube = 117.8 U. S. cubic feet; 4½ klafter = 1 haufen.

Saxony.—The kanne is the unit, and has several values. The kanne of Dresden = 0.2782 gallon = 0.936 litre; the kanne of Leipsic = 0.31808 gallon = 1.204 litres; the gauger's kanne = 0.37092 gallon = 1.404 litres; 9 kannen of Dresden = 7 kannen of Leipsic = 6 gauger's kannen. Multiples, 63 kannen = 1 eimer; 2 eimer = 1 ohm; 6 ohm = 1 fuder. Also, 54 kannen = 6/7 eimer = 1 anker; 3 eimer = 1 oxhoft; 1⅔ oxhoft = 1 fass. Sub-multiples, ½ kanne = 1 nössel; ½ nössel = 1 quartier. Dry measure, the scheffel, as established by law in 1819 for all Saxony = 3.00505 bushels = 105.89 litres; but Dorsther gives 3.04876 = 107.43 as being the actual value in Dresden in 1840. Multiples, 12 scheffel = 1 malter; 2 malter = 1 wispel; sub-multiples, ½ scheffel = 1 viertel; ¼ viertel = 1 metze; ¼ metze = 1 mässchen.

Wurtemberg.—There are three values of the mass, the unit of liquid capacity—viz. the hellaichmass = 0.48531 gallon = 1.837 litres; the trübaichmass = 0.506446 gallon = 1.917 litres; and the schenkmass = 0.44119 gallon = 1.670 litres. It thus appears that 167 hellaichmass = 160 trübaichmass, and that 10 hellaichmass = 11 schenkmass. Multiples, 10 mass = 1 immi; 16 immi = 1 eimer; 6 eimer = 1 fuder. Sub-multiples, ½ mass = 1 schoppen. For dry measure, the scheffel = 5.02962 bushels = 177.23 litres; sub-multiples, ⅛ scheffel = 1 simri; ½ simri = 1 viertel; ½ viertel = 1 achtel; ½ achtel = 1 masslein; ½ masslein = 1 ecklein; ½ ecklein = 1 viertlein.

GREAT BRITAIN AND DEPENDENCIES.—There is no distinction in Great Britain between liquid and dry measures. The gallon, having the capacity of 277.274 cubic inches, and containing 10 pounds avoirdupois, or 70,000 grains, of distilled water, at the temperature of 62° F., as weighed with brass weights under an atmospheric pressure of 30 inches of the barometer, is the standard unit, and is called the imperial gallon. The bushel has the capacity of 8 gallons. Previously to Jan. 1, 1826, the British wine-gallon was 231 cubic inches, and the beer-gallon 282 cubic inches. This wine-gallon is now the sole standard gallon of the U. S. The bushel called the Winchester bushel, from the favorite royal residence of the early kings, formerly the chief market-town of England, was made the standard in 1701 (13 Will. III.), and was of the capacity of 2150.42 cubic inches. This continued to be the standard till 1826, and it is still the standard of the U. S. The eighth part of this was the corn-gallon of 268.8 cubic inches. The multiples of the unit at present are—2 gallons = 1 peck; 4 pecks = 1 bushel; 8 bushels = 1 quarter. The sub-multiples are—¼ gallon = 1 quart; ½ quart = 1 pint; ¼ pint = 1 gill.

GREECE.—The legal system is the metric. Some old measures are used. The bachel for dry measure used at Patras contains 0.8495 bushel = 29.933 litres; and the stajo, similarly used at the same port = 2.5184 bushels = 3 bachels, according to Clarke, but only 2.33049 bushels = 82.12 litres, according to Dourether.

GUINEA.—No ascertained system.

INDIA, BRITISH.—Though the metric system has been legalized, it has not been fully introduced. Both liquid and dry commodities are usually sold by weight, and the measures of capacity are intended to contain certain weights. This circumstance has doubtless contributed to the multiplication of discordant measures in the same places, while every considerable town has, or has had, its own system.

Bengal.—The soallee, a measure of dry capacity of Calcutta = 3.0933 bushels = 109.07 litres, about. Multiple, 16 soallee = 1 khahoon = 49.5216 bushels = 1745 litres. Sub-multiples, 2/3 soallee = 1 maund; ⅛ maund = 1 pallie; ½ pallie = 1 raik; 1/16 raik = 1 khoonke; ⅛ khoonke = 1 chattack. The khahoon is also said to be capable of containing 2986⅔ pounds avoirdupois of grain.

Bombay.—The parah for salt of Bombay = 0.7476 bushel = 26.3426 litres. Multiple, 8 parahs = 1 candy. Sub-multiple, 3/24 parah = 1 adowly. The parah for grain contains 19⅔ pounds avoirdupois. Assuming the mean specific gravity of grains at 0.6, the capacity should be 1.246 bushels = 43.9044 litres, and the candy = 8 parahs = 9.968 bushels = 3.512352 hectolitres. Sub-multiples, ½ parah = 1 pailie; ¼ pailie = 1 seer; ½ seer = 1 tipree. At Anjar, the shye = 0.88241 bushel = 31.094 litres; multiple, 16 shye = 1 culsey; sub-multiples, ¼ shye = 1 mapp; ⅛ mapp = 1 pallee.

Madras.—The parah of Madras for either liquids or grains = 1.7439 bushels = 61.45 litres. Multiples, 4 parahs = 1 candy; 20 candies = 1 garee. Sub-multiples, ½ parah = 1 marcal; ¼ marcal = 1 puddy; ¼ puddy = 1 olluck. At Mangalore, the mudi or morah = 1.27953 bushels = 45.85 litres, and = 38 seers. At Mysore, the morah = 1.3917 bushels = 49.01 litres, and = 40 seers.

ITALY.—The legal measures are metric. The old measures are given below for a few of the states; they are often discordant in the same state:

Naples.—The caraffa, the unit of liquid capacity for wine = 0.19202 gallon = 0.727 litre. Multiples, 60 caraffi = 1 barile; 22 barile = 1 botta; 2 botti = 1 carro. For oil, the quarto = 0.10352 gallon = 0.04894 litre; multiples, 16 quarti = 1 stajo; 16 staji = 1 salma; sub-multiple, ⅙ quarto = 1 misurelle. For dry measure, the tomolo = 1.5671 bushels = 55.224 litres; multiples, 36 tomoli = 1 carro; sub-multiple, 1/24 tomolo = 1 misura.

Rome.—The boccale for wine = 0.18214 gallon = 1.825 litres. Multiples, 32 boccale = 1 barile; 16 barile = 1 botte. Sub-multiples, ¼ boccale = 1 foglietta; ¼ foglietta = 1 quartuccio. Dry measure, the quarta = 2.0888 bushels = 73.605 litres; multiple, 4 quarti = 1 rubbio; sub-multiples, ½ quarta = 1 starello; 8/11 starello = 1 scorzo; ¼ scorzo = 1 quartuccio.

Sardinia.—In Genoa, the barile for liquids = 29.6105 gallons = 74.23 litres; multiple, 2 barili = 1 mezzarnola; sub-multiples, 1/60 barile = 1 pinta; 1/30 barile = 1 amola. In Turin, the rubbio for liquids = 2.4658 gallons = 9.22 litres; multiples, 6 rubbij = 1 brenta; 10 brente = 1 carro; sub-multiples, ⅙ rubbio = 1 pinta; ½ pinta = 1 boccale; ½ boccale = 1 quartino. For dry measure, in Genoa, the mina = 3.4253 bushels = 120.70 litres; sub-multiples, ⅛ mina = 1 quarto; 1/12 quarto = 1 gombetta. In Turin, the sacco = 3.26443 bushels = 115.03 litres; sub-multiples, ½ sacco = 1 stajo; ½ stajo = 1 mina; ½ mina = 1 quartièra; ½ quartièra = 1 copello; 1/20 copello = 1 cucchiaro.

Tuscany.—The fiasco for wine = 2.2075 quarts = 2.089 litres. Multiple, 20 fiasci = 1 barile. Sub-multiples, ½ fiasco = 1 boccale; ¼ boccale = 1 mezzetta; ½ mezzetta = 1 quartuccio. For oil, the barile = 16 fiasci; 2 barile = 1 soma. Dry measure, the sacco = 2.0739 bushels = 73.08 litres; multiple, 8 sacci = 1 moggio; sub-multiples, ½ sacco = 1 stajo; ½ stajo = 1 mina; ½ mina = 1 quarto; ¼ quarto = 1 metadella; ½ metadella = 1 mezzetta; ½ mezzetta = 1 quartuccio; ½ quartuccio = 1 bussolo.

JAPAN.—The koku = 6482690 Japanese cubic lines = 31.737 gallons = 180.39 litres. Sub-multiples, 1/10 koku = 1 to; 1/10 to = 1 sho; 1/10 sho = 1 go. The measures of capacity are square wooden boxes with a diagonal iron rod stretched across the top, the upper surface of which is on a plane with the rim of the box.

MEXICO.—The legal system is the metric. In liquid measure the fraseo = 2.25 quarts = 2.13 litres, is still used. In dry measure, the fanega = 1.603 bushels = 56.40 litres.

MOROCCO.—No system well ascertained. The muhd or mud, for dry measure, is said to be = 5.184 bushels = 182.669 litres.

NETHERLANDS.—The measures are metric.

NORWAY.—The kanna is the unit for liquids = 2.0416 qts. = 1.932 litres. Multiple, 48 kannas = 1 tunna. Sub-multiples, ½ kanna = 1 stop; ¼ stop = 1 qwarter; ¼ qwarter = 1 jungfrus. For dry measure, the span = 2.0774 bushels = 73.25 litres, is the unit; multiple, 2 span = 1 tunna; sub-multiples, ¼ span = 1 fjerding; ¼ fjerding = 1 kappe; ¼ fjerding = 1 kanna; ½ kanna = 1 stop; ¼ stop = 1 qwarter; ¼ qwarter = 1 ort.

PERSIA.—There is no distinction between measures of liquid and dry capacity. The artaba = 1.8514 bushels = 65.236 litres, is the unit. Sub-multiples, ⅛ artaba = 1 collothun; $\frac{1}{25}$ artaba = 1 capicha; ½ capicha = 1 chenica; ¼ chenica = 1 sextario.

PERU.—The metric system is legal, but Spanish measures continue to be used.

PORTUGAL AND DEPENDENCIES.—The metric is the legal system. Of the old liquid measures, the alquière, pote, or cantaro = 2.148 galls. = 8.27 litres, is the unit. Multiples, 2 alquières = 1 almude; 26 almudes = 1 pipa or bota; 2 pipas = 1 tonelada. Sub-multiples, ⅙ alquière = 1 canada; ¼ canada = 1 quartilho. The dry-measure unit is the fanga = 1.5347 bushels = 54.0768 litres in Lisbon; multiple, 15 fangas = 1 moio; sub-multiples, ¼ fanga = 1 alquière; ¼ alquière = 1 quarto; ½ quarto = 1 outava; ½ outava = 1 maquia.

ROUMANIA.—The legal system is the metric. A liquid capacity-measure is used, called the viadra = 3.7434 gallons = 14.1699 litres. Sub-multiple, $\frac{1}{10}$ viadra = 1 oka. For dry measure, the kilo = 12.345 bushels = 434.98 litres.

RUSSIA.—The liquid capacity unit is the vedro = 3.249 gallons = 12.299 litres. Sub-multiples, ½ vedro = 1 polou-vedro; ⅕ polou-vedro = 1 kronchka; ¼ polou-vedro = 1 stoff; ½ stoff = 1 polou-stoff; ½ polou-stoff = 1 quor. For dry measure, the tschetverik is the unit = 0.74397 bushel = 26.216 litres; multiples, 2 tschetveriks = 1 pajak; 2 pajaks = 1 osmina; 2 osminas = 1 tschetviert or chetviert. Sub-multiples, ¼ tschetverik = 1 tschetverka; ½ tschetverka = 1 garnetz.

SANDWICH ISLANDS.—The weights are those of the U. S.

SIAM.—For liquid measure, the can or canan = 1.299 qts. = 2.38 litres. Sub-multiple, ¼ canan = 1 leeng. The sesti is also a measure designed to hold 1 pecal = 135 lbs. av. = 61.25 kgms. of wheat or rice; multiple, 40 sesti = 1 cehi or coyang; sub-multiple, $\frac{1}{40}$ sesti = 1 sat. The actual capacity is variously stated, as estimated from the assumed specific gravity of the grain measured, and is put by Doursther = 80 litres = 21.136 gallons.

SPAIN.—The legal system is the metric. For liquid measure, the cantara or arroba is the unit. The arroba mayor, for wine = 4.079 gallons = 15.44 litres; the arroba menor, for oil = 3.186 gallons = 12.06 litres; sub-multiples, ⅛ arroba = 1 azumbre; ¼ azumbre = 1 quartillo or cuartillo; ¼ quartillo = 1 copa. In dry measure the fanega is the unit = 1.5551 bushels = 54.80 litres; multiple, 12 fanegas = 1 cahiz; sub-multiples, $\frac{1}{12}$ fanega = 1 almude; ½ almude = 1 medio; ½ medio = 1 quartillo; ¼ quartillo = 1 racion; ¼ racion = 1 ochavillo.

SWEDEN.—Measures as in Norway, but in both liquid and dry measures the cubes of the measures of length are used.

SWITZERLAND.—The measures are now metric in values. The unit is the pot = 1.585 quarts = 1.5 litres; multiples, 25 pots = 1 setier; 4 setiers = 1 muid. There is a binary subdivision of the pot down to the eighth. The old values of this measure were various in the different cantons. In Lausanne, Canton de Vaud, the pot was = 1.4133 quarts = 1.35 litres, and 30 pots were = 1 setier, and $\frac{1}{10}$ pot = 1 verre. In Neufchâtel, canton of the same name, the pot was = 1.5123 quarts = 1.9043 litres, and 16 pots = 1 setier. In Geneva the pot was = 1.0061 quarts = 0.9521 litre, and 2 pots = 1 quarteron. The dry-measure unit is the quarteron = 0.38312 bushel = 13.500 litres in Lausanne, or = 0.4976 bushel = 17.535 litres at Castels, or = 0.2266 bushel = 7.981 litres at Freiburg; multiple, 10 quarterons = 1 sac at Lausanne, Gruyères, Boll, and Murten; 12 quarterons = 1 sac at Corbières and Staeffis; and 8 quarterons = 1 sac at Castels; sub-multiples, $\frac{1}{10}$ quarteron = 1 émine; $\frac{1}{10}$ émine = 1 copet. At Freiburg, also 4 quarterons = 1 kopf; ⅛ quarteron = 1 immi.

TRIPOLI.—The maturo is a measure for oil, now disused = 6.4161 gallons = 23.34 litres. The tibero is another old measure, formerly used for grain = 0.37857 bushel = 13.34 litres; multiples, 20 tiberi = 1 caffiso. The *caraffa* is the measure in actual use, and holds 3.4286 lbs. av. = 1.5552 kgm. of oil, or has about the capacity of 1.8387 quarts = 1.74 litres; multiple, 6 caraffas = 1 herbain. For dry-measure, the temen = 0.76157 bushel = 26.836 litres; multiple, 4 temens = 1 ueba; sub-multiples, ¼ temen = 1 orbah; ½ orbah = 1 nufsorbah.

TUNIS.—The mettar or mataro for oil = 5.2268 galls. = 19.69 litres; the mettar for wine = half this capacity. For dry measure, the whiba or weba = $\frac{15}{16}$ bushel = 0.9375 bushel = 33.03 litres; multiple, 16 whibas = 1 caffiso; sub-multiple, $\frac{1}{12}$ whiba = 1 saws or zahs.

TURKEY.—The almude for liquids = 1.38086 gallons. The kiloz, the unit of dry capacity = 0.99638 bushel = 35.11 litres; multiple, 4 kiloz = 1 fortin or fortun; sub-multiple, ¼ kiloz = 1 chénik.

UNITED STATES OF AMERICA.—The unit of liquid capacity is the wine-gallon of Queen Anne of 231 cubic inches. The origin of this gallon, which is somewhat curious, is explained in the article GALLON. It arose out of a series of legislative misapprehensions, and had been some time in use when sanctioned by the statute of 5 Anne (1706). The statute defined it by requiring that the gallon-measure should be a cylindrical vessel 7 inches in diameter and 6 inches deep. As the area of a circle = ½ radius × circumference, and as diameter is to circumference nearly as 7 : 22, the capacity of such a vessel would be ¼ × 7 × 22 × 6 = 7 × 11 × 3 = 231. This gallon was adopted by the treasury department of the U. S. in 1832, on the recommendation of Mr. F. R. Hassler, chief of the U. S. Coast Survey, and the standard gallon-measure is a cylindrical brass vessel which at a temperature of maximum density—*i. e.* 39.1° F. or 3.945° C.—contains 58372.1754 grains = 8.33888220 pounds avoirdupois, of distilled water. The multiples of the gallon commonly cited are 31½ gallons = 1 barrel; 2 barrels = 1 hogshead; 42 gallons = 1 tierce; 2 tierces = 1 puncheon; 1½ puncheons = 1 pipe; 2 pipes = 1 tun; besides which are the smaller measures—10 gallons = 1 anker; 18 gallons = 1 runlet; but casks are made of any convenient size, and sales are made according to the number of gallons contained. Sub-multiples are—¼ gallon = 1 quart; ½ quart = 1 pint; ½ pint = 1 gill. For dry measure the unit is the bushel, which is the Winchester bushel, made standard for England by statute of 13 Will. III. (1701), and abolished in 1826. Its capacity is 2150.42 cubic inches, and the standard gallon-measure is a cylindrical brass vessel which holds of distilled water, at the temperature of maximum density, 543391.89 grains = 77.627413 pounds avoirdupois; multiple, 36 bushels = 1 chaldron. Old English multiples, now disused, were—4 bushels = 1 coomb; 2 coombs = 1 quarter; 5 quarters = 1 wey or load; 2 weys = 1 last; sub-multiples, ¼ bushel = 1 peck; ½ peck = 1 gallon; ¼ gallon = 1 quart; ½ quart = 1 pint. For firewood, 128 cubic feet = 1 cord; sub-multiples, ⅛ cord = 1 cord foot; $\frac{1}{16}$ cord foot = 1 cubic foot.

URUGUAY.—System metric, but old Spanish measures are yet in use.

VENEZUELA.—Measures of Spanish origin.

WEST INDIES.—Measures derived from their earliest European occupants. (For their distribution see *Length* measures above.)

ZANZIBAR.—The only native measure of capacity ascertained is the djezla = 7.305 bushels = 257.4 litres.

IV. WEIGHT.

ABYSSINIA.—The rotl or rottolo = 4800 grs. = $\frac{6}{7}$ pound troy = 311.035 grammes, is the unit. Multiple, 32 rotl = 1 maund. Sub-multiples, $\frac{1}{12}$ rotl = 1 wakea; $\frac{1}{10}$ wakea = 1 dirhem. Also, 12 dirhems = 1 mocha = 480 grains = 1 ounce troy.

ALGERIA.—The rotl or rottolo is the unit, and has different values for different commodities. The rotl-kébir (large rotl), for honey, butter, oil, dates, and soap = 1.806 lbs. avoirdupois = 0.81912 kgm.; the rotl-ghredouri, for fruits and leguminous vegetables = 1.35453 lbs. av. = 0.61434 kgm.; the rotl-feudi, for precious metals and gems = 1.0968 lbs. av. = 0.49743 kgm; and the rotl-attari, for drugs and commodities generally = 1.20403 lbs. av. = 0.54608 kgm. The rotl-feudi and the rotl-attari are subdivided into 16 ounces each, the rotl-ghredouri into 18 ounces, and the rotl-kébir into 24 ounces. The rotl-attari has a multiple by 100, called the kantar-attari, for commodities generally; a multiple by 110 for cheese, almonds, cotton, and some other things, called the kantar-fromage; a multiple by 166 for honey, butter, oil, soap, etc., called the kantar-beurre; and a multiple, called the kantar de lin, of 200 rotl-attari. There are a kantar-ghredouri and a kantar-kébir, each of 100 times the corresponding rotl. The kharouba or karob is a small weight for pearls and jewels = 3 grains = 0.1944 gramme; multiple, 24 karobs = 1 métical.

ANNAM.—The cân or catti = 1.3775 lbs. av., or 624.913 grammes. Multiples, 10 cân = 1 yen; 5 yen = 1 binh; 2 binh = 1 ta; 5 ta = 1 quân. Sub-multiples, ⅝ cân = 1 nen; $\frac{1}{10}$ nen = 1 luong; $\frac{1}{10}$ luong or liang = 1 deng; $\frac{1}{10}$ deng = 1 phan; $\frac{1}{10}$ phan = 1 li. The li = 0.602 grain = 0.03905 gramme, and is fancifully subdivided decimally to the millionth part.

ARABIA.—The unit of weight is the maund = 3 lbs. av. = 1.3608 kgms. Multiples, 10 maunds = 1 frazil; 15 frazils = 1 bahar. Sub-multiples, ½ maund = 1 rottle; $\frac{1}{15}$ rottle

= 1 vakia. At Mocha the maund of coffee contains but 29 vakias. Egyptian weights are also used.

ARGENTINE CONFEDERATION.—The legal system is the metric; old Spanish weights are also in use.

AUSTRALIA. The weights are British.

AUSTRIA.—Since Jan. 1, 1876, the legal weights are metric. The pfund is the old commercial unit. The pfund of Vienna = 1.2317 lbs. av. = 560 grammes; multiples, 20 pfund = 1 stein; 5 stein = 1 centner; 4 centner = 1 karch; 20 centner = 1 schiffast, or shipping ton; 40 centner = 1 ordinary last. The saum = 339.53 lbs. av. = 154 kgms. The saum for steel = 308.68 lbs. av. = 140 kgms.; sub-multiple, ½ saum = 1 fägel. Sub-multiples of the pfund, ½ pfund = 1 mark; ½ mark = 1 vierding; ¼ vierding = 1 unze; ½ unze = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 pfennige. For precious metals the mark is the unit = 0.75226 lb. troy = 280.774 grammes; sub-multiples, $\frac{1}{16}$ mark = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 pfennig. The karat for jewels = 3.4799 grains = 0.206085 gramme. For drugs, the pfund = 0.92843 lb. av. = 421.1287 grammes; sub-multiples, $\frac{1}{12}$ pfund = 1 unze; ⅛ unze = 1 drachmen; ⅓ drachmen = 1 scrupel; $\frac{1}{20}$ scrupel = 1 gran.

BELGIUM.—The weights are metric.

BIRMAH.—The vis of Rangoon = 3.3333⅓ lbs. av. = 1.511966 kgms. Multiple, 150 vis = 1 candy = 500 lbs. av. = 226.7959 kgms. Sub-multiples, $\frac{1}{100}$ vis = 1 tical; $\frac{1}{100}$ tical = 1 moos.

BOLIVIA.—The legal weights are metric; other weights in use are old Spanish. The quintal = 101.4179 lbs. av. = 46 kgms. Sub-multiple, ¼ quintal = 1 arroba.

BRAZIL.—The metric system is legal; other weights in use are of Portuguese origin. For gems, the quilate = 3.075 grains = 0.19158 gramme; for topazes, the oitava = 57.17 grs.

CENTRAL AMERICA.—The weights used in these states are Spanish.

CHILI.—The legal system is metric.

CHINA.—The catty = 1.33333 lbs. = 604.7 grammes; multiples, 2 catties = 1 yin; 50 yin = 1 peeul or tam; sub-multiples, $\frac{1}{16}$ catty = 1 tael; $\frac{1}{10}$ tael = 1 mace. The shik = 160 lbs. av. = 72.575 kgms.; sub-multiple, ¼ shik = 1 kwan. The chu = ⅝ drachm av. = 1.575 grammes; 10 chu = 1 lui.

COLOMBIA.—The legal system is the metric.

DENMARK.—The pund is the unit = 1.102368 lbs. av. = 500 grammes. This is the metric pound used by the old Zollverein. Multiple, 100 pund = 1 centner. Sub-multiples, $\frac{1}{10}$ pund = 1 quint; $\frac{1}{10}$ quint = 1 ort. The old Danish pund was $\frac{1}{62}$d part of the weight of a cubic foot of pure water at the ordinary temperature, and was = 1.10114 lbs. av. = 499.4 grammes; multiples, 16 pund = 1 lispund; 20 lispund = 1 skippund; sub-multiples, ½ pund = 1 mare; ⅛ mare = 1 once; ½ once = 1 lod; ¼ lod = 1 quintin; ¼ quintin = 1 ort. The pund for precious metals was = 1.038 lbs. av. = 470.8 grammes; sub-multiples, ½ pund = 1 mare; $\frac{1}{16}$ mare = 1 lod; ¼ lod = 1 quintin; ¼ quintin = 1 ort; $\frac{1}{16}$ ort = 1 as; ⅛ as = 1 grain. For drugs, the pund = 0.788974 lb. av. = 357.85 grammes. This is the old pharmaceutical pfund of Nuremberg, Bavaria. Sub-multiples, $\frac{1}{12}$ pund = 1 unze; ⅛ unze = 1 drachme; $\frac{1}{20}$ drachme = 1 gran.

ECUADOR.—The system is metric.

EGYPT.—The oka, occa, or cockeeyeh = 2.7275 lbs. av. = 1.237 kgms. Sub-multiples, $\frac{1}{400}$ oka = 1 darhim; $\frac{1}{24}$ darhim = 1 kérat; ¼ kérat = 1 kamha. Also, 144 darhims = 1 rotl or rottolo = 0.9819 lb. av. = 445.41 grammes, and 100 rotl = 1 cantaro.

FRANCE.—(See METRIC SYSTEM.) The old livre of Paris, called *livre poids de mare*, was = 1.0792857 lbs. av. = 489.5 grammes. Sub-multiples, ½ livre = 1 mare; ⅛ mare = 1 once; ⅛ once = 1 gros; ⅛ gros = 1 scrupule or denier; $\frac{1}{24}$ denier = 1 grain; $\frac{1}{24}$ grain = 1 prime or carobe.

GERMAN EMPIRE.—The only legal system since Jan. 1, 1873, is the metric. Previously, several of the states had introduced the system wholly or partially. The old weights in some of the states are given below:

Baden.—In 1810 the metric pfund = ½ kilogramme = 500 grammes = 1.1023 lbs. av., was established by law, with decimal multiples and sub-multiples. Multiples, 10 pfund = 1 stein; 10 stein = 1 centner. Sub-multiples, $\frac{1}{10}$ pfund = 1 zehnling; $\frac{1}{10}$ zehnling = 1 centass; $\frac{1}{10}$ centass = 1 dekass or pfennig; $\frac{1}{10}$ pfennig = 1 ass. The pfund of Carlsruhe was = 1.0305 = 467.4 grammes, divided into 32 loth or 128 quentchen. For apothecaries' weight the same pfund was used in Baden and throughout the states now forming the German empire as is above given for Denmark, with similar subdivisions.

Bavaria.—The pfund of Bavaria, by law of 1811, was made = 560 grammes exactly = 1.23486 lbs. av. Sub-multiples, $\frac{1}{16}$ pfund = 1 once; ½ once = 1 lotb; ¼ loth = 1 quentchen. On joining the Zollverein in 1833, the metric pfund was introduced for customs purposes = 500 grammes = 1.10231 lbs. av., with the sub-multiples, ¼ pfund = 1 vierling; ½ vierling = 1 loth; ½ loth = 1 quentchen. For drugs, the same weights as in Baden.

Bremen.—The pfund = 1.09906 lbs. av. = 0.498 kgm. Sub multiples, ½ pfund = 1 mare; ⅛ mare = 1 unze; ½ unze = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 ort. The centner = 116 pfund. For drugs, the same as in Baden.

Brunswick.—The pfund = 1.0305 lbs. av. = 0.4674 kgm., which was the old pfund of Carlsruhe, Baden. Sub multiples, ½ pfund = 1 mark; $\frac{1}{16}$ mark = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 pfennig; ½ pfennig = 1 heller. For drugs, the same as in Baden.

Hamburg.—The pfund = 1.0680286 = 0.4844 kgm. Sub-multiples, ½ pfund = 1 mark; ⅛ mark = 1 unze; ½ unze = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 pfennig. For drugs, the same as in Baden.

Hanover.—The pfund = 1.0797 = 0.4896 kgm. Sub multiples, ½ pfund = 1 mark; ⅛ mark = 1 unze; ½ unze = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 örtchen. For drugs, the same as in Baden.

Hesse-Cassel.—The pfund = 1.06768 lbs. av. = 0.48424 kgm. Sub-multiples, $\frac{1}{16}$ pfund = 1 unze; ½ unze = 1 loth; ¼ loth = 1 quentchen. For drugs, the weights are the same as in Baden.

Hesse-Darmstadt.—The commercial pfund for wholesale = 1.114106 lbs. av. = 0.505296 kgm. The retail commercial pfund = 1.03158 lbs. av. = 0.4679 kgm. Sub multiples of both, ½ pfund = 1 mare; ⅛ mare = 1 once; ½ once = 1 loth; ¼ loth = 1 quentchen; ¼ quentchen = 1 pfennig; ½ pfennig = 1 heller. For drugs, the same weights as in Baden.

Lubeck.—The pfund = 1.0687 = 0.4846, almost identical with that of Hamburg, with which its sub-multiples correspond. For drugs, the same weights are used as in Baden.

Prussia.—The pfund was fixed by law in 1816 at the weight of the $\frac{1}{60}$th part of a cubic fuss of distilled water weighed *in vacuo* at the temperature of 15° Réaumur; and, according to the report of a commission in 1826, is = 1.031236 lbs. av. = 467.7 grammes. Its subdivisions are the same as those above given for Darmstadt. For drugs, the same weights are used as in Baden. On the formation of the Zollverein the pfund of 500 grammes = 1.1023 lbs. av., was adopted, with multiples and sub-multiples as follows: 100 pfund = 1 centner; 3 centner = 1 tonne; $\frac{1}{30}$ pfund = 1 loth; $\frac{1}{10}$ loth = 1 quentchen; $\frac{1}{10}$ quentchen = 1 zent. Apothecaries' weight as in Baden. For precious metals and coinage, the marc, called the marc of Cologne = 233.77 grammes = 3608 grains troy, is the unit.

Saxony.—The weights are the same as given above for Brunswick. For drugs, the Nuremberg weights are used, as in Baden.

Würtemberg.—The old pfund = 1.03143 = 467.8 grammes, very closely approximating to that of Prussia, to which its subdivisions correspond. More recently, the Zollverein pfund of 500 grammes = 1.1023 lbs. av., has been used. For gold and silver, the mark = 3610 grains troy = 233.855 grammes.

GREAT BRITAIN.—For commercial purposes generally the pound avoirdupois = 7000 grains troy = 0.45359265 kgm., is the unit. Multiples, 14 pounds = 1 stone; 2 stone = 1 quarter; 4 quarters = 1 hundredweight; 20 hundredweight = 1 ton = 2240 lbs. = 1016.01754 kgms. Sub-multiples, $\frac{1}{16}$ lb. = 1 ounce = 28.35 grammes; $\frac{1}{16}$ ounce = 1 dram = 1.77184 grammes. For the precious metals and coinage, the pound troy = 5760 grains = 0.37324195 kgm.; sub-multiples, $\frac{1}{12}$ lb. = 1 ounce; $\frac{1}{20}$ ounce = 1 pennyweight; $\frac{1}{24}$ pennyweight = 1 grain. For drugs, the pound has the same weight, but is differently subdivided. Thus, $\frac{1}{12}$ lb. = 1 ounce; ⅛ ounce = 1 drachm; ⅓ drachm = 1 scruple; $\frac{1}{20}$ scruple = 1 grain.

GREECE.—The legal system is metric. The cantaro of 44 oke is also used. The cantaro of Patras = 116.31 lbs. av. = 52.75 kgms.; that of the Morea generally = 125.71 lbs. av. = 56.11 kgms. The gramme is used under the name drachma, the kilogramme as the mina, and 1½ kgms. = 1 talanton.

GUINEA.—The benda = 2.262 oz. av. = 64.12 grammes. Sub-multiples, ½ benda = 1 benda-offa; ¼ benda-offa = 1 piso; ½ piso = 1 aguirage; ½ aguirage = 1 media-tabla = 30.925 grains troy = 2.0039 grammes. Multiples of the media-tabla are, also, 3 media-tabla = 1 quinto; 2 quintos = 1 seron; 1⅔ seron = 10⅔ media-tabla = 1 eggeba = 0.75396 oz. av. = 21.375 grammes. There is also a rotl = 0.95378 lbs. av. = 0.43263 kgm.

INDIA, BRITISH.—The metric system is legalized, but only as yet partially introduced. The native weights are very various in different cities and provinces.

Bengal.—The maund is the unit for large weights. At Calcutta, the maund of the British factory = 74.672 lbs. av. = 33.865 kgms; the maund of the bazaar of Bengal exceeds this 10 per cent. and = 82.1392 lbs. av. = 37.2515 kgms.

Grains are sold by the factory-maund, and liquids by the bazaar-maund: 40 maunds of grain = 1 khahoon; sub-multiples, $\frac{1}{4}$ maund = 1 pally; $\frac{1}{4}$ pally = 1 raik; $\frac{1}{4}$ raik = 1 khoonke; $\frac{1}{5}$ khoonke = 1 chattack. Sub-multiples of the bazaar-maund, $\frac{1}{8}$ maund = 1 pussaree; $\frac{1}{5}$ pussaree = 1 seer; $\frac{1}{4}$ seer = 1 pouah or pice; $\frac{1}{4}$ pouah = 1 chattack; $\frac{1}{5}$ chattack = 1 sicca.

Bombay.—The maund = 28 lbs. av. = 12.699 kgms. Multiple, 20 maunds = 1 candy. Sub-multiples, $\frac{1}{40}$ maund = 1 seer; $\frac{1}{30}$ seer = 1 pice; $\frac{5}{12}$ pice = 1 tauk. This is the maund of the capital; several others are used in the presidency.

Madras.—The native maund = 24.114 lbs. av. = 10.937 kgms.; the British maund = 25 lbs. av. = 11.339 kgms. Multiple, 20 maunds = 1 candy. Sub-multiples, $\frac{1}{8}$ maund = 1 visay or vis; $\frac{1}{8}$ vis = 1 seer; $\frac{1}{4}$ seer = 1 pollam; $\frac{1}{10}$ pollam = 1 varahun or pagoda.

Italy.—The metric system is now established by law. The old weights are given below for a few of the states:

Naples.—The rottolo, the unit-weight for ordinary commerce = 1.9645 lbs. av. = 0.891 kgm. Sub-multiple, $\frac{9}{25}$ rottolo = 1 libbra = 0.70717 lb. av. = 320.76 grammes. The libbra is the unit for precious metals, spices, cochineal, indigo, wax, and some few other things; the rottolo, for merchandise in general. Sub-multiples of the libbra are—$\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{30}$ oncia = 1 trapeso; $\frac{1}{20}$ trapeso = 1 accino. For drugs, the same libbra is subdivided thus: $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{10}$ oncia = 1 drachma; $\frac{1}{3}$ drachma = 1 scrupolo; $\frac{1}{20}$ scrupolo = 1 accino.

Rome.—The libbra, the unit of commerce of the capital = 0.747714 lb. av. = 0.3391 kgm. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{24}$ oncia = 1 denaro; $\frac{1}{24}$ denaro = 1 grano. In other parts of the late Roman States the libbra has different values and is differently divided. In Bologna it is 0.79814 lb. av. = 362 grammes, and the sub-multiples are—$\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 ottavo; $\frac{1}{2}$ ottavo = 1 ferlino; $\frac{1}{10}$ ferlino = 1 carato; $\frac{1}{3}$ carato = 1 grano.

Sardinia.—In the capital, the libbra = 0.81326 lb. av. = 368.85 grammes. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 ottavo; $\frac{1}{3}$ ottavo = 1 denaro; $\frac{1}{24}$ denaro = 1 grano; $\frac{1}{24}$ grano = 1 granotino. For precious metals, the marco = $\frac{2}{3}$ libbra, is the unit; for drugs, the libbra = $\frac{5}{3}$ marco. In Genoa there is a libbra *peso grosso* and a libbra *peso sottile* or *peso scarso*. The former exceeds the latter by 10 per cent. The libbra peso scarso is used in ordinary commerce, and also for precious metals. It is = 0.69887 lb. av. = 317 grammes. Subdivisions, like those of the city of Rome.

Tuscany.—The libbra of Florence = 0.74864 = 339.55 grammes, and is very nearly equal to the libbra of Rome. Sub-multiples, $\frac{1}{12}$ libbra = 1 oncia; $\frac{1}{8}$ oncia = 1 dramma; $\frac{1}{3}$ dramma = 1 denaro; $\frac{1}{24}$ denaro = 1 grano.

Japan.—The unit of weight, called the mome, or in modern times, the sen = 57.2705 grains troy = 3.756521 grammes, and is decimally subdivided to tenths, hundredths, and thousandths, and has decimal multiples up to 1000 sen = 1 ku-wan-me = 3.756521 kgms. For many kinds of goods, the kin, called by foreigners the catty = 160 sen = 1.325073 lbs. av. = 601.04 grammes, is used. This weight is different for various localities and commodities.

Mexico.—The legal weights are metric. Old Spanish names continue in use. The value of the old libra of the capital was 1.0143 lbs. av. = 460 grammes, divided into 16 onces. The libra of Vera Cruz was 1.01534 lbs. av. = 460.5 grammes. Both are derived from Spain.

Morocco.—The rotl is the unit, and at Mogadore = 1.186614 lbs. av. = 538.18 grammes; at Tangiers = 1.07086 lbs. av. = 481.15 grammes; elsewhere = 1.11243 lbs. av. = 504.54 grammes. Multiple, 100 rotl = 1 cantaro.

Netherlands.—The system is metric.

Norway.—The skälpund is the unit = 1.10114 lbs. av. = 499.4 grammes, and is identical with the pund of Denmark. Multiples, 20 skälpunds = 1 lispund; 400 lispunds = 1 skippund. Sub-multiples, $\frac{1}{2}$ pund = 1 mare; $\frac{1}{8}$ mare = 1 untz; $\frac{1}{2}$ untz = 1 lod; $\frac{1}{4}$ lod = 1 qwintin; $\frac{1}{4}$ qwintin = 1 ort.

Persia.—The rattel or rotl is the unit = 1.027 lbs. av. = 464.88 grammes. This is the value in Tauris. It is different at the capital, and in almost every other place of importance. Multiple, 6 rattels = 1 batman. Sub-multiples, $\frac{1}{50}$ rattel = 1 dirhem; $\frac{1}{2}$ dirhem = 1 mascal.

Peru.—The legal system is metric; Spanish weights and measures are still in use. The libra of Lima is identical with that of Mexico.

Portugal.—The unit is the arratel = 1.01186 lbs. av. = 459 grammes. Multiples, 32 arratels = 1 arroba; 4 arrobas = 1 quintal; 13$\frac{1}{2}$ quintals = 1 tonelada. Sub-multiples, $\frac{1}{16}$ arratel = 1 onça; $\frac{1}{8}$ onça = 1 outava; $\frac{1}{3}$ outava = 1 escropolo; $\frac{1}{24}$ escropolo = 1 grão. For the precious metals the marco of 8 onças = $\frac{1}{2}$ arratel, is the unit, similarly subdivided. For drugs, the libra of 12 onças = $\frac{3}{4}$ arratel, is employed.

Roumania.—The littra of Bucharest = 0.707143 lb. av. = 320.7 grammes. Multiples, 4 littra = 1 oka; 44 okas = 1 cantaro. Sub-multiple, $\frac{1}{100}$ littra = 1 drachma.

Russia.—The funte = 0.902643 lb. av. = 409.4 grammes. Multiples, 40 funtes = 1 pood; 10 poods = 1 berkowitz or berkovetz; 3 berkovetz = 1 packen. Sub-multiples, $\frac{1}{12}$ funto = 1 lana; $\frac{3}{8}$ lana = 1 loth; $\frac{3}{3}$ loth = 1 zolotnik or solotnik; $\frac{1}{96}$ zolotnik = 1 doli. The pharmaceutical funte = $\frac{7}{8}$ commercial funte, and is subdivided as in the U. S.

Siam.—The catty = 1.370 lbs. av. = 612.3 grammes. Multiple, 50 catties = 1 pecul. Sub-multiples, $\frac{1}{20}$ catty = 1 tael; $\frac{1}{4}$ tael = 1 tical.

Spain.—The present system is metric. The legal unit of the realm was previously the libra of Castile = 1.0143 lbs. av. = 460.0 grammes. Multiples, 25 libras = 1 arroba; 4 arrobas = 1 quintal; 20 quintals = 1 tonelada. Sub-multiples, $\frac{1}{2}$ libra = 1 marco; $\frac{1}{8}$ marco = 1 onza; $\frac{1}{8}$ onza = 1 ochava; $\frac{1}{2}$ ochava = 1 adarme; $\frac{1}{3}$ adarme = 1 tomine; $\frac{1}{12}$ tomine = 1 grano.

Sweden.—The skålpund = 0.93374 lb. av. = 423.54 grammes. Multiples, 100 skålpunds = 1 centner; 100 centners = 1 last. Sub-multiples, $\frac{1}{100}$ skålpund = 1 korn; $\frac{1}{100}$ korn = 1 ort. Old subdivision, $\frac{1}{16}$ skålpund = 1 uns; $\frac{1}{2}$ uns = 1 lod; $\frac{1}{4}$ lod = 1 qwintin.

Switzerland.—The weights have metric values, the unit being the livre or pfund of the Zollverein = $\frac{1}{2}$ kilogramme = 1.10231 lbs. av. = 500 grammes. Multiple, 100 livres = 1 quintal. Sub-multiples, decimal, and also $\frac{1}{16}$ livre = 1 once; $\frac{1}{2}$ once = 1 loth.

Tripoli.—The rotl = 1.09714 lbs. av. = 497.60 grammes. Multiples, 2$\frac{1}{2}$ rotl = 1 oka; 40 oke = 1 cantaro. Sub-multiples, $\frac{1}{16}$ rotl = 1 uckia; $\frac{1}{10}$ uckia = 1 drachma; $\frac{1}{16}$ drachma = 1 kharouba. For precious metals, the metical or miscal = 24 kharouba = 72 grains troy = 4.665 grammes.

Tunis.—The rotl = 1.1107 lbs. av. = 503.66 grms. Sub-multiples, $\frac{1}{16}$ rotl = 1 uckia; $\frac{1}{4}$ uckia = 1 metical or termine.

Turkey.—The chequi or cheki, also called yusdrome, of Constantinople = 0.707143 lb. av. = 320.7 grammes. Multiples, 4 chequis = 1 oka; 44 okas = 1 kantar or cantaro. Sub-multiples, $\frac{1}{100}$ chequi = 1 dirhem or drachma; $\frac{1}{4}$ dirhem = 1 deuke; $\frac{1}{4}$ deuke = 1 karat. The chequi of opium = 250 dirhems = 2$\frac{1}{2}$ ordinary chequi. At Smyrna the ordinary chequi = 0.7082143 lb. av. = 321.2 grammes, similarly subdivided; and the chequi of opium = 2$\frac{1}{2}$ ordinary chequi, as above. The batman = 6 okas.

United States of America.—The weights are identical with those of Great Britain.

Uruguay.—The legal system is metric; old Spanish weights continue in use. The libra = 1.0143 lbs. av. = 460.0 grammes.

West Indies.—The weights are those introduced by the first occupants from their respective countries. (For the distribution see *Measures of Length.*)

Zanzibar.—The rotl = 0.98006 lb. av. = 444.547 grammes. Multiple, 36 rotl = 1 franzella. Also, the mane = 3.0071 lbs. av. = 1.365 kgms., and the bazla = 34.226 lbs. av. = 15.525 kgms.

On this subject the following works may be consulted with advantage: Kelly's *Universal Cambist* (2d ed., London, 1842); Tate's *Modern Cambist* (12th ed., London, 1862); Tarbé, *Manuel des Poids et Mesures* (Paris, 1839); Altés, *Traité des Monnaies, Poids et Mesures* (Marseilles, 1832); Nelkenbrecher, *Allgemeines Taschenbuch* (Berlin, 1832); Paucton, *Metrologie, ou Traité des Mesures, Poids et Monnaies des anciens Peuples et des modernes* (Paris, 1780); Shuckburgh Evelyn, *Experiments in Weights and Measures, Phil. Trans.* (London, 1798); Kater, *Account of the Operations of the Standards Commission of 1818, Phil. Trans.* (London, 1826); Doursther, *Dictionnaire universel des Poids et Mesures, anciens et modernes, contenant des Tables des Monnaies de tous les Pays* (Brussels, 1840). [This is a wonderful monument of industry and accuracy, and is almost exhaustive of the subject.] Alexander, *Universal Dictionary of Weights and Measures* (Baltimore, 1850); Hassler, *Reports on Construction of Standards*, etc., made to the secretary of the treasury of the U. S. (Washington, 1832–43); Bache, *Reports of Bureau of Weights and Measures 1845 et seq.* (Washington, 1845–63); Adams, J. Q., *Report to the H. of R. of the U. S. on Weights and Measures* (Washington, 1821); Boeckh, *Metrologische Untersuchungen* (Berlin, 1838); *Royal Standards Commission of 1818, Reports to the Prince Regent* (i.–iii., Parliamentary Blue-Books, London, 1819–21); *Royal Standards Commission of 1867–68, Reports to Her Majesty the Queen* (i.–v., Parliamentary Blue-Books, London, 1868–71); Herschel, J., *The Yard, the Pendulum, and the Mètre*, etc. (Leeds, 1863); Barnard, *The Metric System* (New York, 1872); Hübner, *Statistische Tafel aller Länder der Erde* (Berlin, 1876); Clarke, *Weights and Measures of all Nations* (New York, 1875); Browne, *Money, Weights, and Measures of the Chief Commercial Traders in the World, with British Equivalents* (Lond., 1876). F. A. P. Barnard.

Welck'er (Friedrich Gottlieb), b. at Grünberg, Hesse, Nov. 4, 1784; studied philology at the University of Giessen; lived (1806–09) as tutor in the house of W. von Humboldt in Rome, in intimate intercourse with Zoega, Thorwaldsen, etc.; was appointed professor of archæology at Giessen in 1809; volunteered in the French campaigns 1814–16; became professor at Göttingen in 1816, and at Bonn in 1819. D. at Heidelberg Dec. 17, 1868. He exercised great influence on the study of Greek literature and art both by his lectures and by his numerous writings, of which the most prominent are—*Die Aeschyleische Trilogie* (1824), *Die griechische Tragödien mit Rücksicht auf den epischen Cyklus* (3 vols., 1839), *Griechische Götterlehre* (3 vols., 1857–62), etc.

Wells (William Charles), M. D., F. R. S., b. at Charleston, S. C., in May, 1757; educated at Dumfries and at Edinburgh, Scotland; studied medicine at Charleston; was a surgeon in the English service in Holland; completed his medical studies at Edinburgh Dec., 1780; returned to Charleston early in 1781; practised medicine there, and became a printer, bookseller, and merchant, being noted, like his father, for his loyalty to Great Britain; went with the loyal troops to St. Augustine, Fla., Dec., 1782; published there the first weekly newspaper in that province, and was captain of loyal volunteers; went to England May, 1784; settled in London 1785; became physician to the Finsbury Dispensary 1790, and to St. Thomas's Hospital 1798; published his *Essay on Single Vision with Two Eyes* (1792) and his celebrated *Essay on Dew* (1814), for which he was awarded the gold and silver Rumford medals by the Royal Society 1816. D. in London Sept. 18, 1817. His *Autobiography* was published in 1818, and a new ed. of his *Essay on Dew* appeared in 1866.

Wells (William Harvey), b. at Tolland, Conn., in 1812; was principal of the Massachusetts Normal School at Westfield for some years, and subsequently superintendent of public schools at Chicago, Ill. He was one of the original editors of the *Massachusetts Teacher*; has contributed to several educational journals; is author of a *Grammar of the English Language* (1846), of *A Graded Course of Instruction for Public Schools* (1848), and other educational works.

Welsh (David), D. D., b. at Moffat, Dumfriesshire, Scotland, Dec. 11, 1793; educated at the High School and University of Edinburgh; became minister of the parish of Crossmichael 1821, and of St. David's, Glasgow, 1827; was professor of church history in the University of Edinburgh 1831–43; visited Germany 1834; was prominently associated with Drs. Chalmers and Gordon in 1843 in the foundation of the Free Church of Scotland, of whose General Assembly he was the first moderator, thereby sacrificing his professorship and the secretaryship of the Bible Board; became professor of ecclesiastical history in the new college of the Free Church, and was the founder and first editor of the *North British Review* 1844. D. at Camis Eskin, on the Clyde, Apr. 24, 1845. Author of *An Account of the Life and Writings of Dr. Thomas Brown* (1825), *Sermons on Practical Subjects* (1834), and *Elements of Church History* (1844), and wrote the articles *Jesus* and *Jews* in the *Encyclopædia Britannica* (7th and 8th eds.). A volume of posthumous *Sermons* (1846) was edited, with a *Memoir*, by Alexander Dunlop, Esq.

Welsh, or **Welch** (John), b. in Scotland about 1568; graduated at the University of Edinburgh 1588; became parish minister of Selkirk 1589, of Ayr 1590, and of Kirkcudbright 1594; was noted as a pulpit-orator: preached before the General Assembly (1596) a sermon which was denounced by his enemies as "violent, seditious, and treasonable," being adverse to the royal project of suppressing the general assemblies, for which he was prosecuted by the agents of the king and outlawed, but relieved from the sentence after six months; settled at Ayr 1600: was imprisoned for opposition to royal dictation in ecclesiastical affairs, tried for high treason, and sentenced to exile Jan., 1606; went to France, and there labored many years, at St. Jean d'Angély, among the Huguenots, by whom he was much esteemed. His wife, Elizabeth, was the youngest daughter of John Knox. D. at London in Mar., 1622. His *Life*, by Rev. James Young, appeared in 1866.

Welsh (William), b. in Philadelphia, Pa., about 1810; became a prominent merchant of that city, where he has filled many public posts, including the presidency of the board of trusts, and is widely known as a philanthropist, especially in connection with the Indian peace commission, of which he was one of the members during the early years of the administration of Pres. Grant, but resigned in consequence of differences with the Indian bureau. He is a director of Girard College; was for some years proprietor of the *North American* and of the *Philadelphia Gazette*. Author of *Lay Co-operation in St. Mark's Church* (1861), *Letters on the Home Missionary Work of the P. E. Church* (1863), *The Bishop Potter Memorial Home* (1868), and (with Bishop Whipple and Rev. S. D. Hinman) *Tanpa and his Friends, or Indians' Wrongs and Rights*, etc. (1869). His brother and business partner, John, is also prominent as a philanthropist.

What Cheer, p. v., Keokuk co., Ia., on Coal Creek, a tributary of North Skunk River, 45 miles S. W. of Iowa City, has 1 church, 1 graded school, and 2 grist-mills. It is a coal mart for the neighboring country, over 200,000 bushels having been mined in 1876. J. Andrews.

Whent'on (Frank), b. in Providence, R. I., May 8, 1833; educated for the profession of civil engineering at Brown University; employed as assistant on the U. S. and Mexican boundary survey and government surveys 1850–55, when appointed (Mar. 3) first lieutenant in the 1st U. S. Cavalry; served on frontier duty, and engaged in combat on Wood River Aug. 26, 1856; Cheyenne expedition 1857, participating in the battle of Solomon's Fork, etc.; appointed A. D. C. to Gen. P. F. Smith Nov., 1857, and rejoined his regiment July, 1858, and on frontier duty until June, 1860; became captain Mar., 1861, and engaged in mustering New York volunteers Apr.–July; appointed lieutenant-colonel 2d R. I. Vols. July 16, and engaged in the battle of Bull Run, July 21, succeeding to command of the regiment during the battle upon the fall of Col. Slocum; led his regiment through the Peninsular campaign, at the second battle of Bull Run, Chantilly, Antietam, and Fredericksburg; promoted brigadier-general of volunteers from Nov. 29, 1862, and commanded a brigade 6th corps at the storming of Maryc Heights and battle of Salem Heights, May 3–4, 1863; in command of a division at battle of Gettysburg; detached from the Army of the Potomac Dec. 30, 1863, to defence of Harper's Ferry; rejoined that army Mar., 1864, and in command of brigade 6th corps from Wilderness battles to front of Petersburg; detached with his corps to defence of Washington July, 1864, participating in the Shenandoah campaign, and in command of a division from Sept. 20 to close of the war; was brevetted from lieutenant-colonel to major-general for gallantry in battle, and in July, 1866, appointed lieutenant-colonel 39th U. S. Infantry; became colonel 2d Infantry in 1874.

Wheel'er (Daniel), b. in London, England, in 1771; served six years in the British navy; enlisted in the army as a private soldier; rose to the rank of sergeant-major; joined the Society of Friends 1799; became a tradesman; began to preach 1815; was employed several years from 1818 in Russia by the emperor Alexander, superintending works and agriculture; spent his closing years in missionary travels in Australasia and Oceanica. D. in New York City in 1840. Four volumes of *Extracts* from his letters and journals were published 1835–39. A *Memoir* by his son Daniel appeared in 1842, and another was published in 1859.

Wheeler (John), D. D., b. at Grafton, Vt., Mar. 11, 1798; settled at Orford, N. H., in 1804; graduated at Dartmouth College 1816, at Andover Seminary 1819; was pastor of a church at Windsor, Vt., 1821–33, and president of the University of Vermont 1833–48. D. at Burlington, Vt., Apr. 16, 1862. He published several funeral sermons and historical and anniversary discourses.

White'bait, a name given in England to small fishes which were long supposed to belong to a peculiar species (*Clupea alba*), and even to a special generic type (*Regenia*) of the Clupeidæ, but which are now known to be merely the young of the common herring (*Clupea harengus*). The differences in physiognomy and in dentition between the young and old of the Clupeæ are sufficiently considerable to have afforded some reasons for a distinction originally, especially in connection with the differences of habits. The name "whitebait" is limited to fishes under six inches in length and whose sides are almost uniformly white. Such fishes begin to make their appearance in the river Thames in England about the end of March or early in April, and during the summer months are caught in immense quantities, and are served up to the epicures who frequent, for the purpose of eating them, the taverns of Greenwich and Blackwall. They are mostly fried with fine flour: it has been customary for the cabinet ministers and parliamentary leaders of England to mark the parliamentary season with a dinner of which the chief dainty is the whitebait. Theodore Gill.

White'fish, a name given to fishes of the family Salmonidæ and genus *Coregonus*. These have the form essentially similar to that of the salmons and trouts, although less graceful, and with a stouter tail: the scales are also larger, but are of moderate size: the mouth has a narrow cleft, and the upper jaw projects more or less beyond it, or is truncated; the maxillary bones are short and

broad; the teeth are wanting or extremely minute; the suborbital bones are well developed; the dorsal fin has 13 to 15 rays, the anal 13 to 16; the adipose dorsal fin is moderately developed; the stomach recalls a horse-shoe by its form; the pylorie appendages are very numerous. The species are generally distributed in the colder waters of the northern hemisphere, especially affect the still waters of lakes and ponds, and are rather local in their distribution. About 30 species are known, distributed between Europe, Asia, and North America. Among the most notable of the American species is the *Coregonus albus*, or common whitefish of the lakes. This is one of the most important of the economical fishes of the great system of northern lakes, and employs a large capital. Extensive warehouses exist for its storage in and near the large cities and towns on the lake borders. (For some statistics respecting the species see FISHERIES, in CYCLOPÆDIA.) THEODORE GILL.

White'hall, v. of Livingston parish, La., on the Amite, 75 miles from New Orleans, with which it has communication twice a week by the Amite River packets; has 1 newspaper, manufactures shingles, staves, etc., and is the shipping-point for the produce of the surrounding country. P. about 200. ROBT. BENEFIELD, ED. "WHITEHALL GAZETTE."

Wil'lard (AUCHIBALD M.), b. at Bedford, near Cleveland, O., Aug. 22, 1836; received a rather scanty instruction in drawing and painting; worked as an ornamental painter in a carriage-factory; served during the war, first in the 86th Ohio Vols., then in the 176th; made a more thorough study of painting under J. O. Eaton of New York, and was very successful in 1874 with his *Roman Prisoner*, and in 1876 with his *Yankee Doodle*.

Wil'lis (FREDERICK ARTHUR), entered the British army as ensign in 1844; advanced through successive grades to be colonel in 1865; was distinguished in the Indian mutiny of 1857, being present with Sir Henry Havelock in the actions of June; commanded the 84th regiment, and was severely wounded at the relief of Lucknow; commanded right column at storming of Hirn Khannah; with Outram at the Alumbagh; present at the fall of Lucknow. Brevetted major and lieutenant-colonel and created a C. B. for gallantry.

Wood'ford (STEWART L.), LL.D., b. Sept. 3, 1835, in New York City; graduated at Columbia College 1854; appointed assistant U. S. attorney 1861; entered the U. S. volunteer army in 1862, and was in active service till he resigned in 1865, having been chief of staff in the department of the South, military commandant of Charleston, Savannah, etc., attaining the rank of colonel and brevet brigadier-general; elected lieutenant-governor of New York in 1866; defeated as Republican candidate for governor by Mr. Hoffman in 1870; elected to Congress in 1872; also chosen Presidential elector at large and made chairman of the New York electoral college in 1872; appointed U. S. attorney at New York 1877; is trustee of Cornell University, and author of several pamphlets on classical, financial, and legal subjects. F. A. P. BARNARD.

Wool-Printing, a process somewhat analogous to CALICO-PRINTING (which see in CYCLOPÆDIA), by which figures and colors are impressed and fixed on woollen goods. As woollen goods receive and hold colors printed on them more readily than cotton goods, the proportion among the lighter fabrics which are printed is greater than in cottons or silk goods. Some of the lighter woollen fabrics are woven in figures and colors, as the checks, plaids, etc., woven in the Crompton loom, and some of the figured worsted goods, upholstery and coach laces, etc., which are wrought on looms with Jacquard attachments. But all the figured delaines, and many of the figured worsted goods, scarfs, ties, some descriptions of shawls, felt and woollen druggets, and the so-called Crossley printed carpets, carriage-cloths, a part of the woollen quilts, and many of the felt skirtings, are printed. The process varies little from that employed in printing silk and cotton goods, the patterns and colors being applied either by blocks or by cylinders, but as wool is more susceptible to mordants than cotton, the colors are generally fast. (See WOOL, etc.) L. P. BROCKETT.

Wool, Woollen Manufactures, and the Wool-Trade. (1) *Wool.*—Strictly, wool is the covering or fleece of the sheep, but the term has been extended to include the hair of the angora, cashmere, and other goats, the hairy fleece of the alpaca, vicuna, and other species of the llama, the soft down from the belly of the camel, several kinds of fur which are spun and woven, and even cows-hair, which is made up into a cheap quality of woollen goods. Wool is, however, to be distinguished from all these varieties of hair, as well as from all vegetable fibres, by the corrugated character of its fibres and by its property of felting, which is due to the scales or imbrications which overlap each other along the course of its fibres, and which, under certain conditions, from their corrugation, interlock with each other and form a felted fabric. (See FELT and HAT-MAKING.) Hair possesses very little of this felting property, but by long beating and rubbing develops it to some extent. Wool was the earliest of the textile fibres to be used for the purpose of clothing, and the transition from the use of the pelts rudely fastened together, which formed the only garment of the pre-historic man, as it does of some of the savage tribes at the present day, was made at a very early period in the history of the race. The earliest woven cloths were made from the wool of the sheep, and perhaps a century or two later the hair of the goat was used for the same purpose; but both preceded fabrics of linen and silk. The use of wool in the manufacture of clothing early became universal among all the more civilized nations of the world. Garments, of all sorts—royal robes, head-dresses, and shawls of the finest wool—as well as tent-coverings, carpets, and curtains of that which was of coarser texture, were produced by the Asiatics in such profusion that it would seem to have been for ages almost the only textile in use. The imperial purple of Rome and the kingly robes of all the Oriental nations were of pure wool colored with the Tyrian dye, whose perfect beauty, after being lost for ages, has been reproduced in our own time by the superb aniline dyes. Sheep formed a large part of the wealth of the Oriental nations, particularly of those which were more or less nomadic in their habits; and as these were kept very largely for food, though shorn every year, it is remarkable that in the absence of any special efforts to improve the character of their wool it should have retained its good qualities to such an extent as to enable those nations with their rude processes to have produced fabrics of such delicate and exquisitely fine texture, as we know from the testimony of the writers of those times, issued from their looms.

The first attempts to improve the breeds of sheep with special reference to the production of a finer quality of wool were made by the Romans about the second century B. C. Their Tarrentian sheep produced a long and finely-stapled wool, and their fleeces were very heavy, but the color was either brown or black, and the sheep were so delicate in constitution that they were reared with difficulty, and were kept covered even in the mild climate of Italy. Columella, an eminent Roman agricultural writer, whose active life was passed in the first forty years of our era, relates in his *Re Rustica* that his uncle, Marcus Columella, who was a wealthy agriculturist in Spain, transported some white African rams of great size and beauty to his estate in Boetica (a part of the present province of Estremadura), and by continually crossing them with his Tarrentian ewes and their progeny succeeded in producing a breed of white fine-woolled sheep of vigorous and hardy constitution and yielding a heavy fleece. This cross is supposed by many to have been the original of the Spanish merino sheep, which, with its various modifications and crossings, has been the parent of most of the fine-woolled sheep of Europe and America. Its transportation to France and careful improvement there have led to the production of the French merino, one of the finest of the long-wool breeds. Its introduction into Germany, and modification by crossing and by climatic influences, have produced the fine Saxon wools, adapted to the making of the best broadcloths; and the French sheep of Naz, which yields a still finer and more silky wool of great lustre, though now a distinct breed, bears traces of its early merino origin. In America the Spanish merino, introduced here by Delessert, Livingston, Col. Humphreys, and William Jarvis between 1801 and 1812, has exerted a wide influence, and together with the Saxony sheep, the sheep of Naz, and the French merino constitutes to this day the largest proportion of those flocks which are grown mainly for their wool. The Australian and Cape Colony wools are also largely indebted to the merino sheep for their good qualities. During the last thirty or forty years the greatly-increased demand for mutton as an article of food has led to the breeding of sheep which have larger food-producing value, and with which the wool is an incidental rather than the principal product. The Leicester, Cotswold, and South Down among the English sheep are the best of this class, while the undistinguished breeds of South America, as well as those of our Western States, have some of the same characteristics. These all yield coarser wools, and while the best grades are valuable for the worsted manufacture, for which our native wools are not adapted, the coarser are equally in demand for carpets, friezes, and negro cloths.

Wool is divided by the sorters primarily into pulled and clipped or fleece wools, the former being pulled by the roots from the pelt or skin of the dead animal, and the latter clipped or shorn from the living one. The clipped or fleece wools form the greater part of the wool in market, and these are again divided into long and short staple, or clothing and combing wools. These, again, are classed accord-

ing to their fineness, though as a rule the short-staple clothing or carding wools are much finer than the combing wools, and they also possess the felting property in a high degree, having more serratures or scales to interlock than the others. The clothing wools are used mainly for broadcloths and the thicker woollen cloths; the finer combing wools for soft and thin fabrics for women's wear; the medium for worsted goods, delaines, alpacas, mohairs, etc.; and the coarser for carpets, blankets, and coarse goods generally. The quantity of wool grown has increased very rapidly during the present century in Europe, America, Australia, and Southern Africa. In Asia, where the sheep is valuable alike for its flesh, its fleece, and its pelt, it does not probably vary much from what it was in past ages. The increase in quantity in Europe and America has been largely due to improved methods of breeding and feeding the sheep, which caused them to mature earlier and to yield larger and more uniform fleeces. Much of this improvement and the introduction of the new Leicester breed, the Lincoln, the South and Norfolk Downs, the Dorset and Cheviot, now the best grades of English wools, were due to Robert Bakewell of Dishley and to John Ellman and Jonas Mills, his enterprising and successful competitors in this good work. In this country, since the time of Humphrey and Livingston, already mentioned, the most eminent and successful wool-growers have been Messrs. Stephen Atwood, H. S. Randall, Grove, D. C. Collins, William Chamberlain, Edwin Hammond, and George Geddes. The increase in the production and consumption of wool in Great Britain during the present century is enormous. In 1801 the wool-clip of the United Kingdom amounted to 94,000,000 pounds, and the imports of unmanufactured wool to 8,000,000 pounds more. In 1828 the production was about 112,000,000 pounds, and the imports in round numbers 30,000,000. In 1851 the production was 208,000,000 pounds, and the importation 83,000,000. In 1865 the production was estimated at 250,000,000 pounds, and the importation was 212,206,000 pounds. The next ten years increased the production to 298,000,000 pounds, and the importation to 325,000,000 pounds; and to this was to be added for manufacturing purposes about 85,000,000 pounds of shoddy and wool extract. The exportation of wool at this time was, however, about 100,000,000 pounds. The wool production of France has increased almost as rapidly as that of Great Britain, though mainly in the finer descriptions of wool. France imports also considerable quantities of fine wools from other countries. The Australian colony of New South Wales alone exported in 1875, 75,600,000 pounds of wool. In the U. S. the demands for wool for our own manufactures have increased the production from very small beginnings to 193,000,000 pounds in 1875, and about 195,000,000 pounds in 1876 (of which 51,000,000 were from California), while the amount imported was nearly 55,000,000 pounds in 1875 and 41,642,836 pounds in 1876. Our importation consists of three kinds of wool, neither of which we produce to any great extent—viz. the fine wools of Saxony for broadcloths, etc., the Leicester and other combing wools of high lustre for worsted goods, from Canada and Great Britain, and the coarse long-stapled South American wools for carpets, etc.

(2) *Woollen Manufactures.*—The manufacture of wool into fabrics for clothing is one of the oldest industries in the world. At precisely what date the primitive man, or rather the primitive woman, discovered that the coarse wool of the sheep, the first of domesticated animals, could be spun into long threads, woven on the rude and improvised looms, and then, by rubbing with clay and beating in water, thickened or fulled till it furnished a satisfactory substitute for the pelts of the sheep, which had till then formed the clothing of man, history does not inform us; but it must have been prior to that dispersion of the nations which took place on the plains of Shinar, for this and the traditions of the Creation and the Flood are the only things common to all the tribes of the world. From these rude garments the transition to those of finer and more skilful workmanship was gradual: the production of dyed garments, of shawls, and of carpets, often of elaborate patterns and requiring protracted labor, was attempted at a very early period, and the manufacture of tent and curtain cloths, of tapestry hangings embroidered with needle-work, and of those vestments of lamb's wool and the rich imperial purple robes, came somewhat later. Some of the Persian, Greek, and Roman cloths, robes, and shawls must have been very beautiful; but in the ages which followed the downfall of the Western Roman empire the art of manufacturing them, like most of the fine arts, was nearly lost; the says and serges of the Dark and the Middle Ages were made from coarse and harsh wools, and were not what we should regard as pleasant or desirable goods for wear. The rough friezes, made of still coarser wool in Friesland, were still more objectionable, and the manufacture, such as it was, existed mainly in Florence, in Flanders, in England, and in France. After the thirteenth or fourteenth century silks, satins, and velvets became the favorite and distinguishing clothing of the wealthy. Until after the period of the Reformation the manufacture of woollen goods was almost entirely domestic; the large spinning-wheel and the reel had indeed taken the place of the distaff; and the hand loom, gradually improved, of the rude contrivances of the Oriental weavers. Among the thousands engaged in this domestic manufacture, some possessed greater manual skill and higher ingenuity than others, and consequently their cloths were more in demand; and the assembling of their looms and spinning-wheels in a single building gave them some advantages. The dyeing and fulling of the cloths was a separate business, and for this a water power was required, and so fulling mills sprang up wherever there were considerable quantities of cloths made. The use of the teasel for combing out a nap on the fulled cloths dates from an unknown antiquity. There were frauds in those days—stretching of the goods and the use of flocks or chopped wool—the predecessor of the shoddy of our day—to give the cloths a fraudulent appearance of greater thickness and body. From the end of the thirteenth to the end of the seventeenth century this domestic manufacture of worsteds, baizes, kerseys, serges, friezes, broadcloths, and other cloths was carried on very extensively in England, and considerable quantities of each were exported. The English cloths were mainly of coarse qualities, and inferior to some of those made on the Continent, the Spanish and Flemish fine wools enabling them to make finer and more desirable goods. In the eighteenth century the manufacture of both worsteds and woollens began to be concentrated in Yorkshire, and Leeds, Stroud, Chippenham, and Huddersfield gradually became the seats of the woollen goods manufacture; while Bradford, Halifax, Norwich, and their vicinities absorbed the manufacture of worsted goods and carpets. But, though large quantities of goods were made and sold, their quality was far from uniform, and there was no improvement in the processes of manufacture until the invention of the carding-machine by Lewis Paul, which first came into use for wool in England about 1753, and the spinning-jenny, invented by Hargreaves and improved by Arkwright (1767–69). The gradual introduction of these machines, and the application of steam both as a motor and for dyeing and dressing purposes, greatly improved the character of the English and French cloths, but until the introduction of the power-loom (which, though invented in 1785, did not come into general use till about 1800) and the Jacquard loom (invented in 1811), the woollen and worsted manufactures had not received their greatest impulse in Great Britain. The French manufacturers were progressing meanwhile in a somewhat different direction. With their fine and soft wools they directed their attention very largely to the production of fabrics for women's wear, and with their admirable taste and delicacy of workmanship soon achieved great success. The French merino goods, introduced by Pallotan at Rheims in 1801, have never been surpassed by any all-wool product in softness, durability, and beauty. Other goods, both of wool and worsted, pure and in combination with silk, cotton, and linen, have been produced in vast quantities in England and France. The broadcloths of the highest grade made in France are of better quality than any others, except some of the German goods; but the practice of adulterating these, as well as cassimeres, satinets, and indeed almost every description of the heavier wool goods, with shoddy or the ground and picked fibres of old woollen rags, first proposed in 1813 at Batley, England, but not largely used till 1840, has done much to impair the value and durability of the lower and medium-priced goods. This practice has been carried to a greater excess in Great Britain and Belgium than elsewhere.

In the U. S. the manufacture of woollen goods was almost entirely domestic as late as 1790, and though there had been fulling-mills from the first settlement of the colonies, there was no woollen-factory in successful operation before 1794, when one was established in Byfield parish, Newbury, Mass. The same year the first carding-machine for wool was put in operation in Pittsfield, Mass. Between that time and 1801 four or five were started. Gray-mixed broadcloth of good quality was made at Pittsfield in 1804, and President Madison's inaugural suit of black broadcloth was made there in 1808. In 1809 a woollen-mill was erected by Dr. Capron at Oriskany, Oneida co., N. Y., and in 1812 what was then considered a large manufactory of fine cloths was established at Middletown, Conn., which made thirty or forty yards of broadcloth a day. The same year an American inventor produced what are known as the helicoidal shears, a cutting-machine with spiral blades on a cylinder acting against a straight steel blade, and shearing the nap of the cloth evenly and perfectly. This was first adopted in France. The American inventors were pro-

lific of inventions for the improvement of these manufactures, and to them the world is indebted for the original and best processes for making felted goods, carpetings, broadcloths, hat-bodies, etc.; the knitting-frame, and later the various knitting-machines, the burring-machine, the Crompton loom for weaving by power fancy cassimeres, which, with its successive improvements, is now far superior to any other loom for this purpose; and the still more wonderful automatic Bigelow carpet-loom; the best processes for making a mixed mousseline delaine; Simpson's wool-comber; the Smith moquette carpet-loom; and, latest of all, the compounder or new machine, which makes by a novel and ingenious process, from comparatively thin goods, the heavy pile goods known as the "Windsor fabrics." The woollen manufacturers in this country have had great difficulties to contend with. In addition to the high price of labor as compared with European countries, and the lack for many years of native wool of those qualities best adapted to their use, they have been alternately fostered and ruined by high and low tariffs, and their goods systematically depreciated by the importers and free-traders; but they have at length reached a position in which they can supply more than three-fourths of the woollen and worsted goods consumed here, and, except in a few classes of goods, produce those of better quality than their European rivals. Comparatively few of the finest grades of broadcloths or black cassimeres are made here, none of the finest French merinos or cashmeres, nor some varieties of worsted goods, nor, to any considerable extent, the Persian or Axminster carpets—the broadcloths, merinos, etc., because we have not a sufficient supply of the very finest wools, nor is it profitable either to grow or import them; and the carpets and some of the worsted goods because they are only in demand to a limited extent, and will not pay a fair interest on the costly "plant" necessary for their production. But our mills do produce nearly all the fancy cassimeres, plaid and striped cloths, tricots, and cheviots for business suits, and the larger part of the meltons and silk mixtures used for the same purpose; the beavers, moscows, chinchillas, diagonals, and other cloaking goods for outer garments; knit goods of all grades and for all purposes; and flannels and blankets of superior quality to any in the world for bed-coverings; woollen shawls of exquisite beauty and serviceableness, broche and other fine shawls; delaines, both the all-wool and the mixed goods so generally worn, and now all-wool merino plaids and matelasses; horse blankets, rugs, and felted carpeting, and clothing of all descriptions; felt and wool hats of several grades; ingrain carpets of all qualities; Brussels, velvet, tapestry, and recently some Wilton, Axminster, and Aubusson carpets: printed carpets and floor-cloths; worsted poplins, serges, cloakings, printed cashmeres, alpacas, mohair lustres, and brilliantines; satin lastings and prunellas of excellent quality; all descriptions of upholstery fabrics, including reps, all-wool and union damasks, silk cotelines, lambrequin cloths, carriage trimmings and lace, wool fringes, yak fringes and lace, bunting superior to the British; while in our newly-invented "Windsor fabrics," in which, by a new process, we are able to thrust the fibres of the wool through lighter fabrics and lock and felt them on the under side, we have achieved a great victory both in cheapness and durability over the foreign manufacturers of heavy pile goods.

The growth of the woollen manufacture in the U. S. within the past fifty or sixty years has been very rapid. From 1790 to 1810 there was a large domestic manufacture in proportion to the population, and the greater part of the men and all the boys were clothed in homespun, while the women wore, for every-day use, linsey-wolsey, a fabric composed of linen and wool. In 1810 this domestic manufacture was estimated at $25,608,788. But after this date the domestic production fell off rapidly, and at first the factory-made goods did not supply their place. In 1820 the total value of woollen goods reported was $1,413,068; in 1830, $14,528,166; in 1840, $20,696,999; in 1850, $43,207,545; in 1860, $68,865,963; in 1870, $217,668,826. In 1876, owing to the depression of business, there was a slight falling off in production, and a still larger one in importation. The value of the woollen goods produced in 1876 is estimated at $208,118,875, being the product of 9650 sets, as against 10,073 sets in 1870. Massachusetts has from the first maintained the leading position in these manufactures, her production of all-wool goods, carpetings, worsted, and mixed goods of cotton, linen, or silk and wool, amounting in 1875 to $57,629,587, or more than one-fourth of the whole production of the country. Pennsylvania, New York, Connecticut, and Rhode Island are the other largest producers, though nearly every State has some woollen manufactures. The importations in 1821 were $7,437,737; in 1831, $12,627,229; in 1841, $11,001,939; in 1851, $19,507,309; in 1861, $28,487,166; in 1870, $34,049,070; in 1876, $33,208,808. As the imports are reckoned at gold value, and without duty, their market-value would be about double, or $66,417,616, and the total value of imports and manufactures $274,536,493; so that a little more than three-fourths of the whole amount is produced by American manufacturers.

Processes of Manufacture of Woollen and Worsted Goods.—The variety of goods wholly or in part made of wool, and of those wholly or in part of worsted, is so great that we can only name in the most general way the processes to which each is subjected in its manufacture. The distinction between the woollen and worsted goods begins, as we have already intimated, in the character of the wool used: for all descriptions of heavy wool goods a more or less fine, short-stapled, and readily-felting wool is required; for all goods wholly or in part of worsted the wool must be of long staple (fibres 2¾ to 5 or 6 inches in length), not very fine, and either naturally or by the combing process freed, as much as possible, from those serratures or imbrications which constitute the felting property. This primary difference in the character of the wools required, of course, governs the purchase of the wool, and restricts it to the quality adapted for the use of the particular kind of goods to be made. In the case of the woollen manufactures the wool, which is usually purchased in bales, and not scoured, is (1) sorted, the sorter arranging each pile or lot according to its fineness, length of staple, and silkiness of texture. (2) Scoured: this is accomplished by throwing it into large tanks filled with water and an abundance of soap, and kept at a high temperature by means of steam, and continually moved by means of rakes or stirring-sticks driven by steam-power. When thoroughly cleansed it is drawn out through rollers to squeeze out the water, and then dried by revolving fans or other means. By this scouring and washing not only is the dirt and soil removed from the fleeces, but the yolk or suint—a peculiar fatty secretion of the sheep most abundant in the merino breeds—is also discharged. The English manufacturers extract these matters from the water by a chemical process, and make candles from the product. The wool is next dyed (if it is necessary to dye it in the wool). The next process is willying, or, in the case of Western and South American wools, burring. The object of this is to remove seeds and burs which have become entangled in the wool. The American burring-machine of Mr. S. R. Packhurst does this very perfectly and in combination with the carding-machine. Picking, teasing, or moating is the next process, and is performed by a machine which tears open the matted portions and separates the wool into small tufts, the larger impurities and knots being frequently removed by hand-picking. Either before or immediately after this process the wool is oiled, oleic acid or oleine being now generally used for this purpose, instead of olive oil, and sometimes a mixture of oleine and paraffine oil; these oils are much more readily removed from the yarn or tissues by a brief scouring with carbonate of soda and pure water than the olive oil, and there is much less danger of spontaneous combustion than from the use of the vegetable oils. The wool is now ready for the scrubbing, carding, and slubbing processes, which, though formerly separate, are now continuous by the use of the patent feeder and condenser. Their office is to convert the wool into rolls, which are drawn out and slightly twisted before they are spun. The spinning is the next process, and herein is another difference between woollen and worsted yarns, the yarns for woollen cloths being but slightly twisted, so as to leave them more free for felting, but those for the warp twisted more than those for the weft, as they have to bear more strain; while the worsted yarns are hard-spun and made into a much stronger thread. The slight twisting and comparative lack of strength in woollen yarn renders it more difficult to weave it on a power-loom than the worsted, cotton, silk, or linen yarns. The yarn, when spun, is reeled, and, if to be made into cloth, warped, beamed, singed, sized, and otherwise prepared for weaving. The weaving may take place on a hand-loom, on an ordinary power-loom for broadcloths, flannels, cassimeres, satinets, blankets, etc., etc.; on a Crompton loom for fancy cassimeres, yarns of different colors being introduced; or on the Earnshaw needle-loom, where the goods are made with two faces or different colors are used. Broadcloths, and indeed most woollen goods, are next scoured to remove the oil, and then, if thought necessary, dyed again, and tentered or stretched upon hooks to dry. Burling, or picking off irregular threads, hairs, and dirt, succeeds this, and then, for the cloths, come the fulling process and the teaseling or raising the nap, which is sheared evenly by the helicoidal shears. It is next steamed or scalded to prevent its spotting unevenly from the rain, and pressed between polished iron plates in a powerful hydraulic press. The flannels, blankets, etc., do not go through these last processes. The knit goods are made from the yarn on knitting-machines

and finished by hand. Delaines have usually cotton weft, and are woven on cotton looms, and printed, like calicoes, from rollers. Carpets are made from coarser wools, and do not go through so many preliminary processes before spinning; they are woven on the Bigelow carpet looms or some modification of them. The worsted wools are combed on a combing-machine with heated teeth, to make the fibres straight and parallel, and the shorter fibres are combed out; these are called *noils*. The other processes before the spinning are much the same as already described; the yarns are hard twisted, and for some purposes, as for alpacas, mohairs, and lustred goods, the lustred wools and the hair or wool of the alpaca and vicuna and of the angora goat are used. The weaving and dyeing of these goods are watched with great care. The cow's hair, camel's hair, and calf's hair goods are of cheaper grades, and in quality belong rather to the woollen than the worsted trade. Most of them contain a considerable proportion of the lower grades of wool, woollen waste, and shoddy.

(3) *Wool-Trade.*—The business of dealing in wools is a very ancient one. There are evidences of its existence probably not less than four thousand years ago. Syria and Persia, with their immense flocks, whose fleeces formed an important item of traffic as early as the time of Abraham, whose white wools were sold in the Tyrian market a thousand years later, and at a subsequent period Greece, Asia Minor, and Rome, were all largely interested in the wool-trade. In the Middle Ages the dealer in wool was called a wool-stapler, from his selection and appraisal of the different qualities of wool. This was the calling of Shakspeare's father, and was not an uncommon one at that day. With the vast increase of the wool manufacture throughout Europe and America in the present century, the wool-trade has become one of the most important branches of traffic. Its weekly, monthly, and annual reports are carefully studied in all the great marts of trade. The business is complicated by the great variety of qualities and prices of wools. The report of the wool-trade in the U. S. for 1875 specifies six different classes in the U. S., and embraces so many different qualities that the prices ranged from 24 cents to $1 per pound. Of foreign wools there were importations from twelve or fifteen different ports, and twice that number of grades, ranging from 15 to 50 cents per pound. The total wool-clip of the U. S. in 1875 was about 193,000,000 pounds, and the amount imported 54,901,760 pounds. Of this amount, only 1,164,673 pounds came from Great Britain. (For many important facts and statistics used in this article the writer is indebted to the kindness of John L. Hayes, Esq., secretary of the National Association of Wool Manufacturers, Boston, Mass., and Franklin Allen, Esq., secretary of the Silk Association of America, New York City.) L. P. BROCKETT.

Worms [Ang.-Sax. *wurm*; Lat. *vermis*], a name given to numerous invertebrates whose sole common character is the possession of an elongated flexible body. Under the term are embraced the representatives of not only different classes, but forms so diverse in morphological characters that they have been by some naturalists separated under two or more of the primary divisions (sub-kingdoms or branches) of the animal kingdom: it follows, therefore, that their relations to each other are not only in some cases very distant, but that they may even be most intimate with forms entirely dissimilar in configuration and adaptive characters. The organization may be of the most primitive and simple character (especially so if we extend the term to the Gregarinidæ), or it may be of the most complex nature. The development is also so extremely diverse in the different groups that no common characters can by any possibility be formulated for them in contrast with other groups of animals. Even in habitat, too, they are more than usually variable, and to such an extent, indeed, that kindred forms may vary greatly in this respect; *e. g.* some species are terrestrial, as in the case of the common earthworm and certain planarians; others closely related are inhabitants of the fresh waters; others still are found in the sea; and, finally, species even not distantly related may be parasitic and pass their whole life under some condition or other in the interiors of various animals. "It should also be remembered," says Dr. Packard, "that among worms are many synthetic types which, as regards some organs, remind us of other groups of animals. For example, the rotifers recall the lower Crustacea, and are by some naturalists regarded as such; the planarians have been considered by Girard as mollusks; the polyzoans and brachiopods are still regarded as mollusks by eminent naturalists; and there are very few who do not place the tunicates among the latter. On the other hand, the echinoderms are regarded as worms by some, and *Amphioxus* has been called a worm. Indeed, if any one has any prejudices regarding fixed types in nature, and would learn how regardless of preconceived zoological systems the actual state of our knowledge of the lower animals must lead one to become, let him study the animals now placed among 'worms.'" The truth of these observations will be rendered still more manifest by our subsequent exposition of the diverse views of authors. Under these circumstances it is impossible to give any generalized characters. (1) The general idea of worms, however, is best exemplified in the common earthworms and the species related to them found in the fresh waters and in the sea: this type has been distinguished under the name of Oligochæta. (2) Closely related to these are the worms with well-developed and numerous setiform appendages, common in almost every sea; these have been distinguished as Polychæta. (3) Another type is manifested under the form of the familiar leech, and for it and the quite numerous species more or less resembling this animal has been established a group of variously assessed value under the name of Discophora or Hirudinea. (4) A fourth form is exemplified in animals resembling, superficially, the *bêche-de-mer*, or holothurians, rather than the typical worms; and for such species has been framed the name Gephyrea. (5) A few singular swimming, finned, and comparatively short animals have been segregated under the name Chætognatha. (6) Certain worms passing through a remarkable series of metamorphoses, the first of which greatly resemble those undergone by echinoderms, have, for this and other reasons, been isolated under the name Enteropneusta. (7) More or less elongated, smooth, inarticulated worms are the Turbellarians. (8) Leech-like worms, generally provided with one or more suckers, and with the body flattened and inarticulated, typified by the common fluke, are called Trematods. (9) The tape-worms form another group, named Cestoidea. (10) A peculiar type of parasitic worms without an intestinal canal and with an armed head is called Acanthocephala. (11) Elongated, round, inarticulated forms of simple structure are the Nematoids. (12) Certain microscopic forms are well known under the name of wheel-animals, Rotatoria, and Rotifera. These several forms have been variously combined. Until within the last few years the most common combination was under two classes: the first, second, third, and fourth were grouped under one class as true annelids, while the remaining were segregated under another class as scolecids. By a few authors all the groups above named have been regarded as distinct classes, but by more the first two groups have been recognized as orders of a common groups named chætopods. Recently, there has been a disposition to recast the groups of the animal kingdom based upon developmental characters. Thus, Prof. Huxley, after having primarily grouped all animals into Protozoa and Metazoa, has separated the latter into Gastræa, which have an intestinal canal, and Agastræa, which are destitute of an intestinal canal; the former are further differentiated into Polystomata (the sponges) and Monostomata (all the other animals); and the Monostomata into Archæostomata, or those whose mouth coincides with the primitive aperture of the embryo, and Deuterostomata, or those whose mouth is developed independently of the primitive aperture. The Deuterostomata are again separated into Schizocœla and Enterocœla. Of the groups of worms above enumerated, the first, third, seventh, eighth, eleventh, and twelfth are considered as *Gastræa monostomata archæostomata Scolecimorpha*; the second and fourth as *Gastræa monostomata deuterostomata Schizocœla*; the fifth and sixth as *Gastræa monostomata deuterostomata Enterocœla*; and the ninth and tenth as *Agastræa*. With certain of the forms thus enumerated have also been associated animals very different in general appearance, and at least in the characters of the adult. Thus, the brachiopods and polyzoans have been approximated to the annelids by some recent authors (*e. g.* Morse, Kowalevsky, etc.); and certainly in their developmental history there are many facts which seem to show that they have sprung from one and the same common stock, although subsequently their divergence has been very great. Other types formerly combined with the worms have subsequently been demonstrated to be very different. Thus, *Linguatula* has now for a long time been shown to be a modified arachnoid, and *Peripatus* has recently (by Moseley) been shown to be related to the myriopods. The entire subject-matter is still, however, in a transition stage, and the systematic value of the various characters exhibited by the adult as well as young of the different groups requires re-examination. But it is at least certain that the great assemblage of animals known as "worms" is a heterogeneous mixture of very unlike types. (See also ANNELIDES, OLIGOCHÆTÆ, LEECH, NEMATOIDEA, PARASITES, ROTIFERA, STEREOMINTHA, TAPEWORM, TREMATODS, TURBELLARIA, etc.) THEO. GILL.

Writing-Machines. This term may include all contrivances for recording, either for mechanical purposes or for preserving language written or spoken, as well as to aid in writing. Of the former class are all those means

for permanently recording the pressure of steam, the force and direction of the wind, meteorological phenomena, the investigations of the astronomer, etc. Examples of this class are the steam-engine indicator (see STEAM-ENGINE, Fig. 40), the meteorograph (see OBSERVATORY, METEOROLOGICAL), and the delicate recording apparatus now used in large observatories. The latter class are usually termed type-writers, the simple elements of which are a movement to bring the type into position, an inking device, an impression movement, and means for letter and line spacing. The earliest form perhaps was invented in England in 1714, and many modifications have since been patented in various countries. The most successful seems to be the Sholes and Glidden type-writer, patented by C. L. Sholes of Wisconsin, in 1868, which is about the size of a sewing-machine, and is worked with lettered keys arranged in four rows, each type-carrier being thrown up as its key is struck. The type letters are engraved on the ends of steel bars, which are pivoted in the circumference of a circle, so that the end of each bar will strike at the same point in the centre of the circle. An inked ribbon passes over the centre of the circle, and over the whole a cylinder carries the paper to receive the impression. The cylinder by a spring and ratchet movement revolves the width of a letter, and when a line is completed it has also a lateral movement for each new line. With practice it will print from 60 to 75 words a minute. This machine, used by the Automatic Telegraph Co., has been modified by substituting for letters on the bars the Morse telegraphic characters, which are perforated through the paper, and the sheet is then passed through the apparatus connected with the telegraph, as described in the article TELEGRAPH. The typograph was invented by Charles A. Washburn of San Francisco, Cal., in 1859 and patented in 1870. This machine, like the type-writer, has the different types fixed to the ends of small steel bars connected to a series of keys, which, on being struck by the fingers, throw the types against the paper to be written on. These type-bars are of different lengths, and have different radii, but are so pivoted as to bring the types to a common centre by touching the keys to which they are attached. The paper is made to move laterally a single space as each key is struck, and at the end of each line it is drawn back and thrown up a line space, the letters being impressed on the paper as fast as the fingers can be made to touch the different keys. Several machines have been invented for the use of the blind, among which is Johnson's, which enables a blind person to impress characters in rows and lines so as to be read by the sense of touch. The matrix compositors of John E. Sweet and Pierre Flamm (see PRINTING, in CYCLOPÆDIA) may be used as type-writers by interposing inked ribbon and paper between the type and the impression-bar.

Attempts have been made to record the spoken word by automatic means. One of these is the machine invented by M. H. Huppinger, a Frenchman, which is about the size of the hand, and is put in connection with the vocal organs, recording their movements on a moving band of paper in dots and dashes. The person using it repeats the words of a speaker after him inaudibly, and this lip-language is afterward written out. The phonautograph, described in the article ACOUSTICS, may yet be utilized for recording language by its unerring sound-lines.

A stenographic machine has been invented in France, which has a keyboard of 12 black and 12 white keys on a plane, arranged in three groups of four black and four white keys. The keys, operated like a piano, produce indications in ink on a roll of paper, the black keys giving long marks, and the white ones simple dots. These keys may be simultaneously struck, so that the combinations may give several letters or words for every movement of the operator's fingers. It is said that six months' practice will enable one to follow a speaker. A similar machine was invented by J. C. Zachos of New York, designated the "Zachos steno-phonotype reporter," in which the types are placed on twelve shuttle-bars, two or more of which may be simultaneously placed in position. The impression is given by a plunger or platen common to all the bars. This machine, according to the inventor's scheme, will enable a person to follow a speaker.

Attention may here be drawn to the type-wheel used in the recording telegraph, the telephone for conveying to a distance vocal and musical sounds, and the automatic telegraph, all of which are described under TELEGRAPH. Mention may also be made of the Edison electrical pen, which by electricity rapidly moves a needle while the pen is forming the letters on paper as in ordinary writing. The paper, having every line of the letters perforated by the needle, may be placed on carbon paper or other coloring medium, and a large number of impressions taken on paper by simple pressure, the copy receiving the coloring-matter through the fine holes. WILLIAM S. PATERSON.

Wun'derlich (KARL AUGUST), b. Aug. 4, 1815, at Sulz on the Neckar, in Würtemberg: studied medicine at Tübingen; visited France and Belgium 1837–39; was appointed professor of medicine at Tübingen in 1840 and at Leipsic in 1850. He wrote *Handbuch der Pathologie und Therapie* (3 vols., 1846–54), *Versuch einer pathologischen Physiologie des Bluts* (1844), *Geschichte der Medicin* (1859), and *Eigenwärme in Krankheiten* (1868). With Roser in 1841 he founded the *Archiv für physiologische Heilkunde*, representing his peculiar views as a physician and scientist. D. Sept. 25, 1877.

Wutt'ke (KARL FRIEDRICH ADOLF), b. Nov. 10, 1819, at Breslau, Prussian Silesia, studied theology and philosophy at the university of his native city, and was appointed professor of theology in Berlin, 1854, and in Halle, 1861. His principal works are: *Geschichte des Heidenthums in Bezug auf Religion, Wissen, Kunst, Sittlichkeit und Staatsleben*, 2 vols., Breslau, 1851–53; *Handbuch der christlichen Sittenlehre*, 2 vols., Berlin, 1860–61; *Der deutsche Volksaberglaube der Gegenwart*, Hamburg, 1860.

Wyck (THOMAS), b. at Haarlem in 1616; resided for several years in Italy; settled afterward in London, where he enjoyed a great reputation as a genre painter, and d. there in 1682 or 1686. Among his most celebrated pictures are those of London during and after the conflagration of 1660. His drawings and etchings, which are very scarce, are also highly esteemed.

Wy'nants (JOHN), b. at Haarlem in 1600, and d. there in 1677. Of his personal life nothing is known, but his pictures, generally representing prospects from the surroundings of his native city, sandhills in the background and old tree-trunks and wild flowers in the foreground, are highly esteemed and command a very high price. Among his pupils were Wouverman and Adrian van der Velde.

Wysock'i (PIOTR), b. at Warsaw in 1799; entered the royal guard in 1817; received his higher military education in the academy of Warsaw, and was a lieutenant in one of the regiments stationed in that city when in 1828 he formed a secret union of all the younger officers of the garrison for the re-establishment of an independent Poland. On Nov. 29, 1830, the insurrection burst forth, and as aide-de-camp to Prince Radziwill he fought with distinction at Wavre and Grochow. He afterward followed Dwernicki in his unfortunate campaign into Volhynia and crossed the Galician frontier, but succeeded in escaping and returned to Warsaw. As colonel of the 10th regiment he was severely wounded at the storming of Wola, Sept. 6, 1831, and taken prisoner by the Russians, who sent him to work in the Siberian mines, where he d. in 1837.

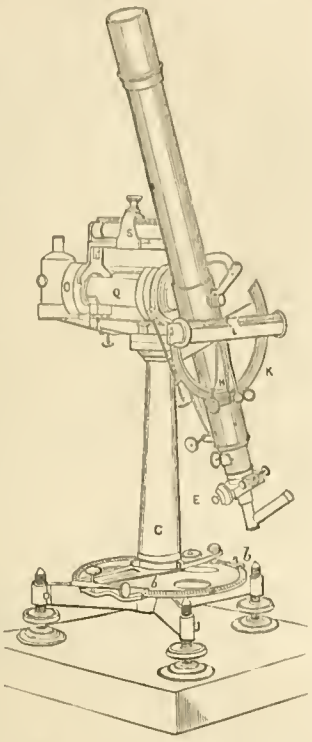
Y.

Young (ROBERT ANDERSON), D. D., b. at Campbell's Station, Knox co., Tenn., Jan. 23, 1824; graduated at Washington College, East Tennessee; was licensed to preach Jan., 1845; was ordained by Bishop Paine at Clarksville, Tenn., 1848, and elder by Bishop Andrew at Athens, Ala., in 1850; has filled important stations in the Tennessee conference of the M. E. Church, South, of which he has been secretary for many years, and which he has several times represented in the General Conference; was seven years in the St. Louis conference, and three years president of Florence University, Ala.; has been since May 9, 1873, secretary of board of trust of Vanderbilt University; is the author of *Personages*. T. O. SUMMERS.

Young'husband (C. W.), entered the Royal Artillery Dec. 14, 1837; became captain in 1846 and colonel 1863; was employed in making a magnetic survey in Canada 1841–46, and at Woolwich in reducing his observations 1846–51; served in the Crimean campaign Oct.–Nov., 1854, including the battle of Inkerman and siege of Sevastopol; was appointed secretary to the Royal Artillery Institution 1855; superintendent of contracts in Belgium and Prussia in 1857; member of the ordnance select committee in 1863; superintendent of the royal gunpowder factory, Waltham Abbey, in 1868; which latter position he vacated in 1875, when appointed superintendent of the royal gun-factories, royal arsenal, Woolwich.

Z.

Ze'nith Tel'escope, an astronomical instrument for measuring small differences of zenith distances. It was designed by Capt. Andrew Talcott, U. S. Engineers, about the year 1834, and the method of determining the latitude, in which it is principally used, is hence known as *Talcott's method*. The results obtained with this portable instrument rival in accuracy those of the instruments of a fixed observatory. In our own Coast Survey it is used exclusively for the determination of latitude, and occasionally for the determination of local time. The figure represents a zenith telescope of the Coast Survey, having an aperture of about 3½ inches, a focal length of about 15 inches, and a magnifying power varying between 160 and 120. Stars of the seventh magnitude may be observed with it. The tube rotates around a horizontal axis Q, and is counterpoised by a weight at O. A striding-level at S indicates the deviation of this axis from horizontality. The essential parts of the instrument consist in the sensitive level L and the micrometer E. The level is connected with the telescope, so that the inclination of its line of collimation may be known. The graduated semicircle K is attached to the tube, and by means of the vernier H, which is attached by an arm to the movable level L, zenith distances can be read to within 30″. The micrometer-screw is used for measuring apparent differences of zenith distance when the telescope is pointed alternately from the first star to the second star of a pair which culminate at opposite zenith distances, differing from each other by less than the diameter of the field of view of the telescope. The value of one revolution of the screw is about 45″, and the value of one division of the level L is about three-fourths of a second.



In using the instrument, pairs of stars are selected at approximately equal and opposite zenith distances, and having small differences of right ascension. This condition often limits the observer to the selection of stars whose places are comparatively doubtful, and it is quite probable that in these cases the errors of star-places exceed all the other errors combined of Talcott's method in the hands of a skilful observer. After setting up the instrument, the stops *b b* are set, so that the instrument may turn upon its vertical axis C, and be checked at two points 180° apart, with the telescope in the meridian in each position. By means of the vertical semicircle the instrument is set for the star which culminates first, and the observer bisects the star when it is on or near the meridian with the micrometer-thread. He then reads the micrometer-head and level, turns the instrument 180° in azimuth, and observes the second star in the same manner. This completes a single observation for latitude.

The general expression for the latitude from observations made in this manner is

$$\phi = \tfrac{1}{2}(\delta + \delta') + \tfrac{1}{2}(z - z') + \frac{b}{4}\left\{(n + n') - (s + s')\right\} + \tfrac{1}{2}(r - r') + \tfrac{1}{2}(m' - m),$$

$$\text{in which } \tfrac{1}{2}(z - z') = \tfrac{1}{2}(M - M')R.$$

Where

ϕ = the desired latitude;

δ and δ' = the declinations of the N. and S. stars respectively;

z and z' = the observed zenith distances of the N. and S. stars;

b = the value of one division of the level;

r and r' = the refraction; and

m and m' = the reduction to the meridian for the N. and S. stars respectively, where the stars are bisected a short distance from the meridian.

(See *Appendix No. 10 U. S. Coast Survey Report* (1866); *App. No. 12 U. S. C. S. Report* (1869); Chauvenet's *Manual of Spherical and Practical Astronomy* (1874, vol. ii. pp. 340–367).) L. Waldo.

Zodi'acal Light. A faint illumination, not wholly unlike an aurora-borealis, which, at certain seasons especially, is visible soon after sunset, or also a little before sunrise, in the region of the *zodiac*; whence its name. In our latitudes it is most conspicuous when the plane of the ecliptic in the region in which the light is visible, and also the plane of the sun's equator, make the greatest angle with the horizon. Hence it is most distinctly seen in the evening in the months of April and May, and at the opposite seasons of the year before sunrise. The apparent distance of its vertex from the sun is found to vary according to circumstances from 40° to 90° or 100°; and sometimes, indeed, it has been seen to extend entirely across the heavens. Its breadth at its visible base, in a direction perpendicular to its axis, varies from 8° to 30°. It is best seen in tropical countries. Humboldt says that it is almost always visible in those regions, and that he has seen it sufficiently luminous to cause a sensible glow on the opposite quarter of the heavens. Numerous observations of this opposite glow are detailed in the *Astronomische Nachrichten*, as the same are reported by European observers: and the light has been observed to extend entirely across the sky by Lias in Brazil; by George Jones, A. M., late chaplain in the U. S. navy; by Col. Charles G. Forshey, U. S. A., while he was stationed in an elevated and dry region of Texas; and by Henry C. Lewis of Germantown (Philadelphia), Pa.

The Zodiacal Light appears to many observers to be of a reddish hue, especially at its base, where also it is by far the most bright, and where "it effaces small stars." Chaplain Jones also speaks confidently of undulations, and likewise of a sort of flashing which he had noticed in it. George F. Chambers, Esq. (*Descriptive Astronomy*, p. 257), intimates that the historian Nicephoras must be regarded as the first to (unequivocally) record the existence of the Zodiacal Light, as observed in 410 A. D. It was treated of by Kepler, and soon afterward by Descartes (about the year 1630); then by Childrey in 1659. It was, however, J. Dominique Cassini who called special attention to the phenomenon, and gave it its name. He first observed it on Mar. 18, 1683. Unusual attention has recently been attracted to the observation of the Zodiacal Light.

The glow opposite to the sun (Ger. *Gegenschein*) described by Humboldt, and frequently observed by others, and the observations of the light extending entirely across the sky, already alluded to, together indicate that the material to which the light is to be attributed extends beyond the orbit of the earth. Various hypotheses have been framed to account for the phenomena presented by the Zodiacal Light, which all have one feature in common—viz. that they make the material in question, whatever may be its composition, to be a direct appendage of the sun. But all these hypotheses, whatever may be the composition of the material in question, seem to be inconsistent with the *very broad base* to the more dense, and so also *distant*, portion of the material in question, the very conditions seeming to require that the apparent form of the Zodiacal Light should be somewhat like that of the head of a comet, with the *expansion* beyond it extending *upward* from the sun. And then there ought, it would seem, to be a conspicuous central core or beam, which we do not find. And, lastly, what shall be said of the planetary perturbations due to a closely-arranged group of meteors? It would seem, then, that the material or materials in question cannot be regarded as a direct appendage to the sun.

Rev. George Jones, chaplain on board the flagship of Commodore M. C. Perry in the U. S. naval expedition to Japan in 1852, during which he conducted an elaborate and long-continued series of observations upon this phenomenon, proposes a very different hypothesis when he says with respect to all the data in his possession: "It seems to me that those data can be explained only by the supposition of a *nebulous ring, with the earth for its cen-*

tre, and lying within the orbit of the moon." (Vol. iii. of *U. S. Exploring Expedition Narrative.*) The author of this article has so far modified this hypothesis as to substitute a *girdle* for the ring, the middle plane of the girdle approximating to a coincidence with the plane of the ecliptic, or more nearly, perhaps, with the plane of the moon's orbit (for the time being), and extending to a very considerable distance as measured perpendicularly to that plane. (*Smithsonian Contributions to Knowledge*, 280.) But in order to preserve such a girdle from the destructive action of the moon's attraction, it would seem to be requisite that the *periodic time of revolution* (or rather *rotation*) *of the girdle around the earth should be the same with that of the moon.* The dimensions of the girdle to ensure this are stated in the number of the *Smithsonian Contributions* here already quoted, and they place the greater part of the girdle, if not the whole of it, *beyond* the moon. This hypothesis in its application will exhibit the following consistencies: (1) That it provides a conservative force for the maintenance of such an appendage. (2) It will account for the phenomena common to all appearances of the Zodiacal Light, *broad* base and all. (3) It accounts for certain periodical changes in form and intensity, etc., of the same, which seem to be completed in a synodical revolution of the moon. (4) It provides for the *Gegenschein* (opposite glow) in form and position, and possibly also for "a lunar zodiacal light." (5) It renders a plausible account for the fading at times and total disappearance of the Zodiacal Light. (6) It accounts for the absence of a determinate parallax of the girdle. (7) It shows that when E. and W. lights are visible at the same time, the middle even of the zodiacal arch need not be wholly obscured by the earth's shadow. (8) It provides for the "pulsations."

S. ALEXANDER.

NOTE.—The foregoing article on the Zodiacal Light, while presenting the theory of Mr. Jones, and the same theory as modified by the author of the article, is incomplete in omitting any reference to the very rigorous examination of this theory by the principal editor of this CYCLOPÆDIA, in a memoir published in the 21st volume of the *Am. Journal of Science and Arts*, Second Series, 1856. In the memoir referred to it is conclusively shown that the light cannot proceed from a ring or girdle of any supposable dimensions concentric with the earth, because—

(1) The aspects of the light are not such as, on optical principles, a ring or girdle like that supposed ought to exhibit.

(2) If the light is due to such a cause, certain phenomena require that the girdle should be quite near, in which case it would be largely affected by a parallax which is not manifested.

(3) The geometrical inferences to which the theory legitimately leads, as they are deduced from different observations, are inconsistent with each other.

(4) To adopt this theory in order to explain phenomena which are actually observed involves unavoidably a necessity that other still more striking phenomena should present themselves which are never observed.

These four propositions are established in the memoir referred to with all the rigor of mathematical demonstration. The memoir concludes as follows:

"We appear, therefore, to be conducted to one and the same conclusion by the application to this theory of four distinct tests; each one of them having no slight independent weight, and all of them combined possessing an irresistible force. The Zodiacal Light must consequently be regarded as presenting a problem still unsolved. The observations of Mr. Jones, when published [they have since been published, and form vol. iii. of the *Report of the Japanese Exploring Expedition*] may possibly present some clue to the mystery which has not yet been detected in them. But whatever else they may show, the present writer cannot but believe that they will furnish in themselves the most conclusive proof that the luminosity does not reside in any substance physically connected with the earth. Upon the whole, whatever difficulties may attend the theory which regards the Zodiacal Light as having its seat in some appendage of the sun, there seems to be as yet no other supposition possessed of greater plausibility."

No more recent discovery has made it necessary to modify in any manner this conclusion, which expresses at present the general opinion of the astronomical world. (See Chambers's *Descriptive Astronomy*, London, 1867, book iii. chap. v. p. 256.)

F. A. P. BARNARD.

Zoological Geography is that department of science which treats of the zoological peculiarities of the various regions into which the globe may be divided, or, in other words, its faunas or combinations of animals. The term was employed first by Van der Hoeven, and later by Andrew Murray and other authors, with this signification, and in contrast with *geographical zoology*, which treats of the range of animal forms. On a consideration of the geographical range of various animals it soon becomes evident that they are mostly combined in groups which are more or less distinctive of certain regions of varying extent. This truth was first clearly appreciated by the great French naturalist Buffon.

HISTORICAL RÉSUMÉ.—The natural regions, however, were not scientifically distinguished until within a comparatively recent period, and we have to pass by the many writers who contributed to our knowledge of the subject, and limit our notices to a very few writers.

Swainson was perhaps the first to recognize *per se* the chief zoological divisions. In *A Treatise on the Geography and Classification of Animals*, published in 1835,* he proposed the following subdivisions: "1. The European or Caucasian range includes the whole of Europe, properly so called, with part of Asia Minor and the shores of the Mediterranean; in Northern Africa the zoological peculiarities of this region begin to disappear; they are lost to the eastward of the Caucasian Mountains, and are blended with those of Asia and America to the N. 2. The Asiatic range, comprehending the whole of Asia E. of the Ural Mountains, a natural and well-defined barrier between the two continents. The chief seat of this zoological region is probably in Central Asia; its western confines blend into the European toward Persia, and disappear on the W. of the Caucasian chain; it is united to the African range among the provinces of Asia Minor, and is again connected with Europe, and also with America, by the arctic regions of the three continents; finally, its most southern limits are marked by the islands of Java and Sumatra, where the zoological character of the Australian region begins to be apparent. 3. The American range. United to Europe and Asia at its northern limits, this region or province comprehends the whole of the New World, but into which it blends at the other extremity is uncertain. 4. The next includes the whole of Africa S. of the Great Desert: a part, at least, of the countries bordering on the Mediterranean exhibit a decided affinity to the European range; while the absence of large animals in Madagascar, and the presence of genera peculiar to New Holland and the extreme point of Southern Africa, lead us to the fifth or the Australian range. 5. To this region nature has given peculiar characters, both in regard to its geographic situation and to its animal productions. New Guinea and the neighboring islands mark its limits in that direction; Australia proper is its chief seat, and it spreads over the whole of the numerous islands of the Pacific Ocean: whether this province blends with that of America or of Europe remains for future discovery, but its connection with Africa and Asia has been already intimated."

The chief comment to be made upon this is, that the author was evidently influenced rather by the differentiation into land and water, or into the various continents of geographers, than by the distribution of animal life over the surface of the globe. There is far from being a coincidence between the two, and even naturalists to-day need to appreciate this truth. Various investigators, however (*e. g.* Pucheran, Brandt, Forbes, etc.), perceived that the zoological regions were quite different from the geographical ones; and in the case of the European division demonstrated that Northern Asia and Africa N. of the Sahara exhibit essentially the same combinations of animals, and therefore together form one great zoological province. While thus some naturalists were influenced chiefly by geographical considerations or the distribution of land and water in determining zoo-geographical provinces, others were led to combine animals into regions characterized chiefly by thermometrical data. Among such were Humboldt, Agassiz, Wagner, Dana, etc.

Prof. Louis Agassiz,† *e. g.*, divided the earth into faunas, characterized chiefly by temperatures, into three principal divisions—(1) the arctic, (2) the temperate, and (3) the tropical.

(1) The arctic fauna was homogeneous, and embraced the northern extremities of the several boreal continents (Europe, Asia, and America) down "to the isothermal zero; that is, the line where the average temperature of the year is at 32° of Fahrenheit."

(2) The temperate faunas were divided into four: on the one hand were distinguished a northern temperate and a northern warm, and on the other hand a southern warm and a southern temperate. "Taking the contrast of the vegetation as a basis, and the consequent changes of habit

* *A Treatise on the Geography and Classification of Animals.* By William Swainson, Esq. (London, 1835, 16mo.)

† *Essai sur la Géographie des Animaux* (*Revue suisse et Chronique littéraire*, t. viii. pp. 441–452, 538–585, 1845); *Principles of Zoology* (pp. 161–181, 1848); *Geographical Distribution of Animals* (*Christian Examiner*, vol. xlviii. pp. 184–204, 1850; also *Ed. New Phil. Journ.*, vol. xlix. pp. 1–25, 1850). The extracts are from the *Principles of Zoology*.

imposed upon the denizens of the forests, the temperate fauna has been divided into regions; a northern one, where the trees, except the pines, drop their leaves in winter, and a southern one, where they are evergreen." "A peculiar characteristic of the faunas of the temperate regions in the northern hemisphere, when contrasted with those of the southern, is the great similarity of prevailing types on both continents." "The predominant types among the mammals are the bison, deer, ox, horse, hog, numerous rodents, especially squirrels and hares, nearly all the Insectivora, weasels, martens, wolves, foxes, wild-cats, etc." "Among birds there is a multitude of climbers, passerine, gallinaceous, and many rapacious birds. Of reptiles there are lizards and tortoises of small or medium size, serpents, and many batrachians, but no crocodiles. Of fishes there is the trout family, the cyprinoids, sturgeons, the pikes, the cod, and especially the great family of herrings and scombroids, to which latter belong the mackerel and the tunny." The division of the northern faunas into northern temperate and northern warm, above noted, is, however, contravened by another division into minor faunas. Thus, the author distinguished "(1) the fauna of the U. S., properly so called, on this side of the Rocky Mountains;" and "(2) the fauna of Oregon and California, beyond those mountains," for North America: for Europe, (1) "the fauna of Europe;" (2) "the fauna of Siberia;" (3) "the fauna of the great Asiatic table-land;" and (4) "the fauna of China and Japan." "The faunas of the southern temperate regions differ from those of the tropics as much as the northern temperate faunas do; and, like them also, may be distinguished into two provinces, the colder of which embraces Patagonia. But besides differing from the tropical faunas, they are also quite dissimilar to each other on the different continents." "Each of the three continental peninsulas which jut out southerly into the ocean represents, in some sense, a separate world."

(3) "The tropical faunas are distinguished, on all the continents, by the immense variety of animals which they comprise, not less than by the brilliancy of their coverings." "The tropical region is the only one occupied by the Quadrumana, the herbivorous bats, the great Pachydermata, such as the elephant, the hippopotamus, and the tapir, and the whole family of Edentata. Here also are found the largest of the cat tribe, the lion and tiger. Among the birds we may mention the parrots and toucans as essentially tropical; among the reptiles, the largest crocodiles and gigantic tortoises; and finally, among the articulated animals, an immense variety of the most beautiful insects. The marine animals, as a whole, are equally superior to those of other regions."

Such are the essential features considered as common. The differentiation into sub-regions need not be here given. The ideas involved are so strange that we have been careful to justify the synopsis given by exact quotations of the author's own words. It need only be added that Prof. Agassiz was peculiar in his views, and it is indeed difficult to conceive how a naturalist of his ability could have ever seriously proposed such a grouping as the expression of natural relations.

Mr. Philip Lutley Sclater in 1858, in a special memoir on the geographical distribution of birds,* proposed the division of the earth into primary regions, which had some good features in common with previous authorities, and some very bad ones originating with the author. The memoir has become very well known, and the views of the author have been quite generally accepted by at least his compatriots. Evidently availing himself, but without any acknowledgment, of the labors of his predecessors, and selecting with considerable judgment (not a slight merit), he has recognized the various primary regions of the earth, and distinguished them as follows: (1) Palæarctic, or Northern Old World region; (2) Western Palæotropical or Ethiopian region; (3) Middle Palæotropical or Indian region; (4) Eastern Palæotropical or Australian region; (5) Nearctic or North American region; and (6) Neotropical or South American region. These regions had already been recognized before, and their approximate limits even appreciated, and Mr. Sclater has simply connected new names with already determined generalizations. But he deserves the credit of having first co-ordinated them into one systematic whole. The chief and novel feature of his arrangement was, however, the combination of the first four regions into a "Palæogean or Old World creation," and the last two into a "Neogean or New World" creation. In so far as zoological geography was concerned, this plan was original with Mr. Sclater, although long adopted by geographers. But no reasons were adduced that could at all justify such combinations as zoo-geographical divisions, and the result was obtained by evidently ignoring the essential differences between the several elements of each, on the one hand, and, on the other, the common characteristics of the members of the two "creations." In defence of Mr. Sclater, however, it may be urged that the class of birds presents some phenomena of distribution which could be used in plausible justification of such a grouping to a greater extent than any other class of animals.

Prof. T. H. Huxley in 1868, in a special memoir on gallinaceous birds,† discussed the geographical distribution of those forms, and, in connection therewith, of other vertebrates, and proposed to recombine the several regions of Mr. Sclater into primary groups totally unlike those of his predecessors, and contrasting especially with those of Mr. Sclater. (1) The Palæarctic and Nearctic regions, as well as Asia and Africa, were united under the common name of "Arctogæa;" (2) the Neotropical region was contrasted as "Austro-Columbia;" and (3–4) the Australian region was differentiated into two—(3) Australasia and (4) New Zealand. "But," continued Mr. Huxley, "this arrangement would leave out of sight the important fact that in some respects the three latter are less unlike one another than they are unlike the first—for example, in the paucity or absence of ungulate mammals, the abundance of edentates and marsupials among mammals; and in the class of birds nothing can be more remarkable than the great development of the Psittacomorphæ [parrots] in both Australasia and Austro-Columbia, while they are comparatively so feebly represented in India and South Africa, and are absent, save a stray species or two, in North America. Not only in this circumstance, but in the wonderful uniformity of the osteology, the Psittacomorphæ nearly repeat the phenomena presented by the Peristeropodes [Cracidæ and Megapodidæ], and help, with them and the three-toed Ratitæ [Rheidæ, Dromæidæ, etc.], to bind together the widely-separated portions of the south world, and justify the adoption for it of the title NOTOGÆA, in contrast to the north world, or ARCTOGÆA."

Mr. P. L. Sclater in 1874‡ published a new scheme for the geographical distribution of animals, and completely abandoned the essential features of his former memoir—*i. e.* the combination of the regions into a "Palæogean or Old World creation" and a "Neogean or New World creation." Profiting by the demonstrations of Prof. Huxley, he recombined his several regions as follows: (1) The Palæarctic, the Ethiopian ("with the lemurian sub-province of Madagascar"), the Indian, and the Nearctic regions were segregated under the common name of "*Arctogæa*, or North Land;" (2) the Neotropical region was differentiated as a second major division—"*Dendrogæa*, or Tree Land;" and (3–4) the former Australian region was divided into two other major divisions—(3) the Australasian region, restricted to Australia and the Malayan Archipelago up to Wallace's line, being named "*Antarctogæa*, or South Land;" and (4) New Zealand being distinguished as "*Ornithogæa*, or Bird Land." As will be perceived, the only essential difference between this and Prof. Huxley's distribution, except the ignoring of the two primary groups, is one of nomenclature, Mr. Sclater, with his usual proclivity, having given in part new names to the four divisions recognized by Prof. Huxley.

Mr. Alfred Russel Wallace, in an extensive work on the geographical distribution of animals,§ published in 1876, distributed the several faunas of the earth under six primary regions, with the names given by Mr. Sclater—viz. (1) The Palæarctic, (2) the Ethiopian, (3) the Indian, (4) the Australian, (5) the Neotropical, and (6) the Antarctic regions. Each of these regions was divided into four sub-regions—viz. (1) the Palæarctic into (*a*) North Europe, (*b*) Mediterranean (or S. Europe), (*c*) Siberia, and (*d*) Manchuria (or Japan); (2) the Ethiopian into (*a*) East Africa, (*b*) West Africa, (*c*) South Africa, and (*d*) Madagascar; (3) the Oriental into (*a*) Hindostan (or Central India), (*b*) Ceylon, (*c*) Indo-China (or Himalayas), and (*d*) Indo-Malaya; (4) the Australian into (*a*) Austro-Malaya, (*b*) Australia, (*c*) Polynesia, and (*d*) New Zealand; (5) the Neotropical into (*a*) Chili (or S. Temperate America), (*b*) Brazil, (*c*) Mexico (or Tropical North America), and (*d*) Antilles; and (6) the Nearctic into (*a*) California, (*b*) Rocky Mountains, (*c*) Alleghanies (or East U. S.), and (*d*) Canada.

THE PRIMARY ZOOLOGICAL REGIONS OR REALMS.—We

* *On the Geographical Distribution of the Members of the Class Aves* (*Jour. of the Proc. of the London Soc.*, vol. iii.—Zoology—pp. 130–139, 1858).

† *On the Classification and Distribution of the Alectoromorphæ and Heteromorphæ* (*Proc. Sc. Meetings Zool. Soc. London*, for 1868, pp. 294–319, with map).

‡ *On the Geographical Distribution of Mammals* (*Science Lectures for the People*, 6th series, No. 5, 1874).

§ *The Geographical Distribution of Animals, with a Study of the Relations of Living and Extinct Faunas as elucidating the past changes of the Earth's Surface.* With maps and illustrations. In two volumes. (London, 1876, 8vo.)

may conveniently consider, as have done Wallace and his predecessors, those regions of the earth over which are severally distributed essentially the same animals, and which are six or seven in number. The combinations of animals characteristic of these are partly determined by thermometrical conditions, and partly by natural barriers, such as oceans and mountains. Commencing, naturally, with that region which is most familiar to us, we will proceed to those which are successively more differentiated by the nature of their inhabitants.

1. *The North American or Nearctic Realm* embraces North America from its northern boundaries, where it is fused into the European, southward into Northern Mexico, projecting into that country to a considerable distance along the extension of the Rocky Mountains, and ceasing near the south-western borders of the U. S. on the lowlands. It has representatives of 26 families and about 250 species of mammals, exclusive of the marine types; 60 families and about 800 species and sub-species of birds (*Baird*, *Brewer*, and *Ridgway*); 25 families and about 250 species of reptiles; 14 families and about 100 species of amphibians; 17 families and about 600 species of fresh-water fishes; and 1 family and 6 or 7 species of marsipobranchiates: of these several are peculiar to the region. These are, of mammals, Antilocapridæ and Haploodontidæ; of birds, Chamæidæ (of very doubtful value); of reptiles, Lichanuridæ; of amphibians (according to Cope), Scaphiopodidæ, Plethodontidæ, Amblystomidæ, Amphiumidæ, and Sirenidæ; and of fishes, Centrarchidæ, Aphredoderidæ, Amblyopsidæ, Percopsidæ, Hyodontidæ, and Amiidæ. Of the others, those characteristic of the northern portions of the region are shared in common with Europe and Northern Asia, while those more especially represented in the southern portions are held in common with South America. On the whole, however, the predominant type of the region—and only more decidedly so to the northward—is that of the Eastern hemisphere, and the South American aspect given to the region is apparently due rather to the (geologically) recent intrusion of South American types than to its being the natal abode of such forms.

Of the other classes of animals, those most noteworthy are the gasteropods and conchifers: the former is extremely rich in species of the family Ceraphasiidæ, or Melaniidæ of peculiar genera; the latter is even to a still greater degree exuberant in species representing also numerous sections, or sub-genera, peculiar to the region. In fact, over 400 species of gasteropods, most of which belong to the family Ceraphasiidæ, and about 600 species of conchifers, the greater portion of which are members of the family Unionidæ, have been attributed to the region; but these numbers are undoubtedly greatly exaggerated. It may be added, in conclusion, that several of the families and genera now peculiar to the realm were, in early geological epochs, represented elsewhere: the family Amiidæ, *e. g.*, having formerly had members in Europe. Several of the peculiar genera are also of great antiquity, characteristic sections or genera of Viviparidæ, Melaniidæ, and Unionidæ having existed as early as the Cretaceous, and even the Jurassic, period.

The realm has been variously subdivided into sub-regions by different authors—*e. g.* Agassiz, Baird, Verrill, Allen, and Cope—each of whom has based his divisions primarily upon special classes, though availing himself of his knowledge of other vertebrates. For present purposes perhaps the most useful will be that of Prof. Cope, and although liable to certain objections, his divisions on the whole are the most truthful expressions of the general assemblages characteristic of different portions of the continent. The sub-regions that may be thus recognized are as follows:

(1) The Northernmost or Circumpolar region has essentially the same features as the corresponding zone in Northern Europe and Asia, and is characterized by its pinnipeds of the families Phocidæ and Rosmaridæ; the arctic fox, the musk ox, the lemmings, and water-birds belonging to the various genera of Anatidæ, etc.

(2) The Eastern region extends from about the isotherm of 50° F. in the N. to that of 77° in the S., and from the Atlantic Ocean on the E. to the prairies of the Far West. To this region the mole genus *Condylura* is restricted, and it is especially the home, although not peculiarly so, of the several genera of North American Siluridæ, as well as the Ceraphasiidæ and Unionidæ; to it is also limited the fish genus *Polyodon*. It is, however, perhaps distinguished from the Austro-riparian region rather by its negative than by its positive characteristics. The region has been subdivided by several American authors into several ultimate districts or faunas—*e. g.* the Hudsonian or sub-frigid district, the Canadian or cold temperate district, the Alleghanian or sub-temperate district, and the Carolinian or temperate district.

(3) The Austro-riparian region, according to Cope, "commences near Norfolk, Va., and occupies a belt along the coast, extending inland in North Carolina. It passes S. of the Georgia mountains, and to the north-westward up the Mississippi Valley to the southern part of Illinois. W. of the Mississippi the boundary extends S. along the southern boundary of the highlands of Texas, reaching the Gulf at the mouth of the Rio Grande." In it are found a number of peculiar genera of mammals, birds, and reptiles, or, more generally, such as extend from South America into the region, but no farther. The most noteworthy mammals are the cotton rat (*Sigmodon hispidum*), the Florida rat (*Neotoma floridana*), and two species of hare of a peculiar section; among the reptiles are species of *Anolis* (the so-called "chameleon"), *Cemophora*, and *Alligator*; among the amphibians the genus *Siren* is peculiar: there are also several genera of fishes, and among them may be especially enumerated the centrarchoid types *Acantharchus*, *Mesogonistius*, *Enneacanthus*, and *Centrarchus*. It has been differentiated into the Floridian, Louisianian, and Texan districts.

Both the preceding (second and third) regions have many characteristics in common, and among the most noticeable is the development of percoid and centrarchoid fishes.

(4) The central region includes the elevated plains of the West and the eastern decline of the "backbone of the continent." Botanically, it is distinguished by the paucity of forests. It has a number of peculiar generic and, still more, specific types. To it are almost restricted the genera *Mazama* (Rocky Mountain goat), *Ovis* (sheep), and *Antilocapra* (antelope), as well as the black-tailed deer (*Cariacus macrotis*); here are also found in their greatest development the genera *Taxidea* (badger), *Cynomys* (prairie-dog), *Dipodomys*, *Perognathus*, and *Lagomys*: the most remarkable birds are the sage-cock (*Centrocercus urophasianus*) and the cock-of-the-plains (*Pediocætes phasianellus*); the reptiles and amphibians are not numerous nor especially noteworthy; the class of fishes is very poor in family types, and lacks almost altogether the characteristic American types.

(5) The Pacific region embraces the western slope of the territory of the U. S. between the Sierra Nevada and the Pacific Ocean. Its arboreal vegetation is generally very richly developed. Its characteristic, if not entirely peculiar, types are, among birds, *Geococcyx* (chaparral-cock or ground-cuckoo), *Chamæa*, and several species of Ortyginæ ("quails"); among reptiles, *Charina* (a genus of boas) and several lizard genera; among amphibians, the salamandroid genera *Ambystoma*, *Batrachoseps*, and *Dicamptodon*; and among fresh-water fishes, the genera *Archoplites* (centrarchoid), *Hysterocarpus* (embiotocoid or viviparous fish), and several peculiar genera of cyprinoids. The terrestrial mollusks are peculiar, and recall the types of Europe and Northern Asia rather than those of Eastern America.

Both of the last two agree in the paucity of fishes of peculiar American types. The species belong chiefly to the families of Salmonidæ, Cyprinidæ, and Catastomidæ; and *Archoplites*, peculiar to California, is the only known representative in that region of any special American family.

If, now, we should combine the regions thus defined, we would be much tempted to unite, on the one hand, the Eastern and the Austro-riparian, and, on the other, the Central and Pacific. Two other regions have been distinguished whose affinities seem to be also greatest with the last.

(6) The Sonoran region, according to Cope, "includes parts of Nevada, New Mexico, Arizona, and Sonora in Mexico. It does not cross the Sierra Nevada nor the Mojave Desert, nor extend into the peninsula of Lower California. It sends a belt northward on the E. side of the Sierra Nevada as far as, including Owen's Valley in Eastern California, lat. 37°, and enters other valleys in Nevada in the same way. It occupies the lower valley of the Rio Grande, and extends into Texas as far as the desert E. of the Rio Pecos. It extends southward in Western Mexico as far as Mazathn." It is poor in mammals, and not rich in birds, but, according to Cope, four genera of lizards (*Heloderma*, *Sauromalus*, *Uma*, and *Ceonyx*) and five of serpents (*Gyalopium*, *Chionactis*, *Sonora*, *Rhinochilus*, and *Chilopoma*) "are not found in any of the other regions described." It is the paradise of rattlesnakes, nine species inhabiting its territory. Into this region also extend peculiar South American types, the cichlid genus *Heros* and the characinid genus *Astyanax* being represented each by a single species.

(7) The Lower Californian region, also defined by Cope, "occupies the peninsula of that name as far N. as San Diego." It has many characters in common with the So-

noran region, but has many species of birds and reptiles peculiar to itself. It has, according to Cope, three genera of lizards (*Verticaria*, *Diplodactylus*, and *Cyclura*) and one of serpents (*Lichanura*) peculiar to the region or found elsewhere only farther southward.

Such are the regions into which some of the best authorities have divided the North American realm. It is impossible in the limits within which this article must be restricted to fully define them or explain wherein they may be modified in the future. Some idea, however, will be conveyed of the approximate distribution in general of several of the more familiar types of animals, and others, on the whole, are determined by the same laws. The distribution of the marine types is governed by other laws, and must therefore be considered in another connection.

II. *The European or Palæarctic Realm* is the largest of all, and embraces the entire northern portion of the Old World. Its southern limits nearly coincide with the tropic of Cancer in the lowlands, and its isotherm projected therefrom in the more rugged countries. In Africa it extends into the Desert of Sahara, and in Asia it is limited by the Himalaya Mountains and their spurs. It possesses members of 31 families of terrestrial mammals, 55 of birds (according to Wallace), 25 of reptiles, 9 of amphibians (according to Günther), and 16 of fresh-water fishes. None of these families, however, are continuous over the entire area and at the same time peculiar to it. It is true that several families are restricted within its limits, such as the Trogonophidæ and Ophiomoridæ among reptiles, and the Comephoridæ among the fishes, but these are very limited in their distribution: the family Comephoridæ, *e. g.*, is represented by a single species, confined to a single lake (Baikal) of Siberia. The realm is characterized, therefore, rather by what it has not than by what it has. Its subdivisions, or regions, have been variously distinguished. As it is impossible to enter into a discussion of the relative merits of these divisions, we simply reproduce the views of the latest writer on the subject, Mr. A. R. Wallace. According to him, there are four regions, or "sub-regions," which he contends are "in the present state of our knowledge at once the most natural and the only practicable ones." These are—(1) the European, (2) the Mediterranean, (3) the Siberian, and (4) the Mantchurian.

(1) The European region coincides with the homonymous continent and its outlying islands northward, but is limited southward by the Pyrenees and the Alps, the Balkans, the Black Sea, and the Caucasus range. A few genera of vertebrates are peculiar to the region, among which are *Rupicapra*, containing the chamois, and *Myogale*, or the "desman," among the mammals; *Alytes*, *Pelodytes*, and *Proteus* among the amphibians; and *Acerina*, *Percarina*, *Aspro*, and a number of cyprinoid genera among the fresh-water fishes. Other classes of animals present noteworthy features, but the limits of this article forbid even an allusion to them.

(2) The Mediterranean region includes the countries bounded on the N. by the Pyrenees, the Alps, and the Caucasus Mountains, and on the S. by the great desert of Africa: it also embraces Asia Minor, Persia, and part of Afghanistan, as well as the northern part of Arabia. As might be naturally expected from the nature of its climate, it is the richest of all the European regions in the number of species, and herein forms of North and South Europe meet on common ground, and a few African types have wandered into it. It has been subdivided into (*a*) "the Mediterranean sub-region" and (*b*) "the Persian sub-region."

(3) The Siberian region includes the whole of Northern Asia from the Arctic Ocean southward to the borders of Persia and Afghanistan, the Himalaya Mountains, Northern China, and the Amoy River. A number of peculiar genera are present, but these are quite limited in their range, and none extend over the entire area. It is divisible into (*a*) "the Siberian sub-region" and (*b*) "the Tartarian sub-region."

(4) The Mantchurian region includes Mantchuria, as well as the Chinese empire and the Japanese islands, and is characterized by quite a large number of peculiar species of the several classes of vertebrates, which however, are mostly quite limited in their distribution, and few, if any, extend over even the greater part of the territory. It has been differentiated into (*a*) "the Mantchurian sub-region" and (*b*) "the Japanese sub-region."

III. *The Indian or Oriental Realm* is of less extent than either of the two preceding ones, but is nevertheless richer than either in the number of species. It extends northward from the Himalayan range to the Indian Ocean southward, and toward the S. E. is limited by the narrow but deep strait which intervenes between Celebes Island and its dependencies on the S., and Borneo on the N., and between the Islands of Lombok and Sombawa on the one hand, and Bali and Java on the other; it thus includes the peninsulas of Hither and Farther India and the Indo-Malayan Archipelago and Philippine Islands. In it are found 33 families of terrestrial mammals, 71 families of birds (according to Wallace), 25 families of reptiles, 9 of amphibians, and 15 of fresh water fishes. Of these, 12 are peculiar—viz. among mammals, the Tarsiidæ, Galeopithecidæ, and Tupaiidæ; among birds, the Liotrichidæ, Phyllornithidæ, and Eurylæmidæ; among reptiles, the Xenopeltidæ, Uropeltidæ, and Acrochordidæ; and among fishes, the Luciocephalidæ, Ophiocephalidæ, and Mastacembelidæ. As in the case of other regions, there is considerable diversity of opinion as to the relations of it with others and as to its various several subdivisions: by Wallace four are admitted: these are here particularized without the assumption of any personal responsibility by the present writer, and even with the proviso that they will require considerable modification and differentiation, as, *e. g.*, the Philippine Islands.

(1) The first or Hindostan region includes the Indian Peninsula from the Himalayas on the N. to the delta of the Ganges and its approximate isotherm on the S.: "and it probably reaches to about Cashmere in the N. W., and perhaps to the valley of the Indus farther S.; but the great desert tract to the E. of the Indus forms a transition to the S. Palæarctic sub-region." It is impossible in a few words to give the zoological peculiarities of the region; these rather consist in the development of the types than in the exclusive presence of any one.

(2) The Ceylonese region—so called because its characteristics are exhibited in the highest degree in the island of Ceylon—includes not only that island, but also the southern portion of the Indian Peninsula to the confines of the first, or Hindostan, region. According to Wallace, "the main features of this division are—the appearance of numerous animals allied to forms only found again in the Himalayas or in the Malayan sub-region, the possession of several peculiar generic types, and an unusual number of peculiar species."

(3) The Indo-Chinese or Himalayan region includes the peninsula of Farther India and Southern China, and extends from the Himalayas in the N. southward to the Malaccan peninsula. "Taking this sub-region as a whole," says Wallace, "we find it to be characterized by 3 genera of Mammalia [Urva, Arctonyx, and Ælurus], without counting bats, and 44 genera of land-birds, which are altogether peculiar to it; and by 13 genera of Mammalia and 36 of birds, which it possesses in common with the Malayan sub-region." This region, according to some authors, admits of a further subdivision into three—(*a*) Southern and Central China, (*b*) Burmah, Siam, and Cochin, and, as an appendage, (*c*) the Andaman and Nicobar islands.

(4) The Indo-Malayan region includes all the islands of the Indo-Malayan Archipelago and the Philippine Islands, as well as the Malayan Peninsula. "Here alone, in the Oriental region," says Wallace, "are found the most typical equatorial forms of life—organisms adapted to a climate characterized by uniform and not excessive heat, abundant moisture, and no marked departure from the average meteorological state throughout the year. These favorable conditions of life only occur in three widely-separated districts of the globe—the Malay Archipelago, Western Africa, and Equatorial South America. Hence, perhaps [not probably], it is that the tapir and the trogons of Malacca should so closely resemble those of South America, and that the great anthropoid apes and crested hornbills of Western Africa should find their nearest allies in Borneo and Sumatra." The region is capable of subdivision into several others; Mr. Sclater, *e. g.*, has distinguished (*a*) the Malay Peninsula, (*b*) the Indian Islands, and (*c*) the Philippine Archipelago. The last is remarkable for the exuberant development of the terrestrial gasteropods.

The Andaman and Nicobar islands have been combined by some naturalists, as already indicated, with the Indo-Chinese region, but by Wallace have been referred, one (the Andamans) to the Indo-Chinese, and the other (the Nicobars) to the Indo-Malayan.

IV. *The African or Ethiopian Realm*, as the name indicates, includes the greater part of the African continent, but not all, it being limited on the N. by the Desert of Sahara, although on all other sides bounded by the ocean; but it also comprises, according to most recent authors, the island of Madagascar and the Mascarenes, as well as the peninsula of Arabia. It is distinguished especially in that it possesses the highest types, after man, of the order Primates, and which are in all respects the most anthropoid. This region is also further distinguished by the restriction to it of as many as 9 isolated families of mam-

mals—viz. Daubentoniidæ, Cryptoproctidæ, Protelidæ, Camelopardidæ, Hippopotamidæ, Centetidæ Centeninæ, Potamogalidæ, Chrysochloridæ, and Orycteropodidæ. Among birds there are 6 so-called families peculiar to it—Paictidæ, Musophagidæ, Coliidæ, Leptosomidæ, Irrisoridæ, and Serpentariidæ. The most marked, however, are the fishes, of which there are 14 families; of these, 5 are peculiar—viz. Pantodontidæ, Kneriidæ, Mormyridæ, Gymnarchidæ, and Polypteridæ, and three are shared with South America alone—Cichlidæ, Characinidæ, and Lepidosirenidæ. This realm, like all the others, has been subdivided by Wallace into four regions, or, as he designates them, "sub-regions"—viz. (*a*) the East African, (*b*) the West African, (*c*) the South African, and (*d*) the Malagasy.

(1) The East African sub-region, or that of Central or East Africa, includes "all the open country of tropical Africa S. of the Sahara, as well as an undefined southern margin of that great desert." It embraces Nubia and the country toward the S., as well as the entire width of the continent between about the 10th degree of S. lat. and the tropic of Capricorn. "The surface of all this sub-region," in the words of Wallace, "is generally open, covered with a vegetation of high grasses or thorny shrubs, with scattered trees and isolated patches of forests in favorable situations." It is mostly distinguished by negative characters in contrast with the others.

(2) The West African region comprises the western half of the continent at its greatest width, and is bounded on the N. by the Desert of Sahara, and on the E. and S. by the East African region, its southern bounds being nearly coincident, toward the coast, with the river Congo, but further inland with about the 10th degree of S. lat. Among the characteristic animals of the region are the gorilla, the chimpanzee, and two genera of Lemuridæ (*Perodicticus* and *Arctocebus*), constituting a peculiar section of the family Lemuridæ. *Hyomoschus*, the most generalized living type of the family Tragulidæ, *Potamogale*, the sole representative of its family, and *Anomalurus*, also the type of an independent family, are other characteristic mammals.

(3) The South African region embraces the southern portion of the continent, and its limits toward the N. are nearly coequal with the tropic of Capricorn, except along and near the eastern coast, where it extends northward to the vicinity of Mozambique; on all other sides it is bounded by the ocean. To this region, so far as known, are limited several of the forms already enumerated as peculiar to Africa—viz. the Protelidæ, the Chrysochloridæ, and the Orycteropodidæ. A large number of genera in various classes of animals are also peculiar to it.

(4) The Malagasy region comprises the island of Madagascar, as well as the islands of Bourbon, Mauritius, Rodriguez, and the Seychelles. These, however, exhibit remarkable differences among themselves. (*a*) Madagascar is distinguished by the development of several peculiar types of mammals—*e. g.* Daubentoniidæ, Cryptoproctidæ, and Centetidæ;* birds and invertebrates of remarkable character further specialize it as an independent region. (*b*) The Mascarene Islands include all the small ones enumerated, and several of them are remarkable for the large birds provided with imperfect wings which formerly existed on them, but which through the agency of man have now become extinct.

V. *The South American or Neotropical Realm* extends from the N. near the northern boundaries of Mexico in the lowlands, and lower down in the highlands, to the extremity of South America and its dependencies in the S., and with it are also generally associated the West Indian Islands. It has 30 families of mammals, 73 of birds, 35 of reptiles, 16 of amphibians, and 17 of fresh-water fishes. An unusual proportion of these are peculiar to the region, or nearly so. Among the mammals are the Cebidæ, Midiidæ, Desmodidæ, Chinchillidæ, Caviidæ, Hydrochœridæ, Bradypodidæ, Dasypodidæ, Chlamyphoridæ, and Myrmecophagidæ. Several of the families which are shared in common with North America are also almost as characteristic, the North American species being rather intruders therein from the region under question than true autochthones. Such are the Procyonidæ, Bassaridiidæ, Saccomyidæ, Cercolabidæ, Phyllostomidæ, and Didelphididæ. Other families are peculiar in their distribution: for example, of the Tapiridæ two genera and several species are found in South America, and the only other representative is distant as far as the Indo-Malayan Archipelago, and of the Camelidæ one genus (*Auchenia*) is found along the western slope of the Andes, and another (*Camelus*) in Asia and Northern Africa; these are anomalies, however, that become readily explicable when it is recalled that in previous geological epochs both of the said families were extensively distributed over the northern hemisphere, and consequently the widely-separated living forms are evidently simply surviving representatives of formerly widespread types. Of birds, according to the views of Wallace and many ornithologists, 23 families are restricted to the region, and 7 others are common and peculiar to it and the North American region. The peculiar families of birds, according to Wallace, are the Cœrebidæ, or sugar-birds; Phytotomidæ, or plant-cutters; Pipridæ, or manakins; Cotingidæ, or chatterers; Formicariidæ, or ant-thrushes; Dendrocolaptidæ, or tree-creepers; Pteroptochidæ; Rhamphastidæ, or toucans; Bucconidæ, or puff-birds; Galbulidæ, or jacamars; Todidæ, or todies; Momotidæ, or motmots; Steatornithidæ, the guacharo or oil-bird; Cracidæ, or curassows; Tinamidæ, or tinamous; Opisthocomidæ, the hoazin; Thinocoridæ; Cariamidæ; Aramidæ; Psophiidæ, or trumpeters; Eurypigidæ, or sun-bitterns; and Palamedeidæ, or horned screamers. The Trochilidæ, or humming-birds, are especially noteworthy on account of their great numbers. Six families of reptiles have also been claimed as peculiar for the realm, and among the lizards the family of Iguanidæ is remarkably developed. Four families of amphibians and four of fishes are also considered as restricted to the realm. The relation between the fishes of South America and Africa is another feature of special significance: there are three families shared between the two, and found nowhere else, and genera of the respective families are not distantly related, although none are actually common to the two realms.

This realm has been subdivided into four regions ("sub-regions") by Wallace, but it is at least convenient to recognize a larger number.

(1) The Mexican or Central American region extends from Northern Mexico near the coast, and from Central Mexico in the highlands, southward to about the Isthmus of Panama. It is distinguished by the intermixture of North and South American types; here many of the birds that pass their summers in the U. S. sojourn during the winter. There is, however, quite a large number of species and not a few genera peculiar to the region. The most noteworthy of these are *Bassaricyon* (family Procyonidæ), *Elasmognathus* (family Tapiridæ) of the mammals; 37 genera of terrestrial birds; and of the family Cichlidæ of the fishes, *Heros*, and a number of less widely-distributed and species-containing genera. The terrestrial mollusks also deserve special mention, and types otherwise characteristic of the North American, West Indian, and Brazilian regions, besides several peculiar ones, commingle on common ground.

(2) The Antillean, West Indian, or Caribbean region, as it has been variously called, includes most of the islands of the Caribbean Sea. On the whole, the types found on the several islands are most closely related to those of the Mexican region, and there are many species and quite a large number of genera peculiar to it. Undoubtedly, the most noteworthy feature of this region is the great development of terrestrial gasteropods: these exhibit an extraordinary range of variation, both specific and generic. The larger islands (Cuba, Hayti, and Jamaica) are especially remarkable for the manifestation of this form of animal life. The region is susceptible of subdivision into several others well defined by differences in the combinations of land-shells. Cuba, Jamaica, Hayti, Porto Rico, etc., are all centres of peculiar combinations of species.

(3) The Brazilian or Amazonian region embraces the most of tropical America, and its limits are coextensive with the Atlantic Ocean on the N., and generally also on the E., while toward the S. it extends into Uruguay, and toward the W. terminates in the highlands of the Andes. It is extremely rich in representatives of almost every class of terrestrial animals. It is the head-quarters of the platyrhine monkeys, the Caviidæ, the spiny rats, the ant-eaters, the sloths, the armadillos, and the opossums among the mammals; the toucans, the curassows, the tinamous, and many other families among the birds; and the Polycentridæ and Gymnotidæ among the fishes; the insects and terrestrial as well as fluviatile mollusks are also as a whole characteristic.

(4) The Patagonian or Chilian region, as understood by Wallace, includes the western slope of the South American continent from near the equator southward to Cape Horn, and on the eastern slope Patagonia, the Argentine Confederation, and Paraguay. It is deficient in many of the types so characteristic of the other regions, and has several peculiar to itself. Chief of the peculiar ones are *Auchenia* (llama, etc.), *Tremarctos*, mountain tapir, Chinchillidæ, and Chlamyphoridæ among the mammals; Phytotomidæ and Thinocoridæ among the birds; and Percilia and Percichthys among the fishes. Further, of the fishes

* An aberrant type of this family (Solenodontinæ) is represented in the West Indian Islands.

the Haplochitonidæ and Galaxiidæ are elsewhere found only in the Australian or Polynesian realms.

(5) The Gallapagos region includes the archipelago so named, with about fifteen islands situated on either side of the equator and distant about 600 miles westward from South America. Perhaps it is properly a mere faunal district of the Chilian region, and as such Wallace has considered it. It is, however, at least convenient to isolate it as an independent region. Of birds, it has, according to Salvin, 57 known species, 38 of which are peculiar to the islands, and only 19 (and those mostly water-birds) are found elsewhere. The 57 species represent 39 genera, of which 27 are widely diffused, 7 common to the islands and South America, and 5 peculiar, but related to South American types. Of reptiles it has two snakes of South American types, and two lizards typifying peculiar genera, but members of the characteristic South American family Iguanidæ: it is also noteworthy for the immense land-tortoises of several species peculiar to different islands. The insects and gasteropods indicate the same relationship to South America as do the forms specified.

VI. *The Australian Realm* is of all the most distinctly defined by its fauna. As it will be here limited, it comprises Australia and the immediately outlying islands and the Austro-Malayan Archipelago: it is limited northward by Wallace's line or strait, which separates Lumbok from Bailly and Celebes from Borneo, including Papua or New Guinea and the Solomon Islands to the eastward, and southward embraces Tasmania or Van Diemen's Land. It is especially distinguished by its numerous marsupial mammals, and by the almost complete restriction of the class to representatives of that order, the rodents and the bats: the monotremes are also characteristic of the realm, and entirely confined to it. The class of birds likewise has a number of very characteristic types: chief of these are Megapodidæ and Casnaridæ, but there are several others —*e. g.* the Paradiseidæ, Meliphagidæ, Menuridæ, and Atrichidæ—that are almost equally peculiar. The reptiles and amphibians are perhaps less noteworthy, although they present some interesting features of detail. The fresh-water fishes are, however, especially remarkable; while many of what may be called marine families are represented by fluviatile species, there are several that are peculiar to it or only found elsewhere in South America. Among the former is the family Ceratodontidæ, which in former geological epochs was extensively represented in other parts of the world, but is now peculiar to Australia. Among the latter are the families Percophodidæ, Haplochitonidæ, Galaxiidæ, Osteoglossidæ, and Symbranchidæ. The articulates and mollusks also afford a large number of characteristic forms. The primary subdivisions of the realm are two:

(1) The Australian region includes the continent of Australia and the island of Tasmania, as well as several smaller ones near the coast. This is especially the home of the existing types of marsupials, and all the surviving families, with the exception of Didelphididæ, are here best exemplified, and several of them are peculiar. To this region also the family Ornithorhynchidæ of the monotremes is restricted.

(2) The Austro-Malayan or Papuan region includes the island of Papua or New Guinea, and likewise Celebes and the multitudinous islands lying toward the S. and between it and Papua, as well as the Solomon Islands. Among the mammals there is one species of the genus *Sus* known, and one species of Muridæ, but all the others belong to the orders of marsupials and monotremes: the former is represented by the families Macropodidæ, Phalangistidæ, Peramelidæ, and Dasyuridæ; the latter by the family Tachyglossidæ, a large species of which has been very recently described as an inhabitant of the Arfak Mountains of New Guinea. Among the birds the most noteworthy forms are those of the family Paradiseidæ, which are developed to the greatest extent in New Guinea: the family Casuaridæ is also here well represented.

Both of the above-specified regions of the Australian realm, but especially the Papuan one, are susceptible of subdivision into well-marked faunal districts; but for information respecting these reference must be made to Wallace's work, as well as to memoirs by Australian and other naturalists.

VII. *The Polynesian Realm* is one distinguished by negative rather than positive characters, and is to some extent a "refuge of the destitute." It includes all the islands of the Pacific Ocean combined under the general name Polynesia, as well as New Zealand. It is distinguished from all others by the total—or almost total—absence of indigenous types of mammals. The other common characters are very few; the avine types, on the whole—and especially those of New Zealand—recall mostly the Australian forms. It is possible that these islands are the remains of one or more continental areas, and that at least most of them may have been submerged and lost their mammals, and on emergence been repeopled from other territories. However this may be, they are at present sufficiently specialized by their animal inhabitants as independent groups or islands, and sufficient is known to permit of a very decided differentiation of birds and other animals into well-marked faunas. The realm, provisionally so called, is primarily divisible into two sections—(1) New Zealand and (2) Polynesia.

(1) The New Zealand region is a homogeneous one, and characterized by quite a large number of peculiar species of birds. According to Wallace, 115 species are natives of the group, and among these are representatives of 21 peculiar genera; the most remarkable type is the family Apterygidæ. Other specially noteworthy forms are the parrots of the isolated genera *Nestor* and *Strygops*, and *Notornis*, a peculiar genus of rails.

(2) The Polynesian Islands form a heterogeneous combination, and probably, when the natural productions of the different islands are known, they will require to be segregated into several distinct regions. The most characteristic forms, or some at least, belong to the class of gasteropods. Especially remarkable in this respect are the Sandwich Islands, to which are restricted a peculiar group or sub-family (Achatinellinæ) of land-shells, and which is represented by very numerous species.

This completes the résumé of the realms and regions of the globe distinguished by the combinations of terrestrial and fluviatile animals. In accepting them we have mainly relied on Wallace, and in many instances unquestionably the boundaries of the several divisions, as well as the divisions themselves, will be hereafter materially modified; but the present would scarcely be the place to enter into a discussion of their defects.

One question, however, remains to be considered. The "realms" or "regions" admitted by naturalists generally exhibit among themselves relations which can be generalized under still more comprehensive captions. The evidence for these combinations is of very unequal value, and at first appears even to be contradictory: for example, the range of species of passerine birds on the one hand over the eastern hemisphere, and on the other over the western, was taken by Sclater for the combination of the realms into two primary divisions—a *Palæogæa*, corresponding to the Old World of geographers, and a *Neogæa*, identical with the New one. Even the birds, however, do not give unqualified testimony to this effect, and, as we have already seen, by a study of the distribution of gallinaceous types Prof. Huxley was led to segregate Europe and North America, as well as Asia and Africa, into a primary combination which he called *Arctogæa* (northern land) in contradistinction with a *Notogæa* (southern land), which embraces the remaining continents of Australia and South America, as well as Polynesia. The evidence derived from the fresh-water types of animals indicates, too, a still different combination. Which of these points to the most natural is, then, a subject for inquiry.

On the one hand, those forms of animal life which are capable of easy extension over extensive bodies of land or water, such as the birds, which represent the highest types, physiologically speaking, of life, are distributed in a manner to a large extent co-ordinate with the present arrangement of land and water. The birds seem to have especially become modified and adapted to the present topographical features of our earth at a (geologically speaking) recent epoch. On the other hand, those animals of a more lethargic character, or which are prevented by physical environments from extending their range, are grouped entirely otherwise. This is especially the case with the fresh-water animals of various kinds, and especially with the fresh-water fishes.

If the inhabitants of the fresh waters of the globe are taken into consideration, the several realms we have defined may be combined in quite a curious manner, which entirely contradicts the relations which the present combinations of land and water would suggest. It will then be seen that the inhabitants of the northern portions of the several continents of North America, Europe, and Asia belong, in a great degree, to the same types; and although the realms thus associated are characterized by a number of forms peculiar severally to each of them, they form a natural whole in contradistinction with the others. Very closely connected with this division is the East Indian, and this forms with them an integral portion of a whole.

In striking contrast with the association of forms characteristic of the several divisions alluded to are the fresh-water types of Australia. Most closely related to Australia in this respect is South America, and in the fresh waters of that continent are to be found several types which are

common to the two continents. The only remaining continent—Africa—although presenting some forms that are common to it and India, on the whole furnishes us with an association of fresh-water forms which recalls the South American realm more than it does any other. Several families of fishes and a number of types of other animals are common to the two and found nowhere else.

Combining these facts into a systematic whole, it has been proposed to segregate the several realms in the manner hinted at, and to combine under the name *Eogæa* (1) the Australian, (2) South American, and (3) African realms; and under the name *Pliogæa* (4) the North American, (5) the European, and (6) the East Indian realms. *Eogæa* gives to us a number of forms which remind us of the ancient inhabitants of the northern hemisphere, and hence the name, while *Pliogæa* has lost most of the forms that were characteristic of the past, and presents the newest aspect of the earth-faunas in contradistinction with the other.

An explanation of these relations may be found in one or other of two hypotheses: (1) The like forms may have originated where they are now found, and have been ever confined within approximately their present limits; or (2) they may be the survivors of anciently widely-distributed races. Neither hypothesis of itself is a sufficient explanation of all the associations in question, but each is applicable to different cases.

The marine animals by no means follow the distribution of the terrestrial ones, and must be considered apart therefrom; simply the main features of their distribution can be adverted to.

If we take into consideration the cetaceans, the true fishes, the selachians, the crustaceans, the worms, the mollusks, and the radiates, all more or less demonstrate that marine life is primarily distributed rather in zones than in districts conforming with the terrestrial regions indicated. Thus, the arctic region is distinguished by one association of animal forms, the tropical by another; and the antarctic has also its peculiar combination. The intermediate regions exhibit a commingling of the forms characteristic of these, and approximate at their respective termini to the characters of the adjoining ones. The bounds of all the regions are inconstant, and determined mostly by the temperature of the water, which fluctuates with the seasons; sometimes, however, the bounds are nearly coincident with, and to some extent determined by, headlands. One especially noteworthy fact, and which strikingly illustrates the influence of temperature on the distribution of animals, is the not infrequent recurrence, at the opposite poles, of the same or very closely-related types which are absent in the intermediate expanse. This phenomenon can apparently be most rationally accounted for by the hypothesis of the origin of the forms in cold waters either in the deep seas or the polar regions, and their subsequent dispersion northward and southward, or from either extreme, over the bottom of the ocean. This hypothesis is sustained by many facts revealed by the late deep-sea dredgings. The several marine regions are as follows:

(1) The NORTHERN faunas are distinguished by rosmarids and phocine phocids among mammals; pleuronectids, gadids, cottids, etc., among fishes; as well as many peculiar invertebrates.

(2) The TROPICAL faunas are characterized by the great development of the delphinine delphids among mammals; of plectognaths, scarids, labrids, pomacentrids, gerrids, serranids, carangids, etc., among fishes; and of volutids, mitrids, cypræids, etc., among mollusks, etc.

(3) The SOUTHERN faunas are specialized by the presence of stenorhynchine phocids among mammals; nototheniids, harpagiferids, etc., among fishes; and by a goodly number of invertebrate types.

These are divided into regions roughly bounded as follows:

NORTHERN.

1. *Arctic*, extending from the farthest N. to the North Cape and Newfoundland in the Atlantic, and to the Shumagin Islands and northernmost Japan in the Pacific.

2. *Boreal*, N. from the Arctic to Cape Cod and the Naze of Norway S.

3. *Aleutian*, including chiefly the Aleutian Islands.

NORTH TEMPERATE (Intermediate).

4. *Virginian*, N. from Cape Cod S. to Florida.

5. *Celtic*, N. from the Naze and the Shetland Islands S. to the Bay of Biscay.

6. *Japanese*, embracing for the most part the Japanese empire and the neighboring isothermal waters.

7. *Oregonian*, extending N. from the Arctic to Monterey and the Japan Sea S.

TROPICAL.

8. *Caribbean*, N. from Florida to near Rio de Janeiro S.

9. *Panamic*, N. from Monterey, Cal., to Payta in Peru S.

10. *Indo-Pacific*, embracing all the islands of the tropical portions of the Pacific Ocean, as well as the Indian Ocean.

11. *Lusitanian*, S. from about the tropic of Capricorn to the Bay of Biscay N.

SOUTH TEMPERATE (Intermediate).

12. *Patagonian*, N. from near Rio de Janeiro to Point Melo S.

13. *Peruvian*, N. from Payta (Peru) to Concepcion (Chili) S.

14. *Australo-Zelandic*, including the waters of New Zealand and temperate Australia.

15. *Capetonian*, embracing the southern temperate portion of Africa.

SOUTHERN.

16. *Magellanic*, E. from Point Melo to Concepcion W., and including southernmost Patagonia and the neighboring islands.

17. *Antarctic*, embracing the little-known southern polar waters.

Such are the regions most generally recognized; but it may be again recalled that in many cases the limits are only provisional, and that in almost all they must ever be to a considerable degree indeterminate and overlap. From the very nature of the case, each of the regions indicated is further subdivisible into faunas or districts, but these cannot be here particularized. (See also the articles FISH, MAMMALS, etc.) THEODORE GILL.

Zool'ogy [Gr. ζῶον, "animal," and λόγος, "discourse"], that part of biology which relates to animal life, and, as generally understood, the science which treats of the structure, classification, distribution, habits, and derivation of living animals. In its broadest sense, however, zoology includes the structure, relations, and histories of extinct as well as living forms, but this branch of the science is generally considered by itself under the title of "palæontology." The two divisions are, however, so inseparably connected that they can only be properly studied or fully and systematically stated together.

Up to a recent date our knowledge of extinct animals was so limited that the attention of naturalists was exclusively directed to living species, and there are numerous and elaborate treatises on zoology which make little or no reference to extinct forms. On the other hand, of the vast number of fossil animals hitherto described, comparatively few exhibit such a degree of preservation as to show fully their relations to existing species. Hence a large amount of literature has accumulated which could not be woven into the fabric of zoological science. Every day has, however, seen additions made not only to the already long catalogue of well-preserved fossils, but to our knowledge of their structure and relations, learned by more careful study and a wider range of observation.

The derivation and life-histories of many groups of animals have been found written in the records of the past, and many mysteries not only of relation, but of structure, have been solved by going back to find dwarfed organs in full development and widely-separated forms linked together. The zoology of the future will therefore include the animal life of both the past and the present. Even recent zoology has now assumed such dimensions that it is impossible for one intellect in one lifetime to cover the entire ground. The science has therefore been divided and subdivided among specialists, who, cultivating each his special field, furnish to the systematic zoologist materials for his generalizations. In this way the science is growing both in detail and as a whole, and assuming a unity and symmetry which it has hitherto lacked.

No full and satisfactory exposition of the *principles of zoology* has yet been written, though important contributions toward this end have been made by Cuvier, La Marck, Von Baer, Oken, Owen, Agassiz, Gegenbaur, Haeckel, Darwin, Huxley, and others. No résumé even of what has been done and proposed by these great naturalists could be brought within the limits of this work, and the student of general zoology must go to their writings to find what he seeks. Even there he will meet with such diversity of view and discordance of statement that he will have abundant proof that zoology has not yet reached the condition of an exact science.

Some of the more important subdivisions of zoology are MAMMALOGY, ORNITHOLOGY, HERPETOLOGY, ICHTHYOLOGY, ENTOMOLOGY, etc., under which titles, or in the descriptions of families, genera, and species belonging to these larger groups, as well as under the heads of COMPARATIVE ANATOMY, EVOLUTION, OSTEOLOGY, PALÆONTOLOGY, etc., a large amount of information bearing on the general subject of zoology will be found. J. S. NEWBERRY.

EXTRACTS—TESTIMONIALS AND COMPARISONS.

From the Late Rev. M. W. Jacobus, D. D., LL.D., Prof. Theol. Sem., Allegheny, Pa.

JOHNSON'S CYCLOPÆDIA is a wealth of valuable material, and we find more than we expected. Comparing it with *Appletons'* last edition on our shelves, we find thirty additional geographical items on one page, and eight on the next page; and as yet we have found no item in *Appletons'* not found in this; and we write this as a part of our testimony to the very valuable and wonderfully complete material to be found in this cyclopædia, justifying the epithet of "Universal."

From Rev. J. E. Latimer, D. D., Dean of Boston University and Prof. of Systematic Theology.

I pronounce JOHNSON'S *the* cyclopædia for scholars and for the people. It contains far more material than its most imposing rival, and I have no hesitation in commending it to all in preference to the *Britannica*, *Chambers'*, or even *Appletons'* new one.

From J. C. Freeman, A. M., B. D., Prof. of Latin Lang. and Lit., University of Chicago, Ill.

JOHNSON'S is better than *Chambers'*, better than *Appletons'*, better than the *Britannica*; and is *the* cyclopædia.

From Charles O. Thompson, A. M., Prin. and Prof. of Chem., Worcester (Mass.) Free Institute.

I have carefully examined JOHNSON'S CYCLOPÆDIA, and diligently compared it, title by title, with *Chambers'* and with *Appletons'*; and for information about facts, events, things, localities, and persons, it is vastly superior to either of its competitors.

From the Late Rev. W. H. Wyckoff, D. D., LL.D., Cor. Sec. Am. Bible Union, New York.

I have four cyclopædias convenient for reference: they are *Rees's*, *Britannica*, *Penny*, and *Appletons'*. All of them together do not embrace one-third of the subjects comprehended in JOHNSON'S. It excels all its predecessors.

From Hon. H. A. M. Henderson, LL.D., State Supt. of Public Instruction, Frankfort, Ky.

The topics in JOHNSON'S CYCLOPÆDIA are more numerous than in the *Britannica*, *Chambers'*, or *Appletons'*, and what is said under them far more satisfactory. I regard it as a *vade mecum* to all classes, and have never seen a cyclopædia that I could so confidently commend to all.

From Rt. Rev. E. de Schweinitz, D. D., LL.D., Pres. Moravian Coll. and Theol. Sem., Pa.

I have carefully compared JOHNSON'S with *Appletons' New Cyclopædia*, and I find JOHNSON'S not only far more complete, but the articles far more satisfactory than the equivalent articles in *Appletons'*.

From D. G. Brinton, M. D., Editor Medical and Surgical Reporter, Phila.

Appletons' American Cyclopædia is not only double in price, but is notoriously disfigured by partisan views in a number of its historical articles, and unfavorable discriminations in regard to contemporaries. We have no hesitation in commending JOHNSON'S as the most desirable work of its class to be had.

From Rev. W. B. Watkins, D. D., Pittsburg, Pa., Author of Cyclopædia of Methodism.

I have examined, article by article and volume by volume, the two editions of *Appletons' Cyclopædia*. The first edition I consider to be unbiassed—the second is *not*. All the articles of the former edition that appertain to the issues between the Protestants and Catholics have been *altered*, *modified*, *expunged*, *condensed*, or made to say the *opposite* of what they *formerly* said. I award JOHNSON'S the merit of *trustworthiness*, of *unbiassed fairness*, of *comprehensiveness*, of *condensation*, of *inexpensiveness*, and believe it to be fully abreast of the times, and that it eminently meets the wants of the period.

From John G. Whittier, the Quaker Poet.

I have examined JOHNSON'S CYCLOPÆDIA with admiration at its completeness and accuracy. One is appalled at the amount of labor it suggests. It is a most valuable work. I know of nothing in our language superior to it in its department of literature.

From the Hon. Wendell Phillips, LL.D.

I believe JOHNSON'S CYCLOPÆDIA to be the most complete, most useful, and easily usable cyclopædia we have.

From the Hon. Wm. Lloyd Garrison, LL.D.

JOHNSON'S CYCLOPÆDIA is indeed a monumental achievement. It is lucid, able, and comprehensive, and deserves the highest premium and largest patronage.

From the Ex-President of the United States, Gen. U. S. Grant, LL.D.

JOHNSON'S will supply a want long felt, by furnishing a *complete* and *valuable* cyclopædia which will be available for all.

From the Late Ex-Vice-President of the United States, Hon. Henry Wilson, LL.D.

I am very favorably impressed with both its *design* and *execution*, and with the amount of *valuable information* it contains and the compact form in which it is presented.

From the Chief-Justice of the United States, Hon. M. R. Waite, LL.D.

The names of your Editors and Contributors furnish an abundant guaranty that the work you have undertaken will be well done. It seems to me to be *very complete*.

From the Hon. Joseph P. Bradley, LL.D., U. S. Supreme Court.

JOHNSON'S takes the place of larger works—it contains all they do, and in a much more convenient form. I value it highly.

From the Rt. Hon. W. E. Gladstone, LL.D., D. C. L.

The amount of valuable information in JOHNSON'S is truly wonderful.

From Hon. Robert C. Winthrop, LL.D.

I have kept the four volumes of JOHNSON'S CYCLOPÆDIA near me for several weeks past, and have had frequent occasion for consulting them; and it seems to me that no work of the sort could be more convenient, comprehensive, and compact. The names of the Editors and Contributors are an ample guaranty of its correctness.

From Hon. David A. Wells, LL.D.

I like JOHNSON'S CYCLOPÆDIA very much. I find it very useful, and especially convenient for ready reference.

From Hon. L. Q. C. Lamar, U. S. Senator, etc.

I have given JOHNSON'S CYCLOPÆDIA the test of several weeks' constant reference on a wide range of subjects. The result has been satisfactory far beyond anticipation.

From Hon. Thompson Westcott, the Historian, Phila., Pa.

I have frequent necessity to consult JOHNSON'S CYCLOPÆDIA, and I find it far better for my purposes than *Appletons'*, *Chambers'*, or *Zell's*. It is a book not for to-day only, but for this generation.

From Col. A. R. Clarke, Supt. of the Royal Ordnance Survey of Great Britain.

I can scarcely say how greatly I appreciate JOHNSON'S CYCLOPÆDIA. It is a library in itself, and has been greatly admired by all who have examined it in my office.

From Hon. C. P. Daly, LL.D., Chief-Justice of N. Y. and Pres. Geog. and Statis. Society.

JOHNSON'S CYCLOPÆDIA I have found accurate and very full for the limits of such a work.

From Rev. E. G. Robinson, D. D., LL.D., Pres. of Brown University, Providence, R. I.

I prefer JOHNSON'S CYCLOPÆDIA to any other for numerous reasons. It is more comprehensive in matter and more compact in form. It, in short, surpasses all others in the number of thoroughly competent writers who have been employed in preparing it, and in the amount of wholly new and valuable information which it contains.

[OVER.]

From the Rev. Dr. George Leon Walker, late Pastor Centre Cong. Church, New Haven, Conn.

In *Appletons' Cyclopædia* a positive falsification of history is chargeable upon the compiler of several important articles.

From Prof. R. D. Hitchcock, D. D., LL.D., Union Theological Seminary, New York.

For myself, I feel bound to say that I have compared the two editions of *Appletons' Cyclopædia*, and have found abundant proof that the new edition has been carefully manipulated in the interest of the Roman Catholic Church against the truth of history.

From the Rev. Dr. O. H. Tiffany, Pastor of St. Paul's M. E. Church, New York.

Whether intentionally or not, *Appletons' Cyclopædia* seems as thoroughly adapted to the peculiar prejudices of a Roman reader as if it had been issued by the authorities of the Roman Church.

From the Rev. J. Johns, Pastor of Free Tabernacle M. E. Church, New York.

My own judgment concurring with the opinions of Rev. Dr. Walker and Rev. Dr. Tiffany, and other testimony, I have exchanged (*even*) *Appletons' Revised Cyclopædia* for JOHNSON'S.

From the Rev. Dr. William A. Matson (Episcopalian), late Ed. of the N. Y. "Church Journal."

Without having given as minute an examination as the Rev. Dr. Walker has done, so far as I have investigated my conclusions concur with his. I use JOHNSON'S constantly, and I find its articles *clear*, *condensed*, and *thoroughly satisfactory*.

From the Rev. Dr. James M. King, Pastor of Washington Square M. E. Church, New York.

I have spent time and pains in looking into the evidences of the conversion of *Appletons' New Cyclopædia* to the Roman faith, and am satisfied that the evidences ought to be *conclusive* to the most sceptical. The change of heart is evidently thorough. But the publishers ought, in candor, to print a trade-mark in some prominent place pointing toward Rome. There is now but one cyclopædia for American readers. JOHNSON'S is the book for all readers—*Appletons'* for a sect.

From the Rev. Dr. Leonard Woolsey Bacon, Norwich, Conn.

I do not undertake to say which party is getting cheated in this matter—whether the Roman Catholic clergy or the general public. *But there is a fraud somewhere.*

From the Rev. Dr. T. Harwood Pattison, Pastor First Baptist Church, New Haven, Conn.

But even when all this is taken into account, I am compelled to conclude that the important and grave differences which can be detected in the two editions (*of Appletons'*) are not to be justified on the grounds of common honesty.

From the Rev. Dr. Wm. M. Taylor, Pastor of Broadway Tabernacle Cong. Ch., New York.

In the Theological department, which is perhaps the most difficult in such a work to handle, JOHNSON'S is *perfectly fair*, holding back nothing which ought in honesty to be put forward, and putting forward nothing which cannot be substantiated. In the department of Science it is superior to any work of the kind with which I am acquainted; and in that of History it is full and impartial, the articles being written in the interests of truth, and not in those of party.

From the Rev. Dr. Howard Crosby, Chancellor of the University of the City of New York.

I much prefer JOHNSON'S to *Appletons' Cyclopædia* for cyclopædic reference. In *Appletons'* article on "St. Bartholomew Day's Massacre" the *Te Deum* at Rome is apologized for *very foolishly*. In JOHNSON'S the best talent has been engaged from every department of life and learning, and the result is most satisfactory.

From the Eminent Baptist Teacher, Rev. David Moore, D. D., late of Brooklyn, New York.

In its *biographical notices of living men*, and especially of our American authors, teachers, statesmen, scholars, and leaders of public opinion, JOHNSON'S is more full than any other work with which I am acquainted; and I have carefully compared it in this respect with *Appletons'* and *Chambers'*. Its *scientific articles*, so far as I am capable of judging, are very accurate, and brought down to the latest discoveries and conclusions, and, as the names appended to the articles show, they are all written by experts of the highest reputation. The *theological and religious articles* are, so far as I have examined, very able and sound, free from intense partisanship, and they all bear the impress of reverence for good and holy things. The same *cannot* be said of *Appletons'*.

From Prof. Theodore N. Gill, A. M., M. D., Ph. D., M. N. A. S.

An extended examination of the various articles on Zoology in *Appletons' Cyclopædia* has made it evident that they were compiled by persons who had *little*, if any, practical acquaintance with the subjects treated of. The pre-eminent characteristic of the articles in Natural History is the *antiquated* and *obsolete nature* of the information contained therein.

From Prof. E. Darwin Hudson, Jr., M. D., New York.

The instances of *error*, *inaccuracy*, and *omission* in the Medical articles of *Appletons' Cyclopædia* are numerous, and often *flagrant*. Being anonymous, they are accredited neither by the authority of a writer distinguished in medicine nor by the revision of a special editor in the department of medicine.

Extract from a Lecture delivered in Boston, Dec. 8, 1879, by the Rev. Joseph Cook, the Eminent Author and Lecturer.

"If I had time I would show how the massacre of St. Bartholomew is also whitewashed in *Appletons' American Cyclopædia*. Look at the whitewash sprinkled sometimes thickly over every article in that national work referring to Romanism. I know for what I make myself responsible here, but of late I have taken pains to examine the book, and I can say from personal knowledge that the article on the Jesuits has been manipulated most horribly, so that you come out of it with a feeling that there are very few things the Jesuits have ever done that cannot be eulogized."

From the Rev. Dr. A. P. Peabody, Prof. Harvard University, Mass.

It is with emphatic approval that I recognize the *plan* of JOHNSON'S CYCLOPÆDIA as the *only one* that can guarantee those who use it against falsities and errors. I have authorized the purchase of this work in behalf of the Cambridge High School of whose Committee I am Chairman.

From the Rt. Rev. Dr. Horatio Potter, Bishop of New York.

I cannot refrain from expressing my surprise and admiration at the extent and usefulness of JOHNSON'S CYCLOPÆDIA. For exactness and variety of fulness of information it exceeds one's highest hopes, and is an honor to the country.

From the Rev. Dr. Ezra Abbot, Prof. Harvard University, Mass.

I am persuaded that the encomiums JOHNSON'S CYCLOPÆDIA has received are just, and that I made a mistake in becoming a subscriber to *Appletons' American Cyclopædia*.

From the late Hon. William Cullen Bryant, Author, Editor, and Poet.

For a considerable time past I have kept JOHNSON'S UNIVERSAL CYCLOPÆDIA at hand and within reach, that I might consult it whenever the occasion should arise. I expected much from the labors of my accomplished friend Dr. F. A. P. Barnard, and I was not disappointed. I find it full and complete even beyond my expectations.

From the Rev. Dr. J. H. Seelye, President of Amherst College, Mass.

JOHNSON'S CYCLOPÆDIA is a peerless work—the more its torch is shaken the more it will shine. I find my children coming to it for light all the while, and I deem its presence in any family invaluable.

From the Hon. James T. Fields, Author, Poet, etc., Boston, Mass.

JOHNSON'S CYCLOPÆDIA for constant reference is unsurpassed by any one that has yet come from the press which I have ever seen.

From the Rev. Dr. T. D. Woolsey, Ex-Pres. of Yale College, New Haven, Conn.

JOHNSON'S CYCLOPÆDIA embodies within a small compass, and at a comparatively small price, more information than can be found in any similar work.

From the Hon. Alex. H. Stephens, LL.D., House of Representatives, Washington, D. C.

JOHNSON'S is by far the cheapest as well as the best cyclopædia extant.

From the Hon. Justin Winsor, Librarian Harvard University, Mass.

For the price JOHNSON'S CYCLOPÆDIA is decidedly the best completed work in the market.

From the Hon. Charles Francis Adams, Sr., D. C. L., LL.D., Boston, Mass.

JOHNSON'S CYCLOPÆDIA will be good authority to consult for the next half century at least.

From James B. Angell, LL.D., President of the University of Michigan.

The plan of JOHNSON'S CYCLOPÆDIA is happily conceived, and the execution of the plan is excellent. The writers of the important articles on scientific topics will be recognized everywhere as authorities.

From George Woods, LL.D., Chancellor of the Western University, Pittsburg, Pa.

JOHNSON'S CYCLOPÆDIA is the best work of the kind ever, within my knowledge, offered to the public.

From the Hon. J. L. M. Curry, S. T. D., LL.D., Pres. of Richmond College, Va.

For accuracy and fulness of information—for all that constitutes a *vade mecum* for students and men of business—JOHNSON'S CYCLOPÆDIA is invaluable.

From Gen. Q. A. Gillmore, Lieut.-Col. U. S. Engineers and Bvt. Maj.-Gen. U. S. Army.

I believe JOHNSON'S CYCLOPÆDIA to be *unsurpassed* in general excellence and usefulness by any similar work heretofore published.

From the late Rev. W. A. Stearns, D. D., LL.D., Ex-Pres. of Amherst College, Amherst, Mass.

Happily conceived, admirably executed, clear, sufficiently full, condensed, while JOHNSON'S CYCLOPÆDIA will be welcomed by scholars, it seems better adapted for ordinary uses than any other work of the kind with which I am acquainted.

From Thomas Chase, LL.D., Pres. of Haverford College, West Haverford, Pa.

JOHNSON'S CYCLOPÆDIA is a library in itself, and will answer any question likely to arise in an intelligent man's mind on any point of history, science, art, the various occupations of men, and the different fields of human inquiry.

From the Hon. John Austin Stevens, Ex-President of Board of Commerce, New York City.

JOHNSON'S CYCLOPÆDIA is an admirable and compact digest of the information daily needed in every pursuit of life.

From the Rev. R. W. Patterson, S. T. D., President of Lake Forest University, Illinois.

In JOHNSON'S CYCLOPÆDIA comprehensiveness, thoroughness, compactness, accuracy, and adaptation to popular use are admirably united.

From the Rev. Samuel C. Bartlett, S. T. D., President of Dartmouth College, Hanover, N. H.

JOHNSON'S CYCLOPÆDIA embodies a vast amount and variety of matter, presented with great skill, fairness, and thoroughness, and from the latest sources of information.

From the Rev. J. C. Burroughs, S. T. D., Chancellor of the University of Chicago, Illinois.

JOHNSON'S CYCLOPÆDIA seems to me to give evidence of a scope in the selection of topics unequalled by any work of similar compass.

From A. A. Hodge, S. T. D., Prof. of Theology in Alleghany Seminary, Alleghany City, Pa.

JOHNSON'S CYCLOPÆDIA is admirably adapted to accomplish the end designed. Its staff of editors is unparalleled, and is the highest possible guaranty for the excellence of the work.

From the late Hon. H. H. Haight, Ex-Governor of California.

JOHNSON'S CYCLOPÆDIA is *far superior to any cyclopædia* yet published in this country, and will render those which have preceded it of *little practical value.*

From the Rev. H. D. Lathrop, S. T. D., Rector of the Church of the Advent, San Francisco, Cal.

JOHNSON'S CYCLOPÆDIA meets my wants and satisfies my ideas of what such a book should be *better than any book in the English language.*

From the Hon. John J. Bagley, Ex-Governor of the State of Michigan.

I am astonished at the amount of information contained in so small a compass in JOHNSON'S CYCLOPÆDIA. I find it very correct and reliable. It cannot help but become a standard among books of its class.

From the Rev. S. Y. McMasters, S. T. D., LL.D., St. Paul, Minn.

I have no hesitation in saying that JOHNSON'S CYCLOPÆDIA is far the most useful work of the kind that I have ever seen.

From the Rev. R. Irvine, S. T. D., Augusta, Ga.

JOHNSON'S CYCLOPÆDIA possesses merits which excel those of any other of the kind now extant.

From Francis J. Child, Ph. D., LL.D., Prof. of Rhetoric and Oratory, Harvard University, Mass.

JOHNSON'S CYCLOPÆDIA is the only kind of great book that is a great good, and not, as Dr. Johnson said, a great evil. I expect to be grateful to you all the rest of my days for the use I shall have of it.

From Benjamin Silliman, M. D., LL.D., Prof. of Chemistry in Yale College, New Haven, Conn.

JOHNSON'S CYCLOPÆDIA is, as its title declares, "a treasury of useful knowledge," scientific and popular. It is rich in original contributions from American scholars, whose names, appended to the several articles, are vouchers for the care which has been bestowed on their preparation.

From the Hon. John P. King, formerly United States Senator from Georgia.

JOHNSON'S CYCLOPÆDIA supplies the "busy man's cyclopædia" in a *table-book*, the want of which was so much felt by Mr. Greeley.

From the Rev. A. A. E. Taylor, D. D., Pres. of University of Wooster, O.

I heartily recommend JOHNSON'S CYCLOPÆDIA *as at once the most compact and the most complete work of the kind of which I have any knowledge.*

From S. D. Tillman, LL.D., Prof. of Mech'l Phil. and Technology Am. Inst., New York City.

JOHNSON'S CYCLOPÆDIA is a *marvel of abbreviation*, being both *concise* and *comprehensive.* It is not a mere epitome of older works, but is an *original compendium, just adapted to the present wants of the American people.*

From the Hon. Charles O'Conor, LL.D., New York.

JOHNSON'S CYCLOPÆDIA exhibits in great perfection the indispensable qualities—that is to say, *compactness* and *brevity*—without any sacrifice of adequacy to the end in view. *I think it will be found extremely useful to all classes.*

From Gen. Winfield S. Hancock, Major-Gen. U. S. Army.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of rare usefulness and merit. It contains a vast amount of information on important subjects, which is so compactly and clearly presented as to make it a most valuable book of reference.

From Gen. William F. Barry, Col. Second Reg. U. S. Artillery and Bvt. Major-Gen. U. S. Army.

I have had occasion to make frequent reference to JOHNSON'S UNIVERSAL CYCLOPÆDIA, and have never failed to find the subjects I was in search of readily accessible, and, although briefly, nevertheless tersely and satisfactorily, treated.

From Albert G. Brackett, Lieut.-Col. Second U. S. Cavalry, Fort Sanders, Wyoming Terr.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the most comprehensive and complete work of the kind ever published, considering its size. It is fresh, vigorous, and strong: exactly the book that is needed for business-men, and others who are not able to carry considerable libraries about with them. In my opinion it cannot fail to meet with great success, covering as it does a vast deal of information of the most valuable character.

From Hon. Hamilton Fish, LL.D., Ex-Secretary of State of the United States.

The mechanical execution of JOHNSON'S UNIVERSAL CYCLOPÆDIA is *very fine*, and the examination which I have been able to give it commends to me very strongly the plan of the work and its *literary* and *scientific excellence*.

From the Quartermaster-General of the U. S. Army, Gen. M. C. Meigs, M. N. A. S.

The plan of JOHNSON'S UNIVERSAL CYCLOPÆDIA is well devised, and executed in a most liberal manner. *It is a work to lie always ready on the desk or table, and containing what is desired on almost all the subjects for which such a cyclopædia is consulted.*

From Hon. J. E. Hilgard, M. N. A. S., Assist. Supt. of the U. S. Coast Survey, Washington, D. C.

There is no other work in which so much valuable and exact information is compressed in the same compass as in JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From Prof. Joseph Henry, LL.D., M. N. A. S., Sec. of Smithsonian Institution.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is truly a convenient and trustworthy source of useful knowledge.

From S. B. Luce, Capt. United States Navy.

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to me a miracle of brevity and conciseness, while at the same time its range of topics is fully as broad as that of more pretentious works of the same character, and fully up to the times in its treatment of the progressive sciences. The more I consult it, the better I like it. It answers every question in the clearest and most direct way.

From Capt. August Niemann, Editor of the "Almanach de Gotha," Saxony.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a magnificent work, surpassing all other works of the kind known to me in its value of text, in its richness in maps and other illustrations; the general arrangement is eminently practical.

From Rev. Dr. Ludwig Niffert, A. M., Director of the Theological School, Frankfort, Germany.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a treasure indeed; it cannot fail to be highly prized as a book of reference, especially by students and literary workers. The plan of this cyclopædia is unique, and renders it a special convenience for literary men, without detracting from its popular adaptation.

From Rev. Dr. Sulzberger, A. M., Prof. in Theological School, Frankfort, Germany.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a masterly production, sound and full in its science and extraordinary in its practical adaptations. I find its articles severely and uniformly accurate. Literary men, as well as intelligent families, have much needed just such a work. It deserves a place in the first rank of encyclopædias by its literary and scientific ability, while its merits, on the score of practical adaptation, are quite peculiar to it.

From Charles A. Young, Ph. D., M. N. A. S., Prof. of Nat. Phil., Dartmouth Coll., Hanover, N. H.

I find JOHNSON'S UNIVERSAL CYCLOPÆDIA even better than I expected. The plan of having the important articles written by specialists who have an intense personal interest in the subjects on which they write, and who sign their names, and thus become responsible to the public, works admirably; and as the result the amount of reliable and authoritative information contained within the comparatively restricted limits of the work is really surprising. I know of nothing so good at all comparable with it as regards size or price.

From Edmund R. Peaslee, M. D., LL,D., Prof. Med. Dept. of Dartmouth College, N. H.

I have a very high estimate of the value of JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From the Faculty of Middlebury College, Vt., and leading citizens of the town.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of rare excellence. In range of topics, in method of arrangement, and in thoroughness of scholarly treatment its worth is pre-eminent. It is a library in itself. For reliability and convenience of use it is unsurpassed, and, all things considered, we prefer it to any similar work.

PRES. C. B. HULBERT,	PROF. EZRA BRAINERD,	SAMUEL E. COOKE, *Probate Judge*,
PROF. W. H. PARKER,	EX-GOV. J. W. STEWART,	RUFUS WAINWRIGHT, *County Clerk*,
PROF. HENRY M. SEELY,	REV. E. P. HOOKER (Cong.),	JAMES M. SLADE, *State's Attorney*,
PROF. BRAINERD KELLOGG,	REV. W. W. ROWSOM (Meth.),	L. D. ELDREDGE, *Lawyer*,
PROF. E. H. HIGLEY,	C. D. MEAD, *Prin. High School*,	and others.

From E. N. Horsford, M. D., late Prof. of Chemistry in Harvard University, Cambridge, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA saves me much labor and time. It is quite charming to find an encyclopædia so fresh and complete, notwithstanding the necessary and desirable concentration. When one looks at the list of contributors, and considers the ability of the gentlemen at the head of the editorial department, it is not easy to see how it should fail to become the standard resource for the general professional man and for families of culture.

From Prof. Theophilus Parsons, LL.D., Cambridge, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is well adapted to make it an eminently serviceable family-book. Of its fulness, accuracy, and trustworthiness the public have a sufficient assurance in the ability and care of the eminent gentlemen entrusted with its superintendence.

From the eminent Boston Congregationalist, Rev. S. E. Herrick.

So complete a *multum in parvo* as JOHNSON'S UNIVERSAL CYCLOPÆDIA I think I have never seen. It is a veritable university. All the faculties are here, and all on duty. It is thoroughly up to the times. The latest discoveries, the newest inventions, the freshest presentations of scientific questions, are all here. You cannot catch it napping. To have it at one's elbow is to have at one's command the advantages of an immense library, without its inconvenience. As a saver of time it must soon pay for itself.

From Hon. John D. Philbrick, LL.D., Supt. of Schools in Boston, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of extraordinary excellence, admirably adapted to the wants of the times. A vast amount of information has been brought into a comparatively limited compass. All useless lumber has been rigidly excluded. It is in a remarkable degree interesting, accurate, useful, and *fresh*, and is a work which every scholar must desire, and at the same time I should like to see it in every household. It is pre-eminently suited to the purposes of a comprehensive work for reference in schools of all grades above the primary. Every teacher needs such a work in his private library. It is a genuine treasury of science and knowledge.

From Rev. Rufus Anderson, D. D., LL.D., Congregational House, Boston, Mass., formerly Sec. of the A. B. C. F. M.

With the high aim of the publisher, the ability of the editors, and the amount of enlisted talent, JOHNSON'S UNIVERSAL CYCLOPÆDIA must meet the wants of intelligent families all over the United States.

From Geo. B. Emerson, LL.D., the great American Teacher and Author, Boston, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the most valuable work I have ever received. It takes the place of nearly all other dictionaries, besides giving a vast deal of matter in the most agreeable form. I am a lover of natural history. This CYCLOPÆDIA will save me the trouble of consulting many volumes in my own library, thus saving time and thought.

From A. H. Buck, A. M., Prof. of Greek in College of Liberal Arts, Boston University.

I know not where else one could find so much concentrated and authentic knowledge in a form so available and convenient as in JOHNSON'S UNIVERSAL CYCLOPÆDIA. The names of the Editors and Contributors establish its claims as a "Treasury of Useful Knowledge."

From Hon. Richard H. Dana, Jr., LL.D., Boston, Mass.

In JOHNSON'S UNIVERSAL CYCLOPÆDIA I have been struck with the fairness with which the writers upon all controverted subjects have been chosen, and the care taken to select men whose names are guaranties of thoroughness and competency.

From Rev. J. W. Hamilton, D. D., Pastor First M. E. Church, Boston, Mass.

I prefer JOHNSON'S UNIVERSAL CYCLOPÆDIA to *Appletons'* for the following reasons:

1st. It is the busy man's cyclopædia, carefully written by representative men, making it complete, and yet so condensed as not to be cumbersome.

2d. It is the most universal American book of its class, considering the multiplicity and variety of fields it surveys.

3d. It is the cheapest book published, and therefore the most needed by teachers, clergymen, and other persons of limited means.

From Rev. Orville Dewey, D. D., LL.D., Sheffield, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of exceptional value—exceptional, *i. e.*, in embracing a greater variety of topics while compressing some into briefer statements, and enlarging upon others of special practical utility. The work seems to meet a special want, as Mr. Greeley conceived of it.

From the Rev. Dr. J. H. Seelye, President of Amherst College, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a peerless work—the more its torch is shaken the more it will shine. I find my children coming to it for light all the while, and I deem its presence in any family invaluable.

From the Faculty of Amherst College, Amherst, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is one of the most concise, complete, and reliable works of its class. The great number and variety of topics, the brevity, yet fulness of the articles, its condensation into four volumes, its very reasonable price, the high scholarship of its editors, and the fact that most of its articles are by leading specialists and signed by their authors are among the characteristic excellences of the work. Indispensable to scholars and students, such a cyclopædia is one of the most effectual means of making the family intelligent, and of enlightening the community.

PROF. W. S. TYLER,	PROF. E. P. CROWELL,	PROF. H. HUMPHREY NEILL,
PROF. E. S. SNELL,	PROF. E. HITCHCOCK,	PROF. W. C. ESTY,
PROF. EDWARD TUCKERMAN,	PROF. J. W. BURGESS,	PROF. W. L. MONTAGUE.
PROF. E. P. HARRIS,	PROF. J. K. CHICKERING,	

From R. H. Mather, Prof. of Greek and German in Amherst College, Amherst, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is correctly called a "Treasury of Knowledge." I do not believe it is possible to find elsewhere the same amount of interesting, useful, and accurate information within the same compass.

From Charles Upham Shepard, M. D., LL.D., Prof. of Nat. Hist. in Amherst Coll., Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA constitutes the most valuable work of a similar character in the English language.

From George A. White, A. M., Instructor in Latin and Greek in Amherst Coll., Amherst, Mass.

I believe that parents and teachers will find JOHNSON'S UNIVERSAL CYCLOPÆDIA a wonderful help in enlarging their own knowledge and bringing it up to the times, and in answering the many questions which bright children are constantly asking.

From W. S. Clark, Ph. D., Pres., and Prof. of Botany and Horticult., Mass. Agr. Coll., Amherst.

After the Bible and the Dictionary, JOHNSON'S UNIVERSAL CYCLOPÆDIA is the most indispensable book for every library. The number of topics is immense, and the treatment of them admirable.

From Lieut. A. H. Merrill, U. S. A., Prof. of Mil. Sci. and Tactics, Mass. Agr. Coll., Amherst.

I heartily commend JOHNSON'S UNIVERSAL CYCLOPÆDIA, above others of its kind, for its clear, terse, and able treatment of so great a number of current issues, and especially those in reference to all matters of technical science.

From H. W. Parker, M. A., Prof. of Mental, Moral, and Social Sci., Mass. Agr. Coll., Amherst.

The names of its editors and principal contributors vouch for the excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA. They are well known as men of high rank in their departments of study. Every family should possess some work of this kind, though at the cost of abstinence from some luxuries.

From Henry H. Goodell, M. A., Prof. of Modern Languages in Mass. Agr. Coll., Amherst, Mass.

In all matters of art and science, JOHNSON'S UNIVERSAL CYCLOPÆDIA presents the latest information, carefully prepared by the best scholars. It is indeed what it claims to be, "a Treasury of Useful Knowledge."

From Hon. Levi Stockbridge, Prof. of Agri. and Pres. of the Agri. College, Amherst, Mass.

In perfection and thoroughness JOHNSON'S UNIVERSAL CYCLOPÆDIA abundantly sustains the reputation of its editors and contributors, and cannot fail of being extremely valuable to all who have occasion to consult a work of the kind. I can find no fault in it.

From William H. Graves, Prof. of Physics and Civil Engineering in Mass. Agr. Coll., Amherst.

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to be all that is claimed for it,—brief, comprehensive, exact. The amount of matter condensed in so small a space is surprisingly large.

From S. T. Maynard, Assist. Prof. of Botany and Horticulture in the Mass. Agr. Coll., Amherst.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is very complete in botanical information. It is particularly valuable in that it contains the latest information upon this as upon all other subjects.

From Rev. P. A. Chadbourne, D. D., LL.D., Pres. of Williams College, Williamstown, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a standard book of reference.

From Rev. Daniel March, D. D., Woburn, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA excels all others in completeness, condensation, and accuracy. No other reference-book in existence will give a brief, clear, and reliable answer to so many questions that come up in daily reading, conversation, business, and inquiry.

From Rev. Edward Mills, D. D., Pastor of Baptist Church, Woburn, Mass.

I have carefully examined *Appletons'* and *Chambers'* cyclopædias, and also JOHNSON'S UNIVERSAL CYCLOPÆDIA, and am satisfied that the latter is, for all practical and scholastic purposes, the very best. It is a work of great value at a low price.

From A. S. Packard, Jr., M. D., Prof. in the Peabody Academy of Science, Salem, Mass.

I like JOHNSON'S UNIVERSAL CYCLOPÆDIA exceedingly. I have been surprised to see what a diversity of talent has been brought out in physical science. I think the whole work is certainly in advance of *Appletons'*, so far as I have examined the geological and zoological articles.

From Prof. J. R. Herrick, D. D., South Hadley, Mass.

The wide range presented in JOHNSON'S UNIVERSAL CYCLOPÆDIA is wonderful. What is really needed can be readily found, and what is not needed is excluded. The more extended cyclopædias may have their own merits, but certainly this must impress itself upon the mind of one who carefully examines it as most admirably realizing its aim in being, to an unprecedented extent, "*a Scientific and Popular Treasury of Useful Knowledge.*"

From J. P. Weston, D. D., Principal of Dean Academy, Franklin, Mass.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a wonderful compendium of knowledge; in short, a library in itself.

For students and for practical men it is a storehouse of facts, to which it will be well for them to find a way of access.

From Rev. Alexis Caswell, D. D., LL.D., Ex-President of Brown University, Providence, R. I.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of great value, as well to the professional man as to the man of practical pursuits. It is what it claims to be, truly a "thesaurus of useful knowledge." I know of no work of this description within the same compass that I could so confidently recommend.

From John L. Lincoln, LL.D., Prof. of the Latin Language and Literature, and Instructor in German, Brown University, Providence, R. I.

JOHNSON'S UNIVERSAL CYCLOPÆDIA furnishes most valuable and well-digested knowledge in a form fitted for direct and practical use. Indeed, it takes the reader on a grand tour through the whole realm of knowledge, securing for him at every stage whatever is capable of permanent instruction and entertainment.

From T. W. Bancroft, A. M., Prof. of Rhetoric and Eng. Lit., Brown Univ., Providence, R. I.

The knowledge JOHNSON'S UNIVERSAL CYCLOPÆDIA imparts, whether in the realm of religion, science, art, or literature, is given with a freedom from technicalities, and with a clearness and simplicity of statement, that make the work highly valuable as a source of information for those whose time is too limited for extensive research.

From Benj. F. Clarke, A. M., Prof. of Math. and Civ. Eng'g, Brown University, Providence, R. I.

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems admirably fitted to fill the place for which it was designed. The conciseness and clearness of statement will doubtless make it a popular work for general reference. It furnishes so wide a range of subjects as to make it a most useful work for all departments.

From Col. Thos. Wentworth Higginson, Clergyman, Author, etc., Newport, R. I.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a possession of great value. There are purposes for which a student needs a more voluminous work, but he is pretty sure to make more use of a shorter one; and in your book, by the judicious distribution of space, many departments are treated as completely as in much larger compilations.

From the Faculty of Yale College and other distinguished gentlemen of New Haven, Conn.

JOHNSON'S UNIVERSAL CYCLOPÆDIA, a work in four volumes, of nearly 1760 pages each, or about 6800 closely-printed pages, presents the following important features:

It is convenient for ready reference; its most important articles are original productions, prepared for this work by men who are well known to be distinguished in the several departments of learning which they represent, each article being signed by the writer; it embraces a wide range of subjects—about 20,000 in each volume—and is especially adapted to the needs of American readers.

An examination of it must convince any one that, as a table-book for the homes of the people, and for the use of professional men, merchants, and manufacturers, it will prove to be a work of great usefulness.

It is practically a geographical gazetteer, a biographical dictionary, a medical and legal manual, and a scientific repertory. The treatment of the subjects is thorough and comprehensive, and at the same time simple and judiciously adapted to the requirements of general readers.

A fortunate combination of circumstances has, under the energetic and persevering efforts of the chief editors, contributed to the securing of the co-operation of a large number of eminent writers, whose names will be recognized as among the best in the country in their respective branches of learning.

The work contains a vast amount of useful knowledge, presented in a popular and convenient form, and at a moderate price.

THEODORE D. WOOLSEY,
Ex-President of Yale College.

NOAH PORTER,
President of Yale College.

WM. P. TROWBRIDGE,
Higgin Prof. Dynamical Engineering, Yale Col., Adj.-Gen., etc.

W. A. NORTON,
Prof. of Civil Engineering, Yale College.

LEONARD BACON,
Kent Prof. of Law, Yale College.

SAMUEL W. JOHNSON,
Prof. of Theoretical and Agricultural Chemistry, Yale College.

A. E. VERRILL,
Prof. of Zoology, Yale College.

JOHNSON T. PLATT,
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JAMES E. ENGLISH,
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B. SILLIMAN,
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THOMAS A. THATCHER,
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LEONARD J. SANFORD,
Prof. of Anatomy and Physiology, Yale College.

H. A. NEWTON,
Prof. of Mathematics, Yale College.

HENRY B. HARRISON,
Fellow of Yale College, Attorney-at-Law, etc.

CHAS. R. INGERSOLL,
Governor of Conn.

S. R. DENNIN,
Pastor of Third Congregational Church.

From Hon. J. Hammond Trumbull, LL.D., M. N. A. S., Hartford, Conn.

I have read with much interest some of the longer articles in JOHNSON'S UNIVERSAL CYCLOPÆDIA, to which the names of their authors impart the highest authority; but the distinctive excellence of the work is in its comprehensiveness and in the system of judicious *compression*, by which, in almost innumerable items, what the scholar or the general reader cares to know is brought into a few lines or the fraction of a page. I know no work that so well deserves the name or serves the purposes of a "universal cyclopædia."

From W. D. Whitney, Ph.D., LL.D., M. N. A. S., Prof. of Sanscrit and Com. Philology in Yale Coll.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a collection of very high value and utility.

[OVER.]

From Prof. W. P. Blake, A. M., Ph. B., Vice-Pres. of American Institute of Mining Engineering, etc., New Haven, Conn.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is very useful to myself and to the members of my family. The contributions have the great merits of freshness and originality, and of being prepared for the work by specialists of acknowledged authority.

From Rev. James W. Hubbell, Pastor of College Street Church, New Haven, Conn.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is universal in its information. It is not too full, and yet complete. Its information is reliable, and presented by some of the best minds in the country. It is designed not only for professional and scholarly men, but also for plain and practical people, for use in the family every day.

From Rev. John S. C. Abbott, Author, etc., New Haven, Conn.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is an admirable work. In the above commendation by Rev. Mr. Hobbell I cordially concur.

From Hon. Roscoe Conkling, LL.D., U. S. Senator from New York.

For students and readers of all classes JOHNSON'S UNIVERSAL CYCLOPÆDIA is a valuable mine of information, so arranged as to be easily and quickly referred to.

From Hon. Horatio Seymour, LL.D., Ex-Governor of New York.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is very useful and convenient. It will be valuable in all libraries, and in a good degree save the cost of many other books about the numerous subjects of its articles. It is the work of well-known and able writers.

From Prof. Theodore W. Dwight, LL.D., Warden of Columbia College Law School, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best in the English language for general use.

From W. G. Peck, LL.D., Prof. of Mathematics and Astronomy, Columbia College, New York.

From my knowledge of the great ability of its editor-in-chief, as well as from the character of the articles I have had an opportunity to examine, I am convinced that JOHNSON'S UNIVERSAL CYCLOPÆDIA is the most valuable compendium of the principles of modern science that has ever been published.

From Ogden N. Rood, LL.D., Prof. of Mechanics and Physics in Columbia College, N. Y.

I have no hesitation in saying that the profound learning, excellent judgment, and untiring industry of the editors-in-chief, Drs. Barnard and Guyot, are to me a sufficient guaranty for the excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From Prof. H. I. Schmidt, D.D., Columbia College, New York.

I would not upon any consideration be without JOHNSON'S UNIVERSAL CYCLOPÆDIA. Much of the information in it can be obtained nowhere else.

From John Ordronaux, LL.B., M. D., Prof. of Med. Jurisprudence, Columbia College, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a magnificent collection of sterling monographs, which have the flavor of originality about them to a degree not common in American cyclopædias.

From Charles A. Joy, Ph. D., Prof. of Chemistry, Columbia College, New York.

The accurate knowledge and literary skill of the editors, and the well-known practical experience of the publisher, ought to secure for JOHNSON'S UNIVERSAL CYCLOPÆDIA the unqualified appreciation of the public.

From Prof. James A. Whitney, Pres. of the New York Society of Practical Engineering.

Among fourteen different cyclopædias in my office library, I have found JOHNSON'S UNIVERSAL CYCLOPÆDIA the best for general reference, both as concerns its wide scope and the care taken to bring the information down to the most recent dates. The work combines the convenience of smaller ones and the comprehensiveness of those of far more pretentious bulk, and will be valued accordingly by all students, writers, and professional men to whom reliable works of reference are, or should be, felt to be an absolute necessity.

From Hon. Lewis H. Morgan, LL.D., Rochester, N. Y.

I commend JOHNSON'S UNIVERSAL CYCLOPÆDIA for the *number* and *thoroughness* of its original articles, for the care with which other articles have been revised, for the *richness* of its illustrations, and for its *breadth* and *range*.

From Pres. M. H. Anderson, LL.D., Rochester University, Rochester, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA contains more accurate knowledge than an ordinary library.

From S. G. Brown, D. D., LL.D., Pres. of Hamilton College, Clinton, N. Y.

I add my testimonial to the great excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The more I use it the more satisfactory it seems to be. I do not know a series of volumes more useful for the library of a student in any profession or for any family of young or old who desire to keep familiar with the learning of the day.

From the Faculty of Hamilton College, Clinton, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is all that its name implies. It contains the pith and substance of whole libraries. The articles have been carefully prepared by experts.

PROF. HENRY A. FRINK,	PROF. ELLICOTT EVANS,	PROF. C. H. F. PETERS,
PROF. AMBROSE P. KELSEY,	PROF. EDWARD NORTH,	PROF. JOHN W. MEARS,
PROF. O. ROOT,	PROF. ALBERT H. CHESTER,	PROF. ALBERT BARNES.

From G. C. Sawyer, Principal of Utica Academy, Utica, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is at once full and compendious, accurate and complete. It is the best and most usable cyclopædia. I heartily endorse Superintendent Philbrick's opinion of it as "pre-eminently suited to the purposes of a comprehensive work for reference in schools of all grades above the primary. It is a genuine treasury of science and knowledge."

From Gen. P. V. Hagner, Bvt. Brig.-Gen. U. S. Army, Watervliet Arsenal, West Troy, N. Y.

I have carefully examined JOHNSON'S UNIVERSAL CYCLOPÆDIA with increasing interest and admiration to the end, and it seems to me that "the approach to that ideal of excellence which should be the object of all human effort" has been made "by a leap."

From Gen. J. Watts de Peyster, A. M., New York.

As a gazetteer alone for the epoch JOHNSON'S UNIVERSAL CYCLOPÆDIA is invaluable. In a private library of reference almost without a superior, questions were decided by reference to it by important facts therein stated, which could not be found elsewhere. It constitutes a library in itself.

From Hon. Andrew D. White, LL.D., Pres. of Cornell University, Ithaca, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is calculated to serve an excellent purpose for the community at large, and to indicate carefully the sources for the special information of students wishing to make large and thorough studies.

From George J. Fisher, M.D., Pres. of the N. Y. State Medical Society, Sing Sing, N. Y.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is absolutely certain to be a great educator in the land. It is a monument of literary labor.

From Miss Mary L. Booth, Editor of "Harper's Bazar," New York.

In JOHNSON'S UNIVERSAL CYCLOPÆDIA are condensed whole libraries within the limits of four convenient volumes, and the results of the wisdom of ages put within the reach of the masses. The names of its editors are a guaranty of the accuracy of this vast repertory of knowledge.

From R. H. Thurston, C. E., Prof. of Mech. Eng'g in the Stevens Tech. Institute, Hoboken, N. J.

I hardly know which to admire most, the excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA as a specimen of book manufacture, the comprehensiveness and practical character of the plan, the wonderfully thorough, yet concise, character of the articles, or the completeness with which the whole ground, both in science and in art, is covered in the selection of contributors.

From Hon. Henry Stockbridge, Attorney-at-law, Baltimore, Md.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is satisfactory far beyond anticipation—almost beyond belief, as it seems hardly credible that so much breadth, fulness, clearness, and accuracy of information can be brought within the number of pages composing it.

From Hon. George W. Dobbin, Judge of the Superior Court of Baltimore, Md.

JOHNSON'S UNIVERSAL CYCLOPÆDIA most satisfactorily executes the liberal plan upon which it was projected, and is truly the most complete, comprehensive, and at the same time compendious book of general reference which has yet been published.

From Hon. James L. Ridgely, Grand Sec. of U. S. Grand Lodge of I. O. O. F., Baltimore, Md.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is emphatically a colossal collection of learning and practical knowledge. In literature and scholarship it is an inexhaustible storehouse and library, and has no superior in any language.

From C. P. Krauth, D. D., LL.D., Acting-President of Univ. of Pa., Philadelphia, Pa.

Among all the cyclopædias JOHNSON'S UNIVERSAL CYCLOPÆDIA is best adapted for the most frequent and urgent wants. It is of the very best class and of the best in the class. I find by constant experience that in the great majority of cases it contains exactly what I need, and in very many it is the only cyclopædia which has what I look for.

From Henry Hartshorne, A. M., Prof. of Hygiene in the University of Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best table-book of facts—of things, places, persons, and events—in existence; its especial merits being freshness, reliableness, and availability.

From Prof. S. S. Haldeman, of the University of Pa.

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is worthy of the patronage of an intelligent public. The sciences are well represented by writers of known ability, the results are brought down to the latest period, and the necessary figures and maps are given in illustration.

From Prof. George F. Barker, M. D., University of Pennsylvania, Philadelphia, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA contains not only the most reliable information of any similar work known to me, and plenty of it, but what is worth if possible more, because unique, the means of estimating the confidence to be placed in every leading article in it by the knowledge which it gives of its authorship. Its scientific articles in general are particularly good and remarkably new and fresh.

From Hon. Lorin Blodgett, Philadelphia, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is more full and complete than any work of its kind yet issued in all the more valuable departments, and particularly in recent practical research as applied to arts and manufactures. I do not know of any work which would supply its place in the necessary reference of those who would keep pace with the general advance of knowledge, or whose business requires works of authority in special departments.

From Prof. Edward D. Cope, A. M., M. N. A. S., Corresponding Secretary of the Academy of Natural Sciences, Philadelphia, Pa.

The articles on the natural sciences in JOHNSON'S UNIVERSAL CYCLOPÆDIA are fuller and more complete than those of any other American cyclopædia known to me; they are written by the best American authorities, and an unusually large number of these have been engaged on it; it is therefore fuller in the results of the recent labors of American students than any other cyclopædia. While it contains much information not in any other American cyclopædia, its bulk is not so great as to render it inconvenient.

From Hon. C. R. Buckalew, LL.D., U. S. Senator from Pennsylvania.

JOHNSON'S UNIVERSAL CYCLOPÆDIA will at once take its place as one of the standard works of the country, and maintain that position in the future.

From Hon. John W. Forney, Journalist, Philadelphia, Pa.

I have used JOHNSON'S UNIVERSAL CYCLOPÆDIA very frequently, and regard it as one of the most valuable helps to journalists and authors. It is, in fact, almost indispensable to me.

From Dr. Nolan, Librarian of the Academy of Sciences, Philadelphia, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA has been perhaps more frequently consulted than any other similar work in the institution. It has been found particularly reliable, the latest information being given in a clear and concise manner by writers of undoubted authority.

From James W. White, M. D., D. D. S., Ed. of the "Dental Cosmos," Philadelphia, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a marvel of compactness, fulness, and precision. It is indeed a "Treasury of Useful Knowledge," containing concise and accurate information upon almost every subject within the field of human knowledge. It is unquestionably superior to any other.

From Prof. J. Thomas, M. D., LL.D., Philadelphia, Pa.

On account of its great comprehensiveness, as well as the superiority of its leading articles, I place JOHNSON'S UNIVERSAL CYCLOPÆDIA above every other cyclopædia with which I am acquainted. It contains a vast amount of valuable information not to be found in any other cyclopædia, or indeed in any other work, of whatever class, hitherto published.

From Edward P. Crane, Prof. of Logic and Rhetoric in the Western University, Pittsburg, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is eminently adapted to meet the wants of the great mass of the constituency it has in view—the intelligent, but not necessarily learned and scientific, American public.

From Rev. Wm. H. Hornblower, D. D., Prof. in Western Theological Seminary, Allegheny, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is literally a "Treasury of Knowledge," and for men who can afford only one such costly work of reference, or have not time to consult others, is the best cyclopædia in the English language.

From Prof. S. J. Wilson, D. D., Theological Seminary, Allegheny, Pa.

I know of no cyclopædia which gives so much varied and valuable information in the same space as JOHNSON'S.

From A. D. Hyde, D. D., Prof. of Greek and Hebrew, Allegheny College, Meadville, Pa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is all it claims to be—"a treasury of useful knowledge." In all matters on which my own studies have enabled me to have an opinion it is full, accurate, and up even with the best progress of our times. I do not doubt it is as good in all others. He who has it at hand need not be ignorant of anything worth knowing.

From Edward Orton, A. M., President Ohio Mechanical and Agricultural College, Columbus, O.

I am sure that to me, at least, the well-considered opinions in JOHNSON'S UNIVERSAL CYCLOPÆDIA of the eminent men who are connected with its editorial staff and in the list of contributors on the weightiest topics of our day, *over their own signatures* will be worth many times over the price of the work.

From Joseph Milliken, Prof. Eng. and Modern Lang., Ohio Agr. and Mech. Coll., Columbus.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is singularly full, concise, accurate, and free from all suspicion of scissor-work. The mention of leading accessible authorities on important topics, and a thorough system of cross-reference to articles on related subjects, are very valuable features.

From Samuel Sprecher, Pres. of the Theological Depart. of Wittenberg Coll., Springfield, O.

For convenient and available use, JOHNSON'S UNIVERSAL CYCLOPÆDIA is one of the best for the English reader.

From J. A. Schmitz, Prof. of Mod. Lan. and Lit., University of Wooster, O.

JOHNSON'S UNIVERSAL CYCLOPÆDIA, as a practical compend of human knowledge, is superior to any work I know of. The articles, which are more numerous than usual in such works, are short and to the point, giving the reader all the information he desires.

From D. S. Gregory, D. D., Professor of Metaphysics and Logic, University of Wooster, O.

Nothing else of the kind accessible to the American public approaches JOHNSON'S UNIVERSAL CYCLOPÆDIA in its peculiar excellences. It is unequalled in cheapness. It is of convenient size for use as a work of reference. It is complete in four volumes, which may be kept upon the table for constant use. It contains at least as much matter as the books in competition with it. Its treatment of all important subjects is fuller and more complete than in other works of its kind. Its crowning excellence, however, is that what it does contain is inconceivably better than that of other works of like character with which I am acquainted.

From Rev. W. H. Jeffers, A. M., Prof. of Greek Language and Literature, Univ. of Wooster, O.

Condensation and thoroughness are prominent characteristics of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The brevity of its articles, though a feature to which some might object, will be found by most who consult it of very high excellence; for the essential facts are in each case clearly presented, and the attention is not liable to be distracted and the time lost upon unimportant detail. In the number of articles it contains, in the accuracy of its statements, and in its convenience for reference, this work is probably without a rival in our language.

From O. N. Stoddard, LL.D., Prof. of Nat. Science, University of Wooster, O.

I have no doubt of the great value of JOHNSON'S UNIVERSAL CYCLOPÆDIA as a work of reference, not only to the student, but to others, and it seems especially adapted to *family use*. It is rather a repository of facts than of discussion about them.

From F. C. Daugherty, Prin. of Wooster High School, O.

It would be futile to enumerate the excellences of JOHNSON'S UNIVERSAL CYCLOPÆDIA. In all respects it is equal, and in many superior, to any extant. I commend it to the favor of all.

From S. H. McCollester, LL.D., Pres. of Buchtel College, Akron, Ohio.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is an invaluable treasury of information for all who would *seek* and *know*. It is a perfect library of itself. It is marvellous how so much knowledge could be so ably prepared, carefully compiled, and neatly presented in four volumes for so small a sum of money. No home ought to be without it. Let the young be educated to make daily use of it, and they cannot fail to grow in wisdom and extensive learning, for it furnishes the best products of many of the best minds.

From B. A. Hinsdale, A. M., Pres. of Hiram College, Hiram, O.

Its list of editors and contributors is a noble one, and of itself is a sufficient guaranty of the excellence of JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From Rev. C. H. Fowler, D. D., LL.D., President North-Western University, Evanston, Ill.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a valuable library in itself. For the uses of the general reader it is not surpassed. Many of its articles are of great value even to specialists. Familiarity with its contents would make the fullest and readiest man of the time.

From Rev. L. J. Halsey, D. D., Prof. of Theology in Theol. Sem. of the N. W., Chicago, Ill.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a comprehensive treasury of information on all subjects. For complete and thorough knowledge on all important topics, brought within a reasonable limit, I regard it as the best work yet published in our country.

From Rt. Rev. Charles E. Cheney, D. D., LL.D., Bishop of Ref. Epis. Church, Chicago, Ill.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is especially rich in knowledge relating to our own country, and in which all the foreign encyclopædias are notoriously deficient. It gives the latest information upon the constantly progressing science and history of the age.

From Rev. R. W. Patterson, D.D., President of Lake Forest University, Illinois.

In JOHNSON'S UNIVERSAL CYCLOPÆDIA comprehensiveness, thoroughness, compactness, accuracy, and adaptation to popular use are admirably united.

From Rev. D. R. Cheney, D. D., Pastor of Fourth Bap. Ch.; Rev. J. M. Gibson, D. D., Pastor of Second Presb. Ch.; Rev. Arthur Mitchell, D. D., Pastor of First Presb. Ch.; Rev. W. M. Blackburn, Prof. in Presb. Theol. Sem.; and Hon. E. S. Williams, Judge of Circuit Court, Chicago, Ill.

We concur with what the Rev. Dr. Patterson has so well said above concerning JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From Rev. W. W. Patton, D. D., late Editor of the "Advance," Chicago, Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA comes nearer to meeting the practical wants of a professional man or of an intelligent family than any other similar work I have seen.

From Ransom Dexter, A. M., M. D., Lecturer on Com. Anat. and Zoology in the Univ. of Chicago.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is in my opinion the best cyclopædia for general use published.

From Prof. J. F. Everett, A. M., Supt. Rock Island City Schools, Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is far more exhaustive than *Appletons'* in the number of subjects treated, and better arranged in the subject-matter presented. In my opinion, no library is complete without JOHNSON'S.

From Prof. J. H. Ely, Principal of Mt. Carroll Union School, Mt. Carroll, Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the most complete work of the kind published. I have therefore disposed of the volumes I had purchased of D. Appleton & Co. (*The American Cyclopædia*), and cheerfully given an order for JOHNSON'S.

From J. G. Evans, Pres. of Hedding College, Abingdon, Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a scientific and literary library in itself. It ought to be in every library. Indeed, no library can be complete without it.

From J. A. Badger, Prof. of Natural Science in Hedding College, Abingdon, Ill.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is indeed a "Treasury of Useful Knowledge," and, considering the amount of matter it contains, its price is very reasonable.

From Oval Pirkey, LL.D., President of Abingdon College, Abingdon, Ill.

I recommend JOHNSON'S UNIVERSAL CYCLOPÆDIA for general use on account of the compactness and excellence of its articles, the high literary and scientific character of its contributors, and its superior mechanical execution, which render it a most desirable work for every family.

From Prof. A. J. Thompson, A. M., Abingdon College, Abingdon, Ill.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best work of the kind I have ever seen. It is a vast library of concentrated knowledge. Its authorities are among the very highest known, and the names of the writers of special articles are signed to them.

From Hon. Newton Bateman, LL.D., Pres. of Knox College, Galesburg, Illinois, and late State Supt. of Schools in Illinois.

So far as I am able to compare and judge, JOHNSON'S UNIVERSAL CYCLOPÆDIA as a whole is very accurate and trustworthy, the scientific articles being abreast of the actual progress of investigation and discovery, those on speculative subjects being characterized by a spirit of fairness and candor, while the facts and statistics have been collected from the latest and best sources. The work impresses me as one honestly designed and successfully adapted to meet the needs and requirements of general readers, and as such I can and do heartily commend it.

From E. D. Bangs, Supt. of Knox Seminary, Galesburg, Ill.

Having examined JOHNSON'S UNIVERSAL CYCLOPÆDIA in connection with *Appletons' American Cyclopædia*, the trustworthiness and superiority of JOHNSON'S are strikingly manifest, especially in whatever relates to the history and character of Romanism.

From Prof. B. F. Barge, Supt. of Schools, Geneseo, Henry Co., Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is superior to any other in use.

From Prof. W. L. Klein, Supt. of Woodstock Public Schools, Illinois.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best work of the kind. The articles are written by men who stand at the head of their respective professions, and each article contains the best information to be found upon the subject of which it treats. The author's name at the end of the article is a guaranty for it. It contains much more matter than the other encyclopædias.

From Benjamin F. Cocker, D. D., Professor in the University of Michigan.

JOHNSON'S UNIVERSAL CYCLOPÆDIA will meet a real want which has been felt by the public, and must become the most popular of all the cyclopædias. There is a large amount of valuable information judiciously condensed in the articles, especially the scientific articles.

From C. K. Adams, Professor of History in the University of Michigan.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is superior to any other work with which I am acquainted. For the purposes of a student I cannot see how a work could be more convenient or more valuable. It contains a greater variety of information than the larger cyclopædias.

From Rev. A. Owen, D. D., Pastor of Lafayette Av. Baptist Church, Detroit, Mich.

Having been largely prepared by men of special qualifications for the departments in which they have written, the articles in JOHNSON'S UNIVERSAL CYCLOPÆDIA have a value beyond that of any mere compilation. For constant use I prefer it to any other with which I am acquainted.

From Hon. C. I. Walker, of Detroit, Michigan, late Prof. of Law in the University of Michigan.

For all purposes of ordinary reference by the intelligent inquirer I think JOHNSON'S UNIVERSAL CYCLOPÆDIA quite as useful as the larger ones that contain more exhaustive articles upon the several topics discussed. It is admirably adapted to the general reader.

From Rev. William Aikman, D. D., Pastor of Westminster Presbyterian Church, Detroit, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to me to be a very valuable work, and I am surprised at the extent and thoroughness of its articles.

From E. W. Jenks, M. D., Pres. of Detroit Medical College, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of no common merit. It cannot but prove invaluable to a large class—to the student as well as the business-man.

From C. B. Gilbert, M. D., Professor in Detroit Medical College, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is greatly superior to other similar works. The more I examine the more I like it.

From George P. Andrews, M. D., Professor in Detroit Medical College, Mich.

I am very much pleased with both the general scope and the execution of JOHNSON'S UNIVERSAL CYCLOPÆDIA. The authors of the articles, no less than the editorial corps, are a sufficient guaranty for its value.

From G. Weitzel, Major of Engineers, Brevet Major-General U. S. A., Detroit, Mich.

Those subjects in JOHNSON'S UNIVERSAL CYCLOPÆDIA of which I have any knowledge are presented in the concise, clear, and thorough manner which might be expected from the eminent editors and their associates.

From Rev. N. C. Mallory, D. D., Pastor of First Baptist Church, Detroit, Mich.

Another invaluable addition to modern literature is JOHNSON'S UNIVERSAL CYCLOPÆDIA. It is pre-eminently *the busy man's book*. Though compressed into smaller space than other works of this character, it transcends them all in the number of subjects treated.

From Rev. W. T. Sprole, D. D., Pastor of Second Congregational Church, Detroit, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA *is undoubtedly the best work of the kind* which, so far as my knowledge extends, has ever been offered to the American public. It is an extensive library in itself—a *thesaurus of knowledge.*

From Rev. Robert J. Laidlaw, D. D., Pastor of Jefferson Av. Presb. Church, Detroit, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a work of great value, occupying a prominent place among books of its kind, and in some respects calculated to meet wants not met by any other cyclopædia.

From Prof. Isaac M. Wellington, Principal of the Detroit (Mich.) High School.

To the busy business-man JOHNSON'S UNIVERSAL CYCLOPÆDIA furnishes in the shortest possible time, and in a reliable and pointed manner, the pith of what he wants to know. To the scholar, who wants only facts in their most concise form, this work, giving the cream of knowledge of the centuries, must prove indispensable.

From Hon. Ira Mayhew, LL.D., Pres. of Mayhew Business College, Detroit, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a mine of wealth. I consult it with a satisfaction I have never gained from any other, and look upon it not as a luxury merely, but as a necessity.

From Hon. P. R. L. Pierce, Mayor of the City of Grand Rapids, Mich.

JOHNSON'S UNIVERSAL CYCLOPÆDIA contains more than twice the amount of information found in *Appletons'*, and the price is remarkably low. It is a universal history and epitome of the world's knowledge in paragraphs of great value to the ordinary reader as well as the scholar.

From Prof. Henry N. French, Supt. of Marshall Public Schools, Mich.

In the value and amount of matter contained, in method of arrangement and general execution, JOHNSON'S UNIVERSAL CYCLOPÆDIA is in no respect inferior to any of the more voluminous cyclopædias, while in price it has a great advantage over them all.

From Prof. John Bascom, LL.D., Pres. of the University of Wisconsin, Madison, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA seems to be very full in topics, and to present them in a clear, practical form. These qualities, with its illustrations and its compactness, fit it exceedingly well for the work of a popular cyclopædia.

From Rev. William Porter, A. M., Prof. of Latin in Beloit College, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA ranks among the very best of the works of its class. I do not believe it possible to find elsewhere within the same compass and at so small a cost such an amount of information on such a variety of subjects—such a treasury of really useful knowledge.

From James H. Eaton, Ph. D., Prof. of Chemistry and Mineralogy in Beloit College, Wis.

The science-articles of JOHNSON'S UNIVERSAL CYCLOPÆDIA are admirable. It is for every one a "Treasury of Useful Knowledge."

From P. Hendrickson, A. M., Prof. of Modern Languages in Beloit College, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is better than any other publication of the kind. Almost every question in history, geography, and science is clearly and concisely answered, many beautifully illustrated.

From Rev. H. M. Whitney, A. M., Prof. of Rhetoric and Eng. Literature in Beloit College, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA combines in an admirable manner correctness and thoroughness with compactness. For busy men it seems to possess, in this fact, an advantage over works entering more largely into criticism or detail.

From T. C. Chamberlin, A. M., Prof. of Geology, Zoology, and Botany in Beloit College, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is clear, concise, thorough, and reliable. The selection of matter is excellent and the authors are trustworthy.

From Rev. Joseph Emerson, A. M., Williams Prof. of Greek in Beloit College, Wis.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is truly a "Treasury of Knowledge." I know not where else so much, so varied, and such fresh information can be had at so small expense of time, pains, and means.

From I. W. Pettibone, M. A., Principal of the Preparatory School of Beloit College, Wis.

I am greatly pleased with the plan and execution of JOHNSON'S UNIVERSAL CYCLOPÆDIA. Its articles, ably written and thoroughly condensed and digested, place before the reader just the information he is most likely to need upon any topic, in its most accessible form.

From Prof. Wm. F. Phelps, A. M., Pres. of First State Normal School of Minn.

I prefer JOHNSON'S UNIVERSAL CYCLOPÆDIA to any other work of the kind that has come under my notice. The freshness and originality of its more important articles are in striking contrast with the mere compilations of many similar publications, and are among its crowning excellences. The work will certainly prove to be an enduring monument to American scholarship and American enterprise.

From Hon. William Windom, United States Senator from Minn.

I fully concur in the estimate of Prof. W. F. Phelps in relation to the great value of JOHNSON'S UNIVERSAL CYCLOPÆDIA, and its adaptation to meet a public want not hitherto supplied by any similar work. The distinguished names of its editors and contributors are a sufficient guaranty of its trustworthiness.

From Paul F. Eve, M. D., Prof. of Surgery in the University of Nashville, Tenn.

I know of no better book, except the Bible, for our families than JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From Rev. Geo. F. Magoun, D. D., Pres. Iowa College, Grinnell, Iowa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA has great claims on the confidence of all who need—and what intelligent person does not?—such a book of reference. Not only have the articles been committed to unusually competent persons, but the important ones which I have examined have been prepared with great care, and are at once full and succinct, brought down to the present condition of information and learning, trustworthy and satisfactory. The multitude of topics and titles has surprised me.

From Rev. John Wheeler, D. D., late Pres. of the Iowa Wesleyan Univ., Mt. Pleasant, Iowa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA has great value on account of—(1) The high character for ability and scholarship of the Chief, Associate, and Assistant Editors; (2) the superior extensiveness of the *Cyclopædia* alphabet of subjects embraced and treated; (3) the enlarged treatment of subjects not easily accessible at present, eliciting public attention, and which also must be of future and permanent value; (4) the contributions of articles by the editors and contributors in the departments in which each, in the main, is especially skilled; (5) the signatures of the authors to the main articles contributed.

From Prof. I. L. Kephart, Western College, Iowa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is by far the most thorough, complete, and desirable work of the kind extant, quite surpassing *Appletons'* in many important and highly-essential particulars.

From Rev. D. Nicoll, D. D., De Witt, Iowa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is in many respects superior to *Appletons'*, and is a valuable work and worthy a place in every library.

From Hon. W. W. Wylie, Supt. of Public Schools, Lyons, Iowa.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best cyclopædia published, so far as I know. It is certainly far superior to *Appletons'* in many respects, at about half the price. All the recommendation it needs is to be compared, subject by subject, with any other cyclopædia. It should have a place in every library No live teacher can afford to be without it.

From Prof. J. B. Young, Principal Davenport (Iowa) High School.

For *all* purposes of reference and practical use, JOHNSON'S UNIVERSAL CYCLOPÆDIA is *much* superior to any other work of the kind extant. The abundance and excellence of the illustrations, as well as the *fulness* with which the more important topics are treated, challenge attention and approval, while in scope and variety of subjects treated the work is unsurpassed. No library, however full, is complete without it. Its extremely low price brings it within the reach of all.

From Rev. I. O. Kimble and W. M. Glenny, M. D., of Albia, Iowa.

We have subscribed for *Appletons' Cyclopædia*, but would be glad to make an even exchange for JOHNSON'S UNIVERSAL CYCLOPÆDIA, as that is more *scholarly, more reliable* on the most *important subjects;* and, besides, the names of the eminent authors are attached to the articles, and it also includes many subjects not named in *Appleton.*

From Prof. D. W. Lewis, Supt. of City Schools, Washington, Iowa.

To all who want an immense amount of information, briefly stated and at a reasonable expense, I heartily recommend JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From William T. Harris, LL.D., Ed. of "Journal of Speculative Philosophy," St. Louis, Mo.

JOHNSON'S UNIVERSAL CYCLOPÆDIA will grow every day in estimation, great as is the appreciation of it already. Every day I discover some new valuable feature in it.

From Hon. Robert Toombs, LL.D., Ex-U. S. Senator from Georgia.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is the best and most useful one I have ever examined, although I have used both English and American cyclopædias for many years. I consider it almost indispensable to any family of educated persons.

From Prof. Allen H. Weld, the great Author of School-books, and an experienced Teacher.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a grand epitome of human knowledge, comprising a vast array of facts so conveniently arranged and so tersely stated as to render the work invaluable as a book of reference. It justly claims an advantage over other cyclopædias published in this and foreign countries, in giving to the public a book superior to them in many respects at so reasonable a cost as to bring it within the reach of thousands hitherto debarred from purchasing the larger works.

From Hon. John R. Willis, Halifax, N. S.

I hope that JOHNSON'S UNIVERSAL CYCLOPÆDIA may meet with the well-merited success which its minute accuracy, fine typography, and general appearance fairly demand for it.

OPINIONS OF THE PRESS OF JOHNSON'S CYCLOPÆDIA.

From the New York Independent.

We have constantly used the volumes ever since their appearance, and with an ever-increasing sense of their completeness and reliability.

From the New York Christian at Work.

JOHNSON'S CYCLOPÆDIA is a credit to its publishers, a credit to its editors, and a marvel of industrious research, ability, and general correctness.

From the New York Evangelist.

With the addition of Shakspeare and the Bible, no family possessing it can be said to be destitute of a full and well-selected library.

From the New York Baptist Union.

The denominational articles are written by representative men in the respective bodies described, so that no complaint can be urged of partiality or unfairness.

From the New York Church Journal and Gospel Messenger.

Any family owning a copy of this work will find itself in possession of a valuable library.

From the New York Christian Intelligencer.

No other cyclopædia that we have examined is so completely satisfactory.

From the New York Home Journal.

It is a pyramid of brains, and becomes thus not a mere report of what has been said, but a veritable congress of scholars where each one gives with his own word the testimony of that which he knows.

From the New York Jewish Messenger.

It is one of the most desirable acquisitions, not only for the student, but for every man who is desirous of enriching his store of knowledge.

From the New York Christian Advocate.

We can conscientiously say that in all these qualities we believe it surpasses anything of its kind published in the country.

From Harper's Monthly Magazine.

The Third Volume of JOHNSON'S UNIVERSAL CYCLOPÆDIA keeps fully up to the standard of its predecessors. Its illustrations illustrate; they are not mere pictures brought in to justify the title-page. It is characteristic of the work that the moral and religious topics are put into the hand of disciples, not enemies. The work appears to be brought well up to the latest time in its historical as well as in its scientific articles.

From the New York Daily Evening Post.

The fame of the undertaking to which President Barnard and his colleagues are devoting so much labor and scholarship has already gone abroad through the country. The man does not live who is qualified to judge thoroughly such a work as this. The aim of the work has been to combine brevity with sufficiency, and to get within a space as small as possible the *facts* most essential to be known.

From the Rochester (N.Y.) Daily Union and Advertiser.

It should be understood that this is no old cyclopædia, rewritten and brought down to date, but an entirely new one of greatly-extended scope, and intended to convey a large amount of information not to be found in any other similar work; and it should also be as distinctly understood that while condensed in form it is not abridged in material.

From the Boston (Mass.) Zion's Herald.

This universal dictionary of all departments of human knowledge, so remarkably condensed and ably edited, will become, as it is known, a necessity upon the desk of both literary and business men. No poor man can afford to be without this work.

From the Boston (Mass.) Watchman and Reflector.

In the very careful and critical examination we have given it we find little to censure and a great deal to commend. We now have, for reference, what we have often wished for—a truly American cyclopædia.

From the Boston (Mass.) New England Journal of Education.

We can most fully and heartily recommend JOHNSON'S CYCLOPÆDIA for its completeness in matter, convenience in form, cheapness, and the ability and accuracy with which it has been compiled.

From the Boston (Mass.) Congregationalist.

The enterprise of the Publishers, and the ability and industry of the Editors and their assistants, certainly deserve praise. . . . The work certainly deserves the patronage of the public.

From the Worcester (Mass.) Daily Spy.

Every department of knowledge gets attention; nothing is overlooked. The science articles are from men familiar with the present condition of science and scientific speculation. It certainly fills a peculiar place—a place entirely its own—among important books of reference.

From the Worcester (Mass.) Daily Palladium.

For the first time we have a general cyclopædia which does *equal* justice to American geography, biography, or indeed art, science, literature, or institutions.

From the Greenfield (Mass.) Gazette and Courier.

It is a library in itself, and a man with limited means to invest in books can in no way make a more satisfactory outlay than in subscribing for this Cyclopædia.

From the Greenfield (Mass.) Franklin County Times.

It is a work of great merit, and it is safe to say that no library can be complete without a set of JOHNSON'S CYCLOPÆDIA.

From the Stoneham (Mass.) Independent.

It seems to be about as near perfection as any work of human origin can be.

From the Westfield (Mass.) Times and News-Letter.

We have now for reference what we have long desired, a truly *American* cyclopædia—not, like so many of its class, a compilation, but an original work.

From the Leominster (Mass.) Enterprise.

It proves not only a companion, but a friend, and grows upon the esteem of the merchant, the man of affairs, the student, and the scholar. It is an indispensable.

From the Worcester (Mass.) Daily Press.

The array of talent engaged upon this work is perhaps as great as was ever brought to the aid of a literary project.

From the Springfield (Mass.) Daily Republican.

The completion of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA by the recent issue of the Fourth Volume gives occasion to say that, after considerable practical use during its years of publication, and a final examination, we find it the best of the cyclopædias for the American public. One excellent thing for reference is the subdivision of articles by *italic* heads, giving under the head of any country its government, its geology, etc.

From the Springfield (Mass.) Daily Union.

The advantage of JOHNSON'S work over *Appletons'*, in reference to the number of topics treated, appears from a comparison of the first six volumes of *Appleton* with the First Volume of JOHNSON, both embracing the same alphabetical space. In *Appletons'* 11,071 topics are treated, and in JOHNSON'S 19,943, giving an excess of 8872 in favor of the latter. It is difficult to speak too highly of the rigid and skilful condensation that is exhibited in the preparation of the articles.

From the Hartford (Conn.) Daily Courant.

Almost any man who has anything to expend for books can secure the work without a serious encroachment upon his resources, and at a moderate price he is able to possess a work which to the majority of families serves the purpose of quite an extensive library.

From the Meriden (Conn.) Daily Republican.

We could continue this article into numerous columns, and not tire the reader, if we could only do justice to the real merits of this work and the great master-minds that enrich its pages.

From the New Haven (Conn.) Daily Union.

The work is a complete gazetteer, biographical dictionary, popular medical and legal guide, and a comprehensive and condensed family library, very full in everything American, especially historical, political, geographical, and statistical matters.

From the New Haven (Conn.) Daily Journal and Courier.

We counsel all who stand in need of a compact, accurate, and every way excellent cyclopædia to procure this one without fail.

From the New Haven (Conn.) Daily Palladium.

We feel justified in commending it cordially to all who desire a full, accurate, and yet handy work of reference.

From the New Haven (Conn.) Daily Evening Register.

It is a most valuable work.

From the Milford (Conn.) Telegram.

We exhort you all to secure a copy of the greatest, cheapest, and best book in the world, JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From the Milford (Conn.) Sentinel.

It will prove invaluable in the home, the school, the counting-room, and the factory.

From the Newark (N. J.) Daily Journal.

Every doctor, lawyer, minister, business-man, and family needs just such a work.

From the Newark (N. J.) Daily Advertiser.

Of the merits of the work there is sufficient assurance in the list of Editors.

From the Philadelphia (Pa.) Daily Evening Telegraph.

It contains very full and very complete articles upon a great number of important subjects which are entirely overlooked in other cyclopædias. It can be kept on the table, always ready, always reliable—a book whose place can be filled with no other.

From the Philadelphia (Pa.) Daily Bulletin.

The new Cyclopædia is the most comprehensive we have ever had. It is a whole library in itself, and should have a place on the shelf of every man who wishes to keep himself well informed.

From the Philadelphia (Pa.) Daily American and Gazette.

The work is a credit to the country, for it shows by its completeness that general and solid information is wanted by the majority.

[OVER.]

From the Philadelphia (Pa.) Press.

The design of the Editors of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA appears to have arrived at the happy mean, and their four volumes will contain an immense quantity of condensed and accurate information upon all subjects. We conclude as we began, by declaring that JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA is extremely well executed in all its departments.

From the Philadelphia (Pa.) Daily Times.

There has been no work prepared in this country for a great many years of equal importance with the NEW UNIVERSAL CYCLOPÆDIA.

From the Philadelphia (Pa.) Daily Inquirer.

We are delighted to find a cyclopædia of four volumes, containing the gist of everything, with ample references and authorities for those who wish to pursue the subjects farther. The most distinguished specialists and highest authorities have contributed to the work.

From the Pittsburg (Pa.) Commercial.

We do not hesitate to say with confidence that, as a great thesaurus of knowledge, in concise and yet clear, intelligible form, this Cyclopædia has no equal among books known to us.

From the Pittsburg (Pa.) Daily Gazette.

The work is more compact than any other cyclopædia extant, yet sufficiently full to meet all wants.

From the Baltimore (Md.) Daily American.

We know of no work that gives so much accurate information concerning the progress of science and art as this one.

From the Baltimore (Md.) Daily Bee.

It is not less designed for professional and scholarly men than for plain, practical people—for the study and office than for the family and workshop.

From the Baltimore (Md.) Presbyterian Weekly.

We do not wish to detract from other works of kindred character, but, all things considered, we express it as our decided conviction that the UNIVERSAL CYCLOPÆDIA stands at the head of the list by virtue of its intrinsic excellences.

From the Baltimore (Md.) Episcopal Methodist.

We hope that all in want of a cyclopædia will examine this great work before deciding the question of choice; and we feel confident that few indeed will prefer any other to this, the latest, most accurate, most comprehensive on all matters of vital interest to the American people.

From the Baltimore (Md.) Methodist Protestant.

But these four volumes contain as much matter as the sixteen of *Appletons'*, and thousands of subjects are here treated by the first scholars of the world which are not found in *The American*, so called.

From the Washington (D. C.) Daily National Republican.

This great work is in peculiar harmony with American taste and character.

From the Washington (D. C.) Daily Chronicle.

It treats all the topics contained in contemporaneous works, correcting many inaccuracies therein, and discusses within a given amount of space some twenty-five thousand *additional* topics.

From the Cleveland (O.) Leader.

It exactly supplies a demand long expressed for a cheap, condensed, and yet comprehensive cyclopædia.

From the Cleveland (O.) Evening News.

JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA marks a new and higher step in the science of statistical bookmaking. It is almost wholly original.

From the Columbus (O.) Daily Dispatch.

JOHNSON'S UNIVERSAL CYCLOPÆDIA commends itself especially to any person having a family to educate.

From the Columbus (O.) State Journal.

The book is in itself a library, and, what is best of all, it is a library for the table and not for the shelf—a library which the editor may have at his elbow, the merchant at his desk, the mechanic or farmer at his fireside.

From the Wooster (O.) Republican.

We can conscientiously and cordially commend it as being unsurpassed, and in many important features unequalled.

From the Wooster (O.) Wayne County Democrat.

One of the most striking features of this great work is that all special articles are written by the best authorities in this country and Europe.

From the Detroit (Mich.) Evening News.

Its Editors and Contributors are the ripest scholars and the most thorough scientists of the age. It is receiving the highest commendations from eminent scholars in every department of literature and science.

From the Detroit (Mich.) Tribune.

Compactness, unswerving truthfulness and impartiality, literal exactness, thorough fulness, and the careful bringing of all information down to the date of publication, are its leading characteristics. No individual and no household can afford to be without it, any more than without decent clothing and nourishing food.

From the Detroit (Mich.) Free Press.

It differs from its competitors, as it claims, in being to a great extent strictly an original production, the work of specialists, and of the *greatest specialists* in every department.

From the Detroit (Mich.) Post.

In geography, biography, the different departments of science, etc., JOHNSON'S CYCLOPÆDIA is particularly full and accurate.

From the Grand Rapids (Mich.) Eagle.

We think it not too much to affirm that JOHNSON'S UNIVERSAL CYCLOPÆDIA, now attracting so much attention and commendation, stands at the front in the range of secular literature.

From the Grand Rapids (Mich.) Daily Democrat.

As a cyclopædia of useful knowledge it certainly stands far above any publication of the kind yet made in America or elsewhere.

From the Grand Rapids (Mich.) Post.

This great work embraces the whole circle of human knowledge. As such we cordially commend it to the reading public.

From the Lansing (Mich.) State Republican.

We have minutely examined this Cyclopædia, and regard it as exactly the book for a busy, pushing, go-ahead people.

From the Lansing (Mich.) Journal.

We cordially commend the book to the careful examination of all our readers.

From the Chicago (Ill.) Advance.

One great merit of this Cyclopædia is that all the principal subjects are treated analytically with *italic* sub-headings, so that one who wants to look up a specific point has only to glance at the headings.

From the Chicago (Ill.) Inter-Ocean.

The Cyclopædia is really a complete and condensed dictionary of every branch of human knowledge.

From the Chicago (Ill.) Post and Mail.

No library can be complete without it; it is invaluable alike to the editor, the lawyer, the physician, the merchant, the manufacturer, the clergyman, the student, the farmer, and the mechanic.

From the Chicago (Ill.) Educational Weekly.

It embraces all subjects within the ordinary range of human investigation, treating them succinctly, accurately, and thoroughly, and has already taken the highest rank among our literary men and scholars.

From the Chicago (Ill.) Standard.

We feel like commending this work with especial emphasis to those wishing to secure an encyclopædia which shall be full, accurate, available, serviceable, and at the same time not cost a small fortune.

From the Chicago (Ill.) Alliance.

JOHNSON'S NEW ILLUSTRATED UNIVERSAL CYCLOPÆDIA has been carefully examined by us, and we do not hesitate to place it in the front rank of cyclopædias.

From the Chicago (Ill.) New Covenant.

Here we have the ideal book of reference, a model of completeness, brevity, freshness, comprehensiveness, and accuracy.

From the Chicago (Ill.) Post.

Within its pages is a fund of information impossible to express, were it not for the rigid system of condensation, which has stripped knowledge of all its husks and left nothing but the kernel. It is a master-work.

From the Chicago (Ill.) Appeal.

The more we see of this Cyclopædia the better we like it.

From the Chicago (Ill.) Interior.

It bears the test of practical use splendidly.

From the Chicago (Ill.) Tribune.

In all departments of knowledge the book is surprisingly comprehensive.

From the Chicago (Ill.) North-western.

The work has so many excellences, and is in so many points different from all other cyclopædias, that probably few who give it a careful and thorough examination will be satisfied without it, no matter how many others they may have.

From the Chicago and St. Louis Manford's Magazine.

It is just such a work as every young person, every family, and every professional man should have constantly at hand to answer the questions that are continually arising.

From the Galesburg (Ill.) Plain Dealer.

It is certainly the greatest literary work of the century, and is destined to become the standard cyclopædia of America, if not of every nation where the English language is spoken or read.

From the Galesburg (Ill.) Daily Press.

It is invaluable to every student and business-man.

From the Henry County (Ill.) Republican.

We can most fully and heartily recommend JOHNSON'S CYCLOPÆDIA for its completeness in matter, convenience in form, cheapness, and the ability and accuracy with which it has been made. No home ought to be without it. Let the young be educated to make daily use of it.

[OVER.]

From the St. Louis (Mo.) Globe-Democrat.

The treatment of the subjects is thorough and comprehensive, and at the same time simple and judiciously adapted to the requirements of general readers.

From the Louisville (Ky.) Courier-Journal.

The great men of our own country have been better presented than in any work yet published.

From the Beloit (Wis.) Free Press.

He who possesses this treasury when completed may consider himself rich indeed in intellectual stores.

From the St. Paul (Minn.) Pioneer-Press and Tribune.

JOHNSON'S UNIVERSAL CYCLOPÆDIA is a most marvellous production in regard to completeness, condensation, freshness, comprehensiveness, and accuracy.

From the Davenport (Ia.) Daily Democrat.

The entire work, so far, bears the impress of great thoroughness.

From the Davenport (Ia.) Gazette.

We do not see how any really intelligent American can afford to be without this work.

From the Burlington (Ia.) Hawkeye.

In no respect do we believe this work inferior to the best, and in many respects it is vastly superior to any other.

From the Lyons (Ia.) Advertiser.

It is destined to adorn more libraries throughout the country than any other book of a similar character.

From the Cedar Rapids (Ia.) Daily Republican.

In JOHNSON'S NEW CYCLOPÆDIA you have but four volumes, and they cover a wider and more comprehensive range of subjects than any cyclopædia ever published. Beyond a shadow of a doubt, it must in common justice be said that it now stands at the head of its class.

From the Cedar Rapids (Ia.) Weekly Times.

This is no clap-trap, catch-penny, ephemeral work, but as reliable as it is extensive, and as practical as it is important. We do not hesitate to pronounce it altogether the most complete and comprehensive work of the kind with which we are acquainted, not excepting the *American Cyclopædia*, over which it has many advantages.

From the Des Moines (Ia.) State Register.

This is indeed a cyclopædia! You get in a sentence or a paragraph what you will wade through pages and volumes to find elsewhere.

From the Des Moines (Ia.) State Leader.

It is only necessary to mention the names of a few of the Associate Editors to indicate the sterling value of the work.

From the Omaha (Neb.) Daily Bee.

We give the work our unqualified endorsement, and bespeak for it a circulation equal to its merits.

From the Omaha (Neb.) Daily Herald.

We think a careful examination will justify the claim that JOHNSON'S UNIVERSAL CYCLOPÆDIA is more comprehensive in its scope, more condensed in its statements, and at a less price than any work of its class hitherto published.

From the San Francisco (Cal.) Daily Evening Bulletin.

We cannot too highly commend the literary and artistic quality of JOHNSON'S UNIVERSAL CYCLOPÆDIA.

From the San Francisco (Cal.) Daily Alta California.

All will find in this work more information in small space, more real knowledge to be obtained at less expenditure of time, than can possibly be found in any other book or in any other way. No library can be complete without it.

From the San José (Cal.) Daily Mercury.

We can conscientiously say that we believe it surpasses anything of its kind published in this country.

From the San José (Cal.) Patriot.

We heartily commend it to the inspection of all.

From the Santa Rosa (Cal.) Daily Democrat.

Its superiority over all other cyclopædias with which we are acquainted may be found in the fact that it treats of many thousand subjects which they ignore or their compilers were ignorant of, and yet treats them in no prolix manner.

From the Santa Cruz (Cal.) Local Item.

As compared with the other cyclopædias in the field, we find JOHNSON'S much more thorough in its treatment of subjects, its information so clearly and tersely given as to be more readily available, and the authority of all the most important articles placed beyond question by having the writers' names signed to them, making it incomparably superior to any other, of whatever name or pretensions now before the American public.

From the Santa Cruz (Cal.) Sentinel.

The titles are treated in a thorough and exhaustive manner by masters.

From the Yolo (Cal.) Mail.

The work is strictly American in its inception and execution, and we commend it to all as a work of value.

From the Petaluma (Cal.) Weekly Argus.

As compared with other cyclopædias, we believe its information is more clearly and tersely given: we know of no more compact literary work.

A PARTING WORD TO THE PUBLIC.

The above encomiums of the press, together with the preceding personal testimonials from men of eminence, will doubtless suffice to establish the fact that JOHNSON'S UNIVERSAL CYCLOPÆDIA is accepted by the best judges as being *the best* work of the kind in the English language. The Rev. William B. Watkins, S. T. D., of Pittsburg, Pa., after a thorough comparison of JOHNSON'S work with all the rest, and preferring it, said, "The question, indeed, narrows itself down to *two competitive* cyclopædias—*The American Cyclopædia*, by D. Appleton & Co., and JOHNSON'S UNIVERSAL CYCLOPÆDIA, by Alvin J. Johnson & Son." The *quality* of the two cyclopædias being settled decidedly in favor of JOHNSON'S, it may be well to make an estimated comparative statement giving the *quantity* of matter and the *retail prices of each*. This we are justified in doing, because of the allegations of our opponents and their agents, that JOHNSON'S must be, and is, only a "cheap affair," and that Appletons' *16 volumes* will contain much more *type-matter* than JOHNSON'S; and upon these fallacious statements they proceed to convince people who have never seen JOHNSON'S CYCLOPÆDIA that Appletons' is to be preferred, and is much cheaper at $80 in cloth or at $112 in half turkey a set, than JOHNSON'S at $43 in cloth or $51 in half turkey.

ESTIMATED COMPARISON OF TYPE-MATTER OF THE TWO CYCLOPÆDIAS.

JOHNSON'S, complete in **four volumes**:

Estimated number of *words* in JOHNSON'S, counting the space occupied by the *wood-cuts* as *type-matter*	12,087,510
Average number of words per page	1,730
Total number of pages in JOHNSON'S	6,987

The actual number of *words* in JOHNSON'S, put into APPLETONS' *page*, using APPLETONS' *type* and *wood-cuts*, would make OVER SIXTEEN VOLUMES.

APPLETONS', complete in **sixteen volumes**:

Estimated number of *words* in APPLETONS', counting the space occupied by the *wood-cuts* as *type-matter*	12,455,940
Average number of words per page	940
Total number of pages in APPLETONS'	13,251

The actual number of *words* in APPLETONS', put into JOHNSON'S *page*, using JOHNSON'S *type* and *wood-cuts*, would make LESS THAN FOUR VOLUMES.

Besides, JOHNSON'S contains twenty thousand subjects more than APPLETONS', while not an important subject in APPLETONS' is left out in JOHNSON'S, the principal subjects in the latter being signed by eminent specialists, and not one in the former is signed.

Thus it turns out in the end that *Appletons' Cyclopædia* has lost largely in *type-matter*, and JOHNSON'S gained as largely, by the former containing so many *old views of cities, public buildings*, etc., while the latter has utilized space to the best advantage in illustrating *only* where it seemed necessary in order to convey a clearer idea of the subject treated. As *Harper's Monthly Magazine* said, "Its illustrations illustrate; they are not mere pictures brought in to justify the title-page; and it is characteristic of the work that the moral and religious topics are put into the hands of disciples, and not enemies."

A. J. JOHNSON & CO.,

Publishers of Atlases, Cyclopædias, and other Books,

Office: 11 GREAT JONES ST., near Broadway, NEW YORK.

HONORED ABOVE ALL!!

EUROPE ACKNOWLEDGES THE SUPERIORITY OF JOHNSON'S CYCLOPÆDIA.

TWO MEDALS AND A DECORATION OF HONOR.

"*There has been no question as to its merits.*"—PHILBRICK.

From Hon. John D. Philbrick, LL.D., Commissioner of the Ed'l. Sect. of the Interna'l. Expos'n. at Paris.

166 BOULEVARD MONT PARNASSE, PARIS, Oct. 14, 1878. ALVIN J. JOHNSON, ESQ.—DEAR SIR: I am glad to inform you that your excellent ENCYCLOPÆDIA has at last received the "recompense" it deserves. A *Bronze Medal* has been awarded to you as its Publisher, and a *Gold Medal* to Dr. Barnard as its Editor-in-Chief. *There has been no question as to its merits.*

Yours very truly, JOHN D. PHILBRICK.

"HONOR TO WHOM HONOR IS DUE."

In addition to the *two Medals* awarded at the *International Exposition* at Paris, Prof. F. A. P. Barnard, LL.D., president of Columbia College, New York, received the *decoration* of "Officer" of the Grand Legion of Honor for services to science as author, and as EDITOR-IN-CHIEF of JOHNSON'S NEW UNIVERSAL CYCLOPÆDIA.

President Barnard.—(*From the New York Herald, Tuesday, October 22, 1878.*)

Rev. FREDERICK AUGUSTUS PORTER BARNARD, D.D., LL.D., L.H.D., one of the most accomplished of American scientists, is president of Columbia College in this city, a member of the National Academy of Sciences, and was the Chief Editor of JOHNSON'S CYCLOPÆDIA. He is a descendant of Roger Williams, the founder of Rhode Island, and a brother of Major-General John G. Barnard. He was born at Sheffield, Mass., May 5, 1809; graduated at Yale College in 1830; was a tutor there in 1830; professor of mathematics and chemistry in the University of Alabama 1837–54; filled the same post in the University of Mississippi 1854–61, being for several years president and chancellor of that institution; came North at the beginning of the civil war; was connected with the United States Coast Survey 1863–64; and was elected president of Columbia College in May, 1864. He was ordained to the Episcopal ministry in 1854, and was a Commissioner to the Paris Exposition of 1867, upon which he made an elaborate report. He is president of the American branch of the International Metrical Association, and one of the highest American authorities upon all subjects of exact science. He was one of the Commissioners to the Paris Exposition of the present year.

The "Honor" Described.

The Order of the Legion of Honor was instituted by Napoleon Bonaparte in 1802 as a set-off to the old orders which were bestowed by the French kings on the nobility, and may be said to have, for a time at least, created a new nobility. Conferred at first only on soldiers who had distinguished themselves on the field of battle or on men who had gained distinction in literature, art, or politics, it soon began to be abused, and was made a powerful engine of political corruption. On this account it to some extent lost its character, and became the butt for ridicule on the part of men of spirit and independence of all shades of political opinion. It was abolished more than once, and has been frequently amended, but it has been found impossible to permanently do away with it, such is the anxiety of Frenchmen to wear badges of distinction. It may also be said that, whatever its abuses may have been, the number of men distinguished in war, politics, literature, art, and science who have worn it have shed a lustre upon it which cannot be effaced by parliamentary enactments. The Government of National Defence suppressed it in 1870, as far as civilians were concerned, and the Communists a few months later burned down the palace of the order; but France would not do without it, and a new law was passed in 1872 revising its statutes and introducing some necessary reforms. For instance, it was decreed that the government should not have the power to decorate members of either house of the Legislature while they held their seats, and that, with a view to reducing the number of members, only two appointments should be made for every three vacancies that occurred during the next twenty years. At the time this law was introduced a subscription was set on foot by the Grand Chancellor of the order, General Vinoy, to rebuild the palace, and a new building soon arose out of funds collected entirely from members of the Legion.

How Johnson's Cyclopædia and Johnson's Atlas Happened to be Sent to the Exposition.

A few days before Hon. John D. Philbrick sailed for the *International Exposition*, and while in New York, he sent to our office an inquiry why we had decided not to exhibit at the *Exposition*. The following day Dr. Philbrick called personally upon us, and said, in substance, that he was very sorry to learn that we had not seen fit to send the CYCLOPÆDIA to the *Exposition;* that he was exceedingly anxious that America should be well represented in her ability and enterprise in producing books of great merit and fine execution; and that if we would not send the CYCLOPÆDIA, he proposed to purchase a copy and take it there *himself*. Seeing how desirous Dr. Philbrick was of having the CYCLOPÆDIA on exhibition at the *Exposition* as an *American* production, we relented and took the shipping directions, went to the packing-room, and ordered our shipping-clerk to take a set of the CYCLOPÆDIA in Half Turkey Morocco binding and box and send it as directed. Dr. Philbrick, after we had consented to send the CYCLOPÆDIA, requested us to add a copy of JOHNSON'S *Atlas* to the box; which was done. The *Atlas* has also been awarded the Medal, being the second one it has captured at Paris, the first having been awarded in 1867.

We give the above facts to show that we did not intend to exhibit at the *Exposition*, and should not have done so but for Dr. Philbrick; nor did we take any extra pains in selecting the sheets or in binding the set of the CYCLOPÆDIA and the *Atlas* which were thus sent at the eleventh hour.

The following testimonial from Dr. Philbrick shows his high opinion of the CYCLOPÆDIA two years before it was sent to the late *Exposition*, where it received awards which are the highest honors to its editors, collaborators, and publishers, as well as to American art and industry generally:

From Hon. John D. Philbrick, LL.D., Supt. of Schools in Boston, Mass.

Having examined with care JOHNSON'S UNIVERSAL CYCLOPÆDIA, I am fully convinced that it is a work of extraordinary excellence. It is admirably adapted to the wants of the times. By judicious compression a vast amount of information has been brought into a comparatively limited compass. All useless lumber has been rigidly excluded. The matter is in a remarkable degree interesting, accurate, useful, and *fresh*. It seems to me it is a work which every scholar must desire, and at the same time it is just such a book as I should like to see in every household. It is pre-eminently suited to the purposes of a comprehensive work for reference in schools of all grades above the primary. Every teacher needs such a work in his private library; and I hardly know how a teacher could expend to better advantage the amount of its cost than in buying it. In a word, it is a genuine treasury of science and knowledge, which I wish might be put within reach of every American capable of reading.

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